

CONSOLIDATED ELECTRICAL CONTRACTORS



CONSTRUCTION SAFETY MANUAL

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Statement of Policy

The policy of Consolidated Electrical Contractors is to provide a safe and healthy workplace, free from recognizable hazards for all of our employees. It is also the policy of Consolidated Electrical Contractors to comply with federal, state and local regulations governing construction safety and health in the execution of our program.

In support of these policies, Consolidated Electrical Contractors will use its resources to complete our projects with a primary concern for safety and health. We will focus our safety efforts on preventing recognizable hazards, including unsafe acts and unsafe conditions which are the primary causes of accidents, injuries, illnesses, fatalities and property damage.

We will pursue these commitments in the following ways:

- Employee safety and health training
- Regular and frequent safety inspections
- Safety enforcement
- Accident investigations

This manual describes each element of Consolidated Electrical Contractors construction safety and health program, explaining the methods to be used when implementing the program. All supervisors and employees shall perform their duties in accordance with applicable safety and health codes, standards, and this Safety and Health Manual.

President of Consolidated Electrical Contractors

Safety Responsibilities

Managers

Consolidated Electrical Contractors managers have operational responsibility for the implementation of the safety program, including establishing an attitude of concern for safety matters by ensuring that MIOSHA requirements as well as project and Consolidated Electrical Contractors safety requirements are implemented and maintained by all Consolidated Electrical Contractors employees. Specific responsibilities include:

- Ensure that employee safety training including, new hire orientation and periodic safety meetings are conducted.
- Ensure that unsafe conditions and behaviors are corrected promptly.
- Ensure a thorough investigation is performed of all accidents and injuries resulting in root cause being identified and corrective action implemented to prevent recurrence.
- Enforce safety policies by issuing the appropriate level of discipline to employees for violations.
- Stop work any time situations are observed which poses an immediate danger to any employee or has the potential for serious damage.
- Plan work to include the necessary safety equipment such as fall protection harnesses, lifelines, etc. (do we have a harness?)
- Plan work to include the necessary safety procedures such as aerial lift training, scaffold erection procedures, etc.

Safety Officer/Competent Person

Competent persons will be selected by Consolidated Electrical Contractors who are knowledgeable in their designated area or areas and who are given authority to take prompt corrective measures to eliminate unsafe conditions. The specific duties of the Consolidated Electrical Contractors Safety Officer/Competent Person includes:

- Stop work anytime situations are observed which pose an immediate danger to any employee or has the potential for serious damage
- Conduct safety meetings once a week
- Project Manager will perform new hire orientation
- Conduct periodic inspections of the worksite and present written records to show proof it was inspected.
- Perform in the capacity of a "competent person." MIOSHA requires competent persons in many of the work operations encountered in

construction. A competent person is defined as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous or dangerous to employees and who has the authorization to take prompt corrective measures to eliminate them. This person is either a Job Foreman or a Project Manager. The following activities require a competent persons involvement:

- ü Scaffolding
- ü Fall Protection
- ü Ladders
- ü Excavations
- ü

Employees

Employees shall be held responsible for performing their work in a safe manner, in accordance with the safety training received from Consolidated Electrical Contractors. They must also be on the alert at all times and either report or correct unsafe conditions immediately. Employees must also report all work-related near misses, accidents, injuries, or illnesses immediately to their supervisor. Specific employee responsibilities include:

- Use required safety and health equipment
- Inspect work area for unsafe conditions
- Ensure tools are in good repair and do not use any that need repair. Tag, remove from service and notify Consolidated Electrical Contractors management of any defective tool or equipment.
- Use tools safely and in the manner for which they are designed
- Follow all jobsite safety rules, jobsite work rules and perform work in a safe manner in accordance with safety training received from Consolidated Electrical Contractors as a condition of employment.
- Be aware of their physical limitations and are responsible for working within them. Employees are expected to ask for help in performing tasks, which the employee believes, will cause overexertion. Alternative methods may be available for making the work task easier such as using equipment.
- Lift correctly by positioning the body in such a way as to keep the back straight, bend the knees and lift with the leg muscles. The load should be kept close to the body. Twisting at the waist should not be done while lifting. Turn by moving your feet.
- Use two people to setup scaffolding and install planks due to their size and weight. Muscle strains can happen easily with one person trying to move planks due to their weight and length.

Accident/Injury Management

First Aid & Medical Procedures

- First aid kits are provided and available in all Consolidated Electrical Contractors gang boxes or trucks.
- All work related accidents, injuries and illnesses must be reported and documented using the company's Accident Report Form located in the Forms section of this manual. The company will not authorize medical treatment and/or evaluation for any injury or illnesses unless it has been documented as work related and reported to the company.
- Employees must receive authorization from Consolidated Electrical Contractors before seeking medical treatment and/or evaluation for a work related injury or illness except in emergency situation. Employees are responsible for notifying Consolidated Electrical Contractors of all work-related injuries. Unreported injuries and illnesses that later result in a compensation claim will be questioned and investigated by the worker's compensation carrier.
- Employees with minor work related injuries may treat themselves using materials provided in the gang boxes or trucks and must report the injury to their supervisor.
- Cases involving exposure to blood or other body fluids shall be handled in accordance with the Blood borne Pathogens Exposure Control Plan section of this manual.
- Employees who refuse medical treatment and/or evaluation for a work related injury or illness shall only return to work if it is determined that they can continue to work safely without further aggravation.

Accident Reporting & Investigation

Serious Accidents

All accidents are to be reported, however, special reporting procedures are required with serious accidents involving internal injuries, multiple fractures, amputations, hospitalization, multiple injuries or fatalities.

Consolidated Electrical Contractors must be notified as soon as possible whenever a serious accident occurs. MIOSHA requires they be notified by calling 1-800-858-0397 within 8 hours of a fatality or whenever three or more employees are hospitalized from the same accident.

Accident Report

The Accident Investigation form shall be completed by Consolidated Electrical Contractors Supervision for any incident involving a work related injury or illness to a Consolidated Electrical Contractors employee. This report shall be completed prior to transporting the injured worker for medical treatment and/or evaluation, except in the case of an emergency or when a delay would likely cause additional medical problems. Request this form at the time of the accident from the Human Resource Department. A completed investigation form should be completed by the end of the work shift on which the employee was injured.

General Safety & Health Policies

Job Site Inspections

Safety inspections are a primary means of identifying unsafe acts and conditions in the field. Safety inspections also help determine the level of compliance with safety requirements by supervisors and workers.

- Consolidated Electrical Contractors will conduct regular and frequent safety inspections of all work areas at each Consolidated Electrical Contractors jobsite. Inspections will be guided by MIOSHA requirements, the requirements of this Safety and Health Manual and any other contractual requirements. See the sample inspection form located in the Forms Section of this manual titled Jobsite Safety Review. This form will need to be modified depending on the jobsite conditions and activities taking place.
- Safety inspections will be documented and shall include what was inspected, any violations or hazards identified, corrective actions taken or required, and a date that corrective actions were completed.
- Unsafe conditions identified during a safety inspection shall either be corrected immediately or work in the area should be suspended until the condition can be corrected.
- Willful or repeat violations by individuals will result in a written disciplinary notice being issued.

MIOSHA Inspections

Under normal circumstances, Consolidated Electrical Contractors will cooperate with MIOSHA Compliance Officers requesting permission to inspect a Consolidated Electrical Contractors worksite. The credentials of all Compliance Officers should be verified as soon as possible after their arrival or during the opening conference, at the latest. Consolidated Electrical Contractors management should be notified about the inspection as soon as possible after becoming aware of the inspection.

Other persons to be notified about an imminent MIOSHA inspection include the general contractor, other contractors and subcontractors working onsite.

A MIOSHA inspection will always begin with an opening conference. The Compliance Officer should state the reason for the inspection at this conference. Reasons for a MIOSHA inspection include regularly scheduled inspection, an

accident/injury investigation, or an employee complaint. Request a copy of any employee complaint being used as a reason for the inspection.

The Compliance Officer shall be allowed to review documents that are specifically requested. Refusal to provide requested records could result in a warrant being issued for the records. Care shall be taken not to offer anything that was not requested. The Compliance Officer should not be given copies of any Consolidated Electrical Contractors records without permission of Consolidated Electrical Contractors management. Only copies shall be given to the Compliance Officer. Consolidated Electrical Contractors shall retain all originals, with a copy going into an inspection file setup at Consolidated Electrical Contractors offices under the date of the inspection.

During the actual inspection of the jobsite by the Compliance Officer, the person representing Consolidated Electrical Contractors should:

- Take comprehensive notes
- Take photos that are identical to any taken by the Compliance Officer
- Immediately correct any observed violations, if possible
- Not allow employees to recreate or demonstrate unsafe acts or conditions
- Answer questions truthfully but do not volunteer information
- Not agree or disagree with addressing a potential safety or health hazard with the compliance officer.

A MIOSHA inspection will usually end with a closing conference. During this closing conference the Compliance Officer should identify all conditions and practices that may constitute a safety or health violation, which may result in a citation and provide copies of the appropriate standards. Make sure the Compliance Officer has noted any corrective action already taken.

The compliance officer may schedule a follow-up inspection to verify that any corrective action not taken immediately has been completed. This follow-up inspection should be conducted like any other inspection, including the opening and closing conferences. Persons contacted for the original inspection should also be contacted for any follow-up inspections.

Safety Training Orientation

Newly employed, promoted and/or transferred Consolidated Electrical Contractors employees shall be fully instructed in the safe work practices of their assignments and the hazards typically present on a project worksite,

prior to starting work. This training will also include the material covered in this manual. Documentation of this training is to be noted on the Safety Training Attendance Sheet included in the forms section of this manual.

Safety Meetings/Tool Box Talks

Consolidated Electrical Contractors will conduct periodic safety meeting for the entire crew. The subject of this meeting will cover specific safety procedures pertinent to the crew's activity. This meeting will also provide an opportunity to point out any hazardous conditions or unsafe work practices that have been noticed. Documentation of this training is to be noted on the Safety Training Attendance Sheet included in the Forms section of this manual.

Hazard Communication Training

Training is required for employees who may be exposed to hazardous chemicals in their work area. This training must be completed prior to beginning any work that may involve exposure to a hazardous chemical or whenever a new or significant hazard is introduced.

Material Safety Data Sheets are available for every chemical brought onsite by Consolidated Electrical Contractors employees and are kept in Consolidated Electrical Contractors trucks.

All containers must be labeled with the chemical name of the substance and appropriate hazard warnings. This applies to temporary containers also if the product has not been used up in one shift. Labels are not to be removed until the entire container has been emptied and rinsed of all residues.

Other Safety & Health Topics

Additional safety related training would be conducted for employees depending upon the nature of their work, exposures encountered on the job site and requirements of the customer or General Contractor. All safety training will be documented (see the forms section for the Safety Training Attendance Sheet).

Confined Space

A confined space shall not be entered until an authorized person evaluates the space and authorizes entry. Confined spaces are:

1. A space that is not designed for continuous employee occupancy (manhole, process tank, pits deeper than 4 feet, etc.) and
2. Is large enough that a person can enter the space and perform work
3. Has limited or restricted means for exit (smaller than a normal doorway) and

4. May have a possible hazardous atmosphere such as:
- a) Flammable gas
 - b) Airborne combustible dust
 - c) Oxygen deficiency or enrichment
 - d) A toxic atmosphere
 - e) Danger of engulfment (sand, grain, water)
 - f) Danger of entrapment (inward sloping walls, etc.)
 - g) Any other hazards, such as moving unguarded parts, exposed energized components

Hazard Communication

Information and training is required to be provided to all employees who work with or have the potential to be exposed to hazardous chemicals on the jobsite. It is the responsibility of the Safety Coordinator to:

- Assemble all Material Safety Data Sheets and make them available to all jobsite employees
- Compile an index of all hazardous chemicals used throughout the company. A form titled List of Hazardous Chemicals located in the Forms section can be used for this purpose
- Conduct training for all employees who are exposed or have the potential to be exposed to hazardous chemicals while working. Be sure to document this training.
- Ensure that all containers of hazardous chemical are labeled at all times
- Updating and posting the New or Revised MSDS and List of Hazardous Chemicals forms located in the forms section of this manual, when new MSDS' are received
- Complete and post the MSDS Location form (see forms section)
- Ensure employees are aware of hazards presented by other contractors

Lockout Procedure

Locking out of equipment is required to assure that employees are protected from unintended machine startup or movement while work is being done which would cause injury.

General

The power source of any equipment, machine, tool or process to be set-up, adjusted, repaired, serviced, installed or where maintenance work is to be performed and unintended motion or release of energy could cause personal injury should be locked out by each employee doing the work.

Sources of energy include:

- Springs
- Air
- Hydraulic
- Steam
- Chemical
- Electrical
- Gravity

Procedure

1. Notify the equipment operator of the work to be performed and that they are releasing control of the equipment to you
2. Locate all sources of energy and place them in a neutral (off) position
3. Secure each with a safety lockout device and retain the key
4. Make sure the machine cannot be restarted by trying the controls
5. Return controls to off or neutral position
6. After work is completed, all tools and equipment removed and guards reinstalled, each employee removes their own lockout device
7. Notify operator that work is complete and control of machine is returned to them

Personal Protective Equipment

Personal protective equipment, including clothing and all other work accessories, are designed to be protective barriers for employees against workplace hazards. Whenever possible, hazards should be reduced or eliminated using engineering, work practice, and/or administrative controls. Personal protective equipment should be not be used as a substitute for those other control methods.

Hardhats

Hardhats shall be worn at all times when on sites requiring them or when there is the potential for the following:

- Falling objects striking the head
- Collisions with objects

Safety Glasses

Safety glasses shall be worn at all times when on sites requiring them or when there is the potential for objects to fly into the eye. Face shields must be worn with safety glasses during operations that produce sparks, airborne particles or when handling or working with certain hazardous chemicals. Goggles shall be used, as required, to provide eye and face protection when safety glasses are insufficient and face shields are impractical.

Hand Protection

Gloves are recommended for any employee whose hands are exposed to the possibility of cuts, chafes, burns, splinters and/or irritations.

Foot Protection

Employees are required to wear acceptable work boots/shoes at all times. Acceptable work boots/shoes must protect the employee's feet from falling objects, sharp objects and spills. Tennis or athletic shoes are not an acceptable means of foot protection and are therefore not allowed on construction sites.

Hearing Protection

Consolidated Electrical Contractors will furnish appropriate hearing protection equipment for employees when engineering controls are not practical or available to reduce the noise level below MIOSHA's limits. Hearing protection is required in any work area with high levels of noise (more than 90 decibels). In general, hearing protection should be worn whenever employees work in areas where they have to shout to be heard.

IT IS EMPLOYEES RESONSIBILITY TO HAVE ALL ABOVE PROTECTION

Personal Fall Protection

General

- A person exposed to a fall of six feet or more is required to be protected by either a guardrail, safety net system or a personal fall arrest system.
- Holes shall be covered, secured or labeled or have a guardrail system installed around all unprotected sides or edges.

Personal Fall Arrest and Positioning Device Systems

- A personal fall arrest system consists of an anchorage, connectors, a body belt or harness, and may include a lanyard, deceleration device, lifeline, or a suitable combination of these items.
- Body belts and non-locking snap hooks for fall arrest are not allowed.
- Personal fall arrest systems shall limit falls to less than 6 feet
- A horizontal lifeline shall be designed and installed to maintain a safety factor of at least two.
- When vertical lifelines with rope grabs are used, a separate lifeline shall protect each employee.
- A personal fall arrest system shall not be attached to a guardrail system unless a qualified person designs the guardrail system for this use.
- Independent vertical lifelines with a rope grab are required for each employee working off a suspended scaffold.
- Employees are also required to be tied-off when working from an aerial work platform
- Anchorage points for safety harness lanyards and lifelines must be able to withstand a force of 5,000 pounds per person.
- A positioning device system means a body belt or harness rigged to allow a person to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning. A positioning device system shall limit falls to less than two feet.

Rescue Plan

Consolidated Electrical Contractors fully intends to provide prompt rescue of any employee who has fallen and is suspended by a fall arrest system. This will be accomplished using the local fire department rescue service. Any employee who uses fall protection will be trained in this procedure and what to do in the event of a fall.

Excavations

Employees are not allowed to enter excavation unless the proper precautions of have been taken in advance to prevent cave-ins:

- Shields, slopes or shoring, Must be used for all excavations that are more than five feet deep
- Equipment and excavated piles must remain at least two feet back from the edge of the excavation
- Ladders are required for excavations more than four feet deep and must be placed no more than 25 feet apart

- Water must be removed from and controlled in all excavations, before employees are allowed to enter by the qualified person at the jobsite.

Scaffolds

Scaffolds must be built and erected to MIOSHA standards which includes:

- All scaffold erection and teardown must be done under the supervision of the competent person.
- Fully planked work deck secured to the bearing portion of the staging by cleating or wiring. Planking must be visually checked before use. Do not use planking that is split/cracked or not designed for staging use.
- All planking shall be Scaffold Grade, or equivalent. The maximum permissible span for full thickness undressed 2" X 10" or wider planks used for light duty (25 psf) scaffolds are 10 feet. Eight feet maximum span for nominal thickness lumbar.
- The working deck of a scaffold must be at least 18" wide (two planks). Scaffold planking shall be overlapped a minimum of 12 inches or secured from movement. Scaffold planks shall extend over their end supports not less than 6" nor more than 12"
- The poles, legs, or uprights of scaffolds shall be plumb and securely and rigidly braced to prevent swaying and displacement. Where uplift may occur on tubular frame scaffolds, the panels shall be locked together vertically by pins or other equivalent means.
- Tubular welded frame scaffolds and tube and coupler scaffolds shall be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.
- A complete guardrail system including top rails, mid-rails, and toe boards are required on all open sides of work decks over ten feet high and on work decks from 4 to 10 feet high when the minimum width is less than 45 inches.
- Access ladders must be provided to the work deck. Access ladders must be tied off to prevent slipping, where applicable.
- Scaffolds shall be erected on sound, rigid footing, and shall be capable of carrying the maximum intended load without settling or showing signs of displacement. Unstable objects such, as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.
- Scaffolds and their components shall be capable of supporting, without failure, at least 4 times the maximum intended load.

- There shall be a screen with maximum ½ inch openings between toe board and the guardrail where persons are required to work or pass under the scaffold.

Mobile/Rolling Scaffolds

- The height of a freestanding mobile scaffold shall not exceed four times the minimum base dimension.
- Mobile scaffolds shall have proper cross and diagonal bracing.
- Platforms on mobile scaffolds shall be tightly planked and secured. Platforms more than 10 feet above the ground or floor shall be protected with guardrails and toe boards on all open sides and ends.
- A ladder or stairway shall be provided for proper access and exit.
- The wheels shall be locked to prevent any movement when any employee uses a rolling scaffold.
- Employees may not ride a rolling scaffold unless special conditions are met as listed in the MIOSHA standards.

Ladders

Ladders shall be inspected for damage before they are set for use. Employees shall immediately tag, remove from service and notify their supervisor of any ladder they find damaged. The ladder must either be repaired or destroyed.

All ladders purchased by Consolidated Electrical Contractors shall be Class I Heavy Duty Industrial Grade ladders. Straight ladders and extension ladders shall be purchased with safety feet installed.

General safety guidelines for ladders are:

- Inspect each ladder before use. Inspections shall include examining the ladder for split side-rails, broken or split steps or rungs, uneven legs, broken extension brackets, and hardware deficiencies. Ladders that are defective or damaged shall be taken out of service for repair or disposal.
- The pitch of a ladder shall be set up at approximately 4:1 (vertical: horizontal). For every 4 feet the ladder goes up, the base must be one foot from the vertical support.
- Ladders placed in any location where they can be struck by traffic, such as in doorways, driveways or passageways, shall be secured to prevent accidental tip over or a barrier erected to keep traffic away from the ladder.

- Know the capacity (load) of the ladder and do not overload it.
- Job built ladders have special requirements for construction and placement. Do not build one unless you understand these requirements.
- Straight ladders must be set up so they are stable. The top and/or bottom shall be secured as required to prevent slipping. Ladders with slip resistant feet shall be used whenever possible. Ladders with plain feet or those with slip resistant feet on slippery surfaces shall have their bottom and top secured as necessary to keep them from moving.
- Straight ladders shall extend at least three feet above the level being accessed. Use a ladder of the proper length to do the job safely.
- The top and top step of a ladder shall not be used. If tempted – get a longer stepladder.
- Proper use of ladders includes:
 - ü Facing the ladder when climbing
 - ü Using both hands while climbing the ladder
 - ü Making sure shoes are clean of oil and grease
- Stepladders are not to be used in the folded closed position (as a straight ladder).
- Metal ladders shall not be used in areas where exposed electrical wires are present

Aerial Lifts & Work Platforms

Self-actuated aerial lifts and work platforms are to be used by authorized employees only. Consolidated Electrical Contractors will provide training on the specific aerial lift or work platform that employees are authorized to use. **Do not operate an aerial lift unless you have been authorized to do so and have been trained.**

- Employees must work with their feet on the floor of the lift and are not allowed to climb on the handrails, use ladders, planks, or other extensions to reach higher.
- Fall protection is required with tie-off to an approved anchorage point on the lift or basket
- Aerial lifts shall not be moved when the boom is elevated except as specifically allowed by the manufacturer and the jobsite conditions. A lift cannot be moved with the basket raised unless the operator can see all wheels and surrounding terrain. Extreme caution must be exercised when moving a lift with the basket rose to prevent tip over.

Hand & Power Tools

General

All hand and power tools and similar equipment shall be maintained in a safe condition. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded, if such parts are exposed to contact by employees or otherwise create a hazard.

Portable power tools must be grounded or double insulated. Do not cut the grounding lug off electrical plugs.

All hand-held powered tools shall be equipped with a constant pressure switch that will shut off the power when the pressure is released.

Defective tools and extension cords should be removed from service, tagged with a defective note and your supervisor notified.

Use a Ground Fault Circuit Interrupter on every extension cord that is tied into a sites temporary wiring system and/or used in a location subject to moisture.

Powder-Actuated Tools

Powder-Actuated tools operate like a loaded gun and must be treated with extreme caution.

- Only persons who have been trained and issued a permit are authorized to operate powder-actuated tools.
- Employees must wear suitable ear, eye and face protection.
- The correct powder level – high or low velocity – that is appropriate for the powder-actuated tool and necessary to do the work without excessive force shall be used.
- The muzzle end of the tool must have a protective shield or guard centered perpendicular to and concentric with the barrel to confine any fragments when the tool is fired.
- All powder-actuated tools shall be inspected daily before use with defects being corrected prior to use.
- Tools shall not be left unattended and shall not be loaded until ready to use.
- If the tool misfires, the user must hold the tool in the operating position for at least 30 seconds before trying to fire it again. If the tool still will not fire, the user must hold the tool in the operating position for another 30 seconds and then carefully remove the load in accordance with the manufacturer's instructions. The bad cartridge should then be put in water immediately after removal.

- Powder-actuated tools must not be used in explosive or flammable atmospheres.
- When using powder-actuated tools to apply fasteners, several additional procedures must be followed:
 - ü Do not fire fasteners into material that would allow the fastener to pass through to the other side.
 - ü Do not drive fasteners into very hard or brittle material that might chip or splatter, or make the fasteners ricochet.
 - ü Always use an alignment guide when shooting fasteners into existing holes.
 - ü When using a high-velocity tool, do not drive fasteners more than 3 inches from an unsupported edge or corner of material such as brick or concrete.
 - ü When using a high velocity tool, do not place fasteners in steel any closer than ½ inch from an unsupported corner edge unless a special guard, fixture, or jig is used.

Abrasive Wheels & Tools

- Grinder guards shall be kept in place. Employees must not remove guards unless the wheel of the grinder is protected by some other means.
- The operator must wear safety glasses or goggles and a face shield while operating this equipment.

Woodworking Tools

- All powered circular saws are required to be guarded, unless a jig or fixture protects the operator. Guarding is required above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.
- Portable power saws must have a momentary switch that will release and shut off the tool when the operator releases the switch. The power control for table saws and crosscut saws must be within reach of the operator.

Electrical Safety

- Employees, unless under the supervision of a licensed electrician, are required stay at least 10 feet away from all live exposed electrical circuits above 50 volts.
- Portable power tools must be grounded or double insulated. Do not cut the grounding lug off electrical plugs.
- Defective tools and extension cords are to be removed from service, tagged with a defective note and your supervisor notified.
- Do not tamper with temporary electric panels or attempt to splice into any cable.
- Consolidated Electrical Contractors has elected to use Ground Fault Circuit Interrupters (GFCI) to ensure grounding adequacy.
- Every extension cord that is tied into a sites temporary wiring system and/or used in a location subject to moisture shall be connected through a GFCI.
- If an extension cord is tied into a sites permanent wiring system, the receptacles on the ends of the extension cord must be the GFCI type.
- GFCI's shall be tested periodically to determine if they are functioning properly. Pushing the test button and verifying that the power has been cut off may test them.
- Portable electrical extension cord sets must have a third wire ground and must have a heavy duty jacket that is capable of resisting chafes and cuts. Heavy-duty cable is defined as types SJ, ST, SJT, SO, SJO, or STO.

Housekeeping

Keep stored material out of walkways and stored at the sides of work areas. Do not store excessive amounts of material in the immediate work area.

Clean up scrap in the work area daily

Scrap wood should be removed from a building promptly to reduce fire hazards.

Respiratory Protection

When required, dust masks will be made available to employees who are capable of wearing them. Consolidated Electrical Contractors controls respirator issue.

After being medically cleared, employees will receive training in the proper selection of dust masks, putting them on, proper adjustments, fit testing, use, maintenance, and limitations. (SEE INSERT)

Blood borne Pathogens

Blood borne pathogens are microorganisms present in human blood that can cause disease in humans. These include, but are not limited to, the hepatitis B virus (HBV) and the human immunodeficiency virus (HIV).

Exposure Control Plan

The purpose of this Blood borne Pathogen Exposure Control Plan is to eliminate or minimize work related employee exposure to blood or other potentially infectious materials.

Exposure Determination

Consolidated Electrical Contractors has evaluated all job classifications and determined that no employees within the company currently have responsibilities where they may incur work related exposure to blood or other potentially infectious materials at Consolidated Electrical Contractors jobsites. This determination was made without regard to personal protective equipment.

Methods of Compliance

Any employee who incurs an exposure to their skin or mucous membranes shall wash or flush those areas with water as appropriate and as soon as feasible following contact.

Post-Exposure Evaluation and Follow-up

All work related exposure incidents involving blood or other potentially infectious material must be reported to Consolidated Electrical Contractors.

The source individual's blood shall be tested and documented after consent has been obtained in writing. If consent is not obtained, Consolidated Electrical Contractors shall document that the legally required consent cannot be obtained. Consolidated Electrical Contractors will also immediately offer a confidential medical evaluation and follow-up to any employee involved in the exposure incident who had contact with blood or other potentially infectious material. This evaluation and follow-up shall include:

- Documentation of the routes of exposure and the circumstances under which the exposure occurred.
- Identification and documentation of the source individual
- Collection and testing of the exposed employee's blood
- Post-exposure protective and preventative medical treatment
- Counseling
- Evaluation of reported illnesses

Should we make a consent form? Should CEC pay for surrounding employees that are subjected to exposure?

Consolidated Electrical Contractors will ensure that the healthcare professional evaluating an employee after an exposure incident is provided the following information:

- A copy of the MIOSHA blood borne pathogens regulation
- A description of the exposed employee's duties
- Documentation of the routes of exposure and the circumstances under which the exposure occurred
- Results of the source individual's blood test, if available

Consolidated Electrical Contractors shall obtain and provide the exposed employee with a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation. (SEE INSERT)

Work on Roofs

Inspect for and remove frost and other slipping hazards before getting onto roof structures.

Use a safety harness system with a solid anchor point on steep roofs with pitch greater than 8:12 or if the ground to eave height exceeds 25 feet.

Stop work on roofs when storms, high winds or other adverse weather conditions create unsafe conditions.

Disciplinary Action

Consolidated Electrical Contractors is committed to providing our employees with a safe and healthy workplace. In order to enforce compliance with jobsite safety rules, regulations and procedures and to ensure that each employee is treated fairly, Consolidated Electrical Contractors has established an employee disciplinary program.

Each Consolidated Electrical Contractors employee will be informed and trained regarding general and project specific safety requirements. This information will be communicated through employee meetings and new hire orientation.

As a condition of employment, each Consolidated Electrical Contractors employee will be expected to perform their assigned duties and tasks in a manner consistent with the project safety requirements. Observed violations by Consolidated Electrical Contractors employees will be verbally corrected as a minimum. Written disciplinary notices and disciplinary actions up to and including termination will also be used for willful or repeat safety violations.

Procedure

Any Consolidated Electrical Contractors employee observed violating a project safety rule, regulation or procedure will immediately be given a verbal warning and clearly instructed to correct the violations.

Consolidated Electrical Contractors will determine if the safety violation committed by the employee was due to ignorance, a misunderstanding or was a willful or repeat action. If it is determined that the violation was committed due to ignorance or a misunderstanding, then retraining and other instruction shall be given and the matter closed without a written safety violation.

For willful and repeat violations, a determination will be made as to the seriousness of the violation and a written disciplinary notice will be issued. The disciplinary action will vary depending on the seriousness of the violation.

A minor violation is defined as an unsafe act that is not likely to result in serious injury or significant property damage. Disciplinary actions for minor violations are as follows:

- First Notice – Retraining and instruction
- Second Notice – Three-day suspension without pay
- Third Notice – Termination

A major violation is defined as an unsafe act that is likely to result in serious injury or property damage. Disciplinary actions for major violations are at the discretion of Consolidated Electrical Contractors and may involve retraining, suspension without pay, or termination depending on the circumstances. A major violation that is willful and premeditated or a second major violation shall always result in termination of the employee.

Drug Testing

Consolidated Electrical Contractors has implemented a policy on alcohol and substance abuse testing for all employees following an accident or based on reasonable cause.

Post Accident

This policy requires drug testing following an accident that involves medical treatment beyond first aid of any person. Employees who have been sent by Consolidated Electrical Contractors for medical treatment other than first aid will be tested. Employees who cause, or may have caused, an injury to another person as a result of their actions will be tested. Guidelines similar to those used in MIOSHA record keeping shall be used in distinguishing medical care from first aid.

Reasonable Cause

This policy requires alcohol and drug testing in situations where based on physical, behavioral, or performance indicators a reasonable person would suspect the person is using drugs, alcohol or is otherwise unfit for duty as determined by Consolidated Electrical Contractors management.

If we do this where do we send the employee for each location?

Forms

Emergency Numbers
Acknowledgement Form
List of Chemicals
Revised MSDS Form
MSDS Location
Job Safety Review

Emergency Phone Number Poster

EMERGENCY PHONE NUMBERS

AMBULANCE 911

FIRE DEPT. T.C. (231) 946-0320
 Lansing (517) 483-4558
 G.R. (616) 243-0792

POLICE T.C. (231) 946-4646
 Lansing (517) 485-1700
 G.R. (616) 456-3403

HOSPITAL Munson (231) 935-5000
 Sparrow (517) 364-1000
 Spectrum (616) 391-5999

Consolidated Electrical Contractors

T.C. (231) 263-0816

Lansing (517) 484-8413

G.R. (616) 366-0111

Employee Acknowledgement Form

I acknowledge receipt of this handbook. Furthermore, I have read, understand and agree to abide by all the instructions provided in it in order to provide a safe work environment for myself as well as my co-workers.

Printed Name

Signature

Date

List of Hazardous Chemicals

Chemical Name
DAP – Beats the Nail
A/D – Fire Barrier
Gasoline
Kerosene
Chico – Sealing Compound
Ideal – Yellow 77 Wire Pulling Lubricant
Ideal – Noalox Anti-Oxidant
Sherwin – Sprayon Cutting Oil
Sherwin – Sprayon Silicone Lubricant
Carlton – Standard PVC Cement
Carlton – All Weather PVC Cement
CRC – Cable Clean (aerosol)
CRC – Electrical Silicon (aerosol)
CRC – Wasp & Hornet Killer
CRC – Contact Cleaner (aerosol)
CRC – Minimal Expanding Foam
3M – Firedam 150+ Caulk
3M – Fire Barrier
3M – Scotch-Weld Rubber Adhesive
3M – Sealing Pack (connector sealing)
3M – Scotchkote Electrical Coating

New or Revised MSDS Form

**As Required by the
Michigan
Right To
Know Law**



TO BE POSTED THROUGHOUT THE
WORKPLACE NEXT TO MSDS LOCATION POSTERS

**New or Revised
MSDS**

NEW OR REVISED TITLE	RECEIPT DATE	POSTING DATE	LOCATION OF NEW OR REVISED MSDS
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____



"Serving Michigan...Serving You"
MICHIGAN DEPARTMENT OF CONSUMER & INDUSTRY SERVICES
 Bureau of Safety & Regulation
 Consultation Education & Training Division
 7150 Harris Drive P.O. Box 30643
 Lansing, MI 48909-8143 (517)-322-1809

Print in part with
 Bureau of Safety & Regulation
 Form 2108 (Rev. 02/02)



MSDS Location Form

This Workplace Covered by the Michigan Right To Know Law



Employers must make available for employees in a readily accessible manner, Material Safety Data Sheets (MSDS)* for those hazardous chemicals in their workplace.

Employees cannot be discharged or discriminated against for exercising their rights including the request for information on hazardous chemicals.

Employees must be notified and given direction (by employer posting) for locating Material Safety Data Sheets and the receipt of new or revised MSDS(s).

* Employees may also request MSDS from the Michigan Department of Consumer & Industry Services, Bureau of Safety & Regulation, Occupational Health Division, 7150 Harris Dr., PO Box 30649, Lansing, Michigan 48909-8149, (517) 322-1608



BSR/CET #2105 (Rev. 03/02)



"Serving Michigan...Serving You"

Michigan Department Of Consumer & Industry Services

MSDS(s) For This Workplace Are Located At

LOCATION(S)

LOCATION(S)

PERSON(S) responsible for MSDS(S)

PHONE

Jobsite Safety Review

1

JOBSITE SAFETY REVIEW

A. Does not apply. Job Name _____ Job Number _____
 B. Adequate at time of review.
 C. Needs immediate attention. Date _____ Reviewer _____

A	B	C	COMMENTS/CORRECTIVE ACTIONS	CORRECTED	
				INIT	DATE
A. POSTERS & RECORDS					
			1. MIOSHA poster displayed?		
			2. Supervisors holding weekly safety meetings-recording?		
			3. Emergency medical numbers posted?		
			4. Copy of MIOSHA regulations on jobsite?		
			5. Have utility company contacts been made/recorded?		
			6. Are safety talk subjects available?		
			7. Using employee applications before hiring?		
			8. Are safety posters being displayed?		
			9. Exit signs over doors in offices & storage buildings?		
			10. Accident reporting procedure being used?		
B. HOUSEKEEPING & SANITATION					
			11. Job trailer properly set up?		
			12. General housekeeping of jobsite?		
			13. Passageways and walkways clean?		
			14. Nails removed from lumber?		
			15. Materials of all types properly stockpiled?		
			16. Is an area provided for waste & trash and is it removed regularly?		
			17. Adequate lighting in passageways, stairways and work areas?		
			18. Toilet facilities adequate & clean?		
			19. Sanitary supply of drinking water?		
			20. Disposable drinking cups & refuse container?		
C. FIRE PROTECTION					
			21. Are "NO SMOKING" or "FLAMMABLE" signs posted at all storage & fueling locations?		
			22. Clear access provided to all fire fighting equipment/are inspections recorded?		
			23. Locations of fire fighting equipment prominently marked?		
			24. Are flammable liquids stored in approved containers with flash arresters?		
			25. Fire extinguisher adequate size?		
			26. Large fuel tanks properly diked & separated?		
			27. Fuel tanks protected from damage?		
			28. Static electric bonding provided from fuel tank?		

A	B	C	COMMENTS/CORRECTIVE ACTIONS	CORRECTED	
				INIT	DATE
			29. Tanks properly labeled for contents & HazCom data?		
			30. Vehicles carrying flammables properly marked?		
			31. Charged fire extinguisher in all vehicles?		
D. FIRST AID					
			32. First aid kits well stocked?		
			33. Trained first-aiders on jobsite?		
E. ELECTRICAL					
			34. Distribution boxes covered and marked?		
			35. GFCI's in use?		
			36. Temporary lighting protected?		
			37. Generators insulated from ground? (placed on dry boards)		
			38. Electric cords, heavy duty type?		
			39. Circuits properly identified?		
			40. All extension cords equipped with ground pin?		
			41. Electric cords inspected for broken insulation & damaged plugs?		
F. TOOLS					
			42. Damaged or broken tools tagged out of service and repaired?		
			43. Proper storage space provided?		
			44. Operative guards on all power tools?		
			45. Persons using power actuated tools certified?		
			46. Are guards provided on grinders?		
			47. Air hose couplers secured with tie wire?		
			48. Tools being properly used?		
			49. Correct personal protective equipment being used?		
			50. Guards in place and used on wood working machines?		
			51. Belts, pulleys, shafts, gears & chains guarded on all machinery & equipment?		
			52. Concrete saws guarded & personal protective equipment being used?		
			53. Laser warning signs in place?		
			54. Safety switches in working order on all trowel machines?		
			55. Safety straps on boom pump hoses connections over worker's heads?		
			56. Slick line blow-out system operated by trained employee?		
G. STRUCTURES					
			57. Floor openings covered & secured or guardrailed?		
			58. Standard guard railing on scaffolds including ends, bridge decks, floors of buildings, work platforms & walkways?		

A	B	C	COMMENTS/CORRECTIVE ACTIONS	CORRECTED	
				INIT	DATE
			59. Work areas, walkways and steps clear of debris, snow, ice & grease?		
			60. Adequate fire protection?		
			61. Stairways provided with handrails?		
			62. Hollow pan treads filled with material?		
			63. Ladders properly constructed?		
			64. Side rails of ladders extend 36" above landing & secured?		
			65. Scaffold properly anchored, braced & plumb?		
			66. Protection provided over vertical & horizontal rebars in working area?		
			67. Safety belts in use when guardrails absent?		
			68. Safety lines used in suspended scaffold?		
			69. Heating devices properly ventilated?		
			70. Gates functioning on all levels when material or personnel hoists used?		
			71. Safe procedures used to wreck forms?		
			72. Scaffold grade lumber only used for scaffolds?		
			73. Scaffold installation supervised by trained personnel?		
			74. Forming & shoring erected according to plan, then inspected by a competent person?		
H. TRAFFIC CONTROL					
			75. Advance signing at approach to work area?		
			76. Correct message on sign?		
			77. Traffic control on highways meet DOT regulations?		
			78. Flag persons properly dressed & equipped?		
			79. Flag persons performing properly?		
I. WELDING & CUTTING					
			80. Using right type of personal protective equipment including eye protection & respirators?		
			81. Gauges, valves, torches & lines in good condition & free of oil & grease?		
			82. Cylinders not used capped?		
			83. Cylinders in use or stored secured upright?		
			84. Stored oxygen separate from acetylene by 20"?		
			85. Fire extinguisher near welding or cutting area?		
			86. Adequate ventilation provided?		
			87. Grounding for arc welding machine?		
			88. All parts of arc welding outfits properly insulated?		
			89. Torch sets stored only in ventilated boxes?		

A	B	C	COMMENTS/CORRECTIVE ACTIONS	CORRECTED	
				INIT	DATE
J. HEAVY EQUIPMENT					
			90. Operators wearing hard hats?		
			91. Hearing protection being used?		
			92. Dust controls?		
			93. Haul road adequate and maintained?		
			94. Equipment speeds excessive for safety?		
			95. Horns & back-up alarms functioning?		
			96. Engine shut-down when refueling or lubricating?		
			97. Seat belts used on machines with ROPS?		
			98. Steps & hand holds adequate and in safe condition?		
			99. Adequate lighting & haul roads at night?		
			100. Parked or unattended equipment have blade, forks or bucket lowered to ground?		
			101. No hitchhikers riding on equipment?		
			102. Full fire extinguisher near refueling station?		
			103. Overhead guard on fork lift truck?		
K. CRANES					
			104. Electric power lines distance from machines minimum of 10'?		
			105. Annual inspection?		
			106. Wire rope in safe condition?		
			107. Rear swing protection and pinch point guarding?		
			108. Exposed gears shafts & belts guarded?		
			109. Fire extinguisher, boom angle indicator, load capacity chart and hand signal poster in crane?		
			110. Signs and/or flags on cranes in transit?		
			111. Operator making daily inspections and tests?		
			112. Employees clear swing of crane loads?		
			113. Tag lines used on suspended crane loads?		
L. TRENCHING & EXCAVATIONS					
			114. Trenching side shored, laid back or benched?		
			115. Utilities contacted & located before digging?		
			116. Ladder in the trench sight at intervals of 25'?		
			117. Stop logs placed where necessary along top of the trench?		
			118. Excavated material stockpiled far enough from the trench, 2' back?		
			119. Traffic control adequate?		
			120. Sides of excavation for building stored or protected?		

A	B	C	COMMENTS/CORRECTIVE ACTIONS	CORRECTED	
				INIT	DATE
			121. Oxygen & flammable gas level tested in tunnel, shafts or confined space?		
			122. Public protected from exposure to open excavation?		
M. PERSONAL PROTECTIVE EQUIPMENT					
			123. Means provided for sanitizing personal protective equipment?		
			124. Sufficient quantities of approved personal protective equipment on the jobsites?		
			125. Everyone wearing hardhats?		
			126. Everyone wearing safety glasses all the time?		
			127. Back pack vibrator wearing ear protection?		
			128. Jack hammer operator wearing ear & foot protection?		
			129. Bush hammer operator using ear protection?		
N. MISCELLANEOUS					
			130. Procedures established to handle toxic and carcinogenic materials?		
			131. Sewers, vaults, tanks and bins tested for adequate oxygen & flammable gas levels before employees are permitted to enter?		
			132. Fall protection being used where required (especially steel erection)?		
			133. Walls properly braced (form work)?		
			134. If toxic fumes, vapors and dusts are present, is ventilation adequate?		
O. HAZARD COMMUNICATION					
			135. MSDS sheets on hand and recorded?		
			136. Containers properly labeled?		
			137. Employees properly trained & recorded?		
			138. HazCom signs in place?		
			139. Empty containers properly disposed of?		



**DEPARTMENT OF LABOR & ECONOMIC GROWTH
DIRECTOR'S OFFICE
OCCUPATIONAL HEALTH STANDARDS**

Filed with the Secretary of State on June 30, 1993 (as amended November 14, 1996)
(as amended June 28, 2001)

These rules take effect on October 18, 2001

(By authority conferred on the director of the department of consumer and industry services by sections 14 and 24 of 1974 PA 154, MCL 408.1014 and 408.1024, and Executive Reorganization Order Nos. 1996-1 and 1996-2, MCL 330.3101 and 445.2001)

R 325.70001, R 325.70002, R 325.70004, and R 325.70015 of the Michigan Administrative code are amended as follows:

Visit our web site at: www.michigan.gov/mioshastandards

PART 554. BLOODBORNE INFECTIOUS DISEASES

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R 325.70001 Scope.

Rule 1. These rules apply to all employers that have employees with occupational exposure to blood and other potentially infectious material.

R 325.70002 Definitions.

Rule 2. As used in these rules:

- (a) **“Act”** means 1974 PA 154, MCL 408.1001 et seq.
- (b) **“Biologically hazardous conditions”** means equipment, containers, rooms, materials, experimental animals, animals infected with HBV or HIV virus, or combinations thereof that contain, or are contaminated with, blood or other potentially infectious material.
- (c) **“Blood”** means human blood, human blood components, and products made from human blood.
- (d) **“Bloodborne pathogens”** means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include hepatitis B virus (HBV) and human immunodeficiency virus (HIV).
- (e) **“Clinical laboratory”** means a workplace where diagnostic or other screening procedures are performed on blood or other potentially infectious material.
- (f) **“Contaminated”** means the presence or the reasonably anticipated presence of blood or other potentially infectious material on an item or surface.

- (g) **“Contaminated laundry”** means laundry which has been soiled with blood or other potentially infectious materials or which may contain sharps.
- (h) **“Contaminated sharps”** means any contaminated object that can penetrate the skin, including any of the following:
 - (i) Needles.
 - (ii) Scalpels.
 - (iii) Broken glass.
 - (iv) Broken capillary tubes.
 - (v) Exposed ends of dental wires.
- (i) **“Decontamination”** means the use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.
- (j) **“Department”** means the department of consumer and industry services.
- (k) **“Director”** means the director of the department or his or her designee.
- (l) **“Disinfect”** means to inactivate virtually all recognized pathogenic microorganisms, but not necessarily all microbial forms, on inanimate objects.
- (m) **“Engineering controls”** means controls, for example, sharps disposal containers, self-sheathing needles, or safer medical devices, such as sharps with engineered sharps injury protections

- and needleless systems, that isolate or remove the bloodborne pathogen hazard from the workplace.
- (n) **“Exposure”** means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee’s duties. “Exposure” does not include incidental exposures which may take place on the job, which are neither reasonably nor routinely expected, and which the worker is not required to incur in the normal course of employment.
- (o) **“Exposure incident”** means a specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or other potentially infectious material that results from the performance of an employee’s duties.
- (p) **“Handwashing facilities”** means facilities that provide an adequate supply of running, potable water, soap, and single-use towels or a hot-air drying machine.
- (q) **“Licensed health care professional”** means a person whose legally permitted scope of practice allows him or her to independently perform the activities required by R 325.70013 concerning hepatitis B vaccination and post-exposure evaluation and follow-up.
- (r) **“Needleless systems”** means a device that does not use needles for any of the following:
- (i) The collection of bodily fluids or withdrawal of body fluids after initial venous or arterial access is established.
 - (ii) The administration of medication or fluids.
 - (iii) Any other procedure involving the potential for occupational exposure to bloodborne pathogens due to percutaneous injuries from contaminated sharps.
- (s) **“Other potentially infectious material”** means any of the following:
- (i) Any of the following human body fluids:
 - (A) Semen.
 - (B) Vaginal secretions.
 - (C) Amniotic fluid.
 - (D) Cerebrospinal fluid.
 - (E) Peritoneal fluid.
 - (F) Pleural fluid.
 - (G) Pericardial fluid.
 - (H) Synovial fluid.
 - (I) Saliva in dental procedures.
 - (J) Any body fluid that is visibly contaminated with blood.
 - (K) All body fluids in situations where it is difficult or impossible to differentiate between body fluids.
 - (ii) Any unfixed tissue or organ, other than intact skin, from a living or dead human.
 - (iii) Cell or tissue cultures that contain HIV, organ cultures, and culture medium or other solutions that contain HIV or HBV; and blood, organs, or other tissues from experimental animals infected with HIV or HBV.
- (t) **“Parenteral”** means exposure occurring as a result of piercing mucous membrane or the skin barrier, such as exposure through subcutaneous, intramuscular, intravenous, or arterial routes resulting from needlesticks, human bites, cuts, and abrasions.
- (u) **“Personal protective equipment”** or **“PPE”** means specialized clothing or equipment that is worn by an employee to protect him or her from a hazard. General work clothes, such as uniforms, pants, shirts, or blouses, that are not intended to function as protection against a hazard are not considered to be personal protective equipment.
- (v) **“Production facility”** means a facility that is engaged in the industrial-scale, large-volume production of HIV or HBV or in the high-concentration production of HIV or HBV.
- (w) **“Regulated waste”** means any of the following:
- (i) Liquid or semiliquid blood or other potentially infectious material.
 - (ii) Contaminated items that would release blood or other potentially infectious material in a liquid or semiliquid state if compressed.
 - (iii) Items which are caked with dried blood or other potentially infectious material and which are capable of releasing these materials during handling.
 - (iv) Contaminated sharps.
 - (v) Pathological and microbiological waste that contains blood and other potentially infectious material.
- (x) **“Research laboratory”** means a laboratory that produces or uses research laboratory-scale amounts of HIV or HBV. A research laboratory may produce high concentrations of HIV or HBV, but not in the volume found in a production facility.
- (y) **“Sharps with engineered sharps injury protections”** means a nonneedle sharp or a needle device which is used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, and which has a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.
- (z) **“Source individual”** means any living or dead individual whose blood or other potentially infectious material may be a source of occupational exposure to an employee. Examples of a source individual include all of the following:
- (i) A patient of a hospital or clinic.
 - (ii) A client of an institution for the developmentally disabled.
 - (iii) A victim of trauma.
 - (iv) A client of a drug or alcohol treatment facility.
 - (v) A resident of a hospice or nursing home.
 - (vi) Human remains.
 - (vii) An individual who donates or sells his or her blood or blood components.
- (aa) **“Standard operating procedures (SOPs)”** means any of the following that address the performance of work activities so as to reduce the risk of exposure to blood and other potentially infectious material:
- (i) Written policies.
 - (ii) Written procedures.
 - (iii) Written directives.
 - (iv) Written standards of practice.
 - (v) Written protocols.
 - (vi) Written systems of practice.
 - (vii) Elements of an infection control program.
- (bb) **“Sterilize”** means the use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores.
- (cc) **“Universal precautions”** means a method of infection control that treats all human blood and other potentially infectious material as capable of transmitting HIV, HBV, and other bloodborne pathogens.
- (dd) **“Work practices”** means controls that reduce the likelihood of exposure to bloodborne pathogens by altering the manner in which a task is performed.

R 325.70003 Exposure determination.

Rule 3. (1) An employer shall evaluate routine and reasonably anticipated tasks and procedures to determine whether there is actual or reasonably anticipated employee exposure to blood or other potentially infectious material. Based on this evaluation, an employer shall categorize all employees into category A or B as follows:

- (a) Category A consists of occupations that require procedures or other occupation-related tasks that involve exposure or reasonably anticipated exposure to blood or other potentially infectious material or that involve a likelihood for spills or splashes of blood or other potentially infectious material. This includes procedures or tasks conducted in nonroutine situations as a condition of employment.
 - (b) Category B consists of occupations that do not require tasks that involve exposure to blood or other potentially infectious material on a routine or nonroutine basis as a condition of employment. Employees in occupations in this category do not perform or assist in emergency medical care or first aid and are not reasonably anticipated to be exposed in any other way.
- (2) An exposure determination shall be made without regard to the use of personal protective clothing and equipment.
- (3) An employer shall determine and document a rationale for an exposure determination.
- (4) An employer shall maintain a list of all job classifications which are determined to be category A.

R 325.70004 Exposure control plan.

Rule 4. (a) If an employee is determined to be in category A, then an employer shall establish a written exposure control plan to minimize or eliminate employee exposure.

- (b) An exposure control plan shall contain all of the following information:
 - (i) The exposure determination required by R 325.70003(1).
 - (ii) The schedule and method of implementation for each of the applicable rules of these rules.
 - (iii) The contents or a summary of the training program required by R 325.70016.
 - (iv) The procedures for the evaluation of circumstances surrounding exposure incidents as required by R 325.70013(5).
 - (v) Task-specific standard operating procedures (SOPs) that address all of the following areas:
 - (A) Employee recognition of reasonably anticipated exposure to blood and other potentially infectious material.
 - (B) Appropriate selection, use, maintenance, and disposal of personal protective equipment.
 - (C) Contingency plans for foreseeable circumstances that prevent following the recommended SOPs.
- (c) General employer policies or task-specific SOPs shall address the management of inadvertent exposures such as needlesticks or mucus membrane exposures.
- (d) The exposure control plan shall be reviewed at least annually and updated as necessary. A review shall consider changes in employees' tasks and procedures and the latest information from the centers for disease control or the department. See appendix A for addresses of these agencies. The

review and update of the exposure control plans shall comply with both of the following provisions:

- (i) Reflect changes in technology that eliminate or reduce exposure to bloodborne pathogens.
 - (ii) Document annually consideration and implementation of appropriate commercially available and effective safer medical devices designed to eliminate or minimize occupational exposure.
- (e) An employer shall ensure that only a person who has knowledge of applicable control practices is authorized to write and to review an exposure control plan.
 - (f) An employer shall ensure that the exposure control plan is made available to the director or a representative of the director for examination and copying upon request.
 - (g) An employer shall ensure that a copy of the exposure control plan is accessible to category A employees in accordance with R 325.3451 et seq.
 - (h) An employer, who is required to establish an exposure control plan shall solicit input from non-managerial employees responsible for direct patient care who are potentially exposed to injuries from contaminated sharps in the identification, evaluation, and selection of effective engineering and work practice controls and shall document the solicitation in the exposure control plan.

R 325.70005 Universal precautions.

Rule 5. Universal precautions shall be observed to prevent contact with blood and other potentially infectious materials. If differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

R 325.70006 Engineering controls.

Rule 6. (1) Engineering controls shall be used in combination with work practice controls to minimize or eliminate employee exposure to blood and other potentially infectious material. Where exposure remains after use of engineering and work practice controls, personal protective equipment shall also be used.

(2) Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.

(3) An employer shall provide handwashing facilities which are readily accessible to employees. When provision of handwashing facilities is not feasible, an employer shall provide an appropriate antiseptic hand cleanser with clean cloth or paper towels or antiseptic towelettes.

R 325.70007 Work practices.

Rule 7. (1) After implementing appropriate engineering controls, an employer shall further reduce the likelihood of exposure to blood and other potentially infectious material by developing and implementing work practices for each task.

(2) At a minimum, work practices shall ensure all of the following:

- (a) All personal protective equipment shall be removed before leaving the work area and shall be placed in an appropriately designated area or container for storage, washing, decontamination, or disposal.
- (b) If a garment is penetrated by blood or other potentially infectious materials, the garment shall be removed immediately or as soon as feasible.
- (c) An employee shall wash his or her hands immediately after removing gloves or other protective clothing, as soon as possible after hand contact with blood or other potentially infectious

material, and upon leaving the work area. Hand-washing shall be completed using the appropriate facilities, such as utility or rest room sinks. Waterless antiseptic hand cleansers shall be provided on responding units to use when hand-washing facilities are not available. When hand-washing facilities are available, hands shall be washed with warm water and soap or antiseptic cleanser. When hand-washing facilities are not available, a waterless antiseptic hand cleanser shall be used. The manufacturer's recommendations for the product shall be followed. When antiseptic cleaners or towelettes are used, employees shall wash their hands with soap and water as soon as feasible.

- (d) An employer shall ensure that employees wash their hands and any other skin with soap and water following contact of such body areas with blood or other potentially infectious material, or flush mucous membranes with water, immediately or as soon as feasible after contamination.
- (e) Used needles and other contaminated sharps shall not be sheared, bent, or broken and shall not be recapped or resheathed where other disposal methods are practical. Used needles and other sharps shall not be recapped, resheathed, or removed unless the employer can demonstrate that no alternative is feasible or that such action is required by a specific medical procedure. Needle recapping or removal shall be accomplished by use of a mechanical device or a 1-handed technique. The disposal of needles and sharps shall be accomplished in accordance with the provisions of R 325.70010.
- (f) Eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses is prohibited in laboratories and other work areas where there is a reasonable likelihood of exposure.
- (g) Food and drink shall not be stored in refrigerators, freezers, shelves, cabinets, or on countertops or benchtops where blood or other potentially infectious material is present or in other areas of possible contamination.
- (h) All procedures that involve blood or other potentially infectious material shall be performed in a manner that minimizes splashing, spraying, and aerosolization of blood or other potentially infectious material.
- (i) Mouth pipetting or suctioning is prohibited.

R 325.70008 Protective work clothing and equipment.

Rule 8. (1) Protective work clothing and equipment shall be provided and used as follows:

- (a) When there is occupational exposure, an employer shall provide, at no cost to the employee, and assure that an employee uses, appropriate personal protective clothing and equipment, such as any of the following:
 - (i) Gloves.
 - (ii) Gowns.
 - (iii) Fluid-proof aprons.
 - (iv) Laboratory coats.
 - (v) Head and foot coverings.
 - (vi) Faceshields or mask and eye protection.
 - (vii) Mouthpieces.
 - (viii) Resuscitation bags.
 - (ix) Pocket masks.
 - (x) Other ventilation devices.

Personal protective equipment will be considered as appropriate only if it does not permit blood or other

potentially infectious material to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time that the protective equipment will be used.

- (b) An employer shall ensure that an employee uses appropriate personal protective equipment unless the employer shows that the employee temporarily and briefly declined to use PPE when, under rare and extraordinary circumstances, it was the employee's professional judgment that in the specific instance the use of PPE would have prevented the delivery of health care or public safety services or would have posed an increased hazard to the safety of the worker or coworker. When the employee makes this judgment, the circumstances shall be investigated and documented to determine if changes can be made to prevent future occurrences.
- (c) Where splashes can be reasonably anticipated, face shields or protective eyewear and masks shall be provided. If the conditions of exposure include the likelihood that clothing will become soaked with blood, protective outer garments, such as impervious gowns, shall be worn. Appropriate protective equipment shall be used in all of the following instances:
 - (i) In performing invasive procedures when the health care worker has cuts, scratches, or other breaks in his or her skin.
 - (ii) Where there is a high risk of skin or mucous membrane contamination with blood, for example, when performing invasive procedures on an uncooperative patient.
 - (iii) In phlebotomy when performing finger or heel sticks in infants and children.
 - (iv) When persons are receiving training in invasive procedures.
- (d) An employer shall assure that appropriate protective equipment and clothing in the appropriate sizes are readily accessible at the worksite or issued to employees at no cost to the employees. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives shall be readily accessible to employees who are allergic to the gloves normally provided. See appendix A for more information.
- (e) An employer shall provide for the cleaning, laundering, or disposing of protective clothing and equipment required by this rule.
- (f) An employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.
- (g) Gloves shall be worn by an employee if there is a reasonable anticipation of direct skin contact with blood, other potentially infectious material, mucous membranes, or nonintact skin of patients; when performing vascular access procedures, except as specified in subdivision (h) of this subrule; and when handling items or surfaces that are soiled with blood or other potentially infectious material. Gloves shall be made of material that is appropriate for a particular task. Disposable (single-use) gloves, such as surgical or examination gloves, shall be replaced as soon as practical if contaminated or as soon as feasible if torn, punctured, or ineffective as barriers. Disposable gloves shall not be washed or decontaminated for reuse. Gloves shall be changed between patient contacts. Utility gloves shall be discarded if any are

cracked, peeling, discolored, torn, or punctured or exhibit other signs of deterioration, but may be decontaminated for reuse if the integrity of the glove is maintained. Tear and puncture-resistant gloves shall be provided for procedures which involve a high risk of laceration, but which do not require a high degree of dexterity. See appendix A for supplemental information.

- (h) If an employer of a volunteer blood donation center judges that routine gloving for all phlebotomies is not necessary, the employer shall do all of the following:
- (i) Periodically reevaluate this policy.
 - (ii) Make appropriate gloves available to all employees who wish to use them for phlebotomy.
 - (iii) Not discourage the use of gloves for phlebotomy.
 - (iv) Require that gloves be used for phlebotomy in the following circumstances:
 - (A) When the employee has cuts, scratches, or other breaks in the skin on his or her hands or wrists.
 - (B) When the employee judges that hand contamination with blood may occur, for example when performing phlebotomy on an uncooperative patient.
 - (C) When the employee is receiving training in phlebotomy.
- (i) Masks and eye protection or chin-length face shields shall be worn as appropriate if splashes, sprays, spatters, droplets, or aerosols of blood or other potentially infectious material may be generated and if there is a likelihood for eye, nose, or mouth contamination. If there is a significant risk of eye protection breakage or unintended removal, protective eyewear that is suitable for the work to be performed, as required by General Industry Safety Standard Part 33., being R 408.13301 et seq. of the Michigan Administrative Code, and R 325.60001 et seq. of the Michigan Administrative Code, shall be worn.
- (j) Gowns, lab coats, aprons, clinic jackets, or similar outer garments shall be worn where appropriate if there is a reasonably anticipated exposure. Such clothing shall protect all areas of exposed skin that have a significant likelihood for contamination. The type of characteristics will depend upon the task and degree of exposure anticipated.
- (k) Surgical caps or hoods and shoe covers or boots shall be worn where appropriate if there is a reasonable anticipation of gross contamination, for example in autopsies and orthopedic surgery.
- (l) To minimize the need for direct mouth-to-mouth resuscitation, pocket masks, resuscitation bags, or other ventilation devices shall be provided in strategic locations and to trained personnel where the need for resuscitation is likely.

R 325.70009 Housekeeping.

Rule 9. (1) An employer shall assure that the worksite is maintained in a clean and sanitary condition. An employer shall determine and implement an appropriate written schedule for cleaning and for the method of decontamination based on all of the following:

- (a) The location within a facility.
- (b) The type of surface to be cleaned.
- (c) The type of soil present.
- (d) The tasks or procedures being performed.

(2) All equipment and environmental and working surfaces shall be maintained in a sanitary condition as follows:

- (a) Work surfaces shall be cleaned and appropriately decontaminated with an appropriate disinfectant in all of the following instances:
 - (i) After completion of procedures.
 - (ii) When surfaces are overtly contaminated.
 - (iii) Immediately when blood or other potentially infectious material is spilled.
 - (iv) At the end of the work shift if the surface may have become contaminated since the last cleaning. See appendix A for supplemental information.
- (b) Protective coverings such as plastic wrap, aluminum foil, or plastic-backed, absorbent paper may be used to cover equipment and environmental surfaces. These coverings shall be removed and replaced at the end of the work shift if contaminated or as soon as feasible when they become overly contaminated.
- (c) Equipment that may become contaminated with blood or other potentially infectious material shall be examined before servicing or shipping and shall be decontaminated as necessary unless the employer can demonstrate that decontamination is not feasible. If decontamination is not feasible, the employer shall ensure that a readily observable label which states the portions of the equipment that remain contaminated and which is in compliance with the provisions of R 325.70014(2)(h) is attached to the equipment. The employer shall ensure that all affected employees, the servicing representative, or the manufacturer, as appropriate, is notified that equipment decontamination is not feasible and is notified of the portions of the equipment that remain contaminated before handling, servicing, or shipping so that appropriate precautions will be taken.
- (d) All bins, pails, cans, and similar receptacles which are intended for reuse and which have a reasonable likelihood for becoming contaminated with blood and other potentially infectious material shall be inspected and decontaminated on a regularly scheduled basis and shall be cleaned and decontaminated immediately, or as soon as possible, upon visible contamination.
- (e) Broken glassware that may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means, such as a brush and dust pan, tongs, cotton swabs, or forceps.
- (f) Specimens of blood or other potentially infectious material shall be placed in a closable leakproof container during collection, handling, processing, storing, transporting, or shipping. If contamination of the outside of a primary container is likely, a second leakproof container shall be placed over the outside of the first and closed to prevent leakage during handling, processing, storing, transporting, or shipping. If puncture of the primary container is likely, it shall be placed within a leakproof, puncture-resistant secondary container. All containers shall be labeled or color-coded in accordance with the provisions of R 325.70014.
- (g) Reusable items, including reusable sharps, that have been contaminated with blood or other potentially infectious material shall be washed and decontaminated before reprocessing. The order in

which washing and decontamination shall be performed shall be chosen so as to minimize exposure to blood or other potentially infectious material. Reusable sharps shall not be stored or processed in a manner that requires reaching by hand into containers where sharps have been placed.

R 325.70010 Regulated waste disposal.

Rule 10. (1) All regulated waste that is being disposed of shall be placed in closable, leakproof containers or bags that are color-coded or labeled as required by the provisions of R 325.70014. If outside contamination of the container or bag is likely to occur, then a second leakproof container or bag that is closable and labeled or color-coded shall be placed over the outside of the first and closed to prevent leakage during handling, storage, and transport.

(2) Immediately after use, contaminated sharps shall be disposed of in closable, leakproof, puncture-resistant, disposable containers that are labeled or color-coded according to the provisions of R 325.70014. These containers shall be easily accessible to personnel; shall be located in the immediate area of use or where sharps are likely to be found, unless needles are mechanically recapped and transported through nonpublic corridors to the container; and shall be replaced routinely and not allowed to overflow.

(3) The disposal of all medical waste shall be in compliance with the provisions of sections 13801 to 13831 of Act No. 368 of the Public Acts of 1978, as amended, being §§333.13801 to 333.13831 of the Michigan Compiled Laws, and known as the medical waste regulatory act.

R 325.70011 Laundry.

Rule 11. (1) Laundry that is or may be soiled with blood or other potentially infectious material or that may contain contaminated sharps shall be treated as if it were contaminated and shall be handled as little as possible with a minimum of agitation.

(2) Contaminated laundry shall be bagged at the location where it was used and shall not be sorted or rinsed in areas where patients are cared for.

(3) Contaminated laundry shall be placed and transported in bags or containers labeled or color-coded in accordance with the provisions of R 325.70014. If laundry is wet and presents the likelihood for soaking through or leaking from the bag, it shall be placed and transported in leakproof bags.

(4) An employer shall ensure that laundry workers wear protective gloves and other appropriate personal protective work clothing while handling contaminated laundry.

(5) An employer shall ensure that all contaminated laundry is cleaned and laundered in such a way that any bloodborne pathogens present are inactivated or destroyed.

(6) When an employer follows universal precautions in the handling of all soiled laundry, alternative labeling or color coding is sufficient if it permits all employees to recognize the containers that are required to be in compliance with universal precautions.

(7) When an employer ships contaminated laundry off-site to a facility that does not use universal precautions in the handling of all laundry, the shipping employer shall use bags or containers that are labeled or color-coded in accordance with the provisions of R 325.70014.

R 325.70012 HIV and HBV research laboratories and production facilities.

Rule 12. (1) This rule applies to research laboratories and production facilities that are engaged in the culture, production, concentration, experimentation, and

manipulation of HIV and HBV. This rule applies to such laboratories and facilities in addition to the other requirements of these rules. This rule does not apply to clinical or diagnostic laboratories that are engaged solely in the analysis of blood, tissues, or organs.

(2) Research laboratories and production facilities shall be in compliance with all of the following requirements:

- (a) All infectious liquid or solid waste shall be incinerated or decontaminated by a method known to effectively destroy bloodborne pathogens before being disposed of.
- (b) Laboratory doors shall be kept closed when work involving HIV or HBV is in progress.
- (c) Contaminated materials that are to be decontaminated at a site away from the work area shall be placed in a durable, leakproof, labeled or color-coded container that is closed before being removed from the work area.
- (d) Access to the work area shall be limited to authorized persons only. Written policies and procedures shall be established whereby only persons who have been advised of the biohazard, who meet any specific entry requirements, and who comply with all entry and exit procedures shall be allowed to enter the work areas and animal rooms.
- (e) When other potentially infectious material or infected animals are present in the work area or containment module, a hazard warning sign that incorporates the universal biohazard symbol shall be posted on all access doors. The hazard warning sign shall be in compliance with the provisions of R 325.70014(1).
- (f) All activities that involve other potentially infectious material shall be conducted in biological safety cabinets or other physical containment devices within the containment module. Work with such material shall not be conducted on the open bench.
- (g) Laboratory coats, gowns, smocks, uniforms, or other appropriate protective clothing shall be used in the work area and animal rooms. Protective clothing shall not be worn outside of the work area and shall be decontaminated before being laundered.
- (h) Special care shall be taken to avoid skin contamination with other potentially infectious materials. Gloves shall be worn when handling infected animals and when making contact with other potentially infectious materials is unavoidable.
- (i) All waste from work areas, including animal rooms, shall be incinerated or decontaminated by a method known to effectively destroy bloodborne pathogens before disposal.
- (j) Vacuum lines shall be protected with high-efficiency particulate air (HEPA) filters, or equivalent filters, and liquid disinfectant traps. Filters and traps shall be checked routinely and maintained or replaced as necessary.
- (k) Hypodermic needles, syringes, and other sharp instruments shall be used only when a safer alternate technique is not feasible. Only needle-locking syringes or disposable syringe with needle units that have a needle as an integral part of the syringe shall be used for the injection or aspiration of other potentially infectious material. Extreme caution shall be used when handling needles and syringes to avoid autoinoculation and the generation of aerosols during use and disposal. A needle shall not be bent, sheared, replaced in the sheath or guard, or removed from the syringe after being used. The needle and syringe shall be

promptly placed in a puncture-resistant container and decontaminated, preferably by autoclaving, before being discarded or reused.

- (l) A spill or accident that results in an exposure incident shall be immediately reported to the laboratory director or another responsible person. Spills shall immediately be contained and cleaned up by appropriate professional staff who are trained and equipped to work with potentially concentrated infectious material.
- (m) A biosafety manual shall be prepared or adopted and reviewed and updated at least annually. Personnel shall be advised of potential hazards and shall be required to read and follow instructions on practices and procedures.
- (n) Both of the following containment equipment requirements shall be complied with:
 - (i) Class I, II, or III certified biological safety cabinets or other appropriate combinations of personal protection or physical containment devices, such as any of the following, shall be used for all activities with other potentially infectious material that poses a threat of exposure to droplets, splashes, spills, or aerosols:
 - (A) Special protective clothing.
 - (B) Respirators.
 - (C) Centrifuge safety cups.
 - (D) Sealed centrifuge rotors.
 - (E) Containment caging for animals.
 - (ii) Biological safety cabinets shall be certified when installed, at least annually, and when they are relocated.
- (3) HIV and HBV research laboratories shall be in compliance with both of the following requirements:
 - (a) Each laboratory shall contain a sink for washing hands and an eye wash station that are readily available in the work area.
 - (b) An autoclave for the decontamination of regulated wastes shall be available.
- (4) HIV and HBV production facilities shall be in compliance with all of the following requirements:
 - (a) The work areas shall be separated from areas that are open to an unrestricted traffic flow within the building. Passage through 2 sets of doors shall be the basic requirement for entry into the work area from access corridors or other contiguous areas. Physical separation of the high-containment work area from access corridors or other areas or activities may also be provided by a double-doored room for changing clothes, an airlock, or other access facility that requires passing through 2 sets of doors before entering the work area. Showers may be included as part of the changing room.
 - (b) The interior surfaces of walls, floors, and ceilings shall be water-resistant so that they can be easily cleaned. Penetrations in these surfaces shall be sealed or capable of being sealed to facilitate decontamination of the work area.
 - (c) Each work area shall contain a sink for washing hands. The sink shall be foot-operated, elbow operated, or automatically operated and shall be located near the exit door of the work area.
 - (d) Access doors to the work area or containment module shall be self-closing.
 - (e) An autoclave for the decontamination of infectious wastes shall be available within, or as near as possible to, the work area.
 - (f) A ducted exhaust air ventilation system shall be provided. This system shall create directional

airflow that draws air into the work area through the entry area. The exhaust air shall not be recirculated to any other area of the building, shall be discharged to the outside, and shall be dispersed away from occupied areas and air intakes. The proper direction of the airflow into the work area shall be verified.

(5) Additional training requirements for employees in HIV and HBV research laboratories and HIV and HBV production facilities are specified in R 325.70016(6).

R 325.70013 Vaccinations and postexposure follow-up.

Rule 13. (1) An employer shall assure that all medical evaluations and procedures are performed by or under the supervision of a licensed physician or other licensed health care professional and that all laboratory tests are conducted by an accredited laboratory.

(2) An employer shall assure that all evaluations, procedures, vaccinations, and postexposure prophylaxes are provided without cost to the employee, at a reasonable time and place, and according to current recommendations of the United States public health service, unless in conflict with provisions of this rule.

(3) An employer shall assure that all employees will receive appropriate counseling with regard to medical risks and benefits before undergoing any evaluations, procedures, vaccinations, or postexposure prophylaxes.

(4) Within 10 working days of the time of initial assignment and after the employee has received training required by the provisions of R 325.70016(5)(i), an employer shall make all of the following available to each category A employee:

- (a) A hepatitis B vaccination. If an employee initially declines vaccination, but at a later date, while still covered under these rules, decides to accept the HBV vaccine, the employer shall provide the vaccine at that time. If a booster dose or doses are recommended by the United States public health service at a future date, the booster dose or doses shall be made available.
- (b) HBV antibody testing for employees who desire such testing before deciding whether or not to receive HBV vaccination. If an employee has previously received the complete HBV vaccination series, is found to be immune to HBV by virtue of adequate antibody titer, or the vaccine is contraindicated for medical reasons, then the employer is not required to offer the HBV vaccine to that employee.
- (c) An employer shall not make participation in a prescreening program a prerequisite for receiving hepatitis B vaccination.
- (d) An employer shall assure that an employee who declines to accept hepatitis B vaccination signs a waiver statement with all of the following provisions:
 - (i) Understanding of risk.
 - (ii) Acknowledgment of opportunity of vaccination at no cost.
 - (iii) Declining vaccination.
 - (iv) Future availability of vaccination at not cost if desired, if still in at risk status. See appendix B for a sample of an acceptable waiver statement.

(5) An employer shall provide each exposed employee with an opportunity to have a confidential medical evaluation and follow-up subsequent to a reported occupational exposure incident to blood or other potentially infectious material. The evaluation and follow-up shall include, at a minimum, all of the following elements:

- (a) Documentation of the route or routes of exposure and the circumstances under which the exposure incident occurred.
- (b) Identification and documentation of the source individual, unless the employer can establish that identification is infeasible or prohibited by state or local law, shall include all of the following:
 - (i) The source individual's blood shall be tested as soon as feasible and after consent is obtained to determine HBV and HIV infectivity. If consent is not obtained, the employer shall establish that legally required consent cannot be obtained. If the source individual's consent is not required by law, his or her blood, if available, shall be tested and the results documented.
 - (ii) If the source individual is already known to be infected with HBV or HIV, testing need not be repeated.
 - (iii) Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.
- (c) Collection and testing of blood or HBV and HIV serological status shall include both of the following:
 - (i) The exposed employee's blood shall be collected as soon as feasible and tested after consent is obtained.
 - (ii) If the exposed employee consents to baseline blood collection, but not to HIV testing at that time, the sample shall be preserved for not less than 90 days. If within the 90 days the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.
- (d) Postexposure prophylaxis, when medically indicated, as recommended by the United States public health service.
- (e) Counseling on risk reduction and the risks and benefits of HIV testing in accordance with state law.
- (f) Evaluation of reported illnesses.
- (6) An employer shall ensure that the health care professional who is responsible for the hepatitis B Vaccination is provided with a copy of these rules and appendices. An employer shall ensure that the health care professional who evaluates an employee after an exposure incident is provided with all of the following information:
 - (a) A description of the affected employee's duties as they relate to the employee's exposure incident.
 - (b) Documentation of the route or routes of exposure and the circumstances under which exposure occurred.
 - (c) Results of the source individual's blood testing, if available.
 - (d) All medical records which are relevant to the appropriate treatment of the employee, including vaccination status, and which are the employer's responsibility to maintain.
 - (e) A description of any personal protective equipment used or to be used.
- (7) For each evaluation pursuant to the provisions of this rule, an employer shall obtain, and provide an employee with a copy of, the evaluating health care professional's written opinion within 15 working days of the completion of the evaluation. The written opinion shall be limited to the following information:

- (a) The health care professional's recommended limitations upon the employee's use of personal protective clothing or equipment.
- (b) Whether hepatitis B vaccination is indicated for an employee and if the employee has received such vaccination.
- (c) A statement that the employee has been informed of the results of the medical evaluation and that the employee has been told about any medical conditions which have resulted from exposure to blood or other potentially infectious material and which require further evaluation or treatment. The written opinion obtained by the employer shall not reveal specific findings or diagnoses that are unrelated to the employee's ability to wear protective clothing and equipment or receive vaccinations. Such findings and diagnoses shall remain confidential.
- (8) Medical records that are required by these rules shall be maintained in accordance with the provisions of R 325.70015.

R 325.70014 Communication of hazards to employees.

Rule 14. (1) An employer shall post signs at the entrance to work areas specified in R 325.70012. The signs shall bear the following legend:



[Name of infectious agent]

[Special requirements for entering the area]

[Name and telephone number of the laboratory director or other responsible person]

These signs shall be fluorescent orange-red with lettering and symbols in a contrasting color.

(2) Labels shall be in compliance with all of the following requirements:

- (a) Warning labels shall be affixed to containers of regulated waste, refrigerators and freezers that contain blood or other potentially infectious material, and other containers that are used to store or transport blood or other potentially infectious material, except as provided in subdivision (e) or (f) of this subrule.
- (b) Labels that are required pursuant to the provisions of this rule shall include the follow legend:



- (c) Labels shall be fluorescent orange or orange-red or predominately orange or orange-red, with lettering or symbols in a contrasting color.
- (d) Labels shall either be an integral part of the container or shall be affixed as close as safely possible to the container by string, wire, or

adhesive or by another method that prevents the loss of labels or the unintentional removal of labels.

- (e) Red bags or red containers may be substituted for labels.
 - (f) Containers of blood, blood components, or blood products which are labeled as to their contents and which have been released for transfusion or other clinical use are exempted from the labeling requirements of this rule.
 - (g) Individual containers of blood or other potentially infectious materials that are placed in a labeled container during storage, transport, shipment, or disposal are exempted from labeling requirements.
 - (h) Labels required for contaminated equipment shall be in accordance with the provisions of this subrule and shall also describe which portions of the equipment remain contaminated.
 - (i) Regulated waste that has been decontaminated need not be labeled or color-coded.
- (3) All biologically hazardous conditions shall be identified in an identical manner.

R 325.70015 Recordkeeping.

Rule 15. (1) An employer shall establish and maintain medical records for each category A employee in accordance with R 325.3451 et seq.

(2) An employer shall ensure that medical records contain, at a minimum, all of the following information:

- (a) The name and social security number of the employee.
- (b) A copy of the employee's hepatitis B vaccination status, including the dates administered and medical records relating to the employee's ability to receive a vaccination as required by R 325.70013.
- (c) A copy of the medical history and all results of physical examinations, medical testing, and follow-up procedures as they relate to either of the following:
 - (i) The employee's ability to wear protective clothing and equipment and receive vaccination.
 - (ii) Postexposure evaluation after an occupational exposure incident.
- (d) The employer's copy of the physician's written opinion.
- (e) A copy of the information provided to the physician as required by R 325.70013(6).

(3) An employer shall assure that employee medical records that are required by this rule are kept confidential and are not disclosed or reported without the employee's express written consent to any person within or outside the workplace, except as required by this rule or as may be required or permitted by law.

(4) An employer shall maintain employee medical records for not less than the duration of employment plus 30 years in accordance with R 325.3451 et seq.

(5) An employer shall develop and maintain training records for each category A employee. Training records shall be maintained for 3 years beyond the date that the training occurred.

(6) Training records shall include all of the following information:

- (a) The dates of the training sessions.
- (b) The contents or a summary of the training sessions.
- (c) The names and qualifications of persons who conduct the training.
- (d) The names and job titles of all persons who attend the training sessions.

(7) An employer shall assure that all records that are required to be maintained by these rules shall be made available, upon request, to representatives of the department or the director for examination and copying.

(8) An employer shall ensure that employee training records are provided, upon request, for examination and copying to employees, employee representatives, and the director in accordance with R 325.3451 et seq.

(9) An employer shall ensure that employee medical records are provided, upon request, for examination and copying to the subject employee, to anyone who has the written consent of the subject employee, and to the director in accordance with R 325.3451 et seq.

(10) An employer shall comply with the requirements that involve the transfer of records set forth in R 325.3451 et seq.

(11) If an employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, then the employer shall notify the director, not less than 3 months before disposing of the records, and shall transmit the records to the director if required by the director to do so within the 3-month period.

(12) All of the following provisions apply to a sharps injury log:

- (a) An employer shall establish and maintain a sharps injury log for the recording of percutaneous injuries from contaminated sharps. The information in the sharps injury log shall be recorded and maintained in a manner that protects the confidentiality of the injured employee. At a minimum, a sharps injury log shall contain all of the following information:
 - (i) The type and brand of device involved in the incident.
 - (ii) The work unit or work area where the exposure incident occurred.
 - (iii) An explanation of how the incident occurred.
- (b) The requirement to establish and maintain a sharps injury log applies to any employer who is required to maintain a log of occupational injuries and illnesses under R 408.22101 et seq., being Part 11. Recording and Reporting of Occupational Injuries and Illnesses.
- (c) A sharps injury log shall be maintained for the period required by R 408.22101 et seq., Part 11. Recording and Reporting of Occupational Injuries and Illnesses.

R 325.70016 Information and training.

Rule 16. (1) An employer shall ensure that all category A employees participate in a training program provided at no cost to the employees and during working hours.

(2) Training shall be provided at the time of initial assignment to category A work or within 90 days after the effective date of these rules, whichever is later, and at least annually thereafter. If an employee has received training on bloodborne pathogens in the year preceding the effective date of these rules, only training with respect to requirements of this rule that were not included in the previous training need to be provided.

(3) An employer shall provide additional training when changes, such as the modification of tasks or procedures or the institution of new tasks or procedures, affect an employee's occupational exposure. The additional training may be limited to addressing the new exposures created.

(4) Material appropriate in content and vocabulary to the educational level, literacy, and language background of employees shall be used.

(5) The training program shall contain all of the following elements:

- (a) Accessibility of the copy of these rules and an explanation of the contents of these rules, including appendices.
 - (b) A general explanation of the epidemiology and symptoms of bloodborne diseases.
 - (c) An explanation of the modes of transmission of bloodborne pathogens.
 - (d) An explanation of the employer's exposure control plan, including the standard operating procedures, and how an employee can access the written plan.
 - (e) An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious material.
 - (f) An explanation of the use and limitations of practices that will prevent or reduce exposure, including appropriate engineering controls, work practices, and personal protective equipment.
 - (g) Information on all of the following with respect to personal protective clothing and equipment:
 - (i) Types.
 - (ii) Proper use.
 - (iii) Limitations.
 - (iv) Location.
 - (v) Removal.
 - (vi) Handling.
 - (vii) Decontamination.
 - (viii) Disposal.
 - (h) An explanation of the basis for selecting protective clothing and equipment.
 - (i) Information on the hepatitis B vaccine and postexposure prophylaxis, including all of the following information:
 - (i) Availability.
 - (ii) Efficacy.
 - (iii) Safety.
 - (iv) The benefits of being vaccinated.
 - (v) Method of administration.
 - (vi) That vaccination is free of charge.
 - (j) Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious material.
 - (k) An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident, and the medical follow-up and counseling that will be made available.
 - (l) An explanation of the signs and labels or color coding required by the provisions of R 325.70014.
- (6) Employees in HIV or HBV research laboratories and HIV/HBV production facilities shall receive the following initial training in addition to the training requirements specified in subrule (5) of this rule:
- (a) Employees shall be trained in, and demonstrate proficiency in, standard microbiological practices and techniques and in the practices and operations specific to the facility before being allowed to work with HIV and HBV.
 - (b) Employees shall be experienced in the handling of human pathogens or tissue cultures before working with HIV and HBV.
 - (c) A training program shall be provided to employees who have not had experience in handling human pathogens. Initial work activities shall not include the handling of infectious agents. A progression of work activities shall be assigned as techniques are learned and proficiency is developed. An employee shall participate in work activities that involve infectious agents only after proficiency has been demonstrated.

- (7) Training shall be conducted in the following manner:
 - (a) All employees in category A positions shall receive initial training and annual retraining.
 - (b) Training sessions shall afford employees ample opportunity for discussion and the answering of questions by a knowledgeable trainer.
 - (c) The training shall include opportunities for supervised practice with personal protective equipment and other equipment which is designed to reduce the likelihood for exposure and which will be used in the employee's work.
 - (d) The person or persons who conduct training shall be knowledgeable in all of the following areas:
 - (i) The information presented in the training session.
 - (ii) The employer's exposure control plan.
 - (iii) Conditions of the work environment that affect the implementation of the exposure control plan.
 - (e) An employer shall maintain written documentation of attendance at training.
 - (f) An employer may reduce the training specified in subrule (5) of this rule to allow for the previous training of an employee who has received the training from other employment or another academic source. In such cases, the previous training shall be evaluated and documented. At a minimum, an employer shall provide an employee with workplace-specific training that covers the exposure control plan and SOPs.

R 325.70017 Appendices; effect.

Rule 17. Appendices A and B to these rules are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations. Appendices A and B may be obtained from the Michigan Department of Consumer and Industry Services, Occupational Health Division, P.O. Box 30649, Lansing, Michigan 48909.

R 325.70018 Availability of rules; permission to reproduce.

Rule 18. (1) Copies of these rules are available to affected employers and employees from the Michigan Department of Consumer and Industry Services, Occupational Health Division, P.O. Box 30649, Lansing, Michigan 48909.

(2) Permission to reproduce any of these documents in full is granted by the director.

APPENDICES TO MIOSHA STANDARD FOR BLOODBORNE INFECTIOUS DISEASES (R 325.70001 - R 325.70018)

APPENDIX A--INFORMATION SHEET

Occupations with Potential for Exposure

The hazard of exposure to infectious materials affects employees in many types of employment and is not restricted to the healthcare industry. In the list below are a number of job classifications that may be associated with tasks that have occupational exposure to blood and other potentially infectious materials. The scope of the standard is not limited to employees in these jobs. At the same time, employees in the following jobs are not automatically covered unless they have reasonably anticipated occupational exposure:

- Barbers
- Beauticians
- Chiropractors
- Correctional officers
- Day care center workers
- Dental care workers
- Dentists
- Dialysis personnel
- Emergency medical technicians
- Fire fighters
- Foster home workers
- Health care facility support staff
- Housekeepers
- Institutional home workers
- Janitors
- Laboratory workers
- Laundry workers
- Law enforcement employees assigned to provide emergency first aid
- Maintenance workers
- Medical assistants
- Medical health residential workers
- Morticians
- Nursing personnel (professional and nonprofessional)
- Optometrists
- Paramedics
- Phlebotomists
- Physician assistants
- Physicians
- Plumbers
- Podiatrists
- Police officers
- Tattooists

Addresses – Centers for Disease Control CDC and Michigan Department of Consumer and Industry Services (MDCIS)

For current guidelines, contact:

National Prevention Information Network
P.O. Box 6003
Rockville, Maryland 20850
Phone: 1-800-458-5231
Internet Address: www.cdcnpin.org
E-mail Address: info@cdcnpin.org

and

Michigan Department of Consumer and Industry
Services, Occupational Health Division
P.O. Box 30649
Lansing, Michigan 48909
(517) 322-1608

Engineering Controls

Engineering controls including ventilation systems and enclosures such as glove boxes, ventilation cabinets, laboratory hoods and tight fitting lids SHOULD be used to effectively isolate and contain spatters, splashes, mists and aerosols of blood, and other potentially infectious material generated from tissue homogenizers, sonicators, vortex mixers, centrifuges and other items capable of generating splashes, spatters, mists and aerosols. Engineering controls such as self-retracting needles, self-sealing capillary tubes and break resistant tubes should be used to prevent contact with blood or other potentially infectious material.

Disinfectants

Appropriate disinfectants for hospital cleaning including sodium hypochlorite diluted between 1:10 and 1:100 with water or other equally effective disinfectant. Antiseptics available and safe for hands include alcoholic foam cleansers, disposable alcoholic tissue wipes, or even washcloths soaked with 70-90% alcohol. It should be noted that waterless antiseptics are most effective in the absence of gross soil.

Occupations Requiring Tear and Puncture Resistant Gloves

Some occupations which may require tear and puncture resistant gloves are morticians, pathologists, mortuary workers, emergency medical technicians, corrections officers, fire fighters, police officers and other law enforcement occupations.

Gloves

Hypoallergenic gloves may include latex but should not be limited to latex and the new improved glove types (such as vinyl) may be available on the market in the future.

Inappropriate "baggy" gloves, for example, as used by bakers, etc., are not meant for contact with blood of the potentially infectious material.

APPENDIX B--SAMPLE WAIVER STATEMENT WHEN AN EMPLOYEE DECLINES THE HEPATITIS B VACCINATION

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Employee Name (print): _____

Employee Signature: _____

Date: _____



Michigan Occupational Safety and Health Administration
PO Box 30643
Lansing, Michigan 48909-8143
Ph: 517.322.1814
Fx: 517.322.1775

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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on March 2, 1983 (as amended November 15, 1989)
(as amended May 31, 1995) (as amended May 14, 1997) (as amended April 4, 2014)
(as amended May 21, 2015)

These rules become effective immediately upon filing with the Secretary of State
unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs
by sections 16 and 21 of 1974 PA 154, MCL 408.1016 and 408.1021,
and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4, and 2011-4,
MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.13301a, R 408.13385, R 408.13387, and R 408.13387a of the Michigan Administrative Code are amended
and R 408.13388 and R 408.13389 of the Code are added, as follows:

PART 33. PERSONAL PROTECTIVE EQUIPMENT

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GENERAL PROVISIONS

R 408.13301 Scope.

Rule 3301. (1) This standard shall apply to all places of general industry employment in this state and includes requirements of the employer and use by the employee of personal protective equipment and provides reasonable and adequate means, ways, and methods for the proper selection and safe use of this equipment.

(2) Hearing protection shall be in compliance with Occupational Health Standard Part 380 "Occupational Noise Exposure," as referenced in R 408.13301a.

(3) Respiratory protection shall be in compliance with Occupational Health Standard Part 451 "Respiratory Protection," as referenced in R 408.13301a.

R 408.13301a Adopted and referenced standards.

Rule 3301a. (1) The following standards are adopted by reference in these rules and are available from IHS Global, 15 Inverness Way East, Englewood, Colorado, 80112, USA, telephone number: 1-800-854-7179 or via the internet at website: www.global.ihs.com, at a cost of the time of adoption of these rules, as stated in this subrule.

(a) American National Standards Institute Standard (ANSI) Z-41, "American National Standard for Personal Protection -- Protective Footwear," 1999 edition. Cost \$25.00.

(b) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 2003 edition. Cost \$82.00.

(c) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 1989 edition, revised 1998. Cost \$148.00.

(d) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 1989 edition. Cost: \$148.00.

(e) American Society of Testing Materials Standard (ASTM) D-120, "Standard Specification for Rubber Insulating Gloves," 2009 edition. Cost: \$58.00.

(f) ASTM D-178, "Standard Specification for Rubber Insulating Matting," 2001 edition with 2010 supplement. Cost \$47.00.

(g) ASTM D-178, "Standard Specification for Rubber Insulating Matting," 1993 edition. Cost \$56.00.

(h) ASTM D-1048, "Standard Specification for Rubber Insulating Blankets," 2012 edition. Cost \$47.00.

(i) ASTM D-1049, "Standard Specification for Rubber Insulating Covers," 1998 edition with 2010 supplement. Cost \$47.00.

(j) ASTM D-1050 "Standard Specification for Rubber Insulating Line Hose," 2005 edition with 2011 supplement. Cost \$47.00.

(k) ASTM D-1051 "Standard Specification for Rubber Insulating Sleeves," 2008 edition. Cost \$58.00.

(l) ASTM F-478 "Standard Specification for In-Service Care of Insulating Line Hose and Covers," 2009 edition. Cost \$52.00.

(m) ASTM F-479 "Standard Specification for In-Service Care of Insulating Blankets," 2006 edition with 2011 supplement. Cost: \$47.00.

(n) ASTM F-496 "Standard Specification for In-Service Care of Insulating Gloves and Sleeves," 2008 edition. Cost \$58.00.

(o) ASTM F-2412, "Standard Test Methods for Foot Protection," 2005 edition. Cost \$64.00.

(p) ASTM F-2413, "Standard Specification For Performance Requirements For Protective Footwear," 2005 edition. Cost \$56.00.

(q) ASTM F-819 "Standard Terminology Relating to Electrical Protective Equipment for Workers," 2010 edition. Cost \$41.00.

(r) ASTM F-1236 "Standard Guide for Visual Inspection of Electrical Protective Rubber Products," 1996 edition with 2012 supplement. Cost: \$47.00.

(s) Institute of Electrical and Electronics Engineers IEEE Standard 516 "Guide for Maintenance Methods on Energized Power Lines," 2009 edition. Cost: \$135.00.

(2) The following standards are adopted by reference in these rules and are available from Document Center, Inc., Customer Service, 121 Industrial Road, Suite 8, Belmont, CA 94002, USA, telephone: (650) 591-7600 or via the internet at website: www.document-center.com; at a cost as of the time of adoption of these rules, as stated in this subrule.

(a) ANSI Z-89.1 "American National Standard for Industrial Head Protection," 2009 edition. Cost \$61.25.

(b) ANSI Z-89.1, "American National Standard for Industrial Head Protection," 2003 edition. Cost: \$20.00.

(c) ANSI Z-89.1 "American National Standard for Personnel Protection—Protective Headwear for Industrial Workers--Requirements," 1997 edition. Cost: \$20.00.

(3) The standards adopted in these rules are available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143.

(4) Copies of the standards adopted in these rules may be obtained from the publisher or may be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

(5) The following Michigan occupational safety and health standards (MIOSHA) are referenced in these rules. Up to 5 copies of these standards may be obtained at no charge from the Michigan Department of licensing and regulatory affairs, MIOSHA Regulatory Services section, 7150 Harris Drive, P.O. Box 30643, Lansing, MI, 48909-8143 or via the internet at website: www.michigan.gov/mioshastandards. For quantities greater than 5, the cost, at the time of adoption of these rules, is 4 cents per page.

(a) Construction Safety Standard Part 45 "Fall Protection," R 408.44501 to R 408.44502.

(b) Occupational Health Standard Part 380 "Occupational Noise Exposure" R 325.60101 to R 325.30128.

(c) Occupational Health Standard Part 451 "Respiratory Protection," R 325.60051 to R 325.60052.

(d) General Industry Safety Standard Part 86 "Electric Power Generation, Transmission, and Distribution," R 408.18601 to R 408.18605.

(6) The appendices are informational only and are not intended to create any additional obligations or requirements not otherwise imposed or to detract from any established obligations or requirements.

R 408.13302 Definitions, A to E.

Rule 3302. (1) "Absorptive lens" means a filter lens whose physical properties are designed to attenuate the effect of glare, reflective, and stray light.

(2) "Apparatus" means electrical equipment.

(3) "Bare hand technique" means a method of working on energized conductors by isolating the employee from any ground potential and by placing the employee in continuous firm contact with the energized electric field.

(4) "Bump hat or cap" means a device worn on the head to protect the wearer from bumps or blows but which does not meet the requirements of protective helmets.

(5) "Chin protector" means the portion of a device that offers protection to a wearer's chin, lower face, and neck.

(6) "Conductor" means a material, such as a bus bar, wire, or cable, suitable for carrying an electric current.

(7) "Corrective lens" means a lens ground to the wearer's individual prescription.

(8) "Cover lens" means a removable disc or colorless glass, plastic-coated glass, or plastic that covers a filter lens and protects it from weld spatter, pitting, or scratching when used in a goggle.

(9) "Cover plate" means a removable pane of colorless glass, plastic-coated glass, or plastic that covers a filter plate and protects it from weld spatter, pitting, or scratching when used in a helmet, hood, or goggle.

(10) "Energized" also known as "live," means to be electrically charged, or that to which voltage is being applied.

(11) "Eye size" means a measurement expressed in millimeters and denoting the size of the lens-holding section of an eye frame

R 408.13303 Definitions; F, G.

Rule 3303. (1) "Face shield" means a device worn in front of the eyes and a portion or all of the face, whose predominant function is protection of the eyes and face.

(2) "Filter lens" means a lens that attenuates specific wavelengths of ultraviolet, visible, and infrared radiation according to the composition and density of the lens.

(3) "Filter plate" means a removable pane in the window of a helmet, hood, or goggle that absorbs varying proportions of the ultraviolet, visible, and infrared rays according to the composition and density of the plate.

(4) "Foot or toe protection" means a device or equipment, such as, but not limited to, safety toe footwear, toe protectors, or foot guards, that protects an employee's foot or toes against injury.

(5) "Footwear" means apparel worn on the feet, such as shoes, boots, slippers, or overshoes, excluding hosiery.

(6) "Frame" means a device which holds the lens or lenses on the wearer.

(7) "Front" means the part of a spectacle or goggle frame that is intended to contain the lens or lenses.

(8) "Goggle" means a device with contour-shaped eyecups or facial contact with glass or plastic lenses, worn over the eyes and held in place by a headband or other suitable means for the protection of the eyes and eye sockets.

R 408.13304 Definitions; H, I.

Rule 3304. (1) "Hair enclosure" means a hat, cap, or hair net specifically designed to protect the wearer from hair entanglement in moving machinery.

(2) "Handshield" means a hand-held welding helmet. See "welding helmet."

(3) "Headband" means that part of a goggle, helmet, or hood suspension consisting of a supporting band that encircles the head.

(4) "Headgear" means that part of a protective helmet, hood, or faceshield that supports the device on the wearer's head, usually consisting of a headband and crown strap.

(5) "Helmet" also called a hard hat or cap, means a device that is worn on the head that is designed to provide limited protection against impact, flying particles, or electric shock.

(6) "Hood" means a device that is worn to provide protection against acids, chemicals, abrasives, and temperature extremes and entirely encloses the whole head including face, neck, and shoulders. Air line hoods and hoods used to protect wearers from inhalation or harmful atmospheres are not included in this part.

(7) "Isolated" means that all energized conductors or the exposed energized parts of equipment are isolated from the work area by an insulated barrier. Conductors may be isolated by moving them out of reaching distance by use of hot line tools.

R 408.13305 Definitions; L to R.

Rule 3305. (1) "Lanyard" means a tether attached to a safety belt or harness at one end and to a lifeline or a fixed object at the other.

(2) "Lens" means the transparent part of a protective device through which the wearer sees, also referred to as a plate or window for some devices.

(3) "Lifeline" means a rope line, except where used in tree trimming, attached at one end to a fixed object or attended by a person and to which a safety belt or lanyard is secured.

(4) "Lift-front" means a type of mounting frame for a welding helmet, hood, or goggles which is made of 2 connected parts. The front part, which may be removed from the line of vision, contains the high density filter plate with its cover plate, and the back part, which is fixed to the helmet, contains a low density or clear impact resistant plate.

(5) "Light" means an optical radiation weighted by its ability to cause visual sensations.

(6) "Manufacturer" means a business entity that marks or directs the permanent marking of the components or complete devices as compliant with this standard, and sells them as compliant.

(7) "Metatarsal guards" means guards that are designed to protect the top of the foot from the toes to the ankle over the instep of the foot. These guards may be attached to the outside of shoes.

(8) "Non-removable lens" means a lens and holder that are homogeneous and continuous.

(9) "Plano lens" means a lens which does not incorporate a corrective prescription; this lens is not necessarily flat.

(10) "Prescription lens" means a lens manufactured to the wearer's individual corrective prescription.

(11) "Protective footwear" means footwear that is designed, constructed, and classified to protect the wearer from a potential hazard or hazards.

(12) "Protective helmet," "protective hat or cap", or "safety hat or cap" means a rigid device, often referred to as a safety cap or hat, that is worn to provide protection for the head or portions thereof against impact, flying particles, or electric shock, or any combination thereof, and which is held in place by a suitable suspension.

(13) "Protector" means a device that provides eye or face protection against the hazards of processes encountered in employment.

(14) "Radiant energy or radiation" means the following kinds of radiant energy which are pertinent to this standard:

- (a) Ultraviolet.
- (b) Visible light.
- (c) Infrared.

(15) "Reaching distance" means the employee's reach as extended by a conductive material or equipment.

R 408.13306 Definitions; S to W.

Rule 3306. (1) "Safety belt" means a device, usually worn around the waist which, by reason of its attachment to a lanyard and lifeline or a structure, will prevent a worker from falling.

(2) "Safety harness" means a belt with a shoulder strap worn around the waist and shoulder and capable of restraining a pull or fall of an employee.

(3) "Safety strap" means a restraining line secured at both ends to a safety belt or harness to hold an employee to a fixed object.

(4) "Safety toe footwear" means footwear containing a safety toe box of steel or equivalent material capable of meeting the requirements of this part.

(5) "Sanitizing" means an act or process of destroying organisms that may cause disease.

(6) "Shield" means a device to be held in the hand, or supported without the aid of the operator, whose predominant function is protection of the eyes and face.

(7) "Shell" means the portion of welding helmet or handshield that covers the wearer's face and is the part of a helmet which includes the outermost surface.

(8) "Side shield" means a part of, or attachment to, a spectacle that provides side impact resistance.

(9) "Snood" means a flexible attachment to the back of a hood or helmet for protection against injury to the back of the head and neck.

(10) "Spectacles" also known as "safety glasses" means a protective device intended to shield the wearer's eyes from certain hazards, depending on the spectacle type; also means a device patterned after conventional-type spectacle eyewear, but of more substantial construction, with or without sideshields, and with plano or corrective impact resistant lenses of clear or absorptive filter glass or plastic.

(11) "Temple" means the part of a spectacle frame commonly attached to the front and generally extending behind the ear of the wearer.

(12) "Toe guards" means the guards that fit over the toes of regular shoes to protect the toes from impact and compression hazards. These guards may be attached to the outside of shoes.

(13) "Welding goggle" means a goggle intended for limited welding applications.

(14) "Welding faceshield" means a faceshield intended for limited welding applications. Faceshields shall be used only in conjunction with spectacles or goggles or both.

(15) "Welding helmet" means a protective device intended to provide protection for the eyes and face against optical radiation and weld spatter, which shall be worn only in conjunction with spectacles or goggles.

(16) "Window" means the lens portion of a face shield (See definition of "lens" in R 408.13305(2).)

HAZARD ASSESSMENT

R 408.13308 Personal protective hazard assessment and equipment selection.

Rule 3308. (1) An employer shall assess the workplace to determine if hazards are present, or are likely to be present, that necessitate the use of personal protective equipment.

(2) If the hazards are present or are likely to be present then the employer shall do all of the following:

(a) Select, and have each affected employee use, the types of personal protective equipment that will protect the affected employee from the hazards identified in the hazard assessment.

(b) Communicate selection decisions to each affected employee.

(c) Select the personal protective equipment that properly fits each affected employee.

(d) Select personal protective equipment that shall be designed and constructed to be safe for the work to be performed.

Note: Non-mandatory Appendix B contains an example of procedures that complies with the requirement for a hazard assessment.

(3) An employer shall verify that the required workplace hazard assessment has been performed through a written certification which identifies all of the following information:

(a) The workplace evaluated.

(b) The person certifying that the evaluation has been performed.

(c) The date or dates of the personal protective hazard assessment.

(d) The document is a certification of hazard assessment.

TRAINING

R 408.13309 Personal protective equipment training.

Rule 3309. (1) An employer shall provide training to each employee who is required by these rules to use personal protective equipment. The training shall include all of the following:

(a) When personal protective equipment is necessary.

(b) What personal protective equipment is necessary.

(c) How to properly don, doff, adjust, and wear the personal protective equipment.

(d) The limitations of the personal protective equipment.

(e) The proper care, maintenance, useful life, and disposal of the personal protective equipment.

(2) Each affected employee shall demonstrate an understanding of the training specified in subrule (1) of this rule and the ability to use the equipment properly before being allowed to perform work requiring the use of personal protective equipment.

(3) When an employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by subrule (2) of this rule, the employer shall retrain the employee. The occurrence of any of the following circumstances requires retraining:

(a) Changes in the workplace that render previous training obsolete.

(b) Changes in the types of personal protective equipment to be used that render previous training obsolete.

(c) Inadequacies in an affected employee's knowledge or use of assigned personal protective equipment which indicate that the employee has not retained the requisite understanding or skill.

R 408.13310 Employer's and employee's responsibilities.

Rule 3310. (1) An employer shall not permit defective or damaged personal protective equipment to be used.

(2) An employee shall use all of the personal protective equipment provided by the employer.

PAYMENT FOR PERSONAL PROTECTIVE EQUIPMENT

R 408.13310a Payment for personal protective equipment (PPE).

Rule 3310a. (1) An employer shall provide at no cost to employees the personal protective equipment necessary to protect against hazards that the employer is aware of as a result of any required assessments.

(2) An employer shall pay for replacement PPE, as necessary, under either of the following conditions:

(a) When the PPE no longer provides the protection it was designed to provide.

(b) When the previously provided PPE is no longer adequate or functional.

(3) When an employee has lost or intentionally damaged the PPE issued to him or her, an employer is not required to pay for its replacement and may require the employee to pay for its replacement.

(4) An employer is not required to pay for prescription safety eyewear with removable or permanent sideshields if the employer provides safety eyewear that fits over an employee's prescription lenses.

(5) An employer is not required to pay for non-specialty prescription safety eyewear, provided that the employer permits these items to be worn off the job-site.

(6) An employer is not required to pay for non-specialty safety-toe protective footwear, including steel-toe shoes or steel-toe boots, provided that the employer permits these items to be worn off the job-site.

(7) An employer shall provide, at no cost to employees, metatarsal guards attachable to shoes when metatarsal protection is necessary if both the following apply:

(a) If metatarsal protection is necessary and an employer requires employees to use metatarsal shoes instead of detachable guards, then the employer shall provide the metatarsal shoe at no cost to the employee.

(b) If an employer provides metatarsal guards and allows the employee, at his or her request, to use shoes or boots with built-in metatarsal protection, then the employer is not required to pay for the metatarsal shoes or boots.

(8) An employer is not required to pay for either of the following:

(a) Everyday clothing, including any of the following:

(i) Long-sleeve shirts.

(ii) Long pants.

(iii) Street shoes.

(iv) Normal work boots.

(v) Ordinary clothing.

(vi) Skin creams.

(b) Other items used solely for protection from weather, including any of the following:

(i) Winter coats.

(ii) Jackets.

(iii) Gloves.

(iv) Parkas.

(v) Rubber boots.

(vi) Hats.

(vii) Raincoats.

(viii) Ordinary sunglasses.

(ix) Sunscreen.

(9) An employer shall pay for protection when ordinary weather gear is not sufficient to protect an employee and special equipment or extraordinary clothing is needed to protect the employee from unusually severe weather conditions. Clothing used in artificially-controlled environments with extreme hot or cold temperatures, such as freezers, is not considered part of the weather gear exception.

(10) All of the following apply to upgraded and personalized PPE:

(a) An employer is not required to pay for PPE requested by an employee that exceeds the PPE requirements, provided that the employer provides PPE that meets the standards at no cost to the employee.

(b) If an employer allows an employee to acquire and use upgraded or personalized PPE, then the employer is not required to reimburse the employee for the equipment, provided that the employer has provided adequate PPE at no cost to the employee.

(c) An employer shall evaluate an employee's upgraded or personalized PPE to ensure that it complies with all of the following:

(i) Is adequate to protect from hazards present in the workplace.

(ii) Is properly maintained.

(iii) Is kept in a sanitary condition.

(11) If the provisions of another MIOSHA standard specify that the employer shall pay for specific equipment, then the payment provisions of that standard prevails.

EYE AND FACE PROTECTION

R 408.13311 Eye and face protection; consensus standards.

Rule 3311. (1) All protective eye and face protection devices, shall be in compliance with any of the following consensus standards:

(a) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 2003 edition, as adopted in R 408.13301a.

(b) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 1989 (Revised 1998) edition, as adopted in R 408.13301a.

(c) ANSI Z-87.1 "American National Standard Practice for Occupational and Educational Eye and Face Protection," 1989 edition, as adopted in R 408.13301a.

(2) Protective eye and face protection devices that the employer demonstrates are at least as effective as protective eye and face protection devices that are constructed in accordance with 1 of the consensus standards adopted in subrule (1) of this rule shall be considered to be in compliance with this rule.

R 408.13312 Use of eye and face protection.

Rule 3312. (1) An employer shall ensure that each affected employee uses appropriate eye or face protection, when exposed to eye or face hazards from any of the following:

- (a) Flying objects or particles.
- (b) Harmful contacts.
- (c) Exposures.
- (d) Molten metal.
- (e) Liquid chemicals.
- (f) Acids or caustic liquids.
- (g) Chemical fumes, gases or vapors.
- (h) Glare.
- (i) Injurious radiation.
- (j) Electrical flash.
- (k) A combination of these hazards

Note: Appendix B, Appendix Table 1, "Eye and Face Protector Selection Chart," and Appendix Figure 1, "Eye and Face Protective Devices Chart," which shall be used as a guide in the selection of the proper eye and face protection.

(2) An employer shall ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors, such as clip-on or slide-on sideshields, that are in compliance with the pertinent requirements of this rule are acceptable.

(3) A protector shall be in compliance with all of the following minimum requirements:

- (a) Provides adequate protection against the particular hazards for which it is designed.
- (b) Fits snugly and does not unduly interfere with movements of the wearer.
- (c) Is capable of withstanding sanitizing.

(4) An employer shall ensure that eye and face personal protective equipment is distinctly marked to facilitate identification of the manufacturer.

(5) Limitations or precautions indicated by the manufacturer shall be transmitted to the user and care taken to ensure that the limitations or precautions are observed.

R 408.13312a Filter lenses.

Rule 3312a. (1) An employer shall ensure that each affected employee uses equipment that has filter lenses which have shade numbers appropriate for the work being performed for protection from injurious light radiation.

(2) Table 1 is a listing of appropriate shade numbers for various operations.

(3) Table 1 reads as follows:

TABLE 1 FILTER LENSES FOR PROTECTION AGAINST RADIANT ENERGY			
OPERATIONS	PLATE THICKNESS (INCHES)	PLATE THICKNESS (MM)	MINIMUM* PROTECTIVE SHADE
Gas Welding: Light Medium Heavy	Under 1/8 1/8 to 1/2 Over 1/2	Under 3.2 3.2 to 12.7 Over 12.7	4 5 6
Oxygen Cutting Light Medium Heavy	Under 1 1 to 6 Over 6	Under 25 25 to 150 Over 150	3 4 5
OPERATIONS	ELECTRODE SIZE 1/32 IN.	ARC CURRENT	MINIMUM* PROTECTIVE SHADE
Shield metal Arc welding	Less than 3 3 to 5 more than 5 to 8 more than 8	Less than 60 60 to 160 161 to 250 251 to 550	7 8 10 11
Gas metal arc welding and flux	cored arc welding	Less than 60 60 to 160 161 to 250 251 to 500	7 10 10 10
Gas tungsten arc	welding	Less than 50 50 to 150 151 to 500	8 8 10
Air carbon Arc cutting	(Light) (Heavy)	Less than 500 500 to 1000	10 11
Plasma arc welding		Less than 20 20 to 100 101 to 400 401 to 800	6 8 10 11
Plasma arc cutting	(Light)** (Medium)** (Heavy)**	Less than 300 300 to 400 401 to 800	8 9 10
Torch brazing Torch soldering Carbon arc welding			3 2 14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade that gives a sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

** These values apply where the actual arc is clearly seen. Experience has shown that light filters may be used when the arc is hidden by the workpiece.

R 408.13313 Maintenance and cleanliness of protectors.

Rule 3313. (1) A face or eye protector shall be kept clean and in good repair.

(2) Cleaning facilities for protectors shall be provided away from the hazard, but readily accessible to the wearer.

(3) A slack, worn out, sweat-soaked, knotted, or twisted headband shall be replaced.

(4) A face or eye protector is a personal item and shall be for the individual and exclusive use of the person to whom it is issued. If circumstances require reissue, the protector shall be thoroughly cleaned, sanitized, and in good condition.

WELDING HELMETS AND HAND SHIELDS

R 408.13320 Purposes, types, styles, and marking.

Rule 3320. (1) The devices described in R 408.13320 to R 408.13330 are designed to provide protection for the face, eyes, ears, and neck against intense radiant energy and spatter resulting from arc welding.

(2) A helmet and a hand shield are the only permissible types.

(3) A helmet and a hand shield shall be made with the same basic design and of the same basic materials: an opaque, bowl-shaped or modified bowl-shaped device containing a window with filter plate which allows the wearer to see the radiant object, yet prevents harmful intensities or radiation from reaching his eyes. A helmet shall be supported on the head by an adjustable headgear. A hand shield shall have a handle attached to the bottom by which it is held in the hand. The basic designs may be modified to provide protection against special hazards, but modified equipment shall meet the same requirements as the basic design.

(4) A helmet and a hand shield shall bear a permanent and legible marking by which the manufacturer may be readily identified.

R 408.13321 Rigid helmet bodies.

Rule 3321. A helmet body of a rigid helmet shall be of such size and shape as to protect the face, forehead, ears, and neck to a vertical line back of the ears. It shall have 1 or more openings in the front for filter plates or filter lenses. The helmet body shall be attached to the headgear so that it will not come in contact with any part of the head and so that it can be lifted up from in front of the face and hold its position in front of the head. The helmet body shall be made of vulcanized fiber, reinforced plastic, or other suitable material which shall be thermally insulating, noncombustible or slow burning, opaque to visible, ultraviolet, and infrared radiations, and capable of withstanding sanitizing. The inside of the helmet body shall have a low light reflecting finish. Rivets or other metal parts, if terminating on the inside surface, shall be adequately separated from the wearer's head.

R 408.13322 Rigid helmet headgear or cradles.

Rule 3322. A rigid helmet shall have a headgear or cradle that shall hold the helmet body comfortably and firmly on the wearer's head, but shall permit the helmet body to be tilted back over the head. The headgear shall be readily adjustable for all head sizes from 6 1/2 to 7 5/8, without the use of tools. The headgear shall be made of materials which are thermally insulating, noncombustible or slow burning, resistant to heat, and capable of withstanding sanitizing. Where required, the headgear shall be fitted with a removable and replaceable sweatband covering at least the forehead portion of the headband. The sweatband shall be made of leather or other suitable material which is slow-burning and nonirritating.

R 408.13323 Rigid helmet headgear substitutes.

Rule 3323. A headgear for a rigid helmet may be replaced by an impact resistant hat or cap that meets the requirements of R 408.13370 to R 408.13378 of this part, or other suitable device to which the helmet body is connected, if the helmet body may be lifted and adjusted to permit unobstructed vision or lowered to furnish complete protection, as required. The alternative device shall meet the requirements for sanitizing and resistance to heat and, in addition, shall meet the applicable requirements of any additional functions, such as protection against falling objects.

R 408.13324 Rigid helmet filter plates.

Rule 3324. (1) A filter plate on a rigid helmet shall fit into the frame and cover the window.

(2) Both surfaces of a filter plate shall be well polished and shall be free from striae, waves, or other defects that would impair the optical quality of the surfaces. Filter plate surfaces shall be flat and substantially parallel.

(3) Table 2 of R 408.13312 shall be used to select the proper shade number of filter lenses or plates during welding operations.

(4) When specified, a filter plate shall be impact-resistant, unless impact-resistant eye protection is worn in conjunction with a welding helmet.

(5) A filter plate shall be marked with the shade designation and a permanent and legible marking by which the manufacturer may be readily identified. In addition, a glass filter plate, when treated for impact resistance, shall be marked with the letter "H."

(6) A cover plate made of plain glass, of glass coated on 1 or on both sides with plastic, or of a slow-burning solid plastic sheet shall be used to protect a filter plate from damage. A cover plate shall be the same peripheral size and shape as the filter plate, and the thickness of a cover plate shall not be less than 0.050 inches. A cover plate shall transmit not less than 75% of the luminous radiation and shall be substantially free from optical imperfections.

R 408.13325 Nonrigid helmets.

Rule 3325. A helmet may be made of nonrigid materials where it is to be used in confined spaces, or may be collapsible for convenience in carrying or storing. The helmet may be of the same general shape as a rigid helmet, except that a more complete covering of the top of the head is necessary in order to maintain the face, side, and windows in proper position. The requirements for the filter plates, cover plates, and lens mounting frame are the same as for a rigid helmet. A headgear may be used. The material shall be nonconducting and opaque to ultraviolet, visible, and infrared radiations. Stitched seams shall be welded. No stitching shall be exposed.

R 408.13327 Hand shield.

Rule 3327. A hand shield shall be constructed of materials similar to those used for a helmet and in like manner. The materials, lens mounting arrangement, and filter and cover plates shall conform to the requirements for the corresponding parts of the helmet body with headgear. The handle shall be made of a material that is a nonconductor of electricity and is noncombustible or slow burning. It shall be of such size and shape as to be held easily by 1 hand and shall be firmly attached to the lower portion of the shield. A hand shield intended for use by other than a welding operator shall have filter and cover plates suitable for the intended use.

R 408.13329 Helmet and hand shield lift fronts and chin rests.

Rule 3329. (1) The lift front of the helmet shall be fabricated from metal, plastic, or other suitable material. A snap hinge shall be provided so that the front part will stay up or down but will not remain in a partially opened position. The lift front seal against the helmet shall be light tight. The lift front shall be designed to accommodate 3 plates: a clear impact-resisting plate in the back or fixed part; a filter plate, impact-resisting, when specified; and a cover plate in the front part. The back or fixed part plate shall be clear heat treated glass or plastic not more than 3/16 inch thick or less than 1/8 inch and capable of withstanding the impact test.

(2) To avoid contact of a helmet or hand shield with the face of the wearer, a chin rest or adjustable position stop shall be provided. They shall be constructed of suitable rigid material and shall be detachable from the body of the hand shield.

R 408.13330 Helmet snoods, neck protectors, and aprons.

Rule 3330. (1) A snood or back-of-head-and-neck protector where required shall be of material that is flame resistant, that is a good insulator of heat and electricity, and that is capable of withstanding sanitizing. They shall be designed for easy attachment to the helmet, helmet headgear, or cradle.

(2) An apron or bib, where required for a helmet, shall be of nonflammable, nonconducting material that is flexible and capable of withstanding sanitizing.

R 408.13332 Effect of head protection standards.

Rule 3332. The characteristics and performance requirements of these rules for welding helmets shall in no way be altered through their attachment to protective hats and caps, as required by R 408.13370 to R 408.13378 of this part.

FACE SHIELDS**R 408.13340 Purposes and uses.**

Rule 3340. (1) The devices described in R 408.13340 to R 408.13347 of this part are designed to provide protection to the front part of the head, including forehead, cheeks, nose, mouth, and chin, and to the neck, where required, from flying particles and sprays of hazardous liquids, and to provide filter protection where required. Such devices shall be worn over suitable basic eye protection devices.

(2) Typical uses for face shields include, but are not limited to, the following situations:

- (a) Woodworking operations where chips and particles fly.
- (b) Metal machining causing flying particles.
- (c) Buffing, polishing, wire brushing, and grinding operations causing flying particles or objects.
- (d) Spot welding.
- (e) Handling of hot or corrosive materials.

R 408.13342 Types and materials.

Rule 3342. (1) Face shields are of 3 basic styles: headgear without crown protector; headgear with crown protector; and headgear with crown protector and chin protector. Each of these styles shall accommodate any of the following styles of windows:

- (a) Clear transparent.
- (b) Colored transparent.
- (c) Wire screen.
- (d) Combination of plastic and wire screen.
- (e) Fiber window with filter plate mounting.

(2) Materials used in the manufacture of a face shield shall be nonirritating to the skin when subjected to perspiration and shall be capable of withstanding frequent sanitizing. Metals, when used, shall be resistant to corrosion. Plastic materials shall be slow burning. Clear or colored plastic materials used in windows shall be of an optical grade. Plastic windows shall not be used in connection with welding operations unless they meet the requirements of table 1 of this part.

R 408.13343 Components.

Rule 3343. A face shield shall consist of a detachable transparent plastic window, wire screen window, or opaque frame with window; a tilting support, an adjustable headgear; and, as required, a crown protector and chin protector.

R 408.13344 Windows.

Rule 3344. (1) A window shall be designed to fit the contour of the window support.

(2) A window supporting or window holding member, which shall be a band or crown protector, shall be attached to the headgear. The window support shall position the window in front of the face to provide clearance for the nose and eyeglasses of the wearer.

(3) The attachment of the window to the window support shall be secure and shall permit easy removal and replacement. The several sizes and types of windows for a face shield shall be interchangeable for attachment to the window support.

(4) A plastic or wire screen window without frame shall be not less than 9 1/2 inches wide at the top and 8 1/2 inches wide at the bottom, measured over its curved surfaces when attached and in position on the window support, and not less than 6 inches high. A window, when used in a frame, shall not be less than 4 inches wide and 2 inches high, and the frame shall conform to the dimensions specified for a window without a frame. A plastic window shall be not less than 0.040 inch nominal thickness.

(5) The exposed borders of a wire screen window shall be suitably bound or otherwise finished to eliminate sharp, rough, or unfinished edges. A wire screen window shall not be less than 20-mesh screen.

(6) A window support shall be pivotally attached to the sides of the headgear to permit easy tilting, either upward or downward, of the supporting member and of the window attached thereto. The window shall be capable of being tilted sufficiently upward so that the center of its bottom edge shall be out of the line of horizontal vision. The tension of the tilting mechanism shall be sufficient to hold the window without slippage in either the up or down position.

R 408.13345 Headgear.

Rule 3345. (1) A headgear shall consist of at least a headband and a crown strap. The headgear shall be made from materials having a low heat conductivity. The design shall hold the window and window support comfortably and firmly in place on the wearer's head and shall provide for tilting the window away from the face.

(2) A headgear shall be readily adjustable to head sizes from 6 1/2 to 7 5/8 without the use of tools. The crown strap or band shall be attached to and extend between the front and rear centers or from the middle sides of the headband. It shall form an arc over the head to assist in positioning and holding the headgear in place. An adjusting device shall be positive and hold firmly in place after being adjusted. Its mechanisms and movements shall be protected so that the wearer's hair cannot catch in the device.

(3) For greater protection, headgear may be replaced by an impact resistant hat or cap to which the window support is connected. The attachment may be either rigid or swiveled. If swiveled, the design shall permit lifting and adjusting of the window to permit unobstructed vision or lowering to furnish protection.

R 408.13346 Crown and chin protectors.

Rule 3346. (1) A crown protector and chin protector shall be made of material having an impact resistance not less than that of the plastic window. When the crown protector is used in conjunction with the chin protector for protection against sprays of hazardous liquids, the assembly of the crown protector and window support and the assembly of the chin protector and window shall not allow liquids to pass through any opening in the assembly and reach the face, forehead, or chin of the wearer.

(2) A crown protector shall be shaped to cover at least the frontal portion of the head and shall extend around each side at least to a vertical line at the front of the ears. It may be an integral part of the window support or a separate assembly. The design shall provide a comfortable clearance over the forehead and the head of the wearer.

(3) A chin protector shall be shaped to cover at least the chin and upper part of the neck. The design shall provide a comfortable clearance under the chin of the wearer.

R 408.13347 Marking; special operating conditions.

Rule 3347. (1) When a face shield is used in atmospheres or working areas requiring special conditions of nonconductivity or nonsparking, materials used shall meet these requirements. A face shield shall be plainly and permanently labeled, identifying it as a "nonconductive face shield" or "nonsparking face shield."

(2) A headgear and a plastic window shall bear a permanent and legible marking by which the manufacturer may be readily identified. A window offered for protection against glare shall also bear its shade designation.

EYE PROTECTORS**R 408.13350 Prescription lenses.**

Rule 3350. An employer shall assure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards shall wear eye protection which incorporates that prescription in its design or shall wear eye protection which can be worn over the prescription lenses without disturbing the proper position for the prescription lenses or protective lenses.

R 408.13352 Materials.

Rule 3352. Materials used in the manufacturing of eye protectors shall combine mechanical strength and lightness of weight to a high degree, shall be nonirritating to the skin when subjected to perspiration, and shall withstand frequent sanitizing. Metals, where used, shall be corrosion resistant. Plastic materials, when used, shall be noncombustible or slow burning. Cellulose nitrate, or materials having flammability characteristics approximately those of cellulose nitrate, shall not be used.

R 408.13353 Lenses.

Rule 3353. (1) Lenses intended for use in eye protectors are of 4 basic types, as follows:

(a) Clear lenses which are impact-resisting and provide protection against flying objects.

(b) Absorptive lenses of shades 1.7 through 3.0 which are impact-resisting and provide protection against flying objects and glare or which are impact-resisting and provide protection against flying objects, and narrowband spectral transmittance of injurious radiation.

(c) Protective-corrective lenses which are impact-resisting and either clear or absorptive, as specified for persons requiring visual correction.

(d) Filter lenses which are impact-resisting and provide protection against flying objects and narrow-band spectral transmittance of injurious radiation.

(2) Glass filter lenses intended for use in eyecup goggles shall be heat treated.

(3) The height of the safety lens shall not be less than 30 millimeters.

R 408.13355 Eyecup goggles; components.

Rule 3355. Eyecup goggles shall consist of 2 eyecups with lenses and lens retainers, connected by an adjustable bridge, and a replaceable and adjustable headband or other means for retaining the eyecups comfortably in front of the eyes. Recommended applications for the use of eyecup goggles are shown in table 1 of R 408.13312(6).

R 408.13356 Eyecup goggles; types and models.

Rule 3356. (1) Eyecup goggles shall be of 2 types as follows:

(a) Cup-type goggles designed to be worn by individuals who do not wear corrective spectacles.

(b) Cover cup-type goggles designed to fit over corrective spectacles.

(2) The 2 types of eyecup goggles are subdivided into the following classes:

(a) Chipper's models providing impact protection against flying objects.

(b) Dust and splash models providing protection against fine dust particles or liquid splashes and impact.

(c) Welder's and cutter's models providing protection against glare, injurious radiations, and impact.

(3) The basic designs may be modified to provide more protection against special hazards, but the modified equipment shall meet the same requirements as the basic design.

R 408.13357 Eyecup goggles; fit.

Rule 3357. (1) The edge of the eyecup of eyecup goggles which bears against the face shall have a smooth surface free from roughness or irregularities which might exert undue pressure or cause discomfort to the wearer. The eyecups shall be of such shape and size as to protect the entire eye sockets.

(2) Cover cup-type goggles shall provide ample clearance and not interfere with the spectacles of the wearer. The edge of the goggles which bears against the face shall have a smooth surface free from roughness or irregularities which might exert undue pressure or cause discomfort to the wearer.

R 408.13359 Eyecup ventilation.

Rule 3359. (1) Eyecups of chipper's models shall be ventilated in a manner to permit circulation of air.

(2) Eyecups of dust and splash models shall be ventilated in a manner to permit circulation of air. The ventilation openings shall be baffled or screened to prevent direct passage of dust or liquids into the interior of the eyecups.

(3) Eyecups of welder's and cutter's models shall be ventilated in a manner to permit circulation of air and shall be opaque. The ventilation openings shall be baffled to prevent passage of light rays into the interior of the eyecup.

R 408.13360 Eyecup lenses and retaining rings.

Rule 3360. (1) An eyecup shall be provided with a rigidly constructed lens retaining ring of metal or of plastic designed to accommodate lenses and to permit their ready removal and replacement without damage to the eyecup or to the lenses and without the use of tools. The ring shall provide a complete clamping action against the lens. Lens retainers for welder's and cutter's models shall accommodate a filter lens, fiber gasket, and cover lens.

(2) A filter lens shall be marked with the shade designation and a permanent and legible marking by which the manufacturer may be readily identified. A glass filter lens, when treated for impact resistance, shall also be marked with the letter "H".

R 408.13362 Flexible and cushioned fitting goggles; construction.

Rule 3362. Flexible and cushioned fitting goggles shall consist of a wholly flexible frame, forming a lens holder or with a separable lens holder or a rigid frame with integral lens or lenses, having a separate cushioned fitting surface on the full periphery of the facial contact area. Materials used shall be chemical-resistant, nontoxic, nonirritating, and slow burning. There shall be a positive means of support on the face, such as an adjustable headband of suitable material or other suitable means of support to retain the frame comfortable and snugly in place in front of the eyes. A frame which is a lens holder or has a separable lens holder shall hold the lenses firmly and tightly and be removable or replaceable without the use of tools. The goggles may be ventilated or not, as required by their intended use. Where chemical goggles are ventilated, the openings shall be such as to render the goggles splashproof.

R 408.13363 Flexible and cushioned fitting goggles; protection.

Rule 3363. (1) Chipper's models of flexible and cushioned fitting goggles shall provide protection against impact.

(2) Dust and splash models shall provide protection from fine dusts, fumes, liquids, splashes, mists, and spray, alone or with reflected light or glare, wind, and impact.

(3) Gas welder's and cutter's models shall provide protection against glare, injurious radiations, and impact.

R 408.13364 Flexible and cushioned fitting goggles; marking.

Rule 3364. (1) The frame of flexible and cushioned fitting goggles shall bear a trademark or name identifying the manufacturer.

(2) Each separate lens shall be distinctly marked in a manner by which the manufacturer may be identified.

(3) A heat-treated glass filter plate or lens shall also be marked with the shade designation and the letter "H".

(4) The marking shall be clear cut and permanent and so placed as not to interfere with the vision of the wearer.

R 408.13366 Foundrymen's goggles; construction.

Rule 3366. (1) A foundryman's goggles shall consist of a mask made of a flexible, nonirritating, and noncombustible or slow-burning material, such as a leather or flexible plastic, suitable ends holders attached thereto, lenses, and a positive means of support on the face, such as an adjustable headband, to retain the mask comfortably and snugly in place in front of the eyes. The edge of the mask on contact with the face shall be provided with a binding of corduroy or other suitable material. The lens holders shall hold the lenses firmly and tightly and may be readily removable or replaceable. The lens holders shall be ventilated to permit circulation of air.

R 408.13367 Foundrymen's goggles; protection.

Rule 3367. (1) A foundryman's goggles shall provide protection against impact and hot-metal splash hazards encountered in foundry operations such as melting, pouring, chipping, babbiting, grinding, and riveting. Where required, they shall also provide protection against dusts.

(2) Applications for use of foundryman's goggles are shown in table 1.

(3) Materials shall resist flame, corrosion, water, and sanitizing.

SPECTACLES

R 408.13369 Spectacles.

Rule 3369. (1) Spectacles, also known as safety glasses, of metal, plastic, or a combination thereof, shall consist of lenses in a frame that supports the lenses around their entire periphery of suitable size and shape for the purpose intended connected by a nose bridge, and retained on the face by temples or other suitable means.

(2) The spectacles, also known as safety glasses, shall be furnished with or without sideshields depending upon their intended use.

(3) The frames, temples, and sideshields may be metal or plastic, and when made of plastic, shall be of the slow-burning type.

(4) Spectacles, also known as safety glasses, shall provide protection to the eye from flying objects, and, when required, from glare and injurious radiations.

(5) Spectacles, also known as safety glasses, without sideshields are intended to provide frontal protection.

(6) Where side as well as frontal protection is required, the spectacles, also known as safety glasses, shall be provided with sideshields.

Note: Appendix B, Appendix Table 1 "Eye and Face Protector Selection Chart," and Appendix Figure 1, "Eye and Face Protective Devices Chart," shall be used as a guide in the selection of the proper eye and face protection.

(7) Frames shall be designed for industrial exposure and shall bear a trademark identifying the manufacturer on both fronts and temples. The frame front shall carry a designation of the eye size and bridge size, where applicable. Temples shall be marked as to the overall length or fitting value.

(8) Temples may be of the cable or spatula type, as specified, and shall be of such design as to permit adjustment and fit comfortably and securely on the wearer. The size of the temples shall be clearly marked.

(9) Safety lens in frames which do not comply with this part shall not be worn.

HEAD PROTECTION EQUIPMENT

R 408.13370 Use of head protection.

Rule 3370 (1) An employer shall ensure that each affected employee is provided with, and wears, head protection equipment and accessories when the employee is required to be present in areas where a hazard exists from any of the following:

(a) Falling or flying objects.

(b) Other harmful contacts or exposures.

(c) Where there is a risk of injury from any of the following:

(i) Electric shock.

(ii) Hair entanglement.

(iii) Chemicals.

(iv) Temperature extremes.

(2) Service facilities shall be provided for the sanitizing and replacement of needed parts when necessary and before head protection equipment is re-issued.

(3) Head protection equipment that has been physically altered or damaged shall not be worn or reissued to an employee.

(4) An employee shall not physically alter, and shall guard against damage to, the head protection equipment provided.

(5) An employee shall use the provided head protection equipment in accordance with the instructions and training received.

R 408.13372 Criteria for head protection.

Rule 3372. (1) An employer shall provide each employee with head protection that meets the specifications contained in any of the following consensus standards:

(a) ANSI Z-89.1 "American National Standard for Industrial Head Protection," 2009 edition, as adopted in R 408.13301a.

(b) ANSI Z-89.1, "American National Standard for Industrial Head Protection," 2003 edition, as adopted in R 408.13301a.

(c) ANSI Z-89.1 "American National Standard for Personnel Protection—Protective Headwear for Industrial Workers--Requirements," 1997 edition, as adopted in R 408.13301a.

(2) Any head protection device that the employer demonstrates is at least as effective as a head protection device constructed in accordance with 1 of the consensus standards adopted in subrule (1) of this rule is considered to be in compliance with this rule.

R 408.13375 Protective helmets.

Rule 3375. (1) Protective helmets shall be described by impact type and electrical class. All protective helmets shall meet either Type I or Type II requirements. All helmets shall be further classified as meeting Class G, Class E, or Class C electrical requirements. Helmets shall be classified as follows:

(a) Impact type protective helmets shall be either of the following:

(i) Type I helmets shall be intended to reduce the force of impact resulting from a blow only to the top of the head.

(ii) Type II helmets shall be intended to reduce the force of impact resulting from a blow to the top or sides of the head.

(b) Electrical classes for protective helmets shall be 1 of the following:

(i) Class G, general protective helmets are intended to reduce the danger of contact with low voltage conductors. Test samples shall be proof-tested at 2200 volts (phase to ground). This voltage is not intended as an indication of the voltage at which the helmets protects the wearer.

(ii) Class E, electrical protective helmets are intended to reduce the danger of contact with higher voltage conductors. Test samples shall be proof-tested at 20,000 volts (phase to ground). This voltage is not intended as an indication of the voltage at which the helmet protects the wearer.

(iii) Class C, conductive protective helmets are not intended to provide protection against contact with electrical hazards.

(2) A metallic head device shall not be furnished by an employer or used by an employee for head protection, except where it has been determined that the use of other types of protective helmets or safety hats or caps is impractical, such as where chemical reaction will cause the deterioration of other types of head protection.

(3) A protective helmet furnished by an employer shall be identified on the inside of the shell with the name of the manufacturer.

(4) When used in conjunction with protective helmets, faceshields, welding helmets, and goggles shall be in compliance with the requirements in these rules, and hearing protection shall be in compliance with Occupational Health Standard Part 380 "Occupational Noise Exposure," as referenced in R 408.13301a.

(5) Winter liners and chin straps used in conjunction with class E helmets for high-voltage protection shall not contain any metallic parts or other conductive materials.

(6) Winter liners and chin straps used in areas where there is a danger of ignition from heat, flame, or chemical reaction shall be made of materials that are nonburning or flame retardant.

(7) Bump hats or caps or other limited-protection devices shall not be used as a substitute for protective helmets for the hazards described in R 408.13370.

(8) An employer shall ensure that protective helmets designed to reduce electrical shock hazard shall be worn by each affected employee who is near exposed electrical conductors that could come in contact with the employee's head.

R 408.13376 Hoods.

Rule 3376. (1) A hood shall be made of materials that combine all of the following:

(a) Have mechanical strength and lightness of weight to a high degree.

(b) Be non-irritating to the skin when subjected to perspiration.

(c) Be capable of withstanding frequent cleaning and disinfection.

(2) Materials used in the manufacture of hoods shall also be suitable to withstand the hazards to which the user may be exposed.

(3) A hood shall bear a permanent and legible marking by which the manufacturer may be readily identified.

(4) A hood shall be designed to provide adequate ventilation for the wearer.

(5) A protective helmet shall be used in conjunction with a hood where there is a head injury hazard and the hood shall be designed to accommodate such helmet.

R 408.13378 Hair enclosures; face and head.

Rule 3378. (1) A hat, cap, or net shall be worn by a person where there is a danger of hair entanglement in moving machinery or equipment, or where there is exposure to means of ignition.

(2) Hair enclosures include all of the following:

(a) Be designed to be reasonably comfortable to the wearer.

(b) Completely enclose all loose hair.

(c) Be adjustable to accommodate all head sizes.

(3) Be material used for hair enclosures of all of the following:

(a) Fast dyed.

(b) Non-irritating to the skin when subjected to perspiration.

(c) Capable of withstanding frequent cleaning.

(4) Hair enclosures shall not be reissued from 1 employee to another unless it has been thoroughly sanitized.

FOOT AND TOE PROTECTION

R 408.13383 Criteria for protective footwear.

Rule 3383. (1) Protective footwear shall comply with any of the following consensus standards:

(a) ASTM F-2412 "Standard Test Methods for Foot Protection," 2005 edition, as adopted in R 408.13301a.

(b) ASTM F-2413 "Standard Specification for Performance Requirements for Protective Footwear," 2005 edition, as adopted in R 408.13301a.

(c) ANSI Z-41 "American National Standard for Personal Protection -- Protective Footwear," 1999 edition, as adopted in R 408.13301a.

(2) Protective footwear that an employer demonstrates is at least as effective as protective footwear that is constructed in accordance with 1 of the consensus standards adopted in subrule (1) of this rule, shall be considered to be in compliance with the requirements of this rule.

R 408.13384 Toe protection.

Rule 3384. Where toe protection other than safety toe footwear is worn, the toe protection shall have an impact value of not less than that required for the safety toe footwear.

R 408.13385 Use of foot protection.

Rule 3385. (1) An employer shall ensure that each affected employee shall wear protective footwear when working in areas where any of the following occur:

(a) When the use of protective footwear will protect the affected employee from an electrical hazard, such as a static-discharge or electric-shock hazard, that remains after the employer takes other necessary protective measures.

(b) There is a danger of foot injuries due to falling or rolling objects.

(c) There is a danger of objects piercing the sole of the shoe.

(2) An employer shall ensure that safety shoes and boots that are not worn over shoes and that are worn by more than 1 employee are maintained, cleaned, and sanitized inside and out before being issued to another employee

R 408.13386 Foot protection; requirements.

Rule 3386. If a hazard is created from a process, environment, chemical, or mechanical irritant which could cause an injury or impairment to the feet by absorption or physical contact, other than from impact, then the employer shall provide any of the following to the employee:

(a) Boots.

(b) Overshoes.

(c) Rubbers.

(d) Wooden-soled shoes.

(e) The equivalent to subdivisions (a) to (d) of this subrule.

ELECTRICAL PROTECTIVE EQUIPMENT

R 408.13387 Design requirements for specific types of electrical protective equipment.

Rule 3387. (1) Rubber insulating blankets, rubber insulating matting, rubber insulating covers, rubber insulating line hose, rubber insulating gloves, and rubber insulating sleeves shall meet the requirements of this rule.

(a) Blankets, gloves, and sleeves shall be produced by a seamless process.

(b) Each item shall be clearly marked as follows:

(i) Class 00 equipment shall be marked class 00.

(ii) Class 0 equipment shall be marked class 0.

(iii) Class 1 equipment shall be marked class 1.

(iv) Class 2 equipment shall be marked class 2.

(v) Class 3 equipment shall be marked class 3.

(vi) Class 4 equipment shall be marked class 4.

(vii) Non-ozone-resistant equipment shall be marked type I.

(viii) Ozone-resistant equipment shall be marked type II.

(ix) Other relevant markings, such as the manufacturer's identification and the size of the equipment, may also be provided.

(c) Markings shall be nonconducting and shall be applied in such a manner as not to impair the insulating qualities of the equipment.

(d) Markings on gloves shall be confined to the cuff portion of the glove.

(3) Electrical requirements shall be all of the following:

(a) Equipment shall be capable of withstanding the alternating current proof-test voltage specified in Table A or the direct current proof-test voltage specified in Table B. All of the following apply:

- (i) The proof test shall reliably indicate that the equipment can withstand the voltage involved.
- (ii) The test voltage shall be applied continuously for 3 minutes for equipment other than matting and shall be applied continuously for 1 minute for matting.
- (iii) Gloves shall also be capable of separately withstanding the alternating current proof-test voltage specified in Table A after a 16-hour water soak.

(b) When the alternating current proof test is used on gloves, the 60-hertz proof-test current shall not exceed the values specified in Table A at any time during the test period. All of the following apply:

- (i) If the alternating current proof test is made at a frequency other than 60 hertz, the permissible proof-test current shall be computed from the direct ratio of the frequencies.
- (ii) For the test, gloves (right side out) shall be filled with tap water and immersed in water to a depth that is in accordance with Table C. Water shall be added to or removed from the glove, as necessary, so that the water level is the same inside and outside the glove.
- (iii) After the 16-hour water soak specified in this subrule, the 60-hertz proof-test current shall not exceed the values given in Table A by more than 2 milliamperes.

(c) Equipment that has been subjected to a minimum breakdown voltage test shall not be used for electrical protection. See subrule (3) of this rule.

(d) Material used for Type II insulating equipment shall be capable of withstanding an ozone test, with no visible effects. The ozone test shall reliably indicate that the material will resist ozone exposure in actual use. Any visible signs of ozone deterioration of the material, such as checking, cracking, breaks, or pitting, is evidence of failure to meet the requirements for ozone-resistant material. See subrule (3) of this rule.

(4) Workmanship and finish shall comply with both of the following:

(a) Equipment shall be free of physical irregularities that can adversely affect the insulating properties of the equipment and that can be detected by the tests or inspections required by these rules.

(b) Surface irregularities that may be present on all rubber goods, because of imperfections on forms or molds or because of inherent difficulties in the manufacturing process, and that may appear as indentations, protuberances, or imbedded foreign material are acceptable under the following conditions:

- (i) The indentation or protuberance blends into a smooth slope when the material is stretched.
- (ii) Foreign material remains in place when the insulating material is folded and stretches with the insulating material surrounding it.

(5) Rubber insulating equipment meeting the national consensus standards in Table 4 is considered to be in compliance with the performance requirements of these rules.

TABLE 2 AMERICAN SOCIETY OF TESTING MATERIALS STANDARDS			
STANDARD TITLE	ASTM NUMBER	EDITION	SUPPLEMENT
Standard Specification for Rubber Insulating Gloves	D-120	2009	-
Standard Specification for Rubber Insulating Matting	D-178	2001	2010
Standard Specification for Rubber Insulating Blankets	D-1048	2012	-
Standard Specification for Rubber Insulating Covers	D-1049	1998	2010
Standard Specification for Rubber Insulating Line Hose	D-1050	2005	2011
Standard Specification for Rubber Insulating Sleeves	D-1051	2008	-
These standards contain specifications for conducting the various tests required in these rules. For example, the alternating current and direct current proof tests, the breakdown test, the water-soak procedure, and the ozone test described in this rule are described in detail in these ASTM standards.			
ASTM F-1236 "Standard Guide for Visual Inspection of Electrical Protective Rubber Products," 1996 Edition with 2012 supplement, as adopted in R 408.13301a, presents methods and techniques for the visual inspection of electrical protective equipment made of rubber. This guide also contains descriptions and photographs of irregularities that can be found in this equipment			
ASTM F-819 "Standard Terminology Relating to Electrical Protective Equipment for Workers," 2010 edition, as adopted in R 408.13301a, includes definitions of terms relating to the electrical protective equipment covered in these rules.			

R 408.13387a. Electrical protective equipment.

Rule 3387a. (1) Material other than rubber that offers protection equivalent to or greater than rubber may be used if the material is certified to meet the appropriate ASTM standard tests.

(2) An insulated blanket, glove, or sleeve shall be capable of withstanding the voltage to which it may be subjected.

(3) Exposed conductors or equipment, or both, except for conductors or equipment being directly worked on, that is energized from 750 volts to 28,000 volts phase to ground and that an employee may reach into or touch shall be isolated or covered with at least 1 of the following:

- (a) An insulating blanket.
- (b) An insulating hood.
- (c) An insulating line hose.
- (d) An insulating barrier.

(4) An employee shall use insulating gloves and sleeves capable of withstanding the imposed voltage when performing any of the following activities:

(a) Working directly on, or within reaching distance of, a conductor or equipment at a nominal 750 volts or more phase to ground, except when using barehanded techniques or a hot stick. Sleeves are not required for an employee who performs routine switching operations in a substation or powerhouse. An employee who uses gloves and sleeves and works directly on or within reaching distance of a conductor or equipment energized at more than 5,000 volts phase to ground shall do so from an insulated platform or board or an aerial device that has an insulated basket.

(b) Connecting or disconnecting primary neutrals, pole ground wires, or other conductors normally connected to static wires or energized equipment, except that gloves and sleeves shall not be worn while connecting and disconnecting a service neutral or secondary neutral.

(c) Working on a de-energized conductor that extends into an area in which contact may be made with an energized conductor or exposed parts of energized equipment, unless the conductor is grounded or isolated. Insulating sleeves are optional at voltages of less than 750 volts phase to ground.

(5) An employee shall use insulating gloves capable of withstanding the imposed voltage when performing either of the following activities:

(a) When working with a powered or manual hole digger while using booms or using winch lines to install or remove poles or equipment where the hole digger may contact conductors or equipment energized at a voltage of 300 volts or more phase to ground. An employee shall not use the gloves while in the enclosed cab of the equipment.

(b) When working directly on a conductor or equipment energized at a voltage of more than 240 volts phase to ground. This does not include the use of test equipment.

R 408.13388 Design requirements for other types of electrical protective equipment.

Rule 3388. (1) The following requirements apply to the design and manufacture of electrical protective equipment that is not covered by R 408.40650:

(2) Insulating equipment used for the protection of employees shall be capable of withstanding, without failure, the voltages that may be imposed upon it.

Note 1 to subrule (2): These voltages include transient over-voltages, such as switching surges, as well as nominal line voltage. See General Industry Safety Standard Part 86 "Electric Power Generation, Transmission, and Distribution," Appendix B, as referenced in R 408.13301a, for a discussion of transient over-voltages on electric power transmission and distribution systems.

Note 2 to subrule (2): See IEEE 516 "Guide for Maintenance Methods on Energized Power Lines," 2009 edition, as adopted in R 408.13301a, for methods of determining the magnitude of transient over-voltages on an electrical system and for a discussion comparing the ability of insulation equipment to withstand a transient overvoltage based on its ability to withstand alternating current voltage testing.

(3) Equipment current shall comply with both of the following:

(a) Protective equipment used for the primary insulation of employees from energized circuit parts shall be capable of passing a current test when subjected to the highest nominal voltage on which the equipment is to be used.

(b) When insulating equipment is tested pursuant to these rules, the equipment current may not exceed 1 microampere per kilovolt of phase-to-phase applied voltage.

Note 1 to subrule (3): This rule shall apply to equipment that provides primary insulation of employees from energized parts. It does not apply to equipment used for secondary insulation or equipment used for brush contact only.

Note 2 to subrule (3): For alternating current excitation, this current consists of the following three components:

(a) Capacitive current because of the dielectric properties of the insulating material itself.

(b) Conduction current through the volume of the insulating equipment.

(c) Leakage current along the surface of the tool or equipment.

The conduction current shall be normally negligible. For clean, dry insulating equipment, the leakage current shall be small, and the capacitive current shall predominate.

Note 3 to subrule (3): Plastic guard equipment is considered to conform to the performance requirements of this rule, if it meets, and is used in accordance with ASTM F-712 "Standard Test Methods and Specifications for Electrically Insulating Plastic Guard Equipment for Protection of Workers," 2006 edition with 2011 supplement, as adopted in R 408.13301a.

R 408.13389 In-service care and use of electrical protective equipment.

Rule 3389. (1) Electrical protective equipment shall be maintained in a safe, reliable condition.

(2) The following specific requirements apply to rubber insulating blankets, rubber insulating covers, rubber insulating line hose, rubber insulating gloves, and rubber insulating sleeves.

(3) Maximum use voltages shall conform to those listed in Table D.

(4) An employer shall ensure that insulating equipment is inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of causing damage. Insulating gloves shall be given an air test, along with the inspection.

Note to subrule (4): ASTM F-1236 "Standard Guide for Visual Inspection of Electrical Protective Rubber Products," 1996 Edition with 2012 supplement, as adopted in R 408.13301a, presents methods and techniques for the visual inspection of electrical protective equipment made of rubber. This guide also contains descriptions and photographs of irregularities that can be found in this equipment.

(5) Insulating equipment with any of the following defects shall not be used.

(a) A hole, tear, puncture, or cut.

(b) Ozone cutting or ozone checking, that is, a series of interlacing cracks produced by ozone on rubber under mechanical stress.

(c) An embedded foreign object.

(d) Any of the following texture changes:

(i) Swelling.

(ii) Softening.

(iii) Hardening.

(iv) Becoming sticky or inelastic.

(v) Any other defect that damages the insulating properties.

(6) An employer shall ensure that insulating equipment found to have other defects that might affect its insulating properties is removed from service and returned for testing under subrules (10) and (11) of this rule.

(7) An employer shall ensure that insulating equipment is cleaned as needed to remove foreign substances.

(8) Insulating equipment shall be stored in a location and in a manner as to protect it from all of the following:

(a) Light.

(b) Temperature extremes.

(c) Excessive humidity.

(d) Ozone.

(e) Other damaging substances and conditions.

(9) Protector gloves shall be worn over insulating gloves, except under the following conditions:

(a) Protector gloves need not be used with class 0 gloves, under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity.

Note to subrule (9)(a): Persons inspecting rubber insulating gloves used under these conditions shall take extra care in visually examining them. Employees using rubber insulating gloves under these conditions shall take extra care to avoid handling sharp objects.

(b) If the voltage does not exceed 250 volts, ac, or 375 volts, direct current, protector gloves shall not be used with class 00 gloves, under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity.

Note to subrule (9)(b): Persons inspecting rubber insulating gloves used under these conditions shall take extra care in visually examining them. Employees using rubber insulating gloves under these conditions shall take extra care to avoid handling sharp objects.

(c) Any other class of glove may be used without protector gloves, under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity but only if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is 1 class higher than that required for the voltage involved.

(d) Insulating gloves that have been used without protector gloves may not be reused until they have been tested under the provisions of this rule.

(10) Electrical protective equipment shall be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests shall be pursuant to Table D and Table E.

(11) The test method used in this rule shall reliably indicate whether the insulating equipment can withstand the voltages involved.

Note to subrule (11): The standard electrical test methods considered as meeting this requirement are listed in Table 3.

(12) Insulating equipment failing to pass inspections or electrical tests shall not be used by employees, except as follows:

(a) Rubber insulating line hose may be used in shorter lengths with the defective portion cut off.

(b) Rubber insulating blankets may be salvaged by severing the defective area from the undamaged portion of the blanket. The resulting undamaged area shall not be smaller than 560 millimeters by 560 millimeters (22 inches by 22 inches) for class 1, 2, 3, and 4 blankets.

(c) Rubber insulating blankets shall be repaired using a compatible patch that results in physical and electrical properties equal to those of the blanket.

(d) Rubber insulating gloves and sleeves with minor physical defects, such as small cuts, tears, or punctures, shall be repaired by the application of a compatible patch. Also, rubber insulating gloves and sleeves with minor surface blemishes shall be repaired with a compatible liquid compound. The repaired area shall have electrical and physical properties equal to those of the surrounding material. Repairs to gloves shall be permitted only in the area between the wrist and the reinforced edge of the opening.

(13) An employer shall ensure that repaired insulating equipment is retested before it is used by employees.

(14) The employer shall certify that equipment has been tested pursuant to the requirements of this rule. The certification shall identify the equipment that passed the test and the date it was tested and shall be made available upon request to the department of licensing and regulatory affairs director and to MIOSHA employees or their authorized representatives.

Note to subrule (14): Marking equipment with, and entering onto logs, the results of the tests and the dates of testing are acceptable means of meeting the certification requirement.

TABLE 3 AMERICAN SOCIETY OF TESTING MATERIALS STANDARDS			
STANDARD TITLE	ASTM NUMBER	EDITION	SUPPLEMENT
Standard Specification for Rubber Insulating Gloves	D-120	2009	-
Standard Specification for Rubber Insulating Matting	D-178	2001	2010
Standard Specification for Rubber Insulating Blankets	D-1048	2012	
Standard Specification for Rubber Insulating Covers	D-1049	1998	2010
Standard Specification for Rubber Insulating Line Hose	D-1050	2005	2011
Standard Specification for Rubber Insulating Sleeves	D-1051	2008	-
Standard Specification for In-Service Care of Insulating Line Hose and Covers	F-478	2009	-
Standard Specification for In-Service Care of Insulating Blankets	F-479	2006	2011
Standard Specification for In-Service Care of Insulating Gloves And Sleeves	F-496	2008	-

TABLE A ALTERNATING CURRENT PROOF-TEST REQUIREMENTS					
CLASS OF EQUIPMENT	PROOF-TEST VOLTAGE RMS V	Maximum Proof-Test Current, mA (Globes Only)			
		280-mm (11 in) Glove	360-mm (14 in) Glove	410-mm (16 in) Glove	460-mm (18 in) Glove
00	2,500	8	12	-	-
0	5,000	8	12	14	16
1	10,000	-	14	16	18
2	20,000	-	16	18	20
3	30,000	-	18	20	22
4	40,000	-	-	22	24

TABLE B DIRECT CURRENT PROOF-TEST REQUIREMENTS	
CLASS OF EQUIPMENT	PROOF-TEST VOLTAGE
00	10,000
0	20,000
1	40,000
2	50,000
3	60,000
4	70,000

NOTE: The dc voltages listed in this table are not appropriate for proof testing rubber insulating line hose or covers. For this equipment, dc proof tests shall use a voltage high enough to indicate that the equipment can be safely used at the voltages listed in Table D.

See ASTM D-1050 "Standard Specification for Rubber Insulating Line Hose," 2005 edition with 2011 supplement and ASTM D-1049 "Standard Specification for Rubber Insulating Covers," 1998 edition with 2010 supplement, as adopted in R 408.13301a, for further information on proof tests for rubber insulating line hose and covers, respectively.

TABLE C GLOVE TESTS – WATER LEVEL^{1,2}				
CLASS OF GLOVE	ALTERNATING CURRENT PROOF TEST		DIRECT CURRENT PROOF TEST	
	mm	in	mm	in
00	38	1.5	38	1.5
0	38	1.5	38	1.5
1	38	1.5	51	2.0
2	64	2.5	76	3.0
3	89	3.5	102	4.0
4	127	5.0	153	6.0

¹ The water level is given as the clearance from the reinforced edge of the glove to the water line, with a tolerance of ± 13 mm. (± 0.5 in.).

² If atmospheric conditions make the specified clearances impractical, the clearances may be increased by a maximum of 25 mm. (1 in.).

TABLE D RUBBER INSULATING EQUIPMENT, VOLTAGE REQUIREMENTS			
CLASS OF EQUIPMENT	MAXIMUM USE VOLTAGE¹ ALTERNATING CURRENT RMS	RETEST VOLTAGE² ALTERNATING CURRENT RMS	RETEST VOLTAGE² DIRECT CURRENT AVG
00	500	2,500	10,000
0	1,000	5,000	20,000
1	7,500	10,000	40,000
2	17,000	20,000	50,000
3	26,500	30,000	60,000
4	36,000	40,000	70,000

¹ The maximum use voltage is the ac voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits. However, the phase-to-ground potential is considered to be the nominal design voltage under the following conditions:

- (1) There is no multiphase exposure in a system area and the voltage exposure is limited to the phase-to-ground potential, or
- (2) The electric equipment and devices are insulated or isolated or both so that the multiphase exposure on a grounded wye circuit is removed.

² The proof-test voltage shall be applied continuously for at least 1 minute, but no more than 3 minutes.

TABLE E RUBBER INSULATING EQUIPMENT TEST INTERVALS	
TYPE OF EQUIPMENT	WHEN TO TEST
Rubber insulating line hose	Upon indication that insulating value is suspect and after repair.
Rubber insulating covers	Upon indication that insulating value is suspect and after repair.
Rubber insulating blankets	Before first issue and every 12 months thereafter; ¹ upon indication that insulating value is suspect; and after repair
Rubber insulating gloves	Before first issue and every 6 months thereafter; ¹ upon indication that insulating value is suspect; after repair; and after use without protectors
Rubber insulating sleeves	Before first issue and every 12 months thereafter; ¹ upon indication that insulating value is suspect; and after repair

¹ If the insulating equipment has been electrically tested but not issued for service, the insulating equipment shall not be placed into service unless it has been electrically tested within the previous 12 months.

FALL PROTECTION

R 408.13390 Fall protection.

Rule 3390. An employer shall ensure that each employee whose fall protection is not covered by another MIOSHA safety standard, and the employee's work area is more than 6 feet above the ground, floor, water, or other surface, shall be protected as prescribed in Construction Safety Standard Part 45 "Fall Protection," as referenced in R 408.13301a.

The following systems are included in CS Part 45 "Fall Protection:"

- (a) Guardrail systems.
- (b) Safety net systems.
- (c) Personal fall arrest systems.

See Appendix C for reference to the correct safety standards for general industry threshold heights requiring fall prevention/protection equipment.

HAND PROTECTION

R 408.13392 Hand protection.

Rule 3392. An employer shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards, such as those from any of the following:

- (a) Skin absorption of harmful substances.
- (b) Severe cuts or lacerations.
- (c) Severe abrasions.
- (d) Punctures.
- (e) Chemical burns.
- (f) Thermal burns.
- (g) Harmful temperature extremes.

R 408.13393 Hand protection; selection.

Rule 3393. (1) An employer shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection related to all of the following:

- (a) The task or tasks to be performed.
- (b) Conditions present.
- (c) Duration of use.
- (d) The hazards and potential hazards identified.

(2) Hand protection interiors shall be kept free of corrosive or irritating contaminants.

(3) If more than 1 employee wears a pair of gloves, the gloves shall be sanitized before re-issuance.

BODY PROTECTION

R 408.13394 Body protection.

Rule 3394. (1) An employer shall ensure that each employee who is required to work so that his or her clothing becomes wet due to a condition other than the weather or perspiration uses any of the following:

- (a) Aprons.
- (b) Coats.
- (c) Jackets.
- (d) Sleeves.

(e) Other garments that will keep his or her clothing dry.

(2) The material shall be unaffected by the wetting agent.

(3) The provision of dry, clean, acid-resistant clothing, in addition to rubber shoes or short boots and an apron, shall be considered a satisfactory substitute where small parts are cleaned, plated, or acid-dipped in an open tank.

(4) When abrasive blasting is not protected by an enclosure, the operator shall use heavy canvas or leather gloves and aprons or equivalent protection to provide protection from the impact of abrasives.

R 408.13398. Rescinded.

**APPENDIX A – RESOURCES
(NON-MANDATORY)**

<p>For further assistance in implementing requirements for a hazard assessment and the selection of personal protective equipment, contact MIOSHA, OSHA, NIOSH, your union, or industry association.</p>
<p>MIOSHA Michigan Occupational Safety and Health Administration Consultation Education & Training Division (CET) www.michigan.gov/cet Phone: 517.322.1809</p>
<p>OSHA Federal Occupational Safety and Health Administration http://www.osha.gov</p>
<p>NIOSH National Institute of Occupational Safety and Health http://www.cdc.gov/niosh</p>

APPENDIX B
GUIDELINES FOR HAZARD ASSESSMENT AND PERSONAL PROTECTIVE EQUIPMENT SELECTION
(NON-MANDATORY)

This Appendix is intended to provide compliance assistance for employers and employees in implementing requirements for a hazard assessment and the selection of personal protective equipment.

1. CONTROLLING HAZARDS.

PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound manufacturing practices.

2. ASSESSMENT AND SELECTION.

It is necessary to consider certain general guidelines for assessing the eyes, face, head, hands, feet, and body hazard situations that exist in an occupational or educational operation or process, and to match the protective devices to the particular hazard. It should be the responsibility of the safety officer to exercise common sense and appropriate expertise to accomplish these tasks.

3. ASSESSMENT GUIDELINES.

In order to assess the need for PPE the following steps should be taken:

a. Survey. Conduct a walk-through survey of the areas in question. The purpose of the survey is to identify sources of hazards to workers and co-workers. Consideration should be given to the basic hazard categories:

- (a) Impact.
- (b) Penetration.
- (c) Compression (roll-over).
- (d) Chemical.
- (e) Heat.
- (f) Harmful dust.
- (g) Light (optical) radiation.

b. Sources. During the walk-through survey the safety officer should observe:

- (a) Sources of motion; i.e., machinery or processes where any movement of tools, machine elements or particles could exist, or movement of personnel that could result in collision with stationary objects.
- (b) Sources of high temperatures that could result in burns, eye injury or ignition of protective equipment, etc..
- (c) Types of chemical exposures.
- (d) Sources of harmful dust.
- (e) Sources of light radiation, i.e., welding, brazing, cutting, furnaces, heat treating, high intensity lights, etc.
- (f) Sources of falling objects or potential for dropping objects.
- (g) Sources of sharp objects which might pierce the feet or cut the hands.
- (h) Sources of rolling or pinching objects which could brush the feet.
- (i) Layout of workplace and location of co-workers; and
- (j) Any electrical hazards. In addition, injury/accident data should be reviewed to help identify problem areas.

c. Organize data. Following the walk-through survey, it is necessary to organize the data and information for use in the assessment of hazards. The objective is to prepare for an analysis of the hazards in the environment to enable proper selection of protective equipment.

d. Analyze data. Having gathered and organized data on a workplace, an estimate of the potential for injuries should be made. Each of the basic hazards (paragraph 3.a.) should be reviewed and a determination made as to the type, level of risk, and seriousness of the potential injury from each of the hazards found in the area. The possibility of exposure to several hazards simultaneously should be considered.

4. SELECTION GUIDELINES.

After completion of the procedures in paragraph 3, the general procedure for selection of protective equipment is to:

- (a) Become familiar with the potential hazards and the type of protective equipment that is available, and what it can do; i.e., splash protection, impact protection, etc.;
- (b) Compare the hazards associated with the environment; i.e., impact velocities, masses, projectile shape, radiation intensities, with the capabilities of the available protective equipment;
- (c) Select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards; and

(d) Fit the user with the protective device and give instructions on care and use of the PPE. It is very important that end users be made aware of all warning labels for and limitations of their PPE.

5. FITTING THE DEVICE.

Careful consideration must be given to comfort and fit. PPE that fits poorly will not afford the necessary protection. Continued wearing of the device is more likely if it fits the wearer comfortably. Protective devices are generally available in a variety of sizes. Care should be taken to ensure that the right size is selected.

6. DEVICES WITH ADJUSTABLE FEATURES.

Adjustments should be made on an individual basis for a comfortable fit that will maintain the protective device in the proper position. Particular care should be taken in fitting devices for eye protection against dust and chemical splash to ensure that the devices are sealed to the face. In addition, proper fitting of helmets is important to ensure that it will not fall off during work operations. In some cases a chin strap may be necessary to keep the helmet on an employee's head. (Chin straps should break at a reasonable low force, however, so as to prevent a strangulation hazard). Where manufacturer's instructions are available, they should be followed carefully.

7. REASSESSMENT OF HAZARDS.

It is the responsibility of the safety officer to reassess the workplace hazard situation as necessary, by identifying and evaluating new equipment and processes, reviewing accident records, and reevaluating the suitability of previously selected PPE.

8. SELECTION CHART GUIDELINES FOR EYE AND FACE PROTECTION.

Some occupations (not a complete list) for which eye protection should be routinely considered are:

- Assemblers.
- Carpenters.
- Chemical process operators and handlers.
- Electricians.
- Grinding machine operators.
- Laborers.
- Lathe and milling machine operators.
- Machinists.
- Mechanics and repairers.
- Millwrights.
- Plumbers and pipe fitters.
- Sanders.
- Sawyers.
- Sheet metal workers and tinsmiths.
- Timber cutting and logging workers.
- Welders.

Appendix Table 1, "Eye and Face Protector Selection Chart," and Appendix Figure 1, "Eye and Face Protective Devices," are intended to aid in identifying and selecting the types of eye and face protectors that are available, their capabilities and limitation for the hazard "activity and assessment" operations that are listed.

**APPENDIX TABLE 1
EYE AND FACE PROTECTOR SELECTION**

This guide is not intended to be the sole reference in selecting the proper eye and face protector.

Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of the hazards must be provided.

ACTIVITY AND ASSESSMENT	PROTECTOR CATEGORY AND STYLES	LIMITATIONS	NOT RECOMMENDED
IMPACT			
<p>Chipping, grinding, machining, masonry work, riveting, and sanding.</p> <p>Flying fragments, objects, large chips, particles, sand, dirt, etc.</p>	<p>Spectacles, goggles: B, C, D, E, F, G, H, I, J, K, L. For Severe exposure add N. Respirators, R, T.</p> <p>Faceshields shall only be worn over spectacles or goggles.</p> <p>Persons whose vision requires the use of prescription lenses shall wear either protective devices fitted with prescription lenses or protective devices designed to be worn over regular prescription eyewear.</p> <p>Wearers of contact lenses shall also be required to wear appropriate spectacles or goggles depending on the specific hazard. Dusty and/or chemical environments may represent an additional hazard to contact lens wearers. Wearing of contact lenses under an R respirator is permitted.</p> <p>Goggles, helmets and faceshield windows that bear the marking "Z-87+" comply with the High Impact Test Requirements. Those with "Z-87" markings comply only with Basic Impact Testing Requirements. Spectacle lenses that are marked with the manufacturers logo and a "+" sign comply with the High Impact Test Requirements. Those spectacle lenses marked with the manufacturers logo and no "+" comply only with Basic Impact Testing Requirements. (It is important during the selection process to remember that different product categories are tested at different levels of impact resistance. Goggles are tested at a higher level of impact than spectacles and face shields are tested at a higher level than goggles.)</p> <p>The Z-87-2 frame marking indicates the frame meets high impact requirements with a minimum lens thickness of 2mm.</p>	<p>Protective devices do not provide unlimited protection.</p> <p>Note: Caution should be exercised in the use of metal frame protective devices in electrical hazard areas. Metal frame protective devices could potentially cause electrical shock and electrical burns through contact with, or thermal burns from exposure to the hazards of electrical energy, which include radiation from accidental arcs.</p> <p>Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.</p>	<p>Protectors that do not provide protection from side exposure.</p> <p>Filter or tinted lenses that restrict light transmittance, unless it is determined that a glare hazard exists. Refer to OPTICAL RADIATION.</p> <p>Use of faceshields alone, without spectacles or goggles.</p>

**APPENDIX TABLE 1
EYE AND FACE PROTECTOR SELECTION**

This guide is not intended to be the sole reference in selecting the proper eye and face protector.

Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards.
Adequate protection against the highest level of the hazards must be provided.

ACTIVITY AND ASSESSMENT	PROTECTOR CATEGORY AND STYLES	LIMITATIONS	NOT RECOMMENDED
HEAT			
Furnace operations, pouring, casting, hot dipping, gas cutting, and welding.	Note: Operations involving heat may also involve optical radiation. (See electric arc, gas, and glare under Optical Radiation below.) Protection from both hazards shall be provided. Faceshields shall only be worn over spectacles or goggles.	Spectacles, cup and cover type goggles do not provide unlimited facial protection.	Protectors that do not provide protection from side exposure.
Hot Sparks	Goggles, spectacles: B, C, D, E, F, G, H, I, J, K, L. For severe exposure add N. Respirators R, T.	Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.	Use of faceshields alone, without spectacles or goggles.
Splash from molten metals	Faceshields worn over goggles H, K. Respirators R, T or S, U if optical radiation hazard exists.		
High temperature exposure	Screen faceshields, Reflective faceshields over spectacles or goggles.		
CHEMICAL			
Acid and chemicals handling, degreasing, plating. Splash and irritating mists.	Indirect vented: goggles, eyecup and cover types: G, H, K. For severe exposure add N. Respirators R, T. Irritating Mist: Special purpose goggles: G. Cover goggle – No ventilation. Respirators R, T.	Provides protection from splash entry with adequate ventilation. Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	Spectacles, welding, helmets, or handshields.
DUST			
Woodworking, buffing, general dusty conditions. Nuisance dust	Goggles, eyecup and cover types: G, H, K. Respirators R, T.	Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	

**APPENDIX TABLE 1
EYE AND FACE PROTECTOR SELECTION**




















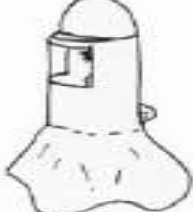


This guide is not intended to be the sole reference in selecting the proper eye and face protector.

Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards.
Adequate protection against the highest level of the hazards must be provided.

ACTIVITY AND ASSESSMENT	PROTECTOR CATEGORY AND STYLES		LIMITATIONS	NOT RECOMMENDED
OPTICAL RADIATION				
WELDING: Electric Arc	Note: Welding helmets or handshields shall be used only over spectacles or goggles.		Protection from optical radiation is directly related to filter lens density. Select the darkest shade that allows adequate tasks performance.	Protectors that do not provide protection from optical radiation.
Viewing electric arc furnaces and boilers	TYPICAL FILTER LENS SHADE: 10-14	PROTECTORS: Welding helmets or Welding Shields: O, P, Q Respirators S, U	Note: Filter lenses shall meet the requirements for shade designations in GI Part 33 Table 1.	Note: Filter lenses shall meet the requirements for shade designations in Table 1.
WELDING: Gas, and viewing gas-fired furnaces and boilers	TYPICAL FILTER LENS SHADE: 4-8	PROTECTORS: Welding goggles, Helmets. Welding Face shields over spectacles or goggles: J, K, L, M, N, O, P, Q or Respirators S, U.	Note: Faceshields and welding helmets shall only be worn over spectacles or goggles.	Use of welding helmets or faceshields alone, without spectacles or goggles.
CUTTING	TYPICAL FILTER LENS SHADE: 3-6	PROTECTORS: Welding goggles, Helmets. Welding face shields: J, K, L, M, N, O, P, Q or Respirators S, U		
TORCH BRAZING	TYPICAL FILTER LENS SHADE: 3-4	PROTECTORS: Welding goggles, Helmets. Welding face shields: J, K, L, M, N, O, P, Q or Respirators S, U		
TORCH SOLDERING	TYPICAL FILTER LENS SHADE: 1.5-3	PROTECTORS: Spectacles or Welding Faceshield over spectacles: B, C, D, E, F, N or Respirators S, U.		
GLARE	Spectacle: A, B, Faceshields N over spectacles or goggles.			

**APPENDIX FIGURE 1
EYE AND FACE PROTECTIVE DEVICES**

The illustrations shown are only representative of protective devices commonly available at this time.
Protective devices do not need to take the forms shown, but must meet the requirements of this standard.

<p>A. Spectacle, No sideshield</p> 	<p>B. Spectacle, Half sideshield</p> 	<p>C. Spectacle, Full Sideshield</p> 	<p>D. Spectacle, Detachable Sideshield</p> 	<p>E. Spectacle, Non-Removable Lens</p> 
<p>F. Spectacle, Lift Front</p> 	<p>G. Cover Goggle, No Ventilation</p> 	<p>H. Cover Goggle, Indirect Ventilation</p> 	<p>I. Cover Goggle, Direct Ventilation</p> 	<p>J. Cup Goggle, Direct Ventilation</p> 
<p>K. Cup Goggle, Indirect Ventilation</p> 	<p>L. Spectacle, Headband Temple</p> 	<p>M. Cover Welding Goggle, Indirect Ventilation</p> 	<p>N. Faceshield</p> 	<p>O. Welding Helmet, hand Hold</p> 
<p>P. Welding Helmet, Stationary Window</p> 	<p>Q. Welding Helmet, Lift Front</p> 	<p>R. Respirator</p> 		
<p>S. Respirator</p> 	<p>T1. Respirator</p> 		<p>T2. Respirator</p> 	<p>U. Respirator</p> 

- (1) Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards must be provided.
- (2) Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
- (3) Faceshields shall only be worn over primary eye protection.
- (4) Filter lenses shall meet the requirements for shade designations in General Industry Safety Standard Part 33 "Personal Protective Equipment," Table 1.
- (5) Persons whose vision requires the use of prescription lenses shall wear either protective devices fitted with prescription lenses or protective devices designed to be worn over regular prescription eyewear.
- (6) Wearers of contact lenses shall also be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.
- (7) Caution should be exercised in the use of metal frame protection devices in electrical hazard areas.
- (8) Refer to Section 6.5 "Special Purpose Lenses" in ANSI Z-87.1 2003 edition, as adopted in R 408.13301a.
- (9) Welding helmets or handshields shall be used only over primary eye protection.
- (10) Non-sideshield spectacles are available for frontal protection only.

9. SELECTION GUIDELINES FOR HEAD PROTECTION.

All head protection (helmets) is designed to provide protection from impact and penetration hazards caused by falling objects. Head protection is also available which provides protection from electric shock and burn. When selecting head protection, knowledge of potential electrical hazards is important.

Protective helmets are described by impact type and electrical class. All protective helmets shall meet either Type I or Type II requirements. All helmets shall be further classified as meeting Class G, Class E, or Class C electrical requirements. Helmets shall be classified as follows:

(a) Impact type protective helmets shall be as follows:

- (i) Type I helmets are intended to reduce the force of impact resulting from a blow only to the top of the head.
- (ii) Type II helmets are intended to reduce the force of impact resulting from a blow to the top or sides of the head.

(b) Electrical classes for protective helmets shall be as follows:

- (i) Class G, General protective helmets are intended to reduce the danger of contact with low voltage conductors. Test samples shall be proof-tested at 2200 volts (phase to ground). This voltage is not intended as an indication of the voltage at which the helmets protects the wearer.
- (ii) Class E, Electrical protective helmets are intended to reduce the danger of contact with higher voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). This voltage is not intended as an indication of the voltage at which the helmet protects the wearer.
- (iii) Class C, Conductive protective helmets are not intended to provide protection against contact with electrical hazards.

Where falling object hazards are present, helmets must be worn. Some examples include: working below other workers who are using tools and materials which could fall; working around or under conveyor belts which are carrying parts or materials; working below machinery or processes which might cause material or objects to fall; and working on exposed energized conductors.

Some examples of occupations for which head protection should be routinely considered are:

- Carpenters.
- Electricians.
- Linemen.
- Mechanics and repairers.
- Plumbers and pipe fitters.
- Assemblers.
- Packers.
- Wrappers.
- Sawyers.
- Welders.
- Laborers.
- Freight handlers.
- Timber cutting and logging.
- Stock handlers.
- Warehouse laborers

10. SELECTION GUIDELINES FOR FOOT PROTECTION.

Safety shoes and boots which meet the American Society for Testing and Materials Standards ASTM F 2412 "Standard Test Methods for Foot Protection," 2005 edition, and ASTM F2413 "Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear," 2005 edition standards that provide both impact and compression protection.

Where necessary, safety shoes can be obtained which provide puncture protection. In some work situations, metatarsal protection should be provided, and in other special situations electrical conductive or insulating safety shoes would be appropriate.

Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and, for other activities where objects might fall onto the feet.

Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts) around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet.

Safety shoes or boots with puncture protection would be required where sharp objects such as nails, wire tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.

Some occupations (not a complete list) for which foot protection should be routinely considered are:

- Assemblers.
- Carpenters.
- Craters.
- Drywall installers and lathers.
- Electricians.
- Freight handlers.
- Gardeners and grounds- keepers.
- Laborers.
- Machinists.
- Mechanics and repairers.
- Packers.
- Plumbers and pipe fitters.
- Punch and stamping press operators.
- Sawyers.
- Shipping and receiving clerks.
- Stock clerks.
- Stock handlers and warehouse laborers.
- structural metal workers.
- timber cutting and logging workers.
- Welders.
- Wrappers.

11. SELECTION GUIDELINES FOR HAND PROTECTION.

Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. MIOSHA is unaware of any gloves that provide protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. These performance characteristics should be assessed by using standard test procedures.

Before purchasing gloves, the employer should request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated. Other factors to be considered for glove selection in general include:

(A) As long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly change cheaper gloves than to reuse more expensive types; and,

(B) The work activities of the employee should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure of the hazard, and the physical stresses that will be applied.

With respect to selection of gloves for protection against chemical hazards:

(A) The toxic properties of the chemical(s) must be determined; in particular, the ability of the chemical to cause local effects on the skin and/or to pass through the skin and cause systemic effects;

(B) Generally, any "chemical resistant" glove can be used for dry powders;

(C) For mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials; and,

(D) Employees must be able to remove the gloves in such a manner as to prevent skin contamination.

12. CLEANING AND MAINTENANCE.

It is important that all PPE be kept clean and properly maintained. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision.

Personal Protective Equipment (PPE) should be inspected, cleaned, and maintained at regular intervals so that the PPE provides the requisite protection. It is also important to ensure that contaminated PPE which cannot be decontaminated is disposed of in a manner that protects employees from exposure to hazards.

**APPENDIX C
GENERAL INDUSTRY THRESHOLD HEIGHTS REQUIRING FALL PREVENTION/PROTECTION**

This chart provides a breakdown of the fall protection requirements of general industry standards.

Check to see if specific rules relate to your industry or activities.

It's important that you look at the specific language in the standard, which can be found by clicking on the hyperlink.

CONDITION	THRESHOLD	METHOD	STANDARD AND RULE
Over dangerous equipment	No minimum	Standard barrier	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 213(1)
Open-sided floor, platform, runway, window wall opening	4 feet	Standard barrier	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 213(2)(5), 217(3)
Vehicle servicing pit	No minimum	12 inch yellow caution line	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 215(2)(b)
Temporary floor/wall holes, openings	4 feet	Standard barrier or attendant	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 215(5)
Skylight	36 inches	Wall, standard barrier, skylight guard	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 215(8)
Chute wall opening	4 feet	Standard barrier	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 217(2)
Open vat or tank of hazardous substance	No minimum	36 inch barrier	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 219
Fixed ladder	20 - 30 feet 30 feet or more	Cage, well or safety device Safety device or landing platforms	Part 3. Fixed Ladders, Rules 351(1)(2), 355
Portable ladder		None Required	Part 4. Portable Ladders
Scaffold (except ladder scaffold, boatswain's chair, needle beam)	10 feet	Standard barrier or lifeline and safety belt	Part 5. Scaffolding, Rule 513(2)
Roof	4 feet	Safety belt & lifeline or standard barrier	Part 2. Floor & Wall Openings, Stairways & Skylights, Rule 213(1)
Stationary refuse packer hopper opening	No minimum	Standard barrier	Part 17. Refuse Packer Units, Rule 1732(1)
Overhead crane, footwalk or catwalk	No minimum	Standard barrier	Part 18. Overhead & Gantry Cranes, Rule 1835(2)
Personnel platforms – overhead, underhung, crawler cranes, powered industrial trucks, tractors	No minimum	Standard barrier	Part 18 Overhead & Gantry Cranes, Part 19 Crawler, Locomotive & Truck Cranes, Part 20 Underhung Cranes & Monorail Systems Part 21 Powered Industrial Trucks Part 22 Tractors

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Check to see if specific rules relate to your industry or activities.

It's important that you look at the specific language in the standard, which can be found by clicking on the hyperlink.

CONDITION	THRESHOLD	METHOD	STANDARD AND RULE
Underhung crane catwalk	No minimum	Standard barrier	Part 20. Underhung Cranes & Monorail Systems , Rule 2016(3)
Manlifts	25 feet No minimum	Standard barrier (emergency landing) Entrances and exits to manlifts	Part 25. Manlifts , Rules 1910.68 (b)(6)(v) and 1910.68 (b)(8)
Telecommunications	4 feet	Personal climbing equipment	GI Part 50 Telecommunications CS Part 30 Telecommunications Rule (g)
Veneer steaming & soaking vats	No minimum	36 inch sides or standard barrier	Part 27. Woodworking Machinery , Rule 2773(1)(2)
When no specific rule applies - climbing on machinery or equipment not equipped with a platform and standard barrier	4 feet	Safety harness and lifeline or lanyard	MIOOSH Act 154 , General Duty Clause



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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
DIRECTOR'S OFFICE
GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on December 28, 1970 (as amended October 25, 1972)
(as amended March 4, 1974) (as amended August 2, 1976) (as amended May 11, 1981)
(as amended March 19, 1982) **(as amended January 9, 2013)**

These rules become effective immediately upon filing with the Secretary of State
unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.
Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs
by sections 16 and 21 of 1974 PA 154, and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4,
and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.10421 of the Michigan Administrative Code is amended
and R 408.10413 of the Code is rescinded as follows:

PART 4. PORTABLE LADDERS

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GENERAL PROVISIONS

R 408.10401. Scope.

Rule 401. This part establishes minimum requirements for the construction, care and use of portable ladders used in, around or about places of employment.

R 408.10403. Definitions; B to D.

Rule 403. (1) "Brand" means marking by burning with a hot iron.

(2) "Check" means a lengthwise separation of wood less than 6 inches in length and 1/2-inch deep, most of which occurs across the rings of annual growth.

(3) "Cleats" means a ladder's crosspieces of rectangular cross section placed on edge on which a person may step to ascend or descend.

(4) "Crack" means a separation of wood cells across the grain line.

(5) "Decay" or "rot" means the disintegration of wood substance due to action of wood-destroying fungi.

R 408.10404. Definitions E.

Rule 404. (1) "Extension ladder" means a non-self-supporting portable ladder adjustable in length. It consists of 2 or more sections traveling in guides or brackets so arranged as to permit adjustment of the ladder's length. Its size is designated by the sum of the lengths of the sections measured along the side rails.

(2) "Extension trestle ladder" means a self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with suitable means for locking the ladders together. The size is designated by the length of the rail of the trestle ladder base.

R 408.10406. Definitions L to R.

Rule 406. (1) "Ladder" means an appliance which usually consists of 2 side rails joined at regular intervals by crosspieces called steps, rungs or cleats, on which a person may step to ascend or descend.

(2) "Ladder stand" means a mobile, fixed size, self-supporting ladder consisting of flat treads in the form of stairs and may include handrails.

(3) "Pitch" means the included angle between the horizontal and the ladder, measured on the opposite side of the ladder from the climbing side.

(4) "Platform ladder" means a self-supporting type of step ladder of fixed size with a platform provided at the working level. The size is determined by the distance along the front rail from the platform to the base of the ladder.

(5) "Portable ladder" means a ladder not permanently fixed in place and which may be used at various locations.

(6) "Rungs" means a ladder's crosspieces of circular or oval cross section on which a person may step to ascend or descend.

R 408.10407. Definitions; S.

Rule 407. (1) "Safety feet" means a safety device placed on the foot of the side rails to reduce the likelihood of the base slipping. Safety feet may be flat pads covered with a nonslip material, pointed metal projections, or spur wheels.

(2) "Sectional ladder" means a non-self-supporting portable ladder, consisting of 2 or more sections so constructed that the sections, when combined by interlocking, will function as a single ladder. Its size is designated by the overall length of the assembled sections. It is not adjustable.

(3) "Single ladder" means a non-self-supporting portable ladder, nonadjustable in length, consisting of only 1 section. Its size is designated by the overall length of the side rail.

(4) "Special-purpose ladder" means a portable ladder which represents either a modification or a combination of design or construction features in 1 or more of the general purpose types of ladders, as defined in this part in order to adapt the ladder to special or specific uses.

(5) "Split" means a lengthwise separation or lateral fault along the grain line; a tearing apart of the wood cells from 1 surface to the opposite or adjoining surface.

(6) "Step ladder" means a self-supporting portable ladder, non-adjustable in length, having flat steps and a hinged back. Its size is measured along the front edge of the side rails.

(7) "Steps" means the flat crosspieces of a ladder on which a person may step to ascend or descend.

R 408.10408. Definitions T to W

Rule 408. (1) "Trestle ladder" means a self-supporting portable ladder, non-adjustable in length, consisting of 2 sections hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge.

(2) "Worn" means the reduction of a dimension of a wood or nonwood part by more than 10% of its original size.

R 408.10413. Rescinded.

WOOD LADDERS

R 408.10421. Portable wood ladders, metal and wood parts.

Rule 421. (1) The strength of metal parts and fittings of a portable wood ladder shall not be less than the design requirements of the ladder to which they are affixed.

(2) Wood parts shall meet the American National Standards Institute (ANSI) standard A 14.1, "Portable Wood Ladders," 1975 edition, which is incorporated herein by reference. This standard is available for inspection at the Michigan Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, MI 48909, and may be purchased from IHS Global, 15 Inverness Way East, Englewood, Colorado, 80112, USA, telephone number: 1-800-854-7179 or via the internet at the website: <http://global.ihs.com>; at a cost as of the time of adoption of these rules of \$20.00.

R 408.10422. Portable wood step ladders.

Rule 422. A step ladder shall be only of a type as follows:

(a) Type I — which shall be an industrial step ladder, 3 to 20 feet in length and manufactured for heavy duty, such as used by utilities, contractors and industries.

(b) Type II — commercial step ladder, 3 to 10 feet for medium duty, such as used by painters, offices and light industries.

R 408.10427. Portable rung ladder lengths.

Rule 427. (1) A portable rung ladder which is of a greater length than given in table 1 shall not be used.

(2) Table 1 reads as follows:

**TABLE 1
PORTABLE RUNG LADDER LENGTHS**

Type of Ladder	Maximum Length
Single ladder	22 feet
Two-section extension ladder	40 feet
Three-section extension ladder	60 feet
Assembled section ladder	21 feet
Trestle ladder or extension sections or base sections of an extension trestle ladder	18 feet

R 408.10428. Portable rung extension ladders.

Rule 428. (1) A portable rung extension ladder shall consist of 1 section which shall fit within the side rails of another section and arranged in such a manner that the upper sections may be raised or lowered.

(2) The minimum overlap of adjacent sections of a 2 or 3 section portable rung extension ladder shall be as follows:

Size of ladder in feet for all sections	Overlap of each section in feet
Up to and including 32	3
Over 32 up to including 48	4
Over 48 up to including 50	5

(3) A portable rung extension ladder shall have positive means which insure the overlap as specified in subrule (2) of this rule.

R 408.10431. Special-purpose ladders.

Rule 431. (1) A special-purpose ladder may be capable of being used as, but not limited to, a step ladder, a single or extension ladder, or a trestle ladder.

(2) A special-purpose ladder, when used as any of the type of ladder listed in subrule (1) of this rule, shall meet the requirements of the applicable rules of this part.

(3) A special-purpose ladder may be used by more than 1 employee if specifically designed for that purpose.

(4) A platform step ladder shall be constructed in accordance with the requirements for a type I step ladder or a type II step ladder. A platform of a platform ladder shall be capable of supporting a load of 200 pounds placed at any point on the platform.

(5) A type II step ladder which is used for painting may have its top omitted.

R 408.10432. Cleat ladders.

Rule 432. (1) A cleat ladder which is longer than 22 feet shall not be used.

(2) Wood in a cleat ladder shall be straight grained and knot free.

(3) Wood side rails of a cleat ladder shall not be less than 2 x 4 inches nominal. Wood cleats of a cleat ladder may not be less than 1 x 4 inches nominal.

(4) The distance between the side rails of a cleat ladder shall be at least 14 1/2 inches, but not more than 16 1/2 inches.

(5) Wooden cleats shall be inset into the 2 side rails of a cleat ladder not less than 1/2 inch or attached directly to the edge of the side rails if filler blocks the thickness of the cleats are securely attached to the edge of the rail for the entire length between the cleats. The cleats shall be fastened to each rail by at least 3 size 10-d wire nails.

R 408.10433. Ladder stands.

Rule 433. (1) A ladder stand shall be capable of sustaining the specified load.

(2) The load, which shall be calculated on the basis of 1 or more 200-pound employees, together with 50 pounds of equipment each, shall be applied uniformly to a 3 1/2 inch wide area, front to back, at the center of the width span, with a safety factor of 4.

(3) The maximum height at the working level shall be not more than 4 times the minimum base dimension. A ladder stand which does not meet this requirement shall be provided outrigger frames to achieve this least base dimension.

(4) The step width shall be not less than 16 inches and the steps shall have a slip resistant surface.

(5) Not less than 2 of the 4 casters of a ladder stand shall be the swivel type, and the caster shall be provided with positive wheel lock, swivel lock or both, to prevent movement.

(6) Steps shall be uniformly spaced and sloped, with a rise of not less than 9 inches nor more than 10 inches, and a depth of not less than 7 inches. The slope of the steps section shall be a minimum of 55 degrees and a maximum of 60 degrees, measured from the horizontal.

(7) Handrails shall be a minimum of 29 inches high. Measurements shall be taken vertically from the center of the step. Units having more than 5 steps, or 60 inches vertical height to the top step, shall be equipped with handrails.

R 408.10441. Handling and transporting ladders.

Rule 441. (1) A ladder shall be handled with reasonable care and not subjected to deliberate dropping or to misuse. A ladder shall not be used as a plank or skid.

(2) A ladder which is carried on a vehicle shall be secured to prevent it from catapulting or falling from the vehicle.

R 408.10442. Maintenance.

Rule 442. (1) A ladder shall not be painted with an opaque material. A ladder, particularly one used out-of-doors should be coated with a suitable transparent protective material to retard splintering caused by weathering.

(2) The side rails and legs of a ladder shall be kept free from splinters. The joint between the side rail and step shall be kept tight, and metal hardware and fittings secured.

(3) A ladder including its safety feet shall be kept free of oil, grease, mud, or any similar slippery substances.

(4) The locks, pulleys, spreader joints, or other movable metal parts of a ladder shall operate freely without undue play. Lubricants shall be applied as needed.

(5) A rope used on a ladder shall not have a long or loosely twisted lay, shall be free of burns and cuts, and shall not show evidence of weakness resulting from fraying, wear, mildew, or rot. Rope ends shall be fastened or whipped.

R 408.10443. Inspection; repair or replacement.

Rule 443. (1) A ladder shall be inspected before its use and after it has fallen or been involved in an accident to determine its condition. A ladder shall be repaired or replaced if it shows:

(a) Splits in its side rails through to opposite surfaces in excess of 3 inches at the rungs or 6 inches along the rails. Splits singly or in combination along the same grain line shall not exceed 6 inches in any 1 foot. Splits through to the opposite broad faces exceeding 6 inches but not more than 1 1/2 feet in length in single or combined lengths may be closed with a 3/16 inch diameter wagon box-head rivet centrally located in the narrow face of the rail. Where the split runs through rung holes, the rivets shall be placed approximately 2 inches from the center of each rung so affected. This subdivision does not refer to checks in a ladder.

(b) Gouges, dents or other damage that may be dressed smooth if the rail is not reduced by more than 10% of the thickness or depth. Damage to corner edges, including splits, may be dressed to a smooth bevel, if the cross section is not reduced by more than 10% of its original area.

(c) Worn, crushed, cracked, split, splintered or missing rungs, steps, tops or platforms.

(d) Longitudinal play of 3/4 inch in the rails due to looseness of rungs or steps.

(e) Broken or bent guide irons, spreaders or locks.

(2) A ladder with a defect, described in subrule (1), shall be tagged "Dangerous. Do Not Use." and it shall be removed from service for repair or destruction. Improvised repairs shall not be made.

R 408.10445. Use of ladders.

Rule 445. (1) A ladder shall not be placed in front of a door which opens toward the ladder unless the door is blocked open, locked, guarded by a person or protected by a barricade.

(2) A ladder shall not be placed on a box, barrel or other unstable base.

(3) A climber shall face the ladder when ascending or descending.

(4) A ladder shall not be used as a brace, skid, guy, gin pole, gangway, or for any other use than that for which it is intended.

(5) A person on a single or sectional ladder shall not overreach, or do any pushing or pulling that may cause the ladder to move or topple. If both shoulders are outside the side rail, the user is overreaching.

(6) The user shall not stand astride a ladder and another object.

(7) A single or sectional ladder manufactured pursuant to these rules shall not be used by more than 1 person at a time.

R 408.10446. Use of step ladders.

Rule 446. (1) A step ladder which is being used shall be opened fully and its spreaders locked.

(2) Each leg of a step ladder shall be in contact with solid footing. A board or plank may be used to secure footing on uneven ground.

(3) If a step ladder does not have a guard rail, the top step and cap shall not be used to work from or to climb on.

(4) A folded step ladder shall not be used as a straight ladder by leaning it against a wall or other support.

(5) When carrying objects up ladders, 1 hand should be kept free to maintain balance and security.

(6) The bracing on the back legs of a step ladder shall not be used for climbing, except as provided in R 408.10431 of this part.

R 408.10447. Use of straight, sectional, and extension ladders.

Rule 447. (1) A straight, sectional or extension ladder shall be placed so that the side rails have a secure footing. Where the surface is uneven, boards, planks, or leveling jacks may be used to create an even surface. A straight, sectional, or extension ladder shall have safety feet. The ladder shall be placed so as to prevent slipping or it shall be lashed or held in position.

(2) A portable non-self-supporting ladder should be erected at a pitch of 75 1/2 degrees for maximum balance and strength. This may be accomplished by placing the base out from the wall or other support 1/4 of the working length of the ladder.

(3) Ladders shall not be tied or fastened together to provide longer sections other than with the hardware provided by the manufacturer.

(4) A person using a straight or extension ladder shall not stand on the top 2 rungs or within 3 feet from the top of the ladder.

(5) If the top of the ladder is secured to an object, the user may secure himself to the ladder by placing 1 leg over the second rung above the rung on which he is standing.

(6) When using a ladder to go from 1 landing to another, the ladder shall extend above the upper landing by not less than 3 feet.

(7) The top rest for a straight or extension ladder shall be reasonably rigid and shall have ample strength to support the applied load.

NONWOOD LADDERS

R 408.10451. Construction of ladders.

Rule 451. (1) The design and construction of a portable nonwood ladder shall be such as to produce a ladder without structural defects or accident hazards such as sharp edges or burrs.

(2) Rungs or steps of portable nonwood ladders shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

R 408.10452. Specifications.

Rule 452. (1) A nonwood straight or extension ladder shall comply with R 408.10426 to R 408.10428, except a nonwood portable extension ladder with an interlocking rail section, such as a channel, shall have not less than a single guide iron on each rail.

(2) To be classified as a standard length ladder, the measured length shall be within plus or minus 1.2 inch of the specified length. A nonwood step ladder which exceeds 16 feet in length shall not be used. The bottom of each rail of a nonwood step ladder shall have nonslip material.

(3) A nonwood trestle ladder or extension sections or base section of a nonwood extension trestle ladder shall comply with R 408.10427.

(4) The length of a nonwood platform ladder shall not exceed 16 feet.

(5) A nonwood platform ladder shall comply with R 408.10422.

R 408.10454. Nonwood ladder care and maintenance.

Rule 454. (1) A nonwood ladder shall be maintained pursuant to R 408.10441 and R 408.10442(3), (4), and (5).

(2) A nonwood ladder shall be inspected before being used and after it has fallen or been involved in an accident to determine its condition.

(3) A nonwood ladder shall be repaired or replaced if it shows: cracked, bent or twisted side rails or legs; rungs where opposite surfaces are bent or deformed; loose or broken rivets and bolts, or other fasteners; broken or bent spreaders, guides or locks.

R 408.10456. Use of nonwood ladders.

Rule 456. (1) A metal ladder, except a ladder provided and used by a life support organization such as a fire department, shall not be furnished or used near an exposed or open electrical source.

(2) A nonwood ladder shall be used pursuant to R 408.10445 to R 408.10447.

(3) When in use, a nonwood, non-self-supporting ladder shall be placed so that the 2 side rails are supported, unless equipped with a single attachment capable of supporting the imposed load.



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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on April 30, 1974 (as amended August 2, 1976)
(as amended April 2, 1979) (as amended March 23, 1982) (as amended June 1, 1994)
(as amended January 14, 1998)

These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services
by sections 16 and 21 of Act No. 154 of the Public Acts of 1974, as amended,
and Executive Reorganization Order No. 1996-2, being §§408.1016, 408.1021,
and 445.2001 of the Michigan Compiled Laws)

R 408.10351 of the Michigan Administrative Code is amended to read as follows:

PART 3. FIXED LADDERS

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GENERAL PROVISIONS

R 408.10301 Purpose and scope.

Rule 301. This part is intended to provide reasonable safety for life and limb by establishing minimum standards for the design and installation of fixed ladders and safe use by employees. A fixed ladder shall be designed to carry a designed minimum load under varying circumstances depending upon placement, length, method of fastening and other requirements of the installation.

Therefore, all parts and appurtenances necessary for a safe and efficient ladder shall necessarily be integral parts of that design. Utility poles and radio, television and transmission towers are excluded from this part.

R 408.10305 Definitions; A to F.

Rule 305. (1) "Allowable unit stress" means the maximum stress allowed to be applied as specified by recognized national codes and standards, such as the American national standards institute (ANSI), the American society of testing and materials (ASTM), and the national fire protection association (NFPA).

(2) "Cage", "cage guard," or "basket guard" means an enclosure fastened to the side rails of a fixed ladder or to the structure to encircle the climbing space of the ladder for the safety of a climber.

(3) "Cleats" means a ladder's crosspieces which are rectangular cross sections placed on edge and on which an employee may step.

(4) "Design factor" means the ratio of the ultimate failure strength of a member or piece of material or equipment to the actual working stress or intended safe load.

(5) "Fastenings" means a device including a fixed, hinged, bearing, or slide-type fastening, for attaching a ladder to a structure, building, or equipment.

(6) "Fixed ladder" means a ladder, including individual rung ladders, that is permanently attached to a structure, building, or equipment. The term does not include a ship's stairs or manhole steps.

R 408.10306 Definitions; G to M.

Rule 306. (1) "Grab bar" means a handhold placed adjacent to, or as an extension above, a ladder for the purpose of providing access beyond the limits of the ladder.

(2) "Individual rung ladder" means a fixed ladder that has each rung individually attached to a structure, building, or equipment.

(3) "Ladder" means an appliance which usually consists of 2 side rails joined at regular intervals by crosspieces called steps, rungs, or cleats and on which a person may step.

(4) "Ladder height" means the distance from ground or floor level to the topmost landing or top of a ladder.

(5) "Ladder safety device" means a device, other than a cage or well, designed to eliminate or reduce the possibility of accidental falls.

(6) "Manhole" means an access through which an employee gains entry to a work area or to equipment below a surface or behind a vertical partition, such as a vessel wall.

(7) "Manhole steps" means a series of steps individually attached or set into the walls of a manhole structure. Manhole steps are not considered to be an individual rung ladder.

R 408.10307 Definitions; P to R.

Rule 307. (1) "Personal fall protection" means a system which is worn by, or attached to, an employee and which is designed to prevent an employee from being injured if the employee falls while ascending or descending a ladder.

(2) "Pitch" means the included angle which is between the horizontal and the ladder and which is measured on the opposite side of the ladder from the climbing side.

(3) "Platform" means a work surface that is elevated above the surrounding work area.

(4) "Railings" means any combination of railings defined in the general industry safety standards commission standard, Part 2. Floor and Wall Openings, Stairways and Skylights, being R 408.10201 et seq. of the Michigan Administrative Code.

(5) "Rail ladder" means a fixed ladder which consists of side rails joined at regular intervals by rungs or cleats and which is fastened for its full length or in sections to a building, structure, or equipment.

(6) "Rungs" means crosspieces which are circular or oval cross sections and on which an employee may step.

R 408.10308 Definitions; S to W.

Rule 308. (1) "Side-step ladder" means a ladder that requires an employee who gets off at the top to step sideways from the ladder to reach the landing.

(2) "Step bolt" means a bolt or rung which is attached at intervals along a structural member and which is used for foot placement during climbing or standing. Step bolts are also referred to as "pole steps."

(3) "Steps" means the flat crosspieces of a ladder on which an employee may step.

(4) "Through ladder" means a ladder that requires an employee who gets off at the top to step through the ladder to reach the landing.

(5) "Tread" means the horizontal member of a step.

(6) "Well" means a permanent complete enclosure around a fixed ladder that protects a climber. Proper clearance for a well will give same protection as a cage.

R 408.10310 Surface conditions and clearances.

Rule 310. (1) Fixed ladder surfaces shall be designed, constructed, and maintained to be free of recognized hazards that might result in death or serious injury to employees.

(2) When fixed ladder surfaces cannot be maintained free of hazards such as snow, ice, or oil, employees shall be provided with a means to avoid or minimize their exposure to the hazards.

R 408.10311 Employee training; ladder use restrictions.

Rule 311. (1) An employer shall ensure that all employees who use ladders that have a working height of 6 feet (1.82 m) or more receive training on how to inspect ladders and how to properly use the ladders.

(2) Ladders shall be used only for the purposes for which they were designed.

R 408.10321 Design.

Rule 321. A fixed ladder, its appurtenances and fastenings shall be designed to meet the following load requirements:

(a) The minimum design live load shall be a single concentrated load of 300 pounds. A ladder installed before the effective date of this part may have a minimum design load of 200 pounds.

(b) The number and position of additional concentrated live loads units of 300 pounds each, or 200 pounds each if installed before the effective date of this part, as determined from anticipated usage of the ladder shall be considered in the design.

(c) The live loads shall be considered to be concentrated at the point or points causing the maximum stress in a structural member.

(d) The weight of the ladder and appurtenances together with the live load shall be considered in the design of rails and fastenings.

R 408.10323 Rungs, cleats, and steps; spacing; maintenance; load requirements.

Rule 323. (1) The distance between rungs, cleats, and steps shall not be more than 12 inches from the top of one rung, cleat, or step to the top of the next rung, cleat, or step above and shall be uniformly spaced throughout the length of the ladder.

(2) Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, and hazardous projections.

(3) Each step or rung shall be capable of supporting, without deflection, at least a single concentrated load of 300 pounds (1,362 kg) applied in the middle of the step or rung.

R 408.10324 Rungs and cleats; length; design; diameter of metal rungs; construction of metal cleats; adoption by reference of standards for wood cleats and other wood components.

Rule 324. (1) The clear length of rungs and cleats shall be not less than 16 inches.

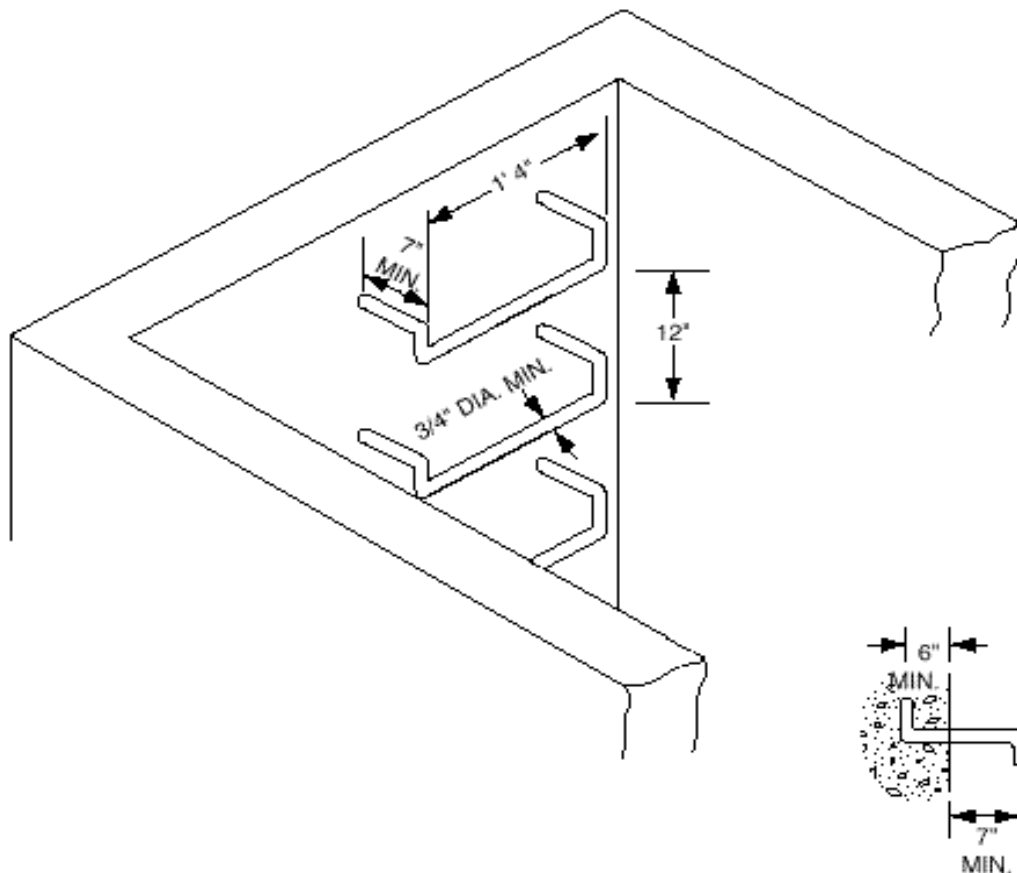
(2) The rungs of an individual rung ladder shall be designed so that an employee's foot cannot slide off the end. See figure 1.

(3) Metal rungs installed after November 15, 1971, shall have a diameter of not less than 3/4 of an inch and be constructed of steel rod or material of equivalent strength, except as provided in R 408.10341(1).

(4) Metal cleats shall be made of steel or a material of equal strength and have a bearing surface that is not less than 1/2 of an inch.

(5) Wood cleats and other wood components of a fixed ladder shall be as prescribed in ANSI standard A14.3-1984, fixed ladders, which is adopted by reference in these rules. The standard is available for inspection at the Lansing office of the department of consumer and industry services. The standard may be purchased from the American National Standards Institute, 11 West 42nd Street, New York, New York 10036, or from the Michigan Department of Consumer and Industry Services, MIOSHA Standards Division, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at a cost as of the time of adoption of this rule of \$13.00.

**FIGURE 1
SUGGESTED DESIGN FOR RUNGS ON INDIVIDUAL RUNG LADDER**



R 408.10325 Side Rails.

Rule 325. A side rail which might be used as a climbing aid shall be of such cross section as to afford a gripping surface without sharp edges, splinters or burrs.

R 408.10326 Fastenings.

Rules 326. Fastenings shall be as strong as the rails and shall be sufficient length to allow a minimum distance, as required by rule 335, between a permanent structure and the rungs of a ladder. Fastenings shall be attached to the permanent structure either by being built into it or by through bolts, rivets or expansion bolts grouted, leaded or the equivalent.

R 408.10328 Splices.

Rule 328. A splice shall meet the design requirements specified in rule 321. A splice or connection shall have a smooth transition with the original members and shall not have sharp or extensive projections.

R 408.10331 Protection from deterioration.

Rule 331. (1) Dissimilar metals shall be protected from electrolytic action when they are joined.

(2) A metal ladder and appurtenances installed in a corrosive environment shall be coated or otherwise treated to resist corrosion.

(3) A wood ladder subject to deterioration shall be treated with a transparent preservative. Paint shall not be used as a preservative. The design and construction shall prevent or minimize the accumulation of water on or between wood parts.

R 408.10333 Maintenance.

Rule 333. (1) A fixed ladder and any attached safety devices shall be inspected regularly. The inspection intervals shall be determined according to the use of the ladder and its exposure to deteriorating elements.

(2) Rungs, cleats, side rails, and other appurtenances shall be maintained to withstand the minimum loads established by this part.

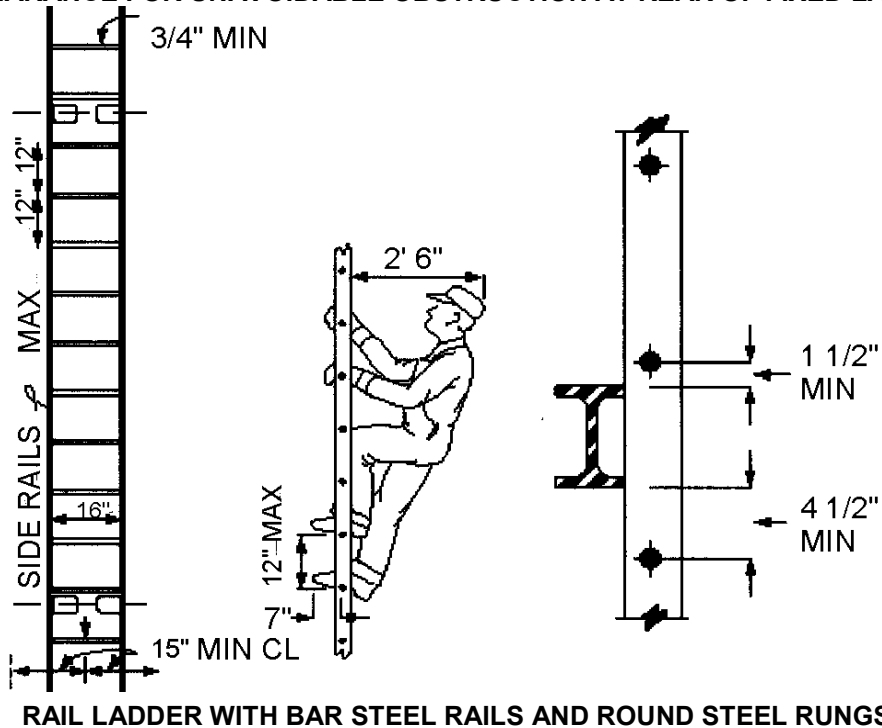
(3) A fixed ladder and any attached safety devices that are not in compliance with the requirements of this part shall be repaired or removed from service.

(4) Rungs, cleats, rails, and fasteners shall be maintained free of broken, worn, loose, or damaged parts that would create a falling hazard. Materials that are used to repair a rung, cleat, rail, or fastener shall be in compliance with the design strength of the rung, cleat, rail, or fastener.

R 408.10335 Clearance.

Rule 335. (1) The perpendicular distance from the center line of the rungs on the climbing side of a fixed ladder shall not be less than 36 inches for a pitch of 76 degrees, and not less than 30 inches for a pitch of 90 degrees to the nearest permanent object, except with respect to a cage or well installation. The minimum clearance for intermediate pitches between these 2 limits shall be in proportion to the slope. See figure 2.

**FIGURE 2
CLEARANCE FOR UNAVOIDABLE OBSTRUCTION AT REAR OF FIXED LADDER**



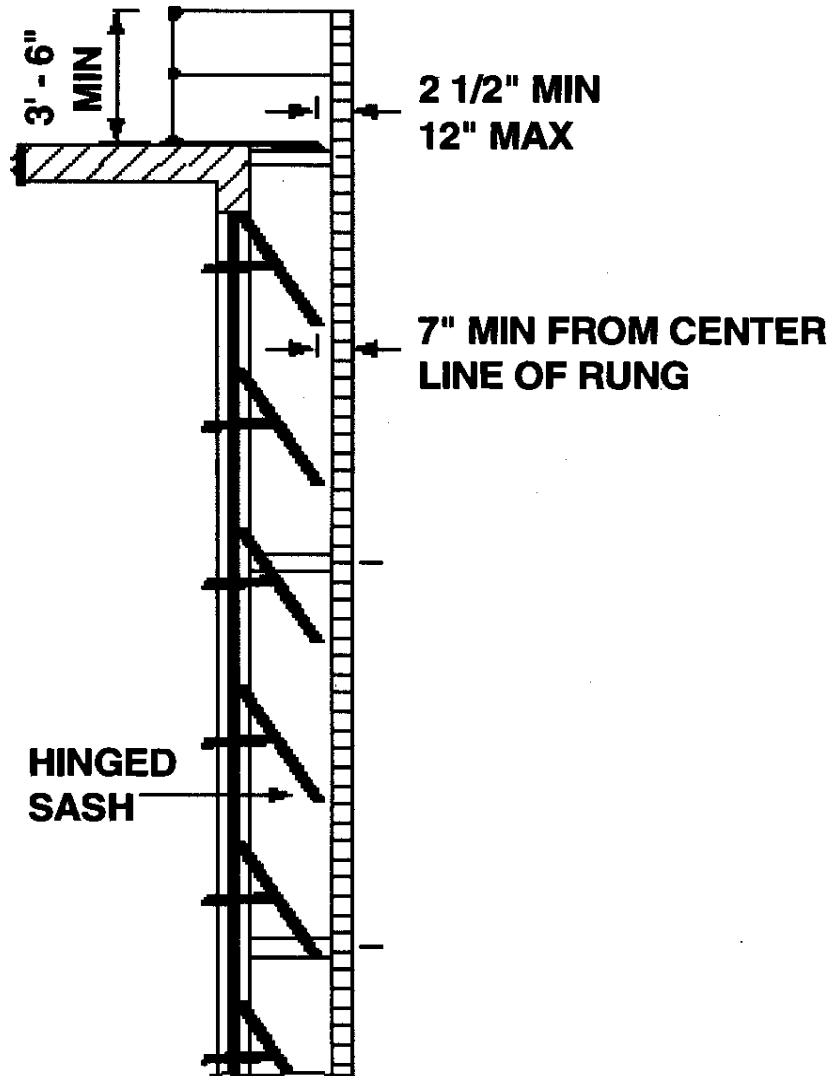
(2) A clear width of not less than 15 inches shall be provided each way from the center line of the fixed ladder to the nearest permanent object, except with respect to a cage or well installation.

(3) The perpendicular distance from the center line of the rung on the back side of a fixed ladder to the nearest permanent object shall be not less than 7 inches, except that when an unavoidable object is encountered, the minimum clearances shown in figure 2 shall be followed.

(4) The distance from the center line of a grab bar to the nearest permanent object in back of the grab bar shall be not less than 4 inches. A grab bar shall not protrude on the climbing side.

(5) The step across distance from the nearest edge of a fixed ladder to equipment or a structure shall be not less than 2 1/2 inches nor more than 12 inches. See figure 3.

**FIGURE 3
LADDER FAR FROM WALL**



(6) Where used, a counterweighted hatch cover shall open not less than 60 degrees from the horizontal. The distance from the center line of the rungs or cleats to the edge of the hatch opening on the climbing side shall be not less than 24 inches for offset walls or 30 inches for straight walls. Protruding potential hazards shall not be permitted within 24 inches of the center line of the rungs or cleats. Such hazards within 30 inches of the center line of the rungs or cleats shall be fitted with deflector plates placed at an angle of 60 degrees to the horizontal. (See figure 4). The relationship of a fixed ladder to a counterweighted hatch cover shall be as prescribed in figure 5.

FIGURE 4
DEFLECTOR PLATES FOR HEAD HAZARDS

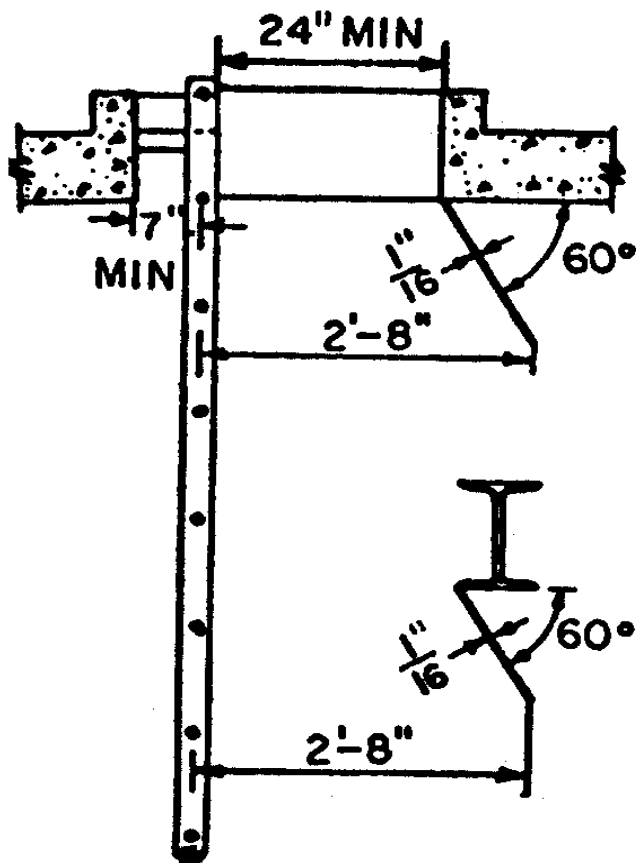
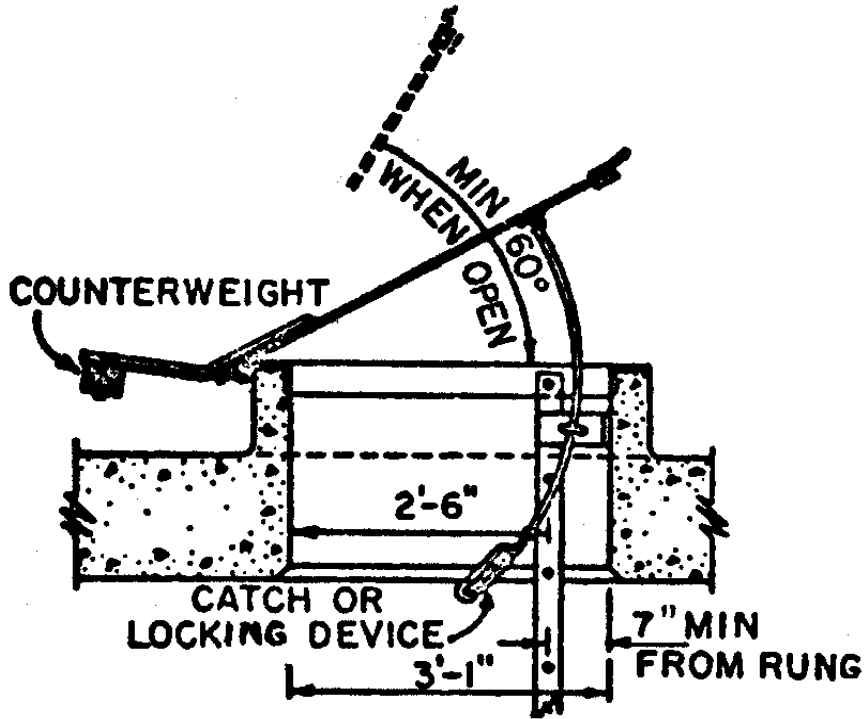


FIGURE 5
RELATIONSHIP OF FIXED LADDER TO A SAFE ACCESS HATCH



Cross Section View

R 408.10341 Special rules for utility manhole fixed ladders.

Rule 341. (1) A utility manhole fixed ladder shall have:

(a) Rungs of not less than 3/4 inch diameter steel rod or material capable of supporting 300 pounds with not less than 10 inch clear length. Rungs existing before the effective date of this part may be 5/8 inch diameter steel rod or material of equal strength capable of supporting 200 pounds.

(b) Rungs not less than 4 inches from the center of the rungs to the wall on the side opposite the climbing side. The rungs shall be embedded not less than 3 inches in the wall and aligned 1 above another.

(c) Rungs not less than 27 inches from the center of the rungs to the wall or projections on the climbing side.

(d) After November 15, 1971, rung configuration shall be so designed that an employee's foot cannot slide off the end. See figure 1.

(e) Spacing between rungs of not more than 16 inches on center and uniformly spaced throughout the entire length.

(2) A utility manhole with a conical shape shall not be provided with a fixed ladder. Access shall be by a portable ladder only.

R 408.10342 Step bolts and manhole steps; specifications.

Rule 342. (1) This rule applies to step bolts and manhole steps used on structures such as towers, stacks, conical manhole sections, and vaults. This rule does not apply to individual rung ladders.

(2) Step bolts and manhole steps shall be continuous and spaced uniformly not less than 6 inches (15 cm) and not more than 18 inches (46 cm) apart.

(3) The minimum clear step width of step bolts shall be 4 1/2 inches (14.4 cm). The minimum clear step width of manhole steps shall be 10 inches (25.4 cm).

(4) The minimum toe clearance for manhole steps shall be 4 inches (11.1 cm) from the point of embedment on the wall to the outside face of the step. The toe clearance in the center of the manhole step shall be a minimum of 4 1/2 inches (11.4 cm) measured to the outside face of the step.

(5) The minimum toe clearance for step bolts shall be 7 inches (17.8 cm). Where obstructions cannot be avoided, toe clearances may be reduced to 4 1/2 inches (11.4 cm).

(6) Step bolts and manhole steps shall be designed to prevent an employee's foot from slipping or sliding off the end of the step bolt or manhole step.

(7) Manhole steps and step bolts which are installed after the effective date of this rule and which are used in corrosive environments shall be constructed of, or coated with, a material that will retard corrosion of the step or bolt.

(8) All manhole steps installed on or after the effective date of this rule shall be provided with slip-resistant surfaces, such as corrugated, knurled, or dimpled surfaces.

(9) Each step bolt shall be capable of withstanding, without failure, not less than 4 times the intended load to be applied to the bolt.

(10) Manhole steps installed before the effective date of this rule shall be capable of supporting their maximum intended load.

R 408.10345 Design of manhole steps.

Rule 345. (1) An employer shall ensure that manhole steps installed on or after the effective date of this rule are in compliance with all the following requirements:

(a) The manhole steps shall be capable of withstanding, and remaining solidly secured after being subjected to, a separate application of a horizontal pull out load of 400 pounds (1,780 n), and a vertical load of 800 pounds (3,650 n).

(b) The manhole steps shall be capable of sustaining the vertical test load without developing a permanent set of more than 1/2 of an inch (1.27 mm).

(c) The loads shall be applied over a width of 3 1/2 inches (8.9 cm) centered on the step and be applied at a uniform rate until the required rate is reached.

(d) There shall not be visible cracking or fracturing of the step or spalling of the concrete.

(2) Step bolts and manhole steps shall be maintained in a safe condition and be visually inspected before each use.

(3) Step bolts that are bent more than 15 degree below the horizontal shall be removed and replaced with bolts that are in compliance with the requirements of these rules. A manhole step that is bent to an extent that reduces the step's projection from the wall to less than 4 inches (1.1 cm) shall be removed and replaced with a step that is in compliance with the requirements of these rules or replaced with a climbing device that is in compliance with the requirements of this rule.

R 408.10351 Safety devices.

Rule 351. (1) A cage, well, or ladder safety device shall be provided on a ladder that is more than 20 feet (6.1 m) long and that rises to a unbroken length of not more than 30 feet (9.1 m).

(2) A ladder safety device may be used on towers, water tanks, and chimney ladders that are more than 20 feet in unbroken length. The ladder safety device takes the place of cage protection. A landing is not required on a tower, water tank, or chimney ladder if a ladder safety device is used.

(3) A ladder safety device, such as one that incorporates a life belt, friction brake, or sliding attachment, shall be in compliance with the design requirements of the ladder it serves.

(4) Cages and wells that are provided for fixed ladders shall be designed to permit easy access to or egress from the ladders that they enclose. The cages and wells shall be continuous throughout the length of the fixed ladders, except for access, egress, and other transfer points. Cages and wells shall be designed and constructed to contain employees in the event of a fall and direct them to a lower landing.

(5) Ladder surfaces shall be free of puncture or laceration hazards.

R 408.10352 Cages.

Rule 352. (1) A cage shall extend not less than 42 inches above the top of a landing, unless other approved protection is provided. See figure 6.

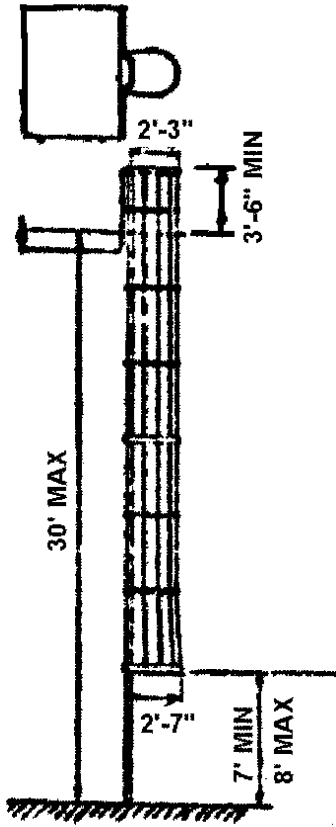
(2) A cage shall extend down a ladder to a point not less than 7 feet nor more than 8 feet above the ground, floor or platform. The bottom shall be flaired not less than 4 inches or the part of the cage opposite the ladder shall be carried to the base.

(3) A cage shall extend not less than 27 nor more than 28 inches from the center line of the rungs of a ladder. A cage shall be not less than 27 inches in width. The inside shall be clear of projections. Vertical bars shall be located at a spacing of not more than 40 degrees around the circumference of the cage, allowing a spacing of not more than approximately 9 1/2 inches center to center.

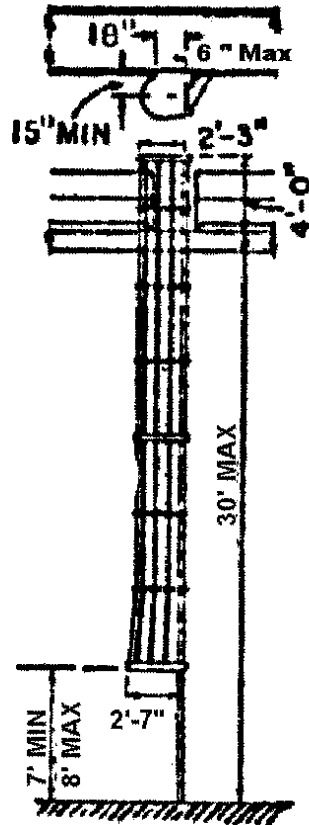
FIGURE 6
CAGES FOR LADDERS MORE THAN 20 FEET HIGH

Six-Step Ladder

Through Ladder

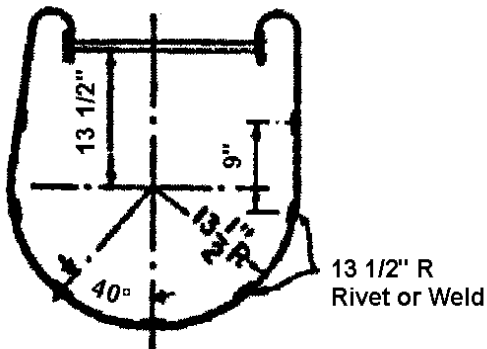
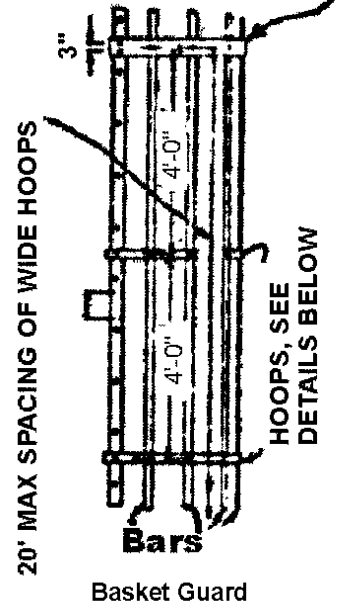


**Access To Landing Platform
Through Ladder**

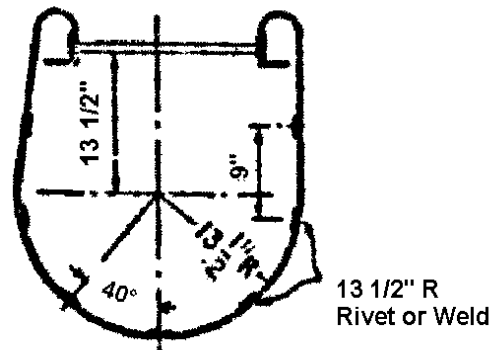


**Access Laterally
From Ladder**

**Top and Bottom Hoops
Also This Size**

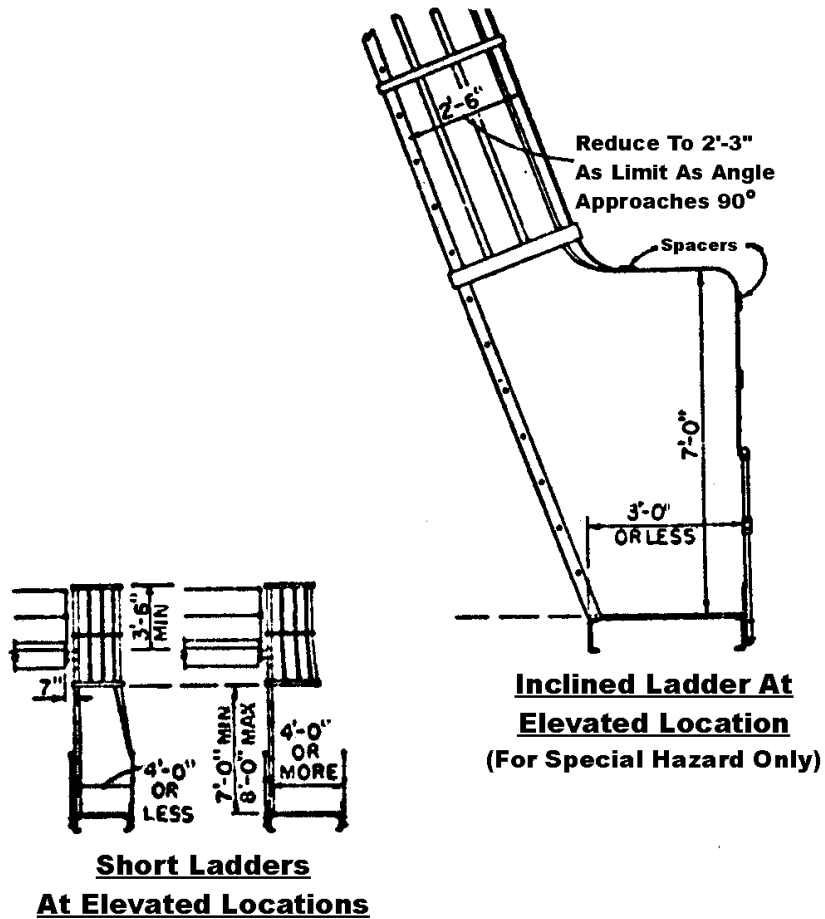


**Basket Guard Hoop
Bar Ladder**



**Basket Guard Hoop
Angle Iron Ladder**

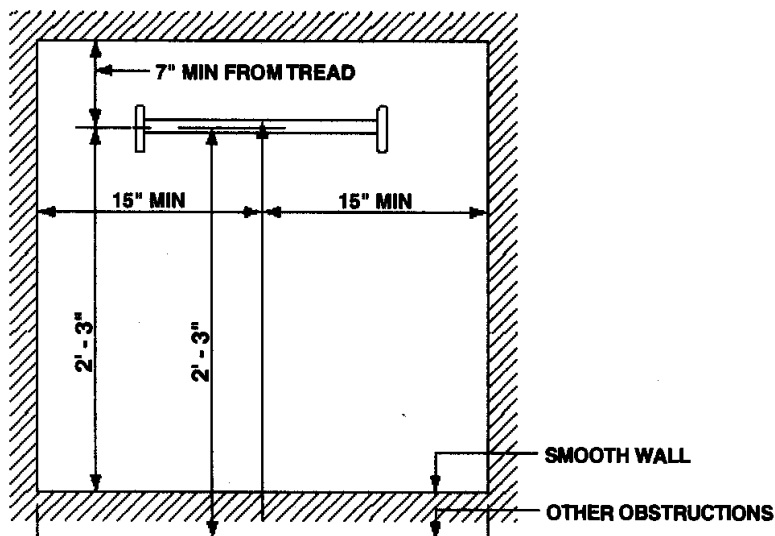
CAGES – SPECIAL APPLICATIONS



R 408.10353 Ladder wells.

Rule 353. A ladder well shall have a clear width of not less than 15 inches, measured each way from the center line of the ladder. On the climbing side of the ladder, not less than 30 inches of clearance shall be provided from the center line of the rungs to any obstruction, except not less than 27 inches from the center line of the rungs on the climbing side shall be provided for a smooth-walled well. See figure 7.

**FIGURE 7
CLEARANCE DIAGRAM FOR FIXED LADDER IN WELL**



R 408.10354 Personal fall protection systems.

Rule 354. (1) If a personal fall protection system for climbing activities is used, it shall permit the employee who uses the system to ascend or descend without continually having to hold, push or pull any part of the system, leaving both hands free for climbing.

(2) The connection between carrier or lifeline and the point of attachment to a body belt or harness shall not be more than 9 inches (23 cm) in length.

(3) A personal fall protection system for climbing activities shall be activated within 2 feet (.61 m) after a fall occurs in order to limit the descending velocity of an employee to 7 feet/sec (2.1 m/sec) or less.

(4) Mountings for rigid carriers shall be attached to each end of the carrier and shall have intermediate mountings, as necessary, spaced along the entire length of the carrier to provide the strength necessary to stop employee falls.

(5) Mountings for flexible carriers shall be attached at each end of the carrier. When the system is exposed to wind, cable guides that utilize a flexible carrier shall be installed at a minimum spacing of 25 feet (7.6 m) and a maximum spacing of 40 feet (12.2 m) along the entire length of the carrier to prevent wind damage to the system.

(6) The design and installation of mountings and cable guides shall not reduce the design strength of the ladder.

(7) Ladder safety devices and their support systems shall be capable of withstanding, without failure, a drop test that consists of an 18-inch (.41 m) drop of a 500 pound (226 kg) weight.

(8) All other personal fall protection systems for climbing activities shall be capable of withstanding, without failure, a drop test that consists of a 4-foot (1.2 m) drop of a 250- pound (113 kg) weight.

R 408.10355 Landing platforms.

Rule 355. (1) A ladder used to ascend to a height of more than 20 feet, except on a chimney, without a ladder safety device shall have a landing platform for each 30 feet of ladder height; provided, however, that where a cage or well is not employed, a landing platform shall be provided for every 20 feet of height or fraction thereof. The requirements for a landing platform pursuant to this subrule and subrule (3) of this rule may be satisfied by complying with the provisions of R 408.10351(2).

(2) A ladder section shall be offset from the adjacent sections with a landing platform provided at each offset, except where the climbing space opening in the platform is closed with a hinged part of the platform. A landing platform shall be as specified in this rule, and be not less than 24 inches by 30 inches (61 cm by 76 cm), and have at least the same strength as the ladder.

(3) Where an employee has to step a distance more than 12 inches from the center line of the rung of a ladder to the nearest edge of a structure or equipment, a landing platform shall be provided. The step-across distance shall be not less than 2 1/2 inches.

(4) The side step from a fixed ladder to a platform shall be not less than 7 inches and not more than 12 inches measured from the side rail to the platform edge.

(5) The side rail of an adjacent ladder shall be offset not less than 5 inches from the edge of a platform.

(6) A landing platform shall be equipped with standard railings as specified in the general industry safety standards commission standard, Part 2. Floor and Wall Openings, Stairways and Skylights, being R 408.10201 to R 408.10241 of the Michigan Administrative Code arranged to give safe access to the ladder. A platform shall be not less than 24 inches in width and not less than 30 inches in length.

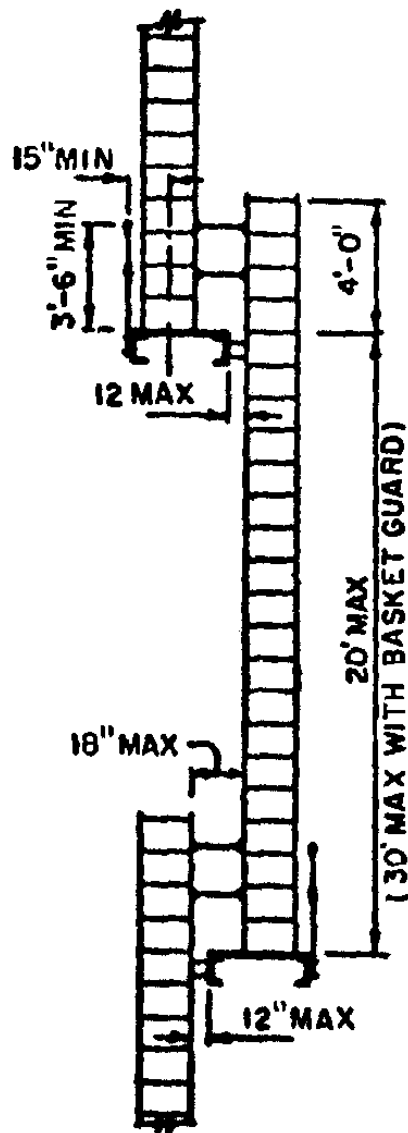
(7) One rung of any section of a ladder shall be located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder shall be used from the landing platform to the first rung below the landing.

R 408.10357 Ladder extensions.

Rule 357. (1) The side rails of a through or side-step ladder extension shall extend 3 1/2 feet above parapets and landings. On a through ladder extension, the rungs shall be omitted from the extension and shall have not less than 18 nor more than 24 inches clearance between rails. For sidestep or offset fixed ladder sections, at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the 3 1/2 feet minimum. See figure 8.

(2) This rule does not apply to a fixed ladder at a hatch cover.

**FIGURE 8
OFFSET FIXED LADDER SECTIONS**



R 408.10361 Grab bars.

Rule 361. Grab bars shall be spaced by a continuation of the rung spacing when they are placed horizontally. Vertical grab bars shall have the same spacing as the ladder side rails. Grab bar diameters shall be the equivalent of the round rung diameters. This rule does not apply to a fixed ladder covered with a manhole cover to allow for traffic.

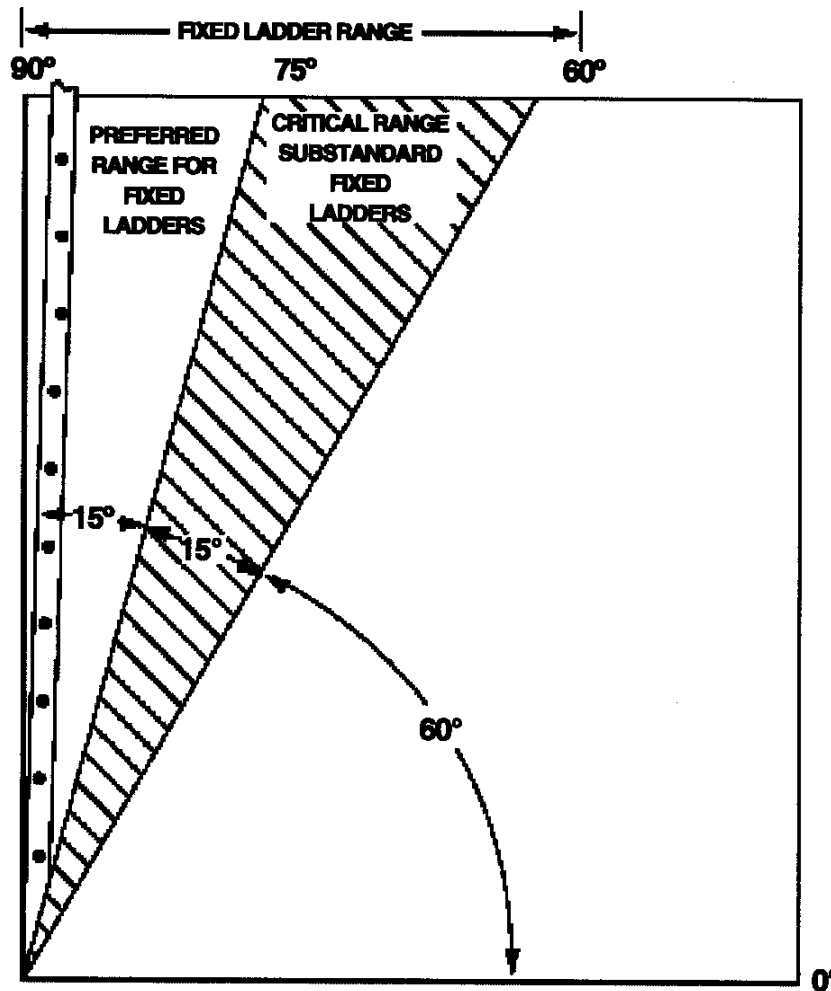
R 408.10365 Pitch.

Rule 365. (1) The preferred pitch of a fixed ladder shall be between 75 degrees and 90 degrees with the horizontal. (See figure 9.) However, a ladder with a pitch of less than 60 degrees shall have steps and raised hand rails, as specified in the general industry safety standards commission standard, Part 2. Floor and Wall Openings, Stairways and Skylights, being R 408.10201 to R 408.10241 of the Michigan Administrative Code.

(2) A fixed ladder is substandard if it is installed within the substandard pitch range of 60 and 75 degrees with the horizontal. A substandard fixed ladder is permitted only where necessary to meet conditions of installation. (See figure 9.) This substandard pitch range shall be avoided, if possible.

(3) A ladder shall not have a pitch of more than 90 degrees with the horizontal.

**FIGURE 9
PITCH OF FIXED LADDERS**



R 408.10371 Test methods for personal fall arrest systems.

Rule 371. The following sets forth test procedures for personal fall arrest systems as defined in the provisions of 29 C.F.R. §1910.129:

(a) Lifelines, lanyards, and deceleration devices shall be attached to anchorage and connected to the body belt or body harness in the same manner as they would be when used to protect employees.

(b) The anchorage shall be rigid and shall not have a deflection or more than .04 inches (1 mm) when a force of 2,250 pounds (10 kn) is applied.

(c) The frequency response of the load measuring instrumentation shall be 120 hz.

(d) The test weight used in the strength and force tests shall be a rigid, metal cylindrical or torso-shaped object that has a girth of 38 inches, plus or minus 4 inches (96 cm, plus or minus 10 cm).

(e) The lanyard or lifeline used to create the free-fall distance shall be supplied with the system or, in its absence, the least elastic lanyard or lifeline available shall be used with the system.

(f) The test weight for each test shall be hoisted to the required level and shall be quickly released without having any appreciable motion imparted to it.

(g) The system's performance shall be evaluated, taking into account the range of environmental conditions for which it is designed to be used.

(h) After the test, the system need not be capable of further operation.

(i) During the testing of all systems, a test weight of 300 pounds, plus or minus 5 pounds (135 kg, plus or minus 2.5 kg), shall be used. (see subdivision (d) of this rule).

(j) The test consists of dropping the test weight once. A new unused system shall be used for each test.

(k) For a lanyard system, the lanyard length shall be 6 feet, plus or minus 2 inches (1.83 m, plus or minus 5 cm), as measured from the fixed anchorage to the attachment on the body belt or body harness.

(l) For a rope-grab-type deceleration system, the length of the lifeline above the centerline of the grabbing mechanism to the lifeline's anchorage point shall not be more than 2 feet (0.61 m).

(m) For a lanyard system, for a system that has a deceleration device which does not automatically limit the free-fall distance to 2 feet (0.61 m) or less, and for a system that has a deceleration device that has a connection distance of more than 1 foot (0.3 m), measured between the centerline of the lifeline and the attachment point to the body belt or harness, that the test weight shall be rigged to free-fall a distance of 7.5 feet (2.3 m) from the point that is 1.5 feet (46 cm) above the anchorage point to its hanging location (6 feet below the anchorage). The test weight shall fall without interference, obstruction, or hitting the floor or ground during the test. In some cases, a nonelastic wire lanyard of sufficient length may need to be added to the system, for test purposes, to create the necessary free-fall distance.

(n) For a deceleration device system that has an integral lifeline or lanyard that automatically limits the free-fall distance to 2 feet (0.61 m) or less, the test weight shall be rigged to free-fall a distance of 4 feet (1.22 m).

(o) Any weight that detaches from the belt or harness constitutes a failure of the strength test.

(p) A force test consists of dropping the respective test weight specified in subdivision (q)(i) or (r)(i) of this rule once. A new, unused system shall be used for each test.

(q) All of the following provisions apply to force tests for a lanyard system:

(i) A test weight of 220 pounds, plus or minus 3 pounds (100 kg, plus or minus 1.6 kg), shall be used. (See subdivision (d) of this rule).

(ii) Lanyard length shall be 6 feet, plus or minus 2 inches (1.83 m, plus or minus 5 cm), as measured from the fixed anchorage to the attachment on the body belt or body harness.

(iii) The test weight shall be fall-free from the anchorage level to its hanging location, a total of 6 feet (1.83 m) free fall-distance, without interference, obstruction, or hitting the floor or ground during the test.

(r) Both of the following provisions apply to force tests for all systems other than a lanyard system:

(i) A test weight of 220 pounds, plus or minus 3 pounds (100 kg, plus or minus 1.6 kg), shall be used. (See subdivision (d) of this rule).

(ii) The free-fall distance to be used in the test shall be the maximum fall distance physically permitted by the system during normal use conditions, up to a maximum free-fall distance for the test weight of 6 feet (1.83 m), except as follows:

(a) For a deceleration system that has a connection link or lanyard, the test weight shall be a distance equal to the connection distance, which is the distance measured between the centerline of the lifeline and the attachment point to the body belt or harness.

(b) For a deceleration device system that has an integral lifeline or lanyard that automatically limits the free-fall distance to 2 feet (0.61 m) or less, the test weight shall free-fall a distance equal to that permitted by the system in normal use. For example, to test a system that has a self-retracting lifeline or lanyard, the test weight shall be supported and the system allowed to retract the lifeline or lanyard as it would in normal use. The test weight would then be released and the force and deceleration distance measured.

(s) A system fails the force test if the recorded maximum arresting force is more than 1,260 pounds (15.6 kn) when using a body belt, or is more than 2,520 pounds (11.2 kn) when using a body harness.

(t) The maximum elongation and deceleration distance shall be recorded during the force test.

(u) All of the following provisions apply to deceleration device tests:

(i) A deceleration device shall be evaluated or tested under the environmental conditions, such as rain, ice, grease, dirt, or type of lifeline, for which the device is designed.

(ii) A rope-grab-type deceleration device shall be moved on a lifeline 1,000 times over the same length or line distance of not less than 1 foot (30.5 cm), and the mechanism shall lock each time unless the device is permanently marked to indicate the type of lifelines that must be used, several types of lifelines that have different diameters and different materials shall be used to test the device.

(iii) The locking mechanism of self-activating-type deceleration devices that is designed for more than 1 arrest shall lock each of 1,000 times as it would in normal service.

R 408.10372 Test methods for positioning device systems.

Rule 372. The following provisions set forth test procedures for positioning device systems as defined in the provisions of 29 C.F.R. §1910.130:

(a) The fixed anchorage shall be rigid and shall not have a deflection of more than .04 inches (.01 mm) when a force of 2,250 pounds (10 kn) is applied.

(b) For lineman's body belts and pole straps, the body belt shall be secured to a 250-pound (113 kg) bag of sand at the point that simulates the waist of an employee. One end of the pole strap shall be attached to the rigid anchorage and the other end to the body belt. The sand bag shall be allowed to free-fall a distance of 4 feet (1.2 m). The pole strap and body belt fail testing if there is any breakage or slippage that permits the bag to fall-free to the ground.



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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on January 1, 1975 (as amended April 30, 1982) (**as amended May 15, 1997**)

These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 16 and 21 of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order No. 1996-2, being §§408.1016, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.12501 of the Michigan Administrative Code, appearing on page 309 of the 1982 Annual Supplement to the 1979 Michigan Administrative Code, is amended to read as follows:

PART 25. MANLIFTS

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GENERAL PROVISIONS

R 408.12501 Adoption of federal regulations; amendments.

Rule 2501. (1) The provisions of 29 C.F.R. §1910.68, Manlifts, except as amended in this rule, are adopted by reference in these rules and may be inspected and obtained at the Lansing office of the Michigan Department of Consumer and Industry Services, Standards Division, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at no charge as of the time of adoption of these rules. A copy of 29 C.F.R. §1910.68 is available, at no charge, from the United States Department of Labor, 801 South Waverly Road, Room 306, Lansing, Michigan 48917.

(2) The provisions of 29 C.F.R. §1910.68 are amended as follows:

(a) A reference to ANSI standard 12.1-1967, safety requirements for floor and wall openings, or a reference to 29 C.F.R. §1910, subpart D, is deemed to be a reference to general industry safety standard Part 2. Floor and Wall Openings, Stairways, and Skylights, being R 408.10201 et seq. of the Michigan Administrative Code.

(b) A reference to ANSI standard A14.3-1956, safety code for fixed ladders, or a reference to 29 C.F.R. §1910.68, subpart D, is deemed to be a reference to general industry safety standard Part 3. Fixed Ladders, being R 408.10301 et seq. of the Michigan Administrative Code.

(c) A reference to ANSI standard B15.1-1958, safety code for mechanical power transmission apparatus, or a reference to 29 C.F.R. §1910.68, subpart O is deemed to be a reference to general industry safety standard Part 7. Guards for Power Transmission, being R 408.10701 et seq. of the Michigan Administrative Code.

(d) A reference to NFPA 70-1971, ANSI C1-1971, or revision of C1-1968 is deemed to be a reference to general industry safety standard Part 39. Design Safety Standards for Electrical Systems and Part 40. Electrical Safety Related Work Practices, being R 408.13901 et seq. and R 408.14001 et seq., respectively, of the Michigan Administrative Code.

1910.68 MANLIFTS

(a) Definitions applicable to this section

- (1) Handhold (handgrip). A handhold is a device attached to the belt which can be grasped by the passenger to provide a means of maintaining balance.
- (2) Open type. One which has a handgrip surface fully exposed and capable of being encircled by the passenger's fingers.
- (3) Closed type. A cup-shaped device, open at the top in the direction of travel of the step for which it is to be used, and closed at the bottom, into which the passenger may place his fingers.
- (4) Limit switch. A device, the purpose of which is to cut off the power to the motor and apply the brake to stop the carrier in the event that a loaded step passes the terminal landing.
- (5) Manlift. A device consisting of a power-driven endless belt moving in one direction only, and provided with steps or platforms and handholds attached to it for the transportation of personnel from floor to floor.
- (6) Rated speed. Rated speed is the speed for which the device is designed and installed.
- (7) Split-rail switch. An electric limit switch operated mechanically by the rollers on the manlift steps. It consists of an additional hinged or "split" rail, mounted on the regular guiderail, over which the step rollers pass. It is spring-loaded in the "split" position. If the step supports no load, the rollers will "bump" over the switch; if a loaded step should pass over the section, the split rail will be forced straight, tripping the switch and opening the electrical circuit.
- (8) Step (platform). A step is a passenger carrying unit.
- (9) Travel. The travel is the distance between the centers of the top and bottom pulleys.

(b) General requirements.

(1) **Application.** This section applies to the construction, maintenance, inspection, and operation of manlifts in relation to accident hazards. Manlifts covered by this section consist of platforms or brackets and accompanying handholds mounted on, or attached to an endless belt, operating vertically in one direction only and being supported by, and driven through pulleys, at the top and bottom. These manlifts are intended for conveyance of persons only. It is not intended that this section cover moving stairways, elevators with enclosed platforms ("Paternoster" elevators), gravity lifts, nor conveyors used only for conveying material. This section applies to manlifts used to carry only personnel trained and authorized by the employer in their use.

(2) **Purpose.** The purpose of this section is to provide reasonable safety for life and limb.

(3) **Design requirements.** All new manlift installations and equipment installed after the effective date of these regulations shall meet the design requirements of the "American National Safety Standard for Manlifts ANSI A90.1-1969," and the requirements of this section.

(4) **Reference to other standards.** The following standards are applicable to this section. General industry standards Part 1. General Provisions; Part 2. Floor and Wall Openings, Stairways and Skylights; Part 3. Fixed Ladders; Part 7. Guards for Power Transmission; Part 39. Design Safety Standards for Electrical Systems; and Part 40. Electrical Safety Related Work Practices.

(5) Floor openings.

(i) Allowable size. Floor openings for both the "up" and "down" runs shall be not less than 28 inches nor more than 36 inches in width for a 12-inch belt; not less than 34 inches nor more than 38 inches for a 14-inch belt; and not less than 36 inches nor more than 40 inches for a 16-inch belt and shall extend not less than 24 inches, nor more than 28 inches from the face of the belt.

(ii) Uniformity. All floor openings for a given manlift shall be uniform in size and shall be approximately circular, and each shall be located vertically above the opening below it.

(6) Landing.

(i) Vertical clearance. The clearance between the floor or mounting platform and the lower edge for the conical guard above it required by subparagraph (7) of this paragraph shall not be less than 7 feet 6 inches. Where this clearance cannot be obtained no access to the manlift shall be provided and the manlift runway shall be enclosed where it passes through such floor.

(ii) Clear landing space. The landing space adjacent to the floor openings shall be free from obstruction and kept clear at all times. This landing space shall be at least 2 feet in width from the edge of the floor opening used for mounting and dismounting.

(iii) Lighting and landing. Adequate lighting, not less than 5-foot candles, shall be provided at each floor landing at all times when the lift is in operation.

(iv) Landing surface. The landing surfaces at the entrances and exits to the manlift shall be constructed and maintained as to provide safe footing at all times.

(v) Emergency landings. Where there is a travel of 50 feet or more between floor landings, one or more emergency landings shall be provided so that there will be a landing (either floor or emergency) for every 25 feet or less of manlift travel.

(a) Emergency landings shall be accessible from both the "up" and "down" rungs of the manlift and shall give access to the ladder required in subparagraph (12) of this paragraph.

(b) Emergency landings shall be completely enclosed with a standard railing and toeboard.

(c) Platforms constructed to give access to bucket elevators or other equipment for the purpose of inspection, lubrication, and repair may also serve as emergency landings under this rule. All such platforms will then be considered part of the emergency landing and shall be provided with standard railings and toeboards.

(7) Guard on underside of floor openings.

(i) Fixed type. On the ascending side of the manlift floor openings shall be provided with a bevel guard or cone meeting the following requirements:

(a) The cone shall make an angle of not less than 45 degrees with the horizontal. An angle of 60 degrees or greater shall be used where ceiling heights permit.

(b) The lower edge of this guard shall extend at least 42 inches outward from any handhold on the belt. It shall not extend beyond the upper surface of the floor above.

(c) The cone shall be made of not less than No. 18 U.S. gauge sheet steel or material of equivalent strength or stiffness. The lower edge shall be rolled to a minimum diameter of one-half inch and the interior shall be smooth with no rivets, bolts or screws protruding.

(ii) Floating type. In lieu of the fixed guards specified in subdivision (i) of this subparagraph, a floating type safety cone may be used, such floating cones to be mounted on hinges at least 6 inches below the underside of the floor and so constructed as to actuate a limit switch should a force of 2 pounds be applied on the edge of the cone closest to the hinge. The depth of this floating cone need not exceed 12 inches.

(8) Protection of entrances and exits.

(i) Guardrail requirement. The entrances and exits at all floor landings affording access to the manlift shall be guarded by a maze (staggered railing) or a handrail equipped with self-closing gates.

(ii) Construction. The rails shall be standard guardrails with toeboards meeting the provisions of the general industry standard Part 2. Floor and Wall Openings, Stairways and Skylights.

(iii) Gates. Gates, if used, shall open outward and shall be self-closing. Corners of gates shall be rounded.

(iv) Maze. Maze or staggered openings shall offer no direct passage between enclosure and outer floor space.

(v) Except where building layout prevents, entrances at all landings shall be in the same relative position.

(vi) Revoked.

(9) Guards for openings.

(i) Construction. The floor opening at each landing shall be guarded on sides not used for entrance or exit by a wall, a railing and toeboard or by panels of wire mesh or suitable strength.

(ii) Height and location. Such rails or guards shall be at least 42 inches in height on the up-running side and 66 inches on the down-running side.

(10) Bottom arrangement.

(i) Bottom landing. At the bottom landing the clear area shall be not smaller than the area enclosed by the guardrails on the floors above, and any wall in front of the down-running side of the belt shall be not less than 48 inches from the face of the belt. This space shall not be encroached upon by stairs or ladders.

(ii) Location of lower pulley. The lower (boot) pulley shall be installed so that it is supported by the lowest landing served. The sides of the pulley support shall be guarded to prevent contact with the pulley or the steps.

(iii) Mounting platform. A mounting platform shall be provided in front or to one side of the uprun at the lowest landing, unless the floor level is such at the following requirement can be met: The floor or platform shall be at or above the point at which the upper surface of the ascending step completes its turn and assumes a horizontal position.

(iv) Guardrails. To guard against persons walking under a descending step, the area on the downside of the manlift shall be guarded in accordance with subparagraph (8) of this paragraph. To guard against a person getting between the mounting platform and an ascending step, the area between the belt and the platform shall be protected by a guardrail.

(11) Top arrangements.

(i) Clearance from floor. A top clearance shall be provided of at least 11 feet above the top terminal landing. This clearance shall be maintained from a plane through each face of the belt to a vertical cylindrical plane having a diameter 2 feet greater than the diameter of the floor opening, extending upward from the top floor to the ceiling on the up-running side of the belt. No encroachment of structural or machine supporting members within this space will be permitted.

(ii) Pulley clearance.

(a) There shall be a clearance of at least 5 feet between the center of the head pulley shaft and any ceiling obstruction.

(b) The center of the head pulley shaft shall be not less than 6 feet above the top terminal landing.

(iii) Emergency grab rail. An emergency grab bar or rail and platform shall be provided at the head pulley when the distance to the head pulley is over 6 feet above the top landing, otherwise only a grab bar or rail is to be provided to permit the rider to swing free should the emergency stops become inoperative.

(12) Emergency exit ladder. A fixed metal ladder accessible from both the “up” and “down” run of the manlift shall be provided for the entire travel of the manlift. Such ladder shall be in accordance with the general industry standard Part 3. Fixed Ladders.

(13) Superstructure bracing. Manlift rails shall be secured in such a manner as to avoid spreading, vibration, and misalignment.

(14) Illumination.

(i) General. Both runs of the manlift shall be illuminated at all times when the lift is in operation. An intensity of not less than 1-foot candle shall be maintained at all points. (However, see subparagraph (6)(iii) of this paragraph for illumination requirements at landings.)

(ii) Control of illumination. Lighting of manlift runways shall be by means of circuits permanently tied in to the building circuits (no switches), or shall be controlled by switches at each landing, any switch shall turn on all lights necessary to illuminate the entire runway.

(15) Weather protection. The entire manlift and its driving mechanism shall be protected from the weather at all times.

(c) Mechanical requirements.

(1) Machines, general.

(i) Brakes. Brakes provided for stopping and holding a manlift shall be inherently self-engaging, by requiring power or force from an external source to cause disengagement. The brake shall be electrically released, and shall be applied to the motor shaft for direct-connected units or to the input shaft for belt driven units. The brake shall be capable of stopping and holding the manlift when the descending side is loaded with 250 pounds on each step.

(ii) Belt.

(a) The belts shall be of hard-woven canvas, rubber coated canvas, leather, or other material meeting the strength requirements of paragraph (b)(3) of this section and having a coefficient of friction such that when used in conjunction with an adequate tension device it will meet the brake test specified in subdivision (i) of this subparagraph.

(b) The width of the belt shall be not less than 12 inches for a travel not exceeding 100 feet, not less than 14 inches for a travel greater than 100 feet but not exceeding 150 feet and 16 inches for a travel exceeding 150 feet.

(c) A belt that has become torn while in use on a manlift shall not be spliced and put back in service.

(2) Speed.

(i) Maximum speed. No manlift designed for a speed in excess of 80 feet per minute shall be installed.

(3) Platforms or steps.

(i) Minimum depth. Steps or platforms shall be not less than 12 inches nor more than 14 inches deep, measured from the belt to the edge of the step or platform.

(ii) Width. The width of the step or platform shall be not less than the width of the belt to which it is attached.

(iii) Distance between steps. The distance between steps shall be equally spaced and not less than 16 feet measured from the upper surface of one step to the upper surface of the next step above it.

(iv) Angle of step. The surface of the step shall make approximately a right angle with the “up” and “down” run of the belt, and shall travel in the approximate horizontal position with the “up” and “down” run of the belt.

(v) Surfaces. The upper or working surfaces of the step shall be of a material having inherent nonslip characteristics (coefficient of friction not less than 0.5) or shall be covered completely by a nonslip tread securely fastened to it.

(vi) Strength of step supports. When subjected to a load of 400 pounds applied at the approximate center of the step, step frames, or supports and their guides shall be of adequate strength to:

- (a) Prevent the disengagement of any step roller.
- (b) Prevent any appreciable misalignment.
- (c) Prevent any visible deformation of the steps or its support.

(vii) Prohibition of steps without handholds. No steps shall be provided unless there is a corresponding handhold above or below it meeting the requirements of subparagraph (4) of this paragraph. If a step is removed for repairs or permanently, the handholds immediately above and below it shall be removed before the lift is again placed in service.

(4) Handholds.

(i) Location. Handholds attached to the belt shall be provided and installed so that they are not less than 4 feet nor more than 4 feet 8 inches above the step tread. These shall be so located as to be available on the both "up" and "down" run of the belt.

(ii) Size. The grab surface of the handhold shall be not less than 4 1/2 inches in width, not less than 3 inches in depth, and shall provide 2 inches of clearance from the belt. Fastenings for handholds shall be located not less than 1 inch from the edge of the belt.

(iii) Strength. The handhold shall be capable of withstanding, without damage, a load of 300 pounds applied parallel to the run of the belt.

(iv) Prohibition of handhold without steps. No handhold shall be provided without a corresponding step. If a handhold is removed permanently or temporarily, the corresponding step and handhold for the opposite direction of travel shall also be removed before the lift is again placed in service.

(v) Type. All handholds shall be of the closed type.

(5) Up limit stops.

(i) Requirements. Two separate automatic stop devices shall be provided to cut off the power and apply the brake when a loaded step passes the upper terminal landing. One of these shall consist of a split-rail switch mechanically operated by the step roller and located not more than 6 inches above the top terminal landing. The second automatic stop device may consist of any of the following:

- (a) Any split-rail switch placed 6 inches above and on the side opposite the first limit switch.
- (b) An electronic device.
- (c) A switch actuated by a lever, rod, or plate, the latter to be placed on the "up" side of the head pulley so as to just clear a passing step.

(ii) Manual reset location. After the manlift has been stopped by a stop device it shall be necessary to reset the automatic stop manually. The device shall be so located that a person resetting it shall have a clear view of both the "up" and "down" runs of the manlift. It shall not be possible to reset the device from any step or platform.

(iii) Cut-off point. The initial limit stop device shall function so that the manlift will be stopped before the loaded step has reached a point 24 inches above the top terminal landing.

(iv) Electrical requirements.

(a) Where such switches open the main motor circuit directly they shall be of the multi-pole type.

(b) Where electronic devices are used they shall be so designed and installed that failure will result in shutting off the power to the driving motor.

(c) Where flammable vapors or dusts may be present all electrical installations shall be in accordance with the National Electrical Code, NFPA 70-1971; ANSI CI-1971 (Rev. of CI-1968), requirements for such locations.

(d) Unless of the oil-immersed type controller contacts carrying the main motor current shall be copper or carbon or equal, except where the circuit is broken at two or more points simultaneously.

(6) Emergency stop.

(i) General. An emergency stop means shall be provided.

(ii) Location. This stop means shall be within easy reach of the ascending and descending runs of the belt.

(iii) Operation. This stop means shall be so connected with the control lever or operating mechanism that it will cut off the power and apply the brake when pulled in the direction of travel.

(iv) Rope. If rope is used, it shall be no less than three-eighths inch in diameter. Wire rope, unless marlin-covered, shall not be used.

(7) Instruction and warning signs.

- (i) Instruction signs at landings or belts. Signs of conspicuous and easily read style giving instructions for the use of the manlift shall be posted at each landing or stenciled on the belt.
 - (a) Reserved.
 - (b) The instructions shall read approximately as follows:
 - Face the Belt.
 - Use the Handholds.
 - To Stop — Pull Rope.
- (ii) Top floor warning sign and light.
 - (a) At the top floor an illuminated sign shall be displayed bearing the following wording:

"TOP FLOOR — GET OFF"

Signs shall be in block letters not less than 2 inches in height. This sign shall be located within easy view of an ascending passenger and not more than 2 feet above the top terminal landing.

(b) In addition to the sign required by subdivision (a) of this subdivision, a red warning light of not less than 40-watt rating shall be provided immediately below the upper landing terminal and so located as to shine in the passenger's face.

(iii) Visitor warning. A conspicuous sign having the following legend -AUTHORIZED PERSONNEL ONLY - shall be displayed at each landing. *

(d) Operating rules

(1) Proper use of manlifts. No freight, packaged goods, pipe, lumber, or construction materials of any kind shall be handled on any manlift.

(e) Periodic inspection.

(1) **Frequency.** All manlifts shall be inspected by a competent designated person at intervals of not more than 30 days. Limit switches shall be checked weekly. Manlifts found to be unsafe shall not be operated until properly repaired.

(2) **Items covered.** This periodic inspection shall cover but is not limited to the following items:

- Steps.
- Step Fastenings.
- Rails.
- Rail Support and Fastenings.
- Rollers and Slides.
- Belt and Belt Tension.
- Handholds and Fastenings.
- Floor Landings.
- Guardrails.
- Lubrication.
- Limit Switches.
- Warning Signs and Lights.
- Illumination.
- Drive Pulley.
- Bottom (boot) Pulley and Clearance.
- Pulley Supports.
- Motor.
- Driving Mechanism.
- Brake.
- Electrical Switches.
- Vibration and Misalignment.
- "Skip" on up or down run when mounting step (indicating worn gears).

(3) **Inspection log.** A written record shall be kept of findings at each inspection. Records of inspection shall be made available to the Assistant Secretary of Labor or his duly authorized representative.



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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on **May 10, 1993**

These rules take affect 15 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 16 and 21 of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order no. 1996-2, being §§408.1016, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.10011(c) and R 408.10032 Rescinded by R 408.18599.

PART 85. THE CONTROL OF HAZARDOUS ENERGY SOURCES

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R 408.18501. Scope.

Rule 8501. (1) These rules establish minimum requirements for the lockout/tagout of energy sources for the protection of employees, in, on, or around machines, equipment, or a process during repair, maintenance, and associated activities, from injury due to unexpected/unintended motion, energization, start-up, or release of stored energy from the machine, equipment, or process.

(2) Except where the provisions of these rules conflict with specific requirements for the lockout/tagout of energy sources in any other general industry safety standard, the provisions of these rules and the requirements specified in any other general industry safety standard rule shall be deemed to have concurrent application. Where a specific general industry safety standard contains lockout/tagout requirements, the specific provisions set forth in the general industry safety standard shall prevail if there is a conflict with the requirements set forth in these rules.

R 408.18502. Adoption by reference of federal standard.

Rule 8502. The provisions of 29 C.F.R. s1910.147, (1990), entitled "Control of Hazardous Energy Sources (Lockout/ Tagout)," are adopted in these rules by reference, with the limitation set forth in R 408.18501(2). The adopted regulations are available from the United States Department of Labor, Occupational Safety and Health Administration, 801 South Waverly, Room 306, Lansing, Michigan 48917, at no charge at the time of adoption of these rules, or from the Michigan Department of Consumer and Industry Services, Safety Standards Division, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at no charge at the time of adoption of these rules.

R 408.18599. Rescission.

Rule 8599. R 408.10011(c) and R 408.10032 of the Michigan Compiled Laws, appearing on pages 3401 and 3402 of the 1979 Michigan Administrative Code, is rescinded.

1910.147 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

(a) SCOPE, APPLICATION AND PURPOSE.

(1) Scope.

- (i) This standard covers the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.
- (ii) This standard does not cover the following:
 - (A) Construction, agriculture and maritime employment;
 - (B) Installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering; and
 - (C) Exposure to electrical hazards from work on, near, or with conductors or equipment in electrical utilization installations; and
 - (D) Oil and gas well drilling and servicing.

(2) Application.

- (i) This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.
- (ii) Normal production operations are not covered by this standard. Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if:
 - (A) An employee is required to remove or bypass a guard or other safety device; or
 - (B) An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

Note: Exception to paragraph (a)(2)(ii): Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this standard if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection.

- (iii) This standard does not apply to the following:

- (A) Work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energization or start up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.
- (B) Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or petroleum products when they are performed on pressurized pipelines, provided that the employer demonstrates that (1) continuity of service is essential; (2) shutdown of the system is impractical; and (3) documented procedures are followed, and special equipment is used which will provide proven effective protection for employees.

(3) Purpose.

- (i) This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employees.
- (ii) When other standards in this part require the use of lockout or tagout, they shall be used and supplemented by the procedural and training requirements of this section.

(b) DEFINITIONS APPLICABLE TO THIS SECTION.

Affected employee. An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee. A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Capable of being locked out. An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

Energized. Connected to an energy source or containing residual or stored energy.

Energy isolating device. A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Energy source. Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Hot tap. A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout. The placement of a lockout device on any energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

Normal production operations. The utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance. Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or start-up of the equipment or release of hazardous energy.

Setting up. Any work performed to prepare a machine or equipment to perform its formal production operation.

Tagout. The placement of a tagout device on any energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

(c) GENERAL.

(1) **Energy control program.** The employer shall establish a program consisting of energy control procedures, employee training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source, and rendered inoperative.

(2) Lockout/tagout.

- (i) If an energy isolating device is not capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize a tagout system.
- (ii) If any energy isolating device is capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize lockout, unless the employer can demonstrate that the utilization of a tagout system will provide full employee protection as set forth in paragraph (c)(3) of this section.
- (iii) After January 2, 1990, whenever replacement or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment shall be designed to accept a lockout device.

(3) Full employee protection.

- (i) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.
- (ii) In demonstrating that a level of safety is achieved in the tagout program which is equivalent to the level of safety obtained by using a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization.

(4) Energy control procedure.

- (i) Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

Note: Exception: The employer need not document the required procedure for a particular machine or equipment, when all of the following elements exists:

- (1) The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which would endanger employees;
 - (2) The machine or equipment has a single energy source which can be readily identified and isolated;
 - (3) The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment;
 - (4) The machine or equipment is isolated from that energy source and locked out during servicing or maintenance;
 - (5) A single lockout device will achieve a locked-out condition;
 - (6) The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance;
 - (7) The servicing or maintenance does not create hazards for other employees; and
 - (8) The employer, in utilizing this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.
- (ii) The procedures shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including, but not limited to, the following:
- (A) A specific statement of the intended use of the procedure;
 - (B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;
 - (C) Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them; and
 - (D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(5) Protective materials and hardware.

- (i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing or blocking of machines, or equipment from energy sources.
- (ii) Lockout devices and tagout devices shall be singularly identified; shall be the only device(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:
- (A) Durable.
 - (1) Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.
 - (2) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.
 - (3) Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.
 - (B) Standardized. Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: color; shape; or size and additionally, in the case of tags at devices, print and format shall be standardized.
 - (C) Substantial.
 - (1) Lockout devices. Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.
 - (2) Tagout devices. Tagout devices, including and their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment- tolerant nylon cable tie.
 - (D) Identifiable. Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s).
- (iii) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: **DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE.**

(6) Periodic Inspection.

- (i) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.
 - (A) The periodic inspection shall be performed by an authorized employee other than the one(s) utilizing the energy control procedure being inspected.
 - (B) The periodic inspection shall be conducted to correct any deviations or inadequacies identified.
 - (C) Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.
 - (D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (c)(7)(ii) of this section.
- (ii) The employer shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

(7) Training and communication.

- (i) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees. The training shall include the following:
 - (A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.
 - (B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.
 - (C) All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.
- (ii) When tagout systems are used, employees shall also be trained in the following limitations of tags:
 - (A) Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.
 - (B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
 - (C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
 - (D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
 - (E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
 - (F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.
- (iii) Employee retraining.
 - (A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.
 - (B) Additional retraining shall also be conducted whenever a periodic inspection under paragraph (c)(6) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.
 - (C) The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.
- (iv) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

(8) Energy isolation.

Lockout or tagout shall be performed only by the authorized employees who are performing the servicing or maintenance.

(9) Notification of employees.

Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout devices or tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

(d) APPLICATION OF CONTROL.

The established procedures for the application of energy control (the lockout or tagout procedures) shall cover the following elements and actions and shall be done in the following sequence:

(1) Preparation for shutdown.

Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(2) Machine or equipment shutdown. T

The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage.

(3) Machine or equipment isolation.

All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).

(4) Lockout or tagout device application.

- (i) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.
- (ii) Lockout devices, where used, shall be affixed in a manner that will hold the energy isolating devices in a "safe" or "off" position.
- (iii) Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.
 - (A) Where tagout devices are used with energy isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached.
 - (B) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(5) Stored energy.

- (i) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe.
- (ii) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

(6) Verification of isolation.

Prior to starting work on a machine or equipment that has been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.

(e) RELEASE FROM LOCKOUT OR TAGOUT.

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

(1) The machine or equipment.

The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.

(2) Employees.

- (i) The work areas shall be checked to ensure that all employees have been safely positioned or removed.
- (ii) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout device(s) have been removed.

(3) Lockout or tagout devices removal.

Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device. Exception to paragraph (e)(3): When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

- (i) Verification by the employer that the authorized employee who applied the device is not at the facility;
- (ii) Making all reasonable efforts to contact the authorized employee to inform him/her that his/ her lockout or tagout device has been removed; and
- (iii) Ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

(f) ADDITIONAL REQUIREMENTS.

(1) Testing or positioning of machines, equipment or components thereof.

In situations in which lockout or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energizing to test or position the machine, equipment or component thereof, the following sequence of actions shall be followed:

- (i) Clear the machine or equipment of tools and materials in accordance with paragraph (e)(1) of this section;
- (ii) Remove employees from the machine or equipment area in accordance with paragraph (e)(2) of this section;
- (iii) Remove the lockout or tagout devices as specified in paragraph (e)(3) of this section;
- (iv) Energize and proceed with testing or positioning;
- (v) Deenergize all systems and reapply energy control measures in accordance with paragraph (d) of this section to continue the servicing and/or maintenance.

(2) Outside personnel (contractors, etc.).

- (i) Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures.
- (ii) The on-site employer shall ensure that his/her employees understand and comply with the restrictions and prohibitions of the outside employer's energy control program.

(3) Group lockout or tagout.

- (i) When servicing and/or maintenance is performed by a crew, craft, department or other group, they shall utilize a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.
- (ii) Group lockout or tagout devices shall be used in accordance with the procedures required by paragraph (c)(4) of this section including, but not necessarily limited to, the following specific requirements:
 - (A) Primary responsibility is vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);
 - (B) Provision for the authorized employee to ascertain the exposure status of individual group members with regard to the lockout or tagout of the machine or equipment and
 - (C) When more than one crew, craft, department, etc. is involved, assignment of overall job-associated lockout or tagout control responsibility to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and
 - (D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

(4) Shift or personnel changes.

Specific procedures shall be utilized during shift or personnel changes to ensure the continuity of lockout or tagout protection, including providing for the orderly transfer of lockout or tagout device protection between off-going and oncoming employees, to minimize exposure to hazards from the unexpected energization or start-up of the machine or equipment, or the release of stored energy.



Michigan Occupational Safety and Health Administration
PO Box 30643
Lansing, Michigan 48909-8143
Ph: 517-284-7740

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**DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
Michigan Occupational Safety and Health Administration (MIOSHA)**

**CONSTRUCTION SAFETY STANDARD
PART 42. HAZARD COMMUNICATION**

**GENERAL INDUSTRY SAFETY STANDARD
PART 92. HAZARD COMMUNICATION**

**OCCUPATIONAL HEALTH STANDARD
PART 430. HAZARD COMMUNICATION**

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FORWARD

BACKGROUND TO MICHIGAN'S RIGHT TO KNOW LAW AND HAZARD COMMUNICATION STANDARDS

The Michigan Occupational Safety and Health Act (MIOSHA) was amended in 1986 and 2012 to include requirements for the communication of information regarding the safe handling of hazardous chemicals present in Michigan workplaces. These amendments were called the Michigan Right To Know Law. The amendments also enabled the adoption of the federal Occupational Safety and Health Administration's (OSHA's) Hazard Communication Standard (29 CFR 1910.1200), which was designed to make information available to employees exposed to hazardous chemicals in their workplaces.

Sections of the Michigan Right To Know Law of particular importance address the following employer responsibilities:

- Posting the "Safety data sheet (SDS)" locations.
- Posting the receipt of a newly received or revised SDS no later than five (5) working days after its receipt.
- Identifying the contents of pipes or piping systems which contain a hazardous chemical.

Additionally, the law discusses the employee's right to request SDSs from their employers. Employees are also afforded protection from any discrimination or discharge resulting from the request of information regarding hazardous chemicals under the law.

The Federal Hazard Communication Standard adopted by the law addressed the following major components:

- Classification of hazardous chemicals (development of SDSs)
- Written hazard communication programs
- Labeling of hazardous chemicals
- Maintaining SDSs
- Employee information and training
- Trade secrets

In 2012, federal OSHA amended the Hazard Communication Standard (29 CFR 1910.1200) and, effective December 21, 2012, Michigan adopted the amended federal standard by reference.

The amendments essentially modify the Hazard Communication Standard (HCS) to closely align with the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

OSHA has concluded this improved information will enhance the effectiveness of the HCS in ensuring that employees are apprised of the chemical hazards to which they may be exposed, and in reducing the incidence of chemical-related occupational illnesses and injuries.

The modifications to the standard include:

- Revised criteria for classification of chemical hazards.
- Revised labeling provisions that include requirements for use of standardized signal words, pictograms, hazard statements, and precautionary statements.
- A specified format for safety data sheets (SDSs).
- Related revisions to definitions of terms used in the standard.
- Requirements for employee training on labels and safety data sheets (SDSs).

OSHA and MIOSHA are also modifying provisions of other standards, including standards for flammable and combustible liquids, process safety management, and most substance-specific health standards, to ensure consistency with the modified HCS requirements. The consequences of these modifications will be to improve safety and to facilitate global harmonization of standards.

The Department of Licensing and Regulatory Affairs also maintain additional information pertaining to the development of an effective hazard communication program in your workplace. For further assistance or questions regarding the Michigan Right To Know Law or the Michigan Hazard Communication Standard, go to the MIOSHA website: www.michigan.gov/miosha or call or write to either of the following divisions:

Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health
Administration (MIOSHA)
Consultation Education and Training Division (CET)
P.O. Box 30643
Lansing, Michigan 48909-8143
(517) 322-1809

Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health
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Lansing, Michigan 48909-8149
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MICHIGAN OCCUPATIONAL SAFETY AND HEALTH ACT (MIOSHA)

**ACT 154 AMENDMENTS
ACT NO. 447 OF THE PUBLIC ACTS OF 2012
EFFECTIVE DECEMBER 27, 2012**

AN ACT to amend 1974 PA 154, entitled "An act to prescribe and regulate working conditions; to prescribe the duties of employers and employees as to places and conditions of employment; to create certain boards, commissions, committees, and divisions relative to occupational and construction health and safety; to prescribe their powers and duties and powers and duties of the department of labor and department of public health; to prescribe certain powers and duties of the directors of the departments of labor, public health, and agriculture; to impose an annual levy to provide revenue for the safety education and training division; to provide remedies and penalties; to repeal certain acts and parts of acts; and to repeal certain acts and parts of act on specific dates," by amending sections 5, 14a, 14b, 14d, 14e, 14f, 14h, 14j, 14k, 14l, 24, 31, 54, and 63 (MCL 408.1005, 408.1014a, 408.1014b, 408.1014d, 408.1014e, 408.1014f, 408.1014h, 408.1014j, 408.1014k, 408.1014l, 408.1024, 408.1031, 408.1054, and 408.1063), sections 5, 31, and 63 as amended and sections 14a, 14b, 14d, 14e, 14h, 14j, 14k, and 14l as added by 1986 PA 80, section 14f as amended by 1996 PA 70, and section 24 as amended by 1991 PA 105; and to repeal acts and parts of acts.

The People of the State of Michigan enact:

Section 1. The title and sections 5, 11, 31, and 63 of Act No. 154 of the Public Acts of 1974, section 11 as amended by Act No. 51 of the Public Acts of 1980, sections 14a, 14b, 14c, 14d, 14e, 14f, 14g, 14h, 14i, 14j, 14k, 14l, and 14m as added by Act No. 80 of the Public Acts of 1986, section 14f as amended by Act 70 of the Public Acts of 1996, section 5, 14a, 14b, 14d, 14e, 14f, 14h, 14j, 14k, 14l, 31, and 63 are amended by Act No. 447 of the Public Acts of 2012, being sections 408.1005, 408.1014a, 408.1014b, 408.1014d, 408.1014e, 408.1014f, 408.1014h, 408.1014j, 408.1014k, 408.1014l, 408.1031, and 408.1063 of the Michigan Compiled Laws, are amended—to read as follows:

**MICHIGAN OCCUPATIONAL SAFETY
AND HEALTH ACT (MIOSHA)
Act 154 of 1974, amended**

An act to prescribe and regulate working conditions; to prescribe the duties of employers and employees as to places and conditions of employment; to create certain boards, commissions, committees, and divisions relative to occupational and construction health and safety; to prescribe their powers and duties and powers and duties of the department of labor and department of public health; to prescribe certain powers and duties of the directors of the departments of labor, public health, and agriculture; to impose an annual levy to provide revenue for the safety education and training division; to provide remedies and penalties; and to repeal certain acts and parts of acts and to repeal certain acts and parts of act on specific dates.

Section 5. Definitions; E to I.

(1) "Employee" means a person permitted to work by an employer.

(2) "Employer" means an individual or organization, including the state or a political subdivision, which employs 1 or more persons.

(3) "Imminent danger" means a condition or practice in a place of employment which is such that a danger exists which could reasonably be expected to cause death or serious physical harm either immediately or before the imminence of the danger can be eliminated through the enforcement procedures otherwise provided. A container of an unknown and unlabeled chemical or a container of hazardous chemicals that is not labeled or for which a safety data sheet is not available as required by the standard incorporated by reference in section 14a shall be considered an imminent danger after meeting the provisions of section 31.

(4) "Inspection" means the examination or survey of a place of employment to detect the presence of an existing or potential occupational safety or health hazard or to determine compliance with this act, rules or standards promulgated, or orders issued pursuant to this act.

(5) "Investigation" means the detailed evaluation or study of working conditions, including equipment, processes, substances, air contaminants, or physical agents with respect to the actual or potential occurrence of occupational accidents, illnesses, or diseases.

Section 11. Employer responsibilities.

An employer shall:

(a) Furnish to each employee, employment and a place of employment which is free from recognized hazards that are causing, or are-likely to cause, death or serious physical harm to the employee.

(b) Comply with this act and with the rules and standards promulgated and the orders issued pursuant to this act.

(c) Post notices and use other appropriate means to keep his or her employees informed of their protections and obligations under this act, including applicable rules and standards.

(d) Provide personal protective equipment at the employer's expense when it is specifically required to be provided at the employer's expense in a rule or a standard promulgated by a standards promulgating commission. When promulgating a rule or a standard concerning personal protective equipment, the standards promulgating commission shall use at least the following criteria in determining who should pay for the equipment:

(i) Whether the equipment is transferable between employees.

(ii) Whether the equipment is maintained by the employer.

(iii) Whether the equipment generally remains at the work site after the work activity has been completed.

(iv) The amount of personal use involved with the equipment.

Section 14a. MIOSHA Adopts OSHA's Hazard Communication Standard.

(1) The occupational safety and health hazard communication standard that has been adopted or promulgated by the United States department of labor and has been codified at 29 CFR 1910.1200 as of May 25, 2012 is incorporated by reference and has the same force and effect as a rule promulgated under this act. In addition to the standard incorporated by reference in this subsection, sections 14b to 14l apply to an employer subject to this act. The applicability of the standard incorporated by reference in this subsection and of sections 14b to 14l is subject to subsections (4), (5), (6), and (7).

(2) If a rule or standard that is continued pursuant to section 24(1) is in conflict with or covers the same or similar subject as a standard incorporated by reference pursuant to subsection (1), the federal standard so incorporated by reference governs and the state rule or standard continued pursuant to section 24(1) is rescinded.

(3) The department of licensing and regulatory affairs shall administer and enforce the provisions of the standard incorporated by reference in subsection (1) in a manner that is consistent with the administration and enforcement of the standard by the federal occupational safety and health administration.

(4) Beginning November 25, 1985, employers who are chemical manufacturers in a classification provided by sector 31-33 — manufacturing, of the North American industry classification system, United States, 1997, published by the office of management and budget or in a standard industrial classification of 20 through 39 of the standard industrial classification code published by the federal department of management and budget, importers, and distributors shall label containers of hazardous chemicals leaving their workplaces, provide safety data sheets with initial shipments, and otherwise comply with any applicable provision of the standard incorporated by reference pursuant to subsection (1) and of sections 14b to 14l. A chemical manufacturer, importer, or distributor subject to this subsection shall provide a safety data sheet and an appropriately labeled container to each employer in this state, regardless of the employer's standard industrial classification in the standard industrial classification code, who purchases a hazardous chemical.

(5) Beginning May 25, 1986, an employer in a classification provided by sector 31-33 — manufacturing, of the North American industry classification system, United States, 1997, published by the office of management and budget or in a standard industrial classification of 20 through 39 of the standard industrial classification code published by the federal department of management and budget shall comply with the requirements of the standard incorporated by reference pursuant to subsection (1) and with sections 14b to 14l with respect to the use of hazardous chemicals in the workplace.

(6) Beginning February 25, 1987, an employer who is subject to this act but who is not otherwise specifically described in subsections (4) or (5) shall comply with the standard incorporated by reference pursuant to subsection (1) and with sections 14b to 14l with respect to the use of hazardous chemicals in the workplace. However, instead of complying with any conflicting provision of the standard incorporated by reference in subsection (1), an employer who is described in this subsection shall do both of the following:

(a) Provide information and training to employees who are exposed to hazardous chemicals in the normal course of employment or who are likely to be exposed to hazardous chemicals in the event of an emergency.

(b) In the case where a hazardous chemical is mixed or combined with any other chemical or hazardous chemical by the employer, maintain and provide a safety data sheet for each constituent hazardous chemical and maintain a material identification system that identifies to employees the appropriate safety data sheets.

(7) The standard incorporated by reference in subsection (1), this section, and sections 14b to 14l shall not be construed to require an employer in a classification provided by sector 31-33 — manufacturing, of the North American industry classification system, United States, 1997, published by the office of management and budget or in a standard industrial classification other than 20 through 39 of the standard industrial classification code published by the federal department of management and budget to evaluate chemicals, to develop labels for containers of hazardous chemicals, or to develop safety data sheets.

Section 14b. Trade secrets disclosures.

In nonemergency situations, a chemical manufacturer, importer, or employer claiming a trade secret, upon request, shall disclose a specific chemical identity, percentage composition, or both, otherwise permitted to be withheld under the standard incorporated by reference in section 14a, in addition to a health professional as specified in 29 CFR 1910.1200(i)(3), to an occupational health nurse providing medical or other occupational health services to exposed employees, to an authorized employee representative of an exposed employee, and to an exposed employee, if the occupational health nurse, the representative, and the employee comply with the requirements described in 29 CFR 1910.1200(i)(3) and (4).

Section 14c. Pipe labeling.

Pipes or piping systems in a workplace that contain a hazardous chemical shall be identified to an employee by a label or by a sign, placard, written operating instructions, process sheet, batch ticket, or a substance identification system that conveys the same information required to be displayed on a label by the standard incorporated by reference in section 14a. The employer shall provide at least 1 label, sign, placard, set of written operating instructions, process sheet, batch ticket, or a substance identification system selected by the employer and readily accessible to each employee at a location in the workplace designated by the employer. The employer shall establish a pipe and stationary process container entry procedure that will assure that the information required by 29 C.F.R. 1910.1200(f) is conveyed to an employee before entry. The requirements of this subsection shall apply in addition to the occupational safety and health hazard communication standard incorporated by reference in section 14a.

Section 14d. Trade secrets.

(1) Upon request of the director, an employer who claims a trade secret under the standard incorporated by reference by section 14a shall support the trade secret claim. Subject to subsection (2), the director shall consider the following factors in determining whether a specific chemical identity may be withheld as a trade secret:

(a) The extent to which the information is known outside the employer's business.

(b) The extent to which it is known by employees and others involved in the employer's business.

(c) The extent of measures taken by the employer to guard the secrecy of the information.

(d) The value of the information to the employer and the employer's competitors.

(e) The amount of effort and money expended by the employer in developing the information.

(f) The ease or difficulty with which the information could be properly acquired or duplicated by others.

(2) The determination made by the director under subsection (1) shall not uphold as a trade secret any chemical identity information that is readily discoverable through reverse engineering.

(3) This section shall not be construed to require the prior approval of trade secret claims by the director.

(4) An exposed employee, a health professional providing medical or other occupational health services to exposed employees, or an authorized employee representative of an exposed employee may petition the director to review a denial of a written request for disclosure of a specific chemical identity. This review shall be conducted as a contested case pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328, and shall be confidential. The director shall review the assertion of trade secrecy and make a determination in accordance with the principles provided in this section and the standard incorporated by reference in section 14a. In preparing the final order, the director shall consider and require any prudent measures necessary to protect the health of employees or the public in general while maintaining the confidentiality of any trade secrets.

(5) The director may revoke any order entered under subsection (4) upholding a trade secret claim after a hearing involving the parties of interest upon showing that a party has not complied with an order issued pursuant to subsection (4).

(6) Records and information obtained by any department, commission, or public agency related to a review by the director under subsection (4) and to information determined by the director to be a trade secret in that review is exempt from disclosure under the freedom of information act, 1976 PA 442, MCL 15.231 to 15.246.

(7) Notwithstanding that information has been claimed as a trade secret pursuant to 29 CFR 1910.1200(i) or has been upheld by the director as a trade secret under this section, a chemical manufacturer, importer, or employer shall provide the specific chemical identity and percentage composition of a hazardous chemical to the director when the director requests that information in the discharge of the director's duties under this act.

Section 14e. Public service announcements.

In order to educate employers, employees, and the public about the hazards of exposure to hazardous chemicals and the requirements of the occupational safety and health hazard communication standard incorporated by reference in section 14a and the requirements of sections 14b to 14l, the department of licensing and regulatory affairs shall distribute periodically public service announcements to newspapers and television and radio stations throughout this state.

Section 14f. Agriculture.

(1) An employer engaged in agricultural operations is not required to comply with the standard incorporated by reference in section 14a or sections 14b to 14l for a hazardous chemical that is regulated under the federal insecticide, fungicide, and rodenticide act, chapter 125, 86 Stat. 973, 7 USC 136 to 136i and 136j to 136y, or part 83 (pesticide control) of the natural resources and environmental protection act, 1994 PA 451, MCL 324.8301 to 324.8336, and any rules or regulations promulgated under those acts.

(2) The director of the department of agriculture and rural development at least annually shall certify to the department of licensing and regulatory affairs a list of chemicals regulated by the acts described in subsection (1).

Section 14g. Chemicals in transit.

An employer is not required to comply with the standard incorporated by reference in section 14a or with sections 14b to 14l with respect to a chemical in a sealed package and in transit by a common carrier if the seal remains intact while in transit.

Section 14h. Construction.

An employer engaged in construction operations may satisfy the requirements of the standard incorporated in section 14a and sections 14b to 14l that a safety data sheet be maintained for each hazardous chemical in the workplace by maintaining safety data sheets in 1 or more central locations at a jobsite.

Section 14i. Fire department plans.

The chief of each organized fire department shall prepare and disseminate to each fire fighting employee of the organized fire department a plan for executing the department's responsibilities with respect to each site within the organized fire department's jurisdiction where hazardous chemicals are used or produced.

Section 14j. Required sign posting.

An employer subject to the standard incorporated by reference in section 14a and to sections 14b to 14l shall post signs throughout the workplace advising employees of all of the following:

(a) The location of the safety data sheets for the hazardous chemicals produced or used in the workplace and the name of the person from whom to obtain the sheets.

(b) That the employer is prohibited from discharging or discriminating against an employee who exercises the rights regarding information about hazardous chemicals in the workplace afforded by the standard incorporated by reference in section 14a and by sections 14b to 14l.

(c) That, as an alternative to requesting the employer for a safety data sheet for a hazardous chemical in the workplace, the employee may obtain a copy of the safety data sheet from the department of licensing and regulatory affairs. The sign shall include the address and telephone number of the division of the department of licensing and regulatory affairs that has the responsibility of responding to such requests.

Section 14k. Safety data sheets.

(1) An employer who is subject to the standard incorporated by reference in section 14a and to sections 14b to 14l shall organize the safety data sheets for the hazardous chemicals in the workplace in a systematic and consistent manner and shall train employees in locating particular safety data sheets.

(2) Not later than 5 working days after receipt of a new or a revised safety data sheet, the employer shall post for a period of 10 working days a notice of the existence of the new or revised sheet and directions for locating the new or revised sheet according to the method used by the employer for organizing safety data sheets.

Section 14l. Access to SDSs.

The failure of an employer who is subject to the standard incorporated by reference in section 14a and to this section and sections 14b to 14k to provide an exposed employee with access to the most current safety data sheet available to the employer shall not be considered by the department as a violation for which a de minimis notice of violation may be issued under section 33(5). The department may consider the violation to be a serious violation or a violation not of a serious nature for which a citation may be issued under section 35.

Section 14m. Conflicting provisions.

The standard incorporated by reference in section 14a and sections 14b to 14l occupy the entire field of regulation of occupational safety and health with respect to hazardous chemicals in the workplace. Except as specifically provided in this act, any provision of any ordinance, law, rule, regulation, policy, or practice of a city, township, village, county, governmental authority created by statute, or other political subdivision of the state that imposes any requirement on an employer or expands the rights of an employee with respect to the communication of the hazards of hazardous chemicals in the workplace shall be considered in conflict with this act and shall not be enforceable.

Section 31 Determination of imminent danger; notice; order; tagging equipment or process; removal of tag; on site review; recommendation; discrimination prohibited; noncompliance with order; petition to restrain condition or practice; action against department; response to imminent danger complaint; opportunity to identify, label, or provide material safety data sheet for container.

(1) When and as soon as a department representative determines that an imminent danger exists in a place of employment, the department representative shall inform the employer and the affected employees of a determination of the imminent danger. The department representative immediately shall recommend to the director that an order be issued to require that steps be taken as may be necessary to avoid, correct, or remove the imminent danger. After receiving authorization for the issuance of an order from the director, the department representative shall apply a tag to the equipment or process that is the source of the imminent danger identifying that an imminent danger exists. The tag shall be removed only by the department representative. At request of the employer, an area supervisor shall, within 24 hours after a request, make an on site review of any tagging and recommend continuance or removal. The order shall prohibit the employment or presence of an individual in locations or under conditions where imminent danger exists, except individuals whose presence is necessary to avoid, correct, or remove the imminent danger in a safe and orderly manner. In tagging the equipment or process that is the source of imminent danger and in issuing the order, consideration shall be given to any necessity to maintain the capacity of a continuous process operation and to the reestablishment of normal operations without a complete cessation of operations.

(2) An employer shall not permit an employee, other than an employee whose presence is necessary to avoid, correct, or remove the imminent danger, to operate equipment or engage in a process that has been tagged by the department and that is the subject of an order issued by the department identifying that an imminent danger exists. An employee who suffers a loss of wages or fringe benefits or is in any manner discriminated against for refusing to operate equipment or engage in a process that has been tagged by the department and that is the subject of an order issued by the department, as provided in this section, may file a discrimination complaint, and the department of licensing and regulatory affairs may order appropriate relief as provided in section 65. This section does not prohibit an employer from assigning an employee to an operation not affected by the imminent danger situation, subject to any collective bargaining agreement.

(3) Upon failure of the employer to promptly comply with a department order, as described in subsection (1), the department shall petition the circuit court having jurisdiction to restrain a condition or practice in a place of employment that the department has determined to cause the imminent danger.

(4) If the department arbitrarily or capriciously fails to seek relief under this section, an employee who may be injured by reason of the failure, or the representative of those employees, may bring action against the department in the circuit court having jurisdiction for a writ of mandamus to compel the department to seek an order and for further relief, as may be appropriate.

(5) The department of licensing and regulatory affairs shall respond within 24 hours after receipt of an imminent danger complaint concerning an unknown and unlabeled container of chemicals or an imminent danger complaint concerning a container of hazardous chemicals that is not labeled or for which a safety data sheet is not available as required by the standard incorporated by reference in section 14a and by sections 14b to 14l.

(6) Before a department representative seeks authorization to issue an order pursuant to the procedures prescribed in subsection (1), an employer shall be given a reasonable opportunity to identify, label, or provide the safety data sheet for the container that is the subject of the imminent danger determination.

Section 63 Confidentiality of trade secrets; protection; information available to public; identity of employee exempt from disclosure.

(1) Information reported to or otherwise obtained by the department of licensing and regulatory affairs in connection with an inspection, investigation, or proceeding under this act that contains or that might reveal a trade secret, including information required to be made available under sections 14a through 14l and section 24(5) and (6) shall be considered confidential. In a proceeding under this act, the director shall promulgate rules for the purpose of protecting trade secrets regarding information required to be made available under sections 14a through 14l and section 24(5) and (6), and the department, the board, or the court shall issue orders as may be appropriate to protect the confidentiality of trade secrets and to carry out the objectives of this act.

(2) Except as otherwise provided by this subsection and subsection (1), information reported to or otherwise obtained by a department from an employee in connection with an inspection, investigation, or proceeding under this act shall be made available to the public pursuant to the freedom of information act, 1976 PA 442, MCL 15.231 to 15.246. The identity of an employee or any information that may lead to the identification of an employee who provides information pertaining to a possible violation or violations of this act is exempt from disclosure.



DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

CONSTRUCTION SAFETY STANDARDS

Filed with the Secretary of State on June 2, 1995, (as amended December 14, 2012)
(as amended January 29, 2014)

These rules become effective immediately upon filing with the Secretary of State
unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs
by sections 19 and 21 of 1974 PA 154, MCL 408.1019 and 408.1021,
and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4,
and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.44201, R 408.44202, and R 408.44203 of the Michigan Administrative Code are amended
and R 408.44204 is added, as follows:

PART 42. HAZARD COMMUNICATION

R 408.44201 Scope and application.

Rule 4201. (1) These rules establish requirements to ensure that the hazards of all chemicals produced or imported by chemical manufacturers or importers are evaluated and that information concerning the hazards is transmitted to affected employers and communicated to employees. These rules establish requirements to ensure that markings, placards, and labels required on hazardous materials and explosives, both in transportation and at stationary facilities, are retained until the materials have been removed to the extent that the materials do not pose a hazard.

(2) The regulations adopted by R 408.44202 shall apply to all chemical manufacturers, chemical importers, and employers pursuant to the provisions of 29 C.F.R. §1910.1200 and 29 C.F.R. §1926.59.

(3) The regulations adopted by R 408.44203 shall apply to workplaces pursuant to the provisions of 29 C.F.R. §1910.1201, 29 C.F.R. §1926.61, and 29 C.F.R. §1928.21.

(4) Section 14a(1) of 1974 PA 154, MCL 408.1014(1) adopted the original federal standard by reference. In addition, sections 14b to 14l of 1974 PA 154, MCL 408.1014b to 408.1014l, set forth additional requirements for Michigan employers. The regulations adopted by R 408.44202 will have the force and effect of law, but only to the extent they are consistent with section 14a(1) of 1974 PA 154, MCL 408.1014a(1). If there is any inconsistency, section 14a(1) of 1974 PA 154, MCL 408.1014a(1) will control.

R 408.44202 Hazard communication; adoption by reference.

Rule 4202. (1) The following federal occupational safety and health administration (OSHA) regulations from the Code of Federal Regulations are adopted by reference in these rules:

(a) 29 C.F.R. §1910.1200 "Hazard Communication," February 8, 2013.

(b) 29 C.F.R. §1926.59 "Hazard Communication," June 20, 1996.

(2) The adopted federal regulations shall have the same force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 408.44203 Retention of department of transportation markings, placards, and labels; adoption by reference.

Rule 4203. (1) The following federal occupational safety and health administration (OSHA) regulations from the Code of Federal Regulations are adopted by reference in these rules:

(a) 29 C.F.R. §1910.1201 "Retention of DOT markings, placards and labels," July 19, 1994.

(b) 29 C.F.R. §1926.61 "Retention of DOT markings, placards and labels," June 20, 1996.

(c) 29 C.F.R. §1928.21 "Applicability of Standards in 29 CFR Part 1910," March 7, 1996.

(2) The adopted federal regulations shall have the force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 408.44204 Availability of adopted rules.

Rule 4204. (1) The standards adopted in these rules are available from the United States Department of Labor, Occupational Safety and Health Administration website: www.osha.gov, at no charge, as of the time of adoption of these rules.

(2) The standards adopted in these rules are also available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, Lansing, Michigan, 48909-8143.

(3) The standards adopted in these rules may be obtained from the publisher or may also be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.



DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on June 2, 1995, (as amended December 14, 2012)
(as amended January 29, 2014)

These rules become effective immediately upon filing with the Secretary of State
unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs
by sections 16 and 21 of 1974 PA 154, MCL 408.1016 and 408.1021,
and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4,
and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.19201, R 408.19202, and R 408.19203 are amended, and R 408.19204 is added
to the Michigan Administrative Code as follows:

PART 92. HAZARD COMMUNICATION

R 408.19201 Scope and application.

Rule 9201. (1) These rules establish requirements to ensure that the hazards of all chemicals produced or imported by chemical manufacturers or importers are evaluated and that information concerning the hazards is transmitted to affected employers and communicated to employees. These rules establish requirements to ensure that markings, placards, and labels required on hazardous materials and explosives, both in transportation and at stationary facilities, are retained until the materials have been removed to the extent that the materials do not pose a hazard.

(2) The regulations adopted by R 408.19202 shall apply to all chemical manufacturers, chemical importers, and employers pursuant to the provisions of 29 C.F.R. §1910.1200.

(3) The regulations adopted by R 408.19203 shall apply to workplaces pursuant to the provisions of 29 C.F.R. §1910.1201 and 29 C.F.R. §1928.21.

(4) Section 14a(1) of 1974 PA 154, MCL 408.1014a(1) adopted the original federal standard by reference. In addition, sections 14b to 14l of 1974 PA 154, MCL 408.1014b to 408.1014l set forth additional requirements for Michigan employers. The regulations adopted by R 408.19202 will have the force and effect of law, but only to the extent they are consistent with section 14a(1) of 1974 PA 154, MCL 408.1014a(1). If there is any inconsistency, section 14a(1) of 1974 PA 154, MCL 408.1014a(1), will control.

R 408.19202 Hazard communication; adoption by reference.

Rule 9202. (1) The federal occupational safety and health administration (OSHA) regulations on hazard communication that have been promulgated by the United States department of labor and codified at 29 C.F.R. §1910.1200, "Hazard Communication" February 8, 2013, is adopted by reference in these rules.

(2) The adopted federal regulations shall have the same force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 408.19203 Retention of department of transportation markings, placards, and labels; adoption by reference.

Rule 9203. (1) The following federal occupational safety and health administration (OSHA) regulations from the Code of Federal Regulations are adopted by reference in these rules:

(a) 29 C.F.R. §1910.1201 "Retention of DOT markings, placards and labels" July 19, 1994.

(b) 29 C.F.R. §1928.21 "Applicability of Standards in 29 CFR Part 1910" March 7, 1996.

(2) The adopted federal regulations shall have the same force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 408.19204 Availability of adopted rules.

Rule 9204. (1) The standards adopted in these rules are available from the United States Department of Labor, Occupational Safety and Health Administration website: www.osha.gov, at no charge, as of the time of adoption of these rules.

(2) The standards adopted in these rules are also available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, Lansing, Michigan, 48909-8143.

(3) The standards adopted in these rules may be obtained from the publisher or may also be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.



DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

OCCUPATIONAL HEALTH STANDARDS

Filed with the Secretary of State on June 2, 1995, (as amended December 14, 2012)
(as amended January 29, 2014)

These rules become effective immediately upon filing with the Secretary of State
unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs
by sections 14 and 24 of 1974 PA 154, MCL 408.1016 and 408.1021,
and Executive Reorganization Order Nos. 1996-1, 1996-2, 2003-1, 2008-4,
and 2011-4, MCL 330.3101, 445.2001, 445.2011, 445.2025, and 445.2030)

R 325.77001, R 325.77002, and R 325.77003 are amended, and R 325.77004 is added
to the Michigan Administrative Code as follows:

PART 430. HAZARD COMMUNICATION

R 325.77001 Scope and application.

Rule 1. (1) These rules establish requirements to ensure that the hazards of all chemicals produced or imported by chemical manufacturers or importers are evaluated and that information concerning the hazards is transmitted to affected employers and communicated to employees. These rules establish requirements to ensure that markings, placards, and labels required on hazardous materials and explosives, both in transportation and at stationary facilities, are retained until the materials have been removed to the extent that the materials do not pose a hazard.

(2) The regulations adopted by R 325.77002 shall apply to all chemical manufacturers, chemical importers, and employers pursuant to the provisions of 29 C.F.R. §1910.1200 and 29 C.F.R. §1926.59.

(3) The regulations adopted by R 325.77003 shall apply to workplaces pursuant to the provisions of 29 C.F.R. §1910.1201, 29 C.F.R. §1926.61, and 29 C.F.R. §1928.21.

(4) Section 14a(1) of 1974 PA 154, MCL 408.1014a(1) adopted the original federal standard by reference. In addition, sections 14b to 14l of 1974 PA 154, MCL 408.1014b to 408.1014l set forth additional requirements for Michigan employers. The regulations adopted by R 325.77002 will have the force and effect of law, but only to the extent they are consistent with section 14a(1) of 1974 PA 154, MCL 408.1014a(1) If there is any inconsistency, section 14a(1) of 1974 PA 154, MCL 408.1014a(1), will control.

R 325.77002 Hazard communication; adoption by reference.

Rule 2. (1) The following federal occupational safety and health administration (OSHA) regulations from the Code of Federal Regulations are adopted by reference in these rules:

(a) 29 C.F.R. §1910.1200 "Hazard Communication," February 8, 2013.

(b) 29 C.F.R. §1926.59 "Hazard Communication," June 20, 1996.

(2) The adopted federal regulations shall have the same force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 325.77003 Retention of department of transportation markings, placards, and labels; adoption by reference.

Rule 3. (1) The following federal occupational safety and health administration (OSHA) regulations from the Code of Federal Regulations are adopted by reference in these rules:

(a) 29 C.F.R. §1910.1201 "Retention of DOT markings, placards and labels" July 19, 1994.

(b) 29 C.F.R. §1926.61 "Retention of DOT markings, placards and labels" June 20, 1996.

(c) 29 C.F.R. §1928.21 "Applicability of Standards in 29 CFR Part 1910" March 7, 1996.

(2) The adopted federal regulations shall have the same force and effect as a rule promulgated under 1974 PA 154, MCL 408.1001 to 408.1094.

R 325.77004 Availability of adopted rules.

Rule 4. (1) The standards adopted in these rules are available from the United States Department of Labor, Occupational Safety and Health Administration website: www.osha.gov, at no charge, as of the time of adoption of these rules.

(2) The standards adopted in these rules are also available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, Lansing, Michigan, 48909-8143.

(3) The standards adopted in these rules may be obtained from the publisher or may also be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

OCCUPATIONAL SAFETY AND HEALTH STANDARDS

§1926.59 HAZARD COMMUNICATION (Construction)

Note: The requirements applicable to construction work under this section are identical to those set forth at 1910.1200 of this chapter.

[52 FR 31877, Aug. 24, 1987, as amended at 53 FR 15035, Apr. 27, 1988; 54 FR 24334, June 7, 1989; 59 FR 6170, Feb. 9, 1994; 59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 31427, June 20, 1996]

§1910.1200 HAZARD COMMUNICATION

Note: The following text for 1910.1200 has been updated to align with the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 3, issued in the Federal Register, March 26, 2012. This rule became effective May 25, 2012.

Also, the [Hazard Communication page](#), on OSHA.gov, includes downloadable versions of the revised 1910.1200 Final Rule and appendices, updated to align with the GHS; a comparison of the Hazard Communication Standard, issued in 1994 (HazCom 1994), with the revised Hazard Communication Final Rule issued in 2012 (HazCom 2012); frequently asked questions on the revisions; and new guidance materials on the revisions. The page also contains the full regulatory text and appendices of [HazCom 1994](#).

1910.1200(a) Purpose.

1910.1200(a)(1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are classified, and that information concerning the classified hazards is transmitted to employers and employees. The requirements of this section are intended to be consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 3. The transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, safety data sheets and employee training.

1910.1200(a)(2) This occupational safety and health standard is intended to address comprehensively the issue of classifying the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legislative or regulatory enactments of a state, or political subdivision of a state, pertaining to this subject. Classifying the potential hazards of chemicals and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

1910.1200(b) Scope and application.

1910.1200(b)(1) This section requires chemical manufacturers or importers to classify the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers. (Employers who do not produce or import chemicals need only focus on those parts of this rule that deal with establishing a workplace program and communicating information to their workers.)

1910.1200(b)(2) This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

1910.1200(b)(3) This section applies to laboratories only as follows:

1910.1200(b)(3)(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(3)(ii) Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible during each workshift to laboratory employees when they are in their work areas;

1910.1200(b)(3)(iii) Employers shall ensure that laboratory employees are provided information and training in accordance with paragraph (h) of this section, except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section; and,

1910.1200(b)(3)(iv) Laboratory employers that ship hazardous chemicals are considered to be either a chemical manufacturer or a distributor under this rule, and thus must ensure that any containers of hazardous chemicals leaving the laboratory are labeled in accordance with paragraph (f) of this section, and that a safety data sheet is provided to distributors and other employers in accordance with paragraphs (g)(6) and (g)(7) of this section.

1910.1200(b)(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

1910.1200(b)(4)(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(4)(ii) Employers shall maintain copies of any safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a safety data sheet as soon as possible for sealed containers of hazardous chemicals received without a safety data sheet if an employee requests the safety data sheet, and shall ensure that the safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

1910.1200(b)(4)(iii) Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

1910.1200(b)(5) This section does not require labeling of the following chemicals:

1910.1200(b)(5)(i) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(ii) Any chemical substance or mixture as such terms are defined in the Toxic Substances Control Act (15 U.S.C. 2601 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(iii) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device or product, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.) or the Virus-Serum-Toxin Act of 1913 (21 U.S.C. 151 et seq.), and regulations issued under those Acts, when they are subject to the labeling requirements under those Acts by either the Food and Drug Administration or the Department of Agriculture;

1910.1200(b)(5)(iv) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 et seq.) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol, Tobacco, Firearms and Explosives;

1910.1200(b)(5)(v) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission; and,

1910.1200(b)(5)(vi) Agricultural or vegetable seed treated with pesticides and labeled in accordance with the Federal Seed Act (7 U.S.C. 1551 et seq.) and the labeling regulations issued under that Act by the Department of Agriculture.

1910.1200(b)(6) This section does not apply to:

1910.1200(b)(6)(i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(6)(ii) Any hazardous substance as such term is defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.) when the hazardous substance is the focus of remedial or removal action being conducted under CERCLA in accordance with Environmental Protection Agency regulations.

1910.1200(b)(6)(iii) Tobacco or tobacco products;

1910.1200(b)(6)(iv) Wood or wood products, including lumber which will not be processed, where the chemical manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility (wood or wood products which have been treated with a hazardous chemical covered by this standard, and wood which may be subsequently sawed or cut, generating dust, are not exempted);

1910.1200(b)(6)(v) Articles (as that term is defined in paragraph (c) of this section);

1910.1200(b)(6)(vi) Food or alcoholic beverages which are sold, used, or prepared in a retail establishment (such as a grocery store, restaurant, or drinking place), and foods intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(vii) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.), when it is in solid, final form for direct administration to the patient (e.g., tablets or pills); drugs which are packaged by the chemical manufacturer for sale to consumers in a retail establishment (e.g., over-the-counter drugs); and drugs intended for personal consumption by employees while in the workplace (e.g., first aid supplies);

1910.1200(b)(6)(viii) Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(ix) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended;

1910.1200(b)(6)(x) Nuisance particulates where the chemical manufacturer or importer can establish that they do not pose any physical or health hazard covered under this section;

1910.1200(b)(6)(xi) Ionizing and nonionizing radiation; and,

1910.1200(b)(6)(xii) Biological hazards.

1910.1200(c) Definitions.

Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Chemical means any substance, or mixture of substances.

Chemical manufacturer means an employer with a workplace where chemical(s) are produced for use or distribution.

Chemical name means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name that will clearly identify the chemical for the purpose of conducting a hazard classification.

Classification means to identify the relevant data regarding the hazards of a chemical; review those data to ascertain the hazards associated with the chemical; and decide whether the chemical will be classified as hazardous according to the definition of hazardous chemical in this section. In addition, classification for health and physical hazards includes the determination of the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

Commercial account means an arrangement whereby a retail distributor sells hazardous chemicals to an employer, generally in large quantities over time and/or at costs that are below the regular retail price.

Common name means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

Designated representative means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Distributor means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

Employee means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

Employer means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

Exposure or exposed means that an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (e.g. accidental or possible) exposure. "Subjected" in terms of health hazards includes any route of entry (e.g. inhalation, ingestion, skin contact or absorption.)

Foreseeable emergency means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

Hazard category means the division of criteria within each hazard class, e.g., oral acute toxicity and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

Hazard class means the nature of the physical or health hazards, e.g., flammable solid, carcinogen, oral acute toxicity.

Hazard not otherwise classified (HNOC) means an adverse physical or health effect identified through evaluation of scientific evidence during the classification process that does not meet the specified criteria for the physical and health hazard classes addressed in this section. This does not extend coverage to adverse physical and health effects for which there is a hazard class addressed in this section, but the effect either falls below the cut-off value/concentration limit of the hazard class or is under a GHS hazard category that has not been adopted by OSHA (e.g., acute toxicity Category 5).

Hazard statement means a statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

Hazardous chemical means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

Health hazard means a chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A to §1910.1200—Health Hazard Criteria.

Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

Importer means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

Label means an appropriate group of written, printed or graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached to the immediate container of a hazardous chemical, or to the outside packaging.

Label elements means the specified pictogram, hazard statement, signal word and precautionary statement for each hazard class and category.

Mixture means a combination or a solution composed of two or more substances in which they do not react.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; or in contact with water emits flammable gas. See Appendix B to §1910.1200—Physical Hazard Criteria.

Pictogram means a composition that may include a symbol plus other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical. Eight pictograms are designated under this standard for application to a hazard category.

Precautionary statement means a phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical, or improper storage or handling.

Produce means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

Product identifier means the name or number used for a hazardous chemical on a label or in the SDS. It provides a unique means by which the user can identify the chemical. The product identifier used shall permit cross-references to be made among the list of hazardous chemicals required in the written hazard communication program, the label and the SDS.

Pyrophoric gas means a chemical in a gaseous state that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.

Responsible party means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

Safety data sheet (SDS) means written or printed material concerning a hazardous chemical that is prepared in accordance with paragraph (g) of this section.

Signal word means a word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used in this section are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for the less severe.

Simple asphyxiant means a substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death.

Specific chemical identity means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

Substance means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix E to §1910.1200—Definition of Trade Secret, sets out the criteria to be used in evaluating trade secrets.

Use means to package, handle, react, emit, extract, generate as a byproduct, or transfer.

Work area means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

Workplace means an establishment, job site, or project, at one geographical location containing one or more work areas.

1910.1200(d) Hazard classification.

1910.1200(d)(1) Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to classify the chemicals in accordance with this section. For each chemical, the chemical manufacturer or importer shall determine the hazard classes, and, where appropriate, the category of each class that apply to the chemical being classified. Employers are not required to classify chemicals unless they choose not to rely on the classification performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

1910.1200(d)(2) Chemical manufacturers, importers or employers classifying chemicals shall identify and consider the full range of available scientific literature and other evidence concerning the potential hazards. There is no requirement to test the chemical to determine how to classify its hazards. Appendix A to § 1910.1200 shall be consulted for classification of health hazards, and Appendix B to § 1910.1200 shall be consulted for the classification of physical hazards.

1910.1200(d)(3) Mixtures.

1910.1200(d)(3)(i) Chemical manufacturers, importers, or employers evaluating chemicals shall follow the procedures described in Appendices A and B to Sec. 1910.1200 to classify the hazards of the chemicals, including determinations regarding when mixtures of the classified chemicals are covered by this section.

1910.1200(d)(3)(ii) When classifying mixtures they produce or import, chemical manufacturers and importers of mixtures may rely on the information provided on the current safety data sheets of the individual ingredients, except where the chemical manufacturer or importer knows, or in the exercise of reasonable diligence should know, that the safety data sheet misstates or omits information required by this section.

1910.1200(e) Written hazard communication program.

1910.1200(e)(1) Employers shall develop, implement, and maintain at each workplace, a written hazard communication program which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, safety data sheets, and employee information and training will be met, and which also includes the following:

1910.1200(e)(1)(i) A list of the hazardous chemicals known to be present using a product identifier that is referenced on the appropriate safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

1910.1200(e)(1)(ii) The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

1910.1200(e)(2) Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

1910.1200(e)(2)(i) The methods the employer will use to provide the other employer(s) on-site access to safety data sheets for each hazardous chemical the other employer(s)' employees may be exposed to while working;

1910.1200(e)(2)(ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

1910.1200(e)(2)(iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

1910.1200(e)(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

1910.1200(e)(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.1020 (e).

1910.1200(e)(5) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the written hazard communication program may be kept at the primary workplace facility.

1910.1200(f) Labels and other forms of warning.

1910.1200(f)(1) Labels on shipped containers. The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked. Hazards not otherwise classified do not have to be addressed on the container. Where the chemical manufacturer or importer is required to label, tag or mark the following information shall be provided:

- 1910.1200(f)(1)(i) Product identifier;
- 1910.1200(f)(1)(ii) Signal word;
- 1910.1200(f)(1)(iii) Hazard statement(s);
- 1910.1200(f)(1)(iv) Pictogram(s);
- 1910.1200(f)(1)(v) Precautionary statement(s); and,
- 1910.1200(f)(1)(vi) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

1910.1200(f)(2) The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(i) through (v) of this section is in accordance with Appendix C to § 1910.1200, for each hazard class and associated hazard category for the hazardous chemical, prominently displayed, and in English (other languages may also be included if appropriate).

1910.1200(f)(3) The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(ii) through (iv) of this section is located together on the label, tag, or mark.

1910.1200(f)(4) Solid materials.

1910.1200(f)(4)(i) For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

1910.1200(f)(4)(ii) The label may be transmitted with the initial shipment itself, or with the safety data sheet that is to be provided prior to or at the time of the first shipment; and,

1910.1200(f)(4)(iii) This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself, and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grains).

1910.1200(f)(5) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.) and regulations issued under that Act by the Department of Transportation.

1910.1200(f)(6) Workplace labeling. Except as provided in paragraphs (f)(7) and (f)(8) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with either:

1910.1200(f)(6)(i) The information specified under paragraphs (f)(1)(i) through (v) of this section for labels on shipped containers; or,

1910.1200(f)(6)(ii) Product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards of the hazardous chemical.

1910.1200(f)(7) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(6) of this section to be on a label. The employer shall ensure the written materials are readily accessible to the employees in their work area throughout each work shift.

1910.1200(f)(8) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. For purposes of this section, drugs which are dispensed by a pharmacy to a health care provider for direct administration to a patient are exempted from labeling.

1910.1200(f)(9) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

1910.1200(f)(10) The employer shall ensure that workplace labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

1910.1200(f)(11) Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within six months of becoming aware of the new information, and shall ensure that labels on containers of hazardous chemicals shipped after that time contain the new information. If the chemical is not currently produced or imported, the chemical manufacturer, importer, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

1910.1200(g) Safety data sheets.

1910.1200(g)(1) Chemical manufacturers and importers shall obtain or develop a safety data sheet for each hazardous chemical they produce or import. Employers shall have a safety data sheet in the workplace for each hazardous chemical which they use.

1910.1200(g)(2) The chemical manufacturer or importer preparing the safety data sheet shall ensure that it is in English (although the employer may maintain copies in other languages as well), and includes at least the following section numbers and headings, and associated information under each heading, in the order listed (See Appendix D to § 1910.1200—Safety Data Sheets, for the specific content of each section of the safety data sheet):

- 1910.1200(g)(2)(i) Section 1, Identification;
- 1910.1200(g)(2)(ii) Section 2, Hazard(s) identification;
- 1910.1200(g)(2)(iii) Section 3, Composition/information on ingredients;
- 1910.1200(g)(2)(iv) Section 4, First-aid measures;
- 1910.1200(g)(2)(v) Section 5, Fire-fighting measures;
- 1910.1200(g)(2)(vi) Section 6, Accidental release measures;
- 1910.1200(g)(2)(vii) Section 7, Handling and storage;
- 1910.1200(g)(2)(viii) Section 8, Exposure controls/personal protection;
- 1910.1200(g)(2)(ix) Section 9, Physical and chemical properties;
- 1910.1200(g)(2)(x) Section 10, Stability and reactivity;
- 1910.1200(g)(2)(xi) Section 11, Toxicological information;
- 1910.1200(g)(2)(xii) Section 12, Ecological information;
- 1910.1200(g)(2)(xiii) Section 13, Disposal considerations;
- 1910.1200(g)(2)(xiv) Section 14, Transport information;
- 1910.1200(g)(2)(xv) Section 15, Regulatory information; and
- 1910.1200(g)(2)(xvi) Section 16, Other information, including date of preparation or last revision.

Note 1 to paragraph (g)(2): To be consistent with the GHS, an SDS must also include the headings in paragraphs (g)(2)(xii) through (g)(2)(xv) in order.

Note 2 to paragraph (g)(2): OSHA will not be enforcing information requirements in sections 12 through 15, as these areas are not under its jurisdiction.

1910.1200(g)(3) If no relevant information is found for any sub-heading within a section on the safety data sheet, the chemical manufacturer, importer or employer preparing the safety data sheet shall mark it to indicate that no applicable information was found.

1910.1200(g)(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one safety data sheet to apply to all of these similar mixtures.

1910.1200(g)(5) The chemical manufacturer, importer or employer preparing the safety data sheet shall ensure that the information provided accurately reflects the scientific evidence used in making the hazard classification. If the chemical manufacturer, importer or employer preparing the safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the safety data sheet within three months. If the chemical is not currently being produced or imported, the chemical manufacturer or importer shall add the information to the safety data sheet before the chemical is introduced into the workplace again.

1910.1200(g)(6)(i) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate safety data sheet with their initial shipment, and with the first shipment after a safety data sheet is updated;

1910.1200(g)(6)(ii) The chemical manufacturer or importer shall either provide safety data sheets with the shipped containers or send them to the distributor or employer prior to or at the time of the shipment;

1910.1200(g)(6)(iii) If the safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the distributor or employer shall obtain one from the chemical manufacturer or importer as soon as possible; and,

1910.1200(g)(6)(iv) The chemical manufacturer or importer shall also provide distributors or employers with a safety data sheet upon request.

1910.1200(g)(7)(i) Distributors shall ensure that safety data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a safety data sheet is updated;

1910.1200(g)(7)(ii) The distributor shall either provide safety data sheets with the shipped containers, or send them to the other distributor or employer prior to or at the time of the shipment;

1910.1200(g)(7)(iii) Retail distributors selling hazardous chemicals to employers having a commercial account shall provide a safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a safety data sheet is available;

1910.1200(g)(7)(iv) Wholesale distributors selling hazardous chemicals to employers over-the-counter may also provide safety data sheets upon the request of the employer at the time of the over-the-counter purchase, and shall post a sign or otherwise inform such employers that a safety data sheet is available;

1910.1200(g)(7)(v) If an employer without a commercial account purchases a hazardous chemical from a retail distributor not required to have safety data sheets on file (i.e., the retail distributor does not have commercial accounts and does not use the materials), the retail distributor shall provide the employer, upon request, with the name, address, and telephone number of the chemical manufacturer, importer, or distributor from which a safety data sheet can be obtained;

1910.1200(g)(7)(vi) Wholesale distributors shall also provide safety data sheets to employers or other distributors upon request; and,

1910.1200(g)(7)(vii) Chemical manufacturers, importers, and distributors need not provide safety data sheets to retail distributors that have informed them that the retail distributor does not sell the product to commercial accounts or open the sealed container to use it in their own workplaces.

1910.1200(g)(8) The employer shall maintain in the workplace copies of the required safety data sheets for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s). (Electronic access and other alternatives to maintaining paper copies of the safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options.)

1910.1200(g)(9) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the material safety data sheets may be kept at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

1910.1200(g)(10) Safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work area(s).

1910.1200(g)(11) Safety data sheets shall also be made readily available, upon request, to designated representatives, the Assistant Secretary, and the Director, in accordance with the requirements of § 1910.1020(e).

1910.1200(h) Employee information and training.

1910.1200(h)(1) Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new chemical hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and safety data sheets.

1910.1200(h)(2) Information. Employees shall be informed of:

1910.1200(h)(2)(i) The requirements of this section;

1910.1200(h)(2)(ii) Any operations in their work area where hazardous chemicals are present; and,

1910.1200(h)(2)(iii) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and safety data sheets required by this section.

1910.1200(h)(3) Training. Employee training shall include at least:

1910.1200(h)(3)(i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

1910.1200(h)(3)(ii) The physical, health, simple asphyxiation, combustible dust, and pyrophoric gas hazards, as well as hazards not otherwise classified, of the chemicals in the work area;

1910.1200(h)(3)(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

1910.1200(h)(3)(iv) The details of the hazard communication program developed by the employer, including an explanation of the labels received on shipped containers and the workplace labeling system used by their employer; the safety data sheet, including the order of information and how employees can obtain and use the appropriate hazard information.

1910.1200(i) Trade secrets.

1910.1200(i)(1)The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name, other specific identification of a hazardous chemical, or the exact percentage (concentration) of the substance in a mixture, from the safety data sheet, provided that:

1910.1200(i)(1)(i) The claim that the information withheld is a trade secret can be supported;

1910.1200(i)(1)(ii) Information contained in the safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

1910.1200(i)(1)(iii)The safety data sheet indicates that the specific chemical identity and/or percentage of composition is being withheld as a trade secret; and,

1910.1200(i)(1)(iv)The specific chemical identity and percentage is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph (i).

1910.1200(i)(2)Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity and/or specific percentage of composition of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity or percentage composition of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

1910.1200(i)(3)In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity or percentage composition, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

1910.1200(i)(3)(i) The request is in writing;

1910.1200(i)(3)(ii) The request describes with reasonable detail one or more of the following occupational health needs for the information:

1910.1200(i)(3)(ii)(A) To assess the hazards of the chemicals to which employees will be exposed;

1910.1200(i)(3)(ii)(B) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

1910.1200(i)(3)(ii)(C) To conduct pre-assignment or periodic medical surveillance of exposed employees;

1910.1200(i)(3)(ii)(D) To provide medical treatment to exposed employees;

1910.1200(i)(3)(ii)(E) To select or assess appropriate personal protective equipment for exposed employees;

1910.1200(i)(3)(ii)(F) To design or assess engineering controls or other protective measures for exposed employees; and,

1910.1200(i)(3)(ii)(G) To conduct studies to determine the health effects of exposure.

1910.1200(i)(3)(iii)The request explains in detail why the disclosure of the specific chemical identity or percentage composition is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:

1910.1200(i)(3)(iii)(A) The properties and effects of the chemical;

1910.1200(i)(3)(iii)(B) Measures for controlling workers' exposure to the chemical;

1910.1200(i)(3)(iii)(C) Methods of monitoring and analyzing worker exposure to the chemical; and,

1910.1200(i)(3)(iii)(D) Methods of diagnosing and treating harmful exposures to the chemical;

1910.1200(i)(3)(iv)The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

1910.1200(i)(3)(v) The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

1910.1200(i)(4)The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

1910.1200(i)(4)(i) May restrict the use of the information to the health purposes indicated in the written statement of need;

1910.1200(i)(4)(ii) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

1910.1200(i)(4)(iii)May not include requirements for the posting of a penalty bond.

1910.1200(i)(5)Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

1910.1200(i)(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

1910.1200(i)(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity or percentage composition, the denial must:

1910.1200(i)(7)(i) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

1910.1200(i)(7)(ii) Be in writing;

1910.1200(i)(7)(iii) Include evidence to support the claim that the specific chemical identity or percent of composition is a trade secret;

1910.1200(i)(7)(iv) State the specific reasons why the request is being denied; and,

1910.1200(i)(7)(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the trade secret.

1910.1200(i)(8) The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

1910.1200(i)(9) When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

1910.1200(i)(9)(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity or percentage composition is a trade secret;

1910.1200(i)(9)(ii) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

1910.1200(i)(9)(iii) The health professional, employee or designated representative has demonstrated adequate means to protect the confidentiality.

1910.1200(i)(10)(i) If OSHA determines that the specific chemical identity or percentage composition requested under paragraph (i)(3) of this section is not a "bona fide" trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

1910.1200(i)(10)(ii) If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

1910.1200(i)(11) If a citation for a failure to release trade secret information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation "in camera" or issue appropriate orders to protect the confidentiality of such matters.

1910.1200(i)(12) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

1910.1200(i)(13) Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process information which is a trade secret.

1910.1200(j) Effective dates.

1910.1200(j)(1) Employers shall train employees regarding the new label elements and safety data sheets format by December 1, 2013.

1910.1200(j)(2) Chemical manufacturers, importers, distributors, and employers shall be in compliance with all modified provisions of this section no later than June 1, 2015, except:

1910.1200(j)(2)(i) After December 1, 2015, the distributor shall not ship containers labeled by the chemical manufacturer or importer unless the label has been modified to comply with paragraph (f)(1) of this section.

1910.1200(j)(2)(ii) All employers shall, as necessary, update any alternative workplace labeling used under paragraph (f)(6) of this section, update the hazard communication program required by paragraph (h)(1), and provide any additional employee training in accordance with paragraph (h)(3) for newly identified physical or health hazards no later than June 1, 2016.

1910.1200(j)(3)Chemical manufacturers, importers, distributors, and employers may comply with either § 1910.1200 revised as of October 1, 2011, or the current version of this standard, or both during the transition period.

[59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 5507, Feb. 13, 1996; 77 FR 17785, March 26, 2012] [78 FR 9313, Feb. 8, 2013]

APPENDIX A HEALTH HAZARD CRITERIA (Mandatory)

A.0 GENERAL CLASSIFICATION CONSIDERATIONS

A.0.1 Classification

A.0.1.1 The term "hazard classification" is used to indicate that only the intrinsic hazardous properties of chemicals are considered. Hazard classification incorporates three steps:

- (a) identification of relevant data regarding the hazards of a chemical;
- (b) subsequent review of those data to ascertain the hazards associated with the chemical;
- (c) determination of whether the chemical will be classified as hazardous and the degree of hazard.

A.0.1.2 For many hazard classes, the criteria are semi quantitative or qualitative and expert judgment is required to interpret the data for classification purposes.

A.0.2 Available data, test methods and test data quality

A.0.2.1 There is no requirement for testing chemicals.

A.0.2.2 The criteria for determining health hazards are test method neutral, i.e., they do not specify particular test methods, as long as the methods are scientifically validated.

A.0.2.3 The term "scientifically validated" refers to the process by which the reliability and the relevance of a procedure are established for a particular purpose. Any test that determines hazardous properties, which is conducted according to recognized scientific principles, can be used for purposes of a hazard determination for health hazards. Test conditions need to be standardized so that the results are reproducible with a given substance, and the standardized test yields "valid" data for defining the hazard class of concern.

A.0.2.4 Existing test data are acceptable for classifying chemicals, although expert judgment also may be needed for classification purposes.

A.0.2.5 The effect of a chemical on biological systems is influenced, by the physico-chemical properties of the substance and/or ingredients of the mixture and the way in which ingredient substances are biologically available. A chemical need not be classified when it can be shown by conclusive experimental data from scientifically validated test methods that the chemical is not biologically available.

A.0.2.6 For classification purposes, epidemiological data and experience on the effects of chemicals on humans (e.g., occupational data, data from accident databases) shall be taken into account in the evaluation of human health hazards of a chemical.

A.0.3 Classification based on weight of evidence

A.0.3.1 For some hazard classes, classification results directly when the data satisfy the criteria. For others, classification of a chemical shall be determined on the basis of the total weight of evidence using expert judgment. This means that all available information bearing on the classification of hazard shall be considered together, including the results of valid in vitro tests, relevant animal data, and human experience such as epidemiological and clinical studies and well-documented case reports and observations.

A.0.3.2 The quality and consistency of the data shall be considered. Information on chemicals related to the material being classified shall be considered as appropriate, as well as site of action and mechanism or mode of action study results. Both positive and negative results shall be considered together in a single weight-of-evidence determination.

A.0.3.3 Positive effects which are consistent with the criteria for classification, whether seen in humans or animals, shall normally justify classification. Where evidence is available from both humans and animals and there is a conflict between the findings, the quality and reliability of the evidence from both sources shall be evaluated in order to resolve the question of classification. Reliable, good quality human data shall generally have precedence over other data. However, even well-designed and conducted epidemiological studies may lack a sufficient number of subjects to detect relatively rare but still significant effects, or to assess potentially confounding factors. Therefore, positive results from well-conducted animal studies are not necessarily negated by the lack of positive human experience but require an assessment of the robustness, quality and statistical power of both the human and animal data.

A.0.3.4 Route of exposure, mechanistic information, and metabolism studies are pertinent to determining the relevance of an effect in humans. When such information raises doubt about relevance in humans, a lower classification may be warranted. When there is scientific evidence demonstrating that the mechanism or mode of action is not relevant to humans, the chemical should not be classified.

A.0.3.5 Both positive and negative results are considered together in the weight of evidence determination. However, a single positive study performed according to good scientific principles and with statistically and biologically significant positive results may justify classification.

A.0.4 Considerations for the classification of mixtures

A.0.4.1 For most hazard classes, the recommended process of classification of mixtures is based on the following sequence:

(a) Where test data are available for the complete mixture, the classification of the mixture will always be based on those data;

(b) Where test data are not available for the mixture itself, the bridging principles designated in each health hazard chapter of this appendix shall be considered for classification of the mixture;

(c) If test data are not available for the mixture itself, and the available information is not sufficient to allow application of the above-mentioned bridging principles, then the method(s) described in each chapter for estimating the hazards based on the information known will be applied to classify the mixture (e.g., application of cut-off values/concentration limits).

A.0.4.2 An exception to the above order or precedence is made for Carcinogenicity, Germ Cell Mutagenicity, and Reproductive Toxicity. For these three hazard classes, mixtures shall be classified based upon information on the ingredient substances, unless on a case-by-case basis, justification can be provided for classifying based upon the mixture as a whole. See chapters A.5, A.6, and A.7 for further information on case-by-case bases.

A.0.4.3 Use of cut-off values/concentration limits

A.0.4.3.1 When classifying an untested mixture based on the hazards of its ingredients, cut-off values/concentration limits for the classified ingredients of the mixture are used for several hazard classes. While the adopted cut-off values/concentration limits adequately identify the hazard for most mixtures, there may be some that contain hazardous ingredients at lower concentrations than the specified cut-off values/concentration limits that still pose an identifiable hazard. There may also be cases where the cut-off value/concentration limit is considerably lower than the established non-hazardous level for an ingredient.

A.0.4.3.2 If the classifier has information that the hazard of an ingredient will be evident (i.e., it presents a health risk) below the specified cut-off value/concentration limit, the mixture containing that ingredient shall be classified accordingly.

A.0.4.3.3 In exceptional cases, conclusive data may demonstrate that the hazard of an ingredient will not be evident (i.e., it does not present a health risk) when present at a level above the specified cut-off value/concentration limit(s). In these cases the mixture may be classified according to those data. The data must exclude the possibility that the ingredient will behave in the mixture in a manner that would increase the hazard over that of the pure substance. Furthermore, the mixture must not contain ingredients that would affect that determination.

A.0.4.4 Synergistic or antagonistic effects

When performing an assessment in accordance with these requirements, the evaluator must take into account all available information about the potential occurrence of synergistic effects among the ingredients of the mixture. Lowering classification of a mixture to a less hazardous category on the basis of antagonistic effects may be done only if the determination is supported by sufficient data.

A.0.5 Bridging principles for the classification of mixtures where test data are not available for the complete mixture

A.0.5.1 Where the mixture itself has not been tested to determine its toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles, subject to any specific provisions for mixtures for each hazard class. These principles ensure that the classification process uses the available data to the greatest extent possible in characterizing the hazards of the mixture.

A.0.5.1.1 Dilution

For mixtures classified in accordance with A.1 through A.10 of this Appendix, if a tested mixture is diluted with a diluent that has an equivalent or lower toxicity classification than the least toxic original ingredient, and which is not expected to affect the toxicity of other ingredients, then:

(a) the new diluted mixture shall be classified as equivalent to the original tested mixture; or

(b) for classification of acute toxicity in accordance with A.1 of this Appendix, paragraph A.1.3.6 (the additivity formula) shall be applied.

A.0.5.1.2 Batching

For mixtures classified in accordance with A.1 through A.10 of this Appendix, the toxicity of a tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same mixture, when produced by or under the control of the same chemical manufacturer, unless there is reason to believe there is significant variation such that the toxicity of the untested batch has changed. If the latter occurs, a new classification is necessary.

A.0.5.1.3 Concentration of mixtures

For mixtures classified in accordance with A.1, A.2, A.3, A.8, A.9, or A.10 of this Appendix, if a tested mixture is classified in Category 1, and the concentration of the ingredients of the tested mixture that are in Category 1 is increased, the resulting untested mixture shall be classified in Category 1.

A.0.5.1.4 Interpolation within one toxicity category

For mixtures classified in accordance with A.1, A.2, A.3, A.8, A.9, or A.10 of this Appendix, for three mixtures (A, B and C) with identical ingredients, where mixtures A and B have been tested and are in the same toxicity category, and where untested mixture C has the same toxicologically active ingredients as mixtures A and B but has concentrations of toxicologically active ingredients intermediate to the concentrations in mixtures A and B, then mixture C is assumed to be in the same toxicity category as A and B.

A.0.5.1.5 Substantially similar mixtures

For mixtures classified in accordance with A.1 through A.10 of this Appendix, given the following set of conditions:

- (a) Where there are two mixtures:
 - (i) A + B;
 - (ii) C + B;
- (b) The concentration of ingredient B is essentially the same in both mixtures;
- (c) The concentration of ingredient A in mixture (i) equals that of ingredient C in mixture (ii);
- (d) And data on toxicity for A and C are available and substantially equivalent; i.e., they are in the same hazard category and are not expected to affect the toxicity of B; then

If mixture (i) or (ii) is already classified based on test data, the other mixture can be assigned the same hazard category.

A.0.5.1.6 Aerosols

For mixtures classified in accordance with A.1, A.2, A.3, A.4, A.8, or A.9 of this Appendix, an aerosol form of a mixture shall be classified in the same hazard category as the tested, non-aerosolized form of the mixture, provided the added propellant does not affect the toxicity of the mixture when spraying.

A.1 ACUTE TOXICITY

A.1.1 Definition

Acute toxicity refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.

A.1.2 Classification criteria for substances

A.1.2.1 Substances can be allocated to one of four toxicity categories based on acute toxicity by the oral, dermal or inhalation route according to the numeric cut-off criteria as shown in Table A.1.1. Acute toxicity values are expressed as (approximate) LD₅₀ (oral, dermal) or LC₅₀ (inhalation) values or as acute toxicity estimates (ATE). See the footnotes following Table A.1.1 for further explanation on the application of these values.

Exposure Route	Category 1	Category 2	Category 3	Category 4
Oral (mg/kg bodyweight) see: Note (a) Note (b)	≤ 5	>5 and ≤ 50	>50 and ≤ 300	>300 and ≤ 2000
Dermal (mg/kg bodyweight) see: Note (a) Note (b)	≤ 50	>50 and ≤ 200	>200 and ≤ 1000	>1000 and ≤ 2000
Inhalation - Gases (ppmV) see: Note (a) Note (b) Note (c)	≤ 100	>100 and ≤ 500	>500 and ≤ 2500	>2500 and ≤ 20000

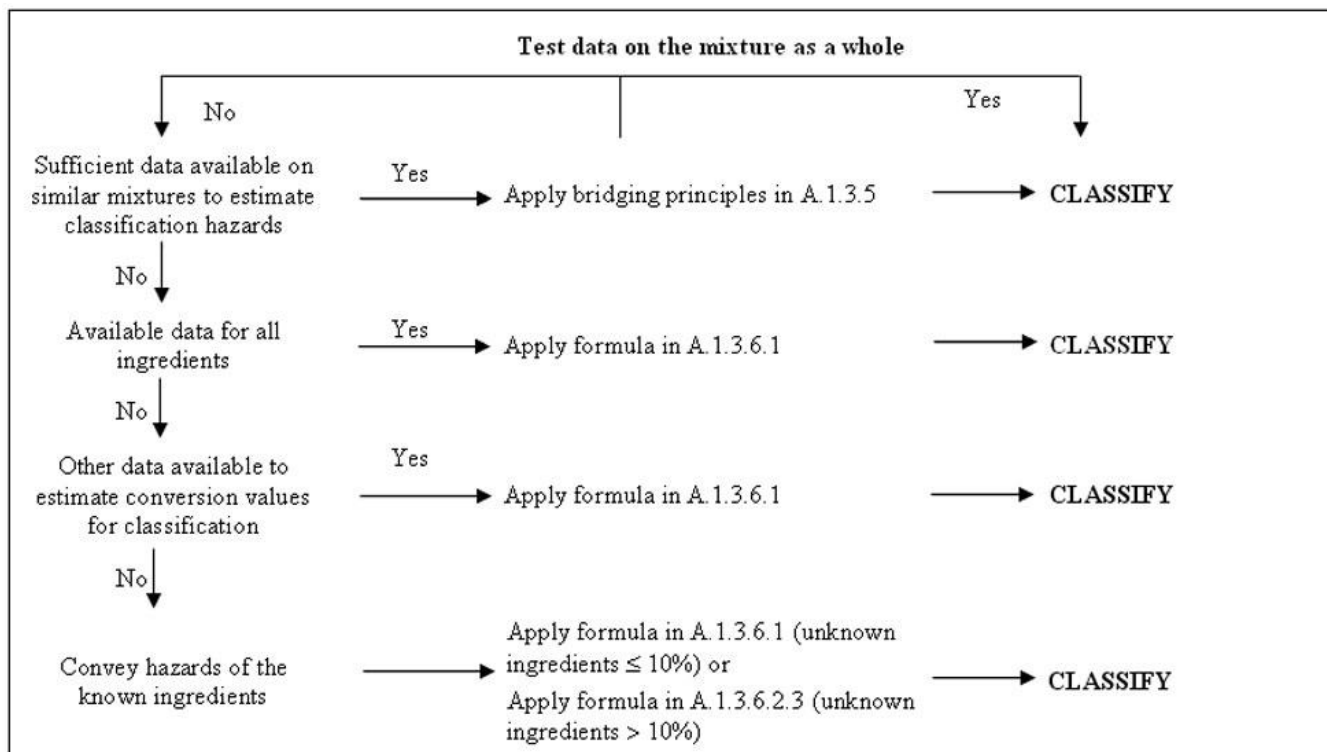
TABLE A.1.1 ACUTE TOXICITY HAZARD CATEGORIES AND ACUTE TOXICITY ESTIMATE (ATE) VALUES DEFINING THE RESPECTIVE CATEGORIES				
Exposure Route	Category 1	Category 2	Category 3	Category 4
Inhalation - Vapors (mg/l) see: Note (a) Note (b) Note (c) Note (d)	≤ 0.5	>0.5 and ≤ 2.0	>2.0 and ≤ 10.0	>10.0 and ≤ 20.0
Inhalation – Dusts and Mists (mg/l) see: Note (a) Note (b) Note (c)	≤ 0.05	>0.05 and ≤ 0.5	>0.5 and ≤ 1.0	>1.0 and ≤ 5.0
Note: Gas concentrations are expressed in parts per million per volume (ppmV).				
Notes to Table A.1.1: (a) The acute toxicity estimate (ATE) for the classification of a substance is derived using the LD ₅₀ /LC ₅₀ where available;				
(b) The acute toxicity estimate (ATE) for the classification of a substance or ingredient in a mixture is derived using: (i) the LD ₅₀ /LC ₅₀ where available. Otherwise, (ii) the appropriate conversion value from Table 1.2 that relates to the results of a range test, or (iii) the appropriate conversion value from Table 1.2 that relates to a classification category;				
Notes to Table A.1.1 (continued): (c) Inhalation cut-off values in the table are based on 4 hour testing exposures. Conversion of existing inhalation toxicity data which has been generated according to 1 hour exposure is achieved by dividing by a factor of 2 for gases and vapors and 4 for dusts and mists;				
(d) For some substances the test atmosphere will be a vapor which consists of a combination of liquid and gaseous phases. For other substances the test atmosphere may consist of a vapor which is nearly all the gaseous phase. In these latter cases, classification is based on ppmV as follows: Category 1 (100 ppmV), Category 2 (500 ppmV), Category 3 (2500 ppmV), Category 4 (20000 ppmV).				
The terms "dust", "mist" and "vapor" are defined as follows: (i) Dust: solid particles of a substance or mixture suspended in a gas (usually air); (ii) Mist: liquid droplets of a substance or mixture suspended in a gas (usually air); (iii) Vapor: the gaseous form of a substance or mixture released from its liquid or solid state.				

A.1.2.3 The preferred test species for evaluation of acute toxicity by the oral and inhalation routes is the rat, while the rat or rabbit are preferred for evaluation of acute dermal toxicity. Test data already generated for the classification of chemicals under existing systems should be accepted when reclassifying these chemicals under the harmonized system. When experimental data for acute toxicity are available in several animal species, scientific judgment should be used in selecting the most appropriate LD50 value from among scientifically validated tests.

A.1.3 Classification criteria for mixtures

A.1.3.1 The approach to classification of mixtures for acute toxicity is tiered, and is dependent upon the amount of information available for the mixture itself and for its ingredients. The flow chart of Figure A.1.1 indicates the process that must be followed:

**FIGURE A.1.1
TIERED APPROACH TO CLASSIFICATION OF MIXTURES FOR ACUTE TOXICITY**



A.1.3.2 Classification of mixtures for acute toxicity may be carried out for each route of exposure, but is only required for one route of exposure as long as this route is followed (estimated or tested) for all ingredients and there is no relevant evidence to suggest acute toxicity by multiple routes. When there is relevant evidence of acute toxicity by multiple routes of exposure, classification is to be conducted for all appropriate routes of exposure. All available information shall be considered. The pictogram and signal word used shall reflect the most severe hazard category; and all relevant hazard statements shall be used.

A.1.3.3 For purposes of classifying the hazards of mixtures in the tiered approach:

(a) The "relevant ingredients" of a mixture are those which are present in concentrations $\geq 1\%$ (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases). If there is reason to suspect that an ingredient present at a concentration $< 1\%$ will affect classification of the mixture for acute toxicity, that ingredient shall also be considered relevant. Consideration of ingredients present at a concentration $< 1\%$ is particularly important when classifying untested mixtures which contain ingredients that are classified in Category 1 and Category 2;

(b) Where a classified mixture is used as an ingredient of another mixture, the actual or derived acute toxicity estimate (ATE) for that mixture is used when calculating the classification of the new mixture using the formulas in A.1.3.6.1 and A.1.3.6.2.4.

(c) If the converted acute toxicity point estimates for all ingredients of a mixture are within the same category, then the mixture should be classified in that category.

(d) When only range data (or acute toxicity hazard category information) are available for ingredients in a mixture, they may be converted to point estimates in accordance with Table A.1.2 when calculating the classification of the new mixture using the formulas in A.1.3.6.1 and A.1.3.6.2.4.

A.1.3.4 Classification of mixtures where acute toxicity test data are available for the complete mixture

Where the mixture itself has been tested to determine its acute toxicity, it is classified according to the same criteria as those used for substances, presented in Table A.1.1. If test data for the mixture are not available, the procedures presented below must be followed.

A.1.3.5 Classification of mixtures where acute toxicity test data are not available for the complete mixture: bridging principles

A.1.3.5.1 Where the mixture itself has not been tested to determine its acute toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.1.3.6 Classification of mixtures based on ingredients of the mixture (additivity formula)

A.1.3.6.1 Data available for all ingredients

The acute toxicity estimate (ATE) of ingredients is considered as follows:

- (a) Include ingredients with a known acute toxicity, which fall into any of the acute toxicity categories, or have an oral or dermal LD50 greater than 2000 but less than or equal to 5000 mg/kg body weight (or the equivalent dose for inhalation);
- (b) Ignore ingredients that are presumed not acutely toxic (e.g., water, sugar);
- (c) Ignore ingredients if the data available are from a limit dose test (at the upper threshold for Category 4 for the appropriate route of exposure as provided in Table A.1.1) and do not show acute toxicity.

Ingredients that fall within the scope of this paragraph are considered to be ingredients with a known acute toxicity estimate (ATE). See note (b) to Table A.1.1 and paragraph A.1.3.3 for appropriate application of available data to the equation below, and paragraph A.1.3.6.2.4.

The ATE of the mixture is determined by calculation from the ATE values for all relevant ingredients according to the following formula below for oral, dermal or inhalation toxicity:

$\frac{100}{ATE_{mix}} = \sum_n \frac{C_i}{ATE_i}$
where:
C_i = concentration of ingredient i
n ingredients and i is running from 1 to n
ATE_i = acute toxicity estimate of ingredient i .

A.1.3.6.2 Data are not available for one or more ingredients of the mixture

A.1.3.6.2.1 Where an ATE is not available for an individual ingredient of the mixture, but available information provides a derived conversion value, the formula in A.1.3.6.1 may be applied. This information may include evaluation of:

- (a) Extrapolation between oral, dermal and inhalation acute toxicity estimates. Such an evaluation requires appropriate pharmacodynamic and pharmacokinetic data;
- (b) Evidence from human exposure that indicates toxic effects but does not provide lethal dose data;
- (c) Evidence from any other toxicity tests/assays available on the substance that indicates toxic acute effects but does not necessarily provide lethal dose data; or
- (d) Data from closely analogous substances using structure/activity relationships.

A.1.3.6.2.2 This approach requires substantial supplemental technical information, and a highly trained and experienced expert, to reliably estimate acute toxicity. If sufficient information is not available to reliably estimate acute toxicity, proceed to the provisions of A.1.3.6.2.3.

A.1.3.6.2.3 In the event that an ingredient with unknown acute toxicity is used in a mixture at a concentration $\geq 1\%$, and the mixture has not been classified based on testing of the mixture as a whole, the mixture cannot be attributed a definitive acute toxicity estimate. In this situation the mixture is classified based on the known ingredients only. (Note: A statement that x percent of the mixture consists of ingredient(s) of unknown toxicity is required on the label and safety data sheet in such cases; see Appendix C, Allocation of Label Elements and Appendix D, Safety Data Sheets.)

Where an ingredient with unknown acute toxicity is used in a mixture at a concentration $\geq 1\%$, and the mixture is not classified based on testing of the mixture as a whole, a statement that $X\%$ of the mixture consists of ingredient(s) of unknown acute toxicity is required on the label and safety data sheet in such cases; see Appendix C, Allocation of Label Elements and Appendix D, Safety Data Sheets.)

A.1.3.6.2.4 If the total concentration of the relevant ingredient(s) with unknown acute toxicity is $\leq 10\%$ then the formula presented in A.1.3.6.1 must be used. If the total concentration of the relevant ingredient(s) with unknown acute toxicity is $> 10\%$, the formula presented in A.1.3.6.1 is corrected to adjust for the percentage of the unknown ingredient(s) as follows:

$\frac{100 - (\sum C_{unknown} \text{ if } > 10\%)}{ATE_{mix}} = \sum_n \frac{C_i}{ATE_i}$
--

TABLE A.1.2 CONVERSION FROM EXPERIMENTALLY OBTAINED ACUTE TOXICITY RANGE VALUES (OR ACUTE TOXICITY HAZARD CATEGORIES) TO ACUTE TOXICITY POINT ESTIMATES FOR USE IN THE FORMULAS FOR THE CLASSIFICATION OF MIXTURES							
Exposure Routes	Classification Category or Experimentally Obtained Acute Toxicity Range Estimate						Converted Acute Toxicity Point Estimate
Oral (mg/kg bodyweight)	0	<	Category	1	≤	5	0.5
	5	<	Category	2	≤	50	5
	50	<	Category	3	≤	300	100
	300	<	Category	4	≤	2000	500
Dermal (mg/kg bodyweight)	0	<	Category	1	≤	50	5
	50	<	Category	2	≤	200	50
	200	<	Category	3	≤	1000	300
	1000	<	Category	4	≤	2000	1100
Gases (ppmV)	0	<	Category	1	≤	100	10
	100	<	Category	2	≤	500	100
	500	<	Category	3	≤	2500	700
	2500	<	Category	4	≤	20000	4500
Vapors (mg/l)	0	<	Category	1	≤	0.5	0.05
	0.5	<	Category	2	≤	2.0	0.5
	2.0	<	Category	3	≤	10.0	3
	10.0	<	Category	4	≤	20.0	11
Dust/mist (mg/l)	0	<	Category	1	≤	0.05	0.005
	0.05	<	Category	2	≤	0.5	0.05
	0.5	<	Category	3	≤	1.0	0.5
	1.0	<	Category	4	≤	5.0	1.5

Note: Gas concentrations are expressed in parts per million per volume (ppmV).

A.2 SKIN CORROSION/IRRITATION

A.2.1 Definitions and general considerations

A.2.1.1 Skin corrosion is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours. Corrosive reactions are typified by ulcers, bleeding, bloody scabs, and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of alopecia, and scars. Histopathology should be considered to evaluate questionable lesions.

Skin irritation is the production of reversible damage to the skin following the application of a test substance for up to 4 hours.

A.2.1.2 Skin corrosion/irritation shall be classified using a tiered approach as detailed in figure A.2.1. Emphasis shall be placed upon existing human data (See A.0.2.6), followed by other sources of information. Classification results directly when the data satisfy the criteria in this section. In case the criteria cannot be directly applied, classification of a substance or a mixture is made on the basis of the total weight of evidence (See A.0.3.1). This means that all available information bearing on the determination of skin corrosion/irritation is considered together, including the results of appropriate scientifically validated in-vitro tests, relevant animal data, and human data such as epidemiological and clinical studies and well-documented case reports and observations.

A.2.2 Classification criteria for substances using animal test data

A.2.2.1 Corrosion

A.2.2.1.1 A corrosive substance is a chemical that produces destruction of skin tissue, namely, visible necrosis through the epidermis and into the dermis, in at least 1 of 3 tested animals after exposure up to a 4-hour duration. Corrosive reactions are typified by ulcers, bleeding, bloody scabs and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of alopecia and scars. Histopathology should be considered to discern questionable lesions.

A.2.2.1.2 Three sub-categories of Category 1 are provided in Table A.2.1, all of which shall be regulated as Category 1.

TABLE A.2.1 SKIN CORROSION CATEGORY AND SUB-CATEGORIES			
Category 1: Corrosive	Corrosive Sub-Categories	Corrosive In ≥ 1 Of 3 Animals	
		Exposure	Observation
	1A	≤ 3 min	≤ 1 h
	1B	> 3 min ≤ 1 h	≤ 14 days
1C	> 1 h ≤ 4 h	≤ 14 days	

A.2.2.2 Irritation

A.2.2.2.1 A single irritant category (Category 2) is presented in the Table A.2.2. The major criterion for the irritant category is that at least 2 tested animals have a mean score of $\geq 2.3 \geq 4.0$.

TABLE A.2.2 SKIN IRRITATION CATEGORY	
Criteria	
Irritant (Category 2)	(1) Mean value of $\geq 2.3 \geq 4.0$ for erythema/eschar or for edema in at least 2 of 3 tested animals from gradings at 24, 48 and 72 hours after patch removal or, if reactions are delayed, from grades on 3 consecutive days after the onset of skin reactions; or
	(2) Inflammation that persists to the end of the observation period normally 14 days in at least 2 animals, particularly taking into account alopecia (limited area), hyperkeratosis, hyperplasia, and scaling; or
	(3) In some cases where there is pronounced variability of response among animals, with very definite positive effects related to chemical exposure in a single animal but less than the criteria above.

A.2.2.2.2 Animal irritant responses within a test can be quite variable, as they are with corrosion. A separate irritant criterion accommodates cases when there is a significant irritant response but less than the mean score criterion for a positive test. For example, a substance might be designated as an irritant if at least 1 of 3 tested animals shows a very elevated mean score throughout the study, including lesions persisting at the end of an observation period of normally 14 days. Other responses could also fulfil this criterion. However, it should be ascertained that the responses are the result of chemical exposure. Addition of this criterion increases the sensitivity of the classification system.

A.2.2.2.3. Reversibility of skin lesions is another consideration in evaluating irritant responses. When inflammation persists to the end of the observation period in 2 or more test animals, taking into consideration alopecia (limited area), hyperkeratosis, hyperplasia and scaling, then a chemical should be considered to be an irritant.

A.2.3 Classification Criteria for Substances Using Other Data Elements

A.2.3.1 Existing human and animal data including information from single or repeated exposure should be the first line of analysis, as they give information directly relevant to effects on the skin. If a substance is highly toxic by the dermal route, a skin corrosion/irritation study may not be practicable since the amount of test substance to be applied would considerably exceed the toxic dose and, consequently, would result in the death of the animals. When observations are made of skin corrosion/irritation in acute toxicity studies and are observed up through the limit dose, these data may be used for classification provided that the dilutions used and species tested are equivalent. In vitro alternatives that have been scientifically validated shall be used to make classification decisions. Solid substances (powders) may become corrosive or irritant when moistened or in contact with moist skin or mucous membranes. Likewise, pH extremes like ≤ 2 and ≥ 11.5 may indicate skin effects, especially when associated with significant buffering capacity.

Generally, such substances are expected to produce significant effects on the skin. In the absence of any other information, a substance is considered corrosive (Skin Category 1) if it has a pH ≤ 2 or a pH ≥ 11.5.

However, if consideration of alkali/acid reserve suggests the substance or mixture may not be corrosive despite the low or high pH value, then further evaluation may be necessary. In some cases enough information may be available from structurally related compounds to make classification decisions.

A.2.3.2 A tiered approach to the evaluation of initial information shall be used (Figure A.2.1) recognizing that all elements may not be relevant in certain cases.

A.2.3.3 The tiered approach explains how to organize information on a substance and to make a weight-of-evidence decision about hazard assessment and hazard classification.

A.2.3.4 All the above information that is available on a substance shall be evaluated. Although information might be gained from the evaluation of single parameters within a tier, there is merit in considering the totality of existing information and making an overall weight of evidence determination. This is especially true when there is information available on some but not all parameters. Emphasis shall be placed upon existing human experience and data, followed by animal experience and testing data, followed by other sources of information, but case-by-case determinations are necessary.

FIGURE A.2.1 TIERED EVALUATION OF SKIN CORROSION AND IRRITATION POTENTIAL			
Step	Parameter	Finding	Conclusion
1a	Existing human or animal data ¹ ↓	→Skin corrosive	→Category 1 ²
	Not corrosive or no data ↓		
1b	Existing human or animal data ¹ ↓	→Skin irritant	→Category 2 ²
	Not an irritant or no data ↓		
1c	Existing human or animal data ¹ ↓	→Not a skin corrosive or skin irritant	→Not classified
	No/Insufficient data ↓		
2	Other, existing skin data in animals ³ ↓	→Skin corrosive Skin irritant	→Category 1 ² →Category 2 ²
	No/Insufficient data ↓		
3	Existing skin corrosive <u>ex vivo / in vitro</u> data ⁴ ↓	→Positive: Skin corrosive	→Category 1 ²
	No/Insufficient data ↓		
	Existing skin irritation <u>ex vivo / in vitro</u> data ⁴ ↓	→Positive: Skin irritant →Negative: Not a skin irritant ⁵	→Category 1 ² Not classified
	No/Insufficient data ↓		
4	pH-Based assessment (with consideration of buffering capacity of the chemical, or no buffering capacity data) ⁵ ↓	→pH ≤ 2 or ≥ 11.5	→Category 1 ²
	Not a pH extreme, No pH data or extreme pH with low/no buffering capacity		

**FIGURE A.2.1
TIERED EVALUATION OF SKIN CORROSION AND IRRITATION POTENTIAL**

Step	Parameter	Finding	Conclusion
5	Validated Structure/Activity Relationship (SAR) models ↓	→Skin corrosive →Skin irritant	→Category 1 ² →Category 2 ²
	No/Insufficient data ↓		
6	Consideration of the total Weight of Evidence ⁶ ↓	→Skin corrosive →Skin irritant	→Category 1 ² →Category 2 ²
	No concern based on consideration of the sum of available data ↓		
7	Not Classified	→	Not Classified

Notes to Figure A.2.1:

- Evidence of existing human or animal data may be derived from single or repeated exposure(s) in occupational, consumer, transportation, or emergency response scenarios; from ethically-conducted human clinical studies; or from purposely-generated data from animal studies conducted according to scientifically validated test methods (at present, there is no internationally accepted test method for human skin irritation testing).
- Classify in the appropriate harmonized category, as shown in Tables A.2.1 and A.2.2.
- Pre-existing animal data (e.g. from an acute dermal toxicity test or a sensitisation test) should be carefully reviewed to determine if sufficient skin corrosion/irritation evidence is available through other, similar information. For example, classification/categorization may be done on the basis of whether a chemical has or has not produced any skin irritation in an acute dermal toxicity test in animals at the limit dose, or produces very toxic effects in an acute dermal toxicity test in animals. In the latter case, the chemical would be classified as being very hazardous by the dermal route for acute toxicity, and it would be moot whether the chemical is also irritating or corrosive on the skin. It should be kept in mind in evaluating acute dermal toxicity information that the reporting of dermal lesions may be incomplete, testing and observations may be made on a species other than the rabbit, and species may differ in sensitivity in their responses.
- Evidence from studies using scientifically validated protocols with isolated human/animal tissues or other, non-tissue-based, though scientifically validated, protocols should be assessed. Examples of scientifically validated test methods for skin corrosion include OECD TG 430 (Transcutaneous Electrical Resistance Test (TER)), 431 (Human Skin Model Test), and 435 (Membrane Barrier Test Method). OECD TG 439 (Reconstructed Human Epidermis Test Method) is a scientifically validated in vitro test method for skin irritation.
- Measurement of pH alone may be adequate, but assessment of acid or alkali reserve (buffering capacity) would be preferable. Presently, there is no scientifically validated and internationally accepted method for assessing this parameter.
- All information that is available on a chemical should be considered and an overall determination made on the total weight of evidence. This is especially true when there is conflict in information available on some parameters. Professional judgment should be exercised in making such a determination.

A.2.4 Classification criteria for mixtures

A.2.4.1 Classification of mixtures when data are available for the complete mixture

A.2.4.1.1 The mixture shall be classified using the criteria for substances (See A.2.3).

A.2.4.2 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.2.4.2.1 Where the mixture itself has not been tested to determine its skin corrosion/irritation, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles, as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.2.4.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.2.4.3.1 For purposes of classifying the skin corrosion/irritation hazards of mixtures in the tiered approach:

The "relevant ingredients" of a mixture are those which are present in concentrations $\geq 1\%$ (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases.) If the classifier has reason to suspect that an ingredient present at a concentration $< 1\%$ will affect classification of the mixture for skin corrosion/irritation, that ingredient shall also be considered relevant.

A.2.4.3.2 In general, the approach to classification of mixtures as irritant or corrosive to skin when data are available on the ingredients, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant ingredient contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive ingredients when they are present at a concentration below the concentration limit for classification with Category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as corrosive or irritant when the sum of the concentrations of such ingredients exceeds a cut-off value/concentration limit.

A.2.4.3.3 Table A.2.3 below provides the cut-off value/concentration limits to be used to determine if the mixture is considered to be an irritant or a corrosive to the skin.

A.2.4.3.4 Particular care shall be taken when classifying certain types of chemicals such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in A.2.4.3.1 and A.2.4.3.2 might not work given that many of such substances are corrosive or irritant at concentrations $< 1\%$. For mixtures containing strong acids or bases the pH should be used as classification criteria since pH will be a better indicator of corrosion than the concentration limits of Table A.2.3. A mixture containing corrosive or irritant ingredients that cannot be classified based on the additivity approach shown in Table A.2.3, due to chemical characteristics that make this approach unworkable, should be classified as Skin Category 1 if it contains $\geq 1\%$ of a corrosive ingredient and as Skin Category 2 when it contains $\geq 3\%$ of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table A.2.3 does not apply is summarized in Table A.2.4 below.

A.2.4.3.5 On occasion, reliable data may show that the skin corrosion/irritation of an ingredient will not be evident when present at a level above the generic concentration cut-off values mentioned in Tables A.2.3 and A.2.4. In these cases the mixture could be classified according to those data (See Use of cut-off values/concentration limits, paragraph A.0.4.3 of this Appendix).

A.2.4.3.6 If there are data showing that (an) ingredient(s) may be corrosive or irritant at a concentration of $< 1\%$ (corrosive) or $< 3\%$ (irritant), the mixture shall be classified accordingly (See Use of cut-off values /concentration limits, paragraph A.0.4.3 of this Appendix).

**TABLE A.2.3
CONCENTRATION OF INGREDIENTS OF A MIXTURE CLASSIFIED
AS SKIN CATEGORY 1 OR 2 THAT WOULD TRIGGER CLASSIFICATION
OF THE MIXTURE AS HAZARDOUS TO SKIN (CATEGORY 1 OR 2)**

Sum of Ingredients Classified as:	Concentration Triggering Classification of a Mixture as:	
	Skin Corrosive	Skin Irritant
	Category 1	Category 2
Skin Category 1	$\geq 5\%$	$\geq 1\%$ but $< 5\%$
Skin Category 2	-	$\geq 10\%$
(10 x Skin Category 1) + Skin Category 2	-	$\geq 10\%$

TABLE A.2.4 CONCENTRATION OF INGREDIENTS OF A MIXTURE FOR WHICH THE ADDITIVITY APPROACH DOES NOT APPLY, THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS HAZARDOUS TO SKIN		
Ingredient:	Concentration:	Mixture Classified as: Skin
Acid with pH ≤ 2	≥ 1%	Category 1
Base with pH ≥ 11.5	≥ 1%	Category 1
Other corrosive (Category 1) ingredients for which additivity does not apply	≥ 1%	Category 1
Other irritant (Category 2) ingredients for which additivity does not apply, including acids and bases	≥ 3%	Category 2

A.3 SERIOUS EYE DAMAGE / EYE IRRITATION

A.3.1 Definitions and general considerations

A.3.1.1 Serious eye damage is the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the anterior surface of the eye, which is not fully reversible within 21 days of application.

Eye irritation is the production of changes in the eye following the application of test substance to the anterior surface of the eye, which are fully reversible within 21 days of application.

A.3.1.2 Serious eye damage/eye irritation shall be classified using a tiered approach as detailed in figure A.3.1. Emphasis shall be placed upon existing human data (See A.0.2.6), followed by animal data, followed by other sources of information. Classification results directly when the data satisfy the criteria in this section. In case the criteria cannot be directly applied, classification of a substance or a mixture is made on the basis of the total weight of evidence (See A.0.3.1). This means that all available information bearing on the determination of serious eye damage/eye irritation is considered together, including the results of appropriate scientifically validated in vitro tests, relevant animal data, and human data such as epidemiological and clinical studies and well-documented case reports and observations.

A.3.2 Classification criteria for substances using animal test data

A.3.2.1 Irreversible effects on the eye/serious damage to eyes (Category 1)

A single hazard category is provided in Table A.3.1, for substances that have the potential to seriously damage the eyes. Category 1, irreversible effects on the eye, includes the criteria listed below. These observations include animals with grade 4 cornea lesions and other severe reactions (e.g. destruction of cornea) observed at any time during the test, as well as persistent corneal opacity, discoloration of the cornea by a dye substance, adhesion, pannus, and interference with the function of the iris or other effects that impair sight. In this context, persistent lesions are considered those which are not fully reversible within an observation period of normally 21 days. Category 1 also contains substances fulfilling the criteria of corneal opacity ≥ 3 and/or iritis > 1.5 detected in a Draize eye test with rabbits, because severe lesions like these usually do not reverse within a 21-day observation period.

TABLE A.3.1 IRREVERSIBLE EYE EFFECTS	
A substance is classified as Serious Eye Damage Category 1 (irreversible effects on the eye) when it produces:	
(a) at least in one tested animal, effects on the cornea, iris or conjunctiva that are not expected to reverse or have not fully reversed within an observation period of normally 21 days; and/or	
(b) at least in 2 of 3 tested animals, a positive response of:	
	(i) corneal opacity ≥ 3; and/or
	(ii) iritis > 1.5;
	calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the substance.

A.3.2.2 Reversible effects on the eye (Category 2)

A single category is provided in Table A.3.2 for substances that have the potential to induce reversible eye irritation.

TABLE A.3.2 REVERSIBLE EYE EFFECTS	
A substance is classified as Eye irritant Category 2A (irritating to eyes) when it produces in at least in 2 of 3 tested animals a positive response of:	
(i) corneal opacity ≥ 1 ; and/or	
(ii) iritis ≥ 1 ; and/or	
(iii) conjunctival redness ≥ 2 ; and/or	
(iv) conjunctival edema (chemosis) ≥ 2	
calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the substance, and which fully reverses within an observation period of normally 21 days.	
An eye irritant is considered mildly irritating to eyes (Category 2B) when the effects listed above are fully reversible within 7 days of observation.	

A.3.2.3 For those chemicals where there is pronounced variability among animal responses, this information may be taken into account in determining the classification.

A.3.3 Classification Criteria for Substances Using Other Data Elements

A.3.3.1 Existing human and animal data should be the first line of analysis, as they give information directly relevant to effects on the eye. Possible skin corrosion shall be evaluated prior to consideration of serious eye damage/eye irritation in order to avoid testing for local effects on eyes with skin corrosive substances. In vitro alternatives that have been scientifically validated and accepted shall be used to make classification decisions. Likewise, pH extremes like ≤ 2 and ≥ 11.5 , may indicate serious eye damage, especially when associated with significant buffering capacity. Generally, such substances are expected to produce significant effects on the eyes. In the absence of any other information, a mixture/substance is considered to cause serious eye damage (Eye Category 1) if it has a pH ≤ 2 or ≥ 11.5 . However, if consideration of acid/alkaline reserve suggests the substance may not have the potential to cause serious eye damage despite the low or high pH value, then further evaluation may be necessary. In some cases enough information may be available from structurally related compounds to make classification decisions.

A.3.3.2 A tiered approach to the evaluation of initial information shall be used where applicable, recognizing that all elements may not be relevant in certain cases (Figure A.3.1).

A.3.3.3 The tiered approach explains how to organize existing information on a substance and to make a weight-of-evidence decision, where appropriate, about hazard assessment and hazard classification.

A.3.3.4 All the above information that is available on a substance shall be evaluated. Although information might be gained from the evaluation of single parameters within a tier, consideration should be given to the totality of existing information and making an overall weight of evidence determination. This is especially true when there is conflict in information available on some parameters.

FIGURE A.3.1 EVALUATION STRATEGY FOR SERIOUS EYE DAMAGE AND EYE IRRITATION (SEE ALSO FIGURE A.2.1)			
Step	Parameter	Finding	Conclusion
1a	Existing human or animal data, eye ¹ ↓	→Serious Eye Damage →Eye Irritant	→Category 1 ² →Category 2 ²
	No/insufficient data or unknown ↓		
1b	Existing human or animal data, skin corrosion ↓	→Skin corrosive	→Category 1 ²
	No/insufficient data or unknown ↓		

FIGURE A.3.1
EVALUATION STRATEGY FOR SERIOUS EYE DAMAGE AND EYE IRRITATION
(SEE ALSO FIGURE A.2.1)

Step	Parameter	Finding	Conclusion
1c	Existing human or animal data, eye ¹ ↓	→Existing data that show that substance does not cause serious eye damage or eye irritation	→Not classified
	No/insufficient data ↓		
2	Other, existing skin/eye data in animals ³ ↓	→Yes; existing data that show that substance may cause serious eye damage or eye irritation	→Category 1 or →Category 2
	No/insufficient data ↓		
3	Existing <u>ex vivo</u> / <u>in vitro</u> data ⁴ ↓	→Positive: serious eye damage → Positive: eye irritant	→Category 1 ² →Category 2 ²
	No/insufficient data ↓		
4	pH-Based assessment (with consideration of buffering capacity of the chemical, or no buffering capacity data) ⁵ ↓	→pH ≤ 2 or ≥ 11.5	→Category 1 ²
	Not a pH extreme, No pH data or extreme pH with low/no buffering capacity		
5	Validated structure/activity relationship (SAR) models ↓	→Severe damage to eyes →Eye irritant →Skin Corrosive	→Category 1 ² →Category 2 ² →Category 1 ²
	No/insufficient data ↓		
6	Consideration of the total weight of evidence ⁶ ↓	→Serious eye damage →Eye irritant	→Category 1 ² →Category 2 ²
	No concern based on consideration of the sum of available data ↓		
7	Not Classified		

Notes to Figure A.2.1:

- Evidence of existing human or animal data may be derived from single or repeated exposure(s) in occupational, consumer, transportation, or emergency response scenarios; from ethically-conducted human clinical studies; or from purposely-generated data from animal studies conducted according to scientifically validated test methods. At present, there are no internationally accepted test methods for human skin or eye irritation testing.
- Classify in the appropriate harmonized category, as shown in Tables A.3.1 and A.3.2.
- Pre-existing animal data should be carefully reviewed to determine if sufficient skin or eye corrosion/irritation evidence is available through other, similar information.
- Evidence from studies using scientifically validated protocols with isolated human/animal tissues or other, non-tissue-based, though scientifically validated, protocols should be assessed. Examples of, scientifically validated test methods for identifying eye corrosives and severe irritants (i.e., Serious Eye Damage) include OECD TG 437 (Bovine Corneal Opacity and Permeability (BCOP)) and TG 438 (Isolated Chicken Eye). Positive test results from a scientifically validated in vitro test for skin corrosion would likely also lead to a conclusion to classify as causing Serious Eye Damage.

FIGURE A.3.1
EVALUATION STRATEGY FOR SERIOUS EYE DAMAGE AND EYE IRRITATION
(SEE ALSO FIGURE A.2.1)

Step	Parameter	Finding	Conclusion
5.	Measurement of pH alone may be adequate, but assessment of acid or alkali reserve (buffering capacity) would be preferable.		
6.	All information that is available on a chemical should be considered and an overall determination made on the total weight of evidence. This is especially true when there is conflict in information available on some parameters. The weight of evidence including information on skin irritation could lead to classification of eye irritation. It is recognized that not all skin irritants are eye irritants as well. Professional judgment should be exercised in making such a determination.		

A.3.4 Classification criteria for mixtures

A.3.4.1 Classification of mixtures when data are available for the complete mixture

A.3.4.1.1 The mixture will be classified using the criteria for substances

A.3.4.1.2 Unlike other hazard classes, there are alternative tests available for skin corrosivity of certain types of chemicals that can give an accurate result for classification purposes, as well as being simple and relatively inexpensive to perform. When considering testing of the mixture, chemical manufacturers are encouraged to use a tiered weight of evidence strategy as included in the criteria for classification of substances for skin corrosion and serious eye damage and eye irritation to help ensure an accurate classification, as well as avoid unnecessary animal testing. In the absence of any other information, a mixture is considered to cause serious eye damage (Eye Category 1) if it has a pH ≤ 2 or ≥ 11.5 . However, if consideration of acid/alkaline reserve suggests the substance or mixture may not have the potential to cause serious eye damage despite the low or high pH value, then further evaluation may be necessary.

A.3.4.2 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.3.4.2.1 Where the mixture itself has not been tested to determine its skin corrosivity or potential to cause serious eye damage or eye irritation, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles, as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.3.4.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.3.4.3.1 For purposes of classifying the eye corrosion/irritation hazards of mixtures in the tiered approach:

The "relevant ingredients" of a mixture are those which are present in concentrations $\geq 1\%$ (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases.) If the classifier has reason to suspect that an ingredient present at a concentration $< 1\%$ will affect classification of the mixture for eye corrosion/irritation, that ingredient shall also be considered relevant.

A.3.4.3.2 In general, the approach to classification of mixtures as seriously damaging to the eye or eye irritant when data are available on the ingredients, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant ingredient contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive ingredients when they are present at a concentration below the concentration limit for classification with Category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as seriously damaging to the eye or eye irritant when the sum of the concentrations of such ingredients exceeds a threshold cut-off value/concentration limit.

A.3.4.3.3 Table A.3.3 provides the cut-off value/concentration limits to be used to determine if the mixture should be classified as seriously damaging to the eye or an eye irritant.

A.3.4.3.4 Particular care must be taken when classifying certain types of chemicals such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in A.3.4.3.1 and A.3.4.3.2 might not work given that many of such substances are corrosive or irritant at concentrations $< 1\%$. For mixtures containing strong acids or bases, the pH should be used as classification criteria (See A.3.4.1) since pH will be a better indicator of serious eye damage than the concentration limits of Table A.3.3. A mixture containing corrosive or irritant ingredients that cannot be classified based on the additivity approach applied in Table A.3.3 due to chemical characteristics that make this approach unworkable, should be classified as Eye Category 1 if it contains $\geq 1\%$ of a corrosive ingredient and as Eye Category 2 when it contains $\geq 3\%$ of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table A.3.3 does not apply is summarized in Table A.3.4.

A.3.4.3.5 On occasion, reliable data may show that the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic cut-off values/concentration limits mentioned in Tables A.3.3 and A.3.4. In these cases the mixture could be classified according to those data (See also A.0.4.3 Use of cut-off values/concentration limits").

On occasion, when it is expected that the skin corrosion/irritation or the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic concentration/cut-off levels mentioned in Tables A.3.3 and A.3.4, testing of the mixture may be considered.

In those cases, the tiered weight of evidence strategy should be applied as referred to in section A.3.3, Figure A.3.1 and explained in detail in this chapter.

A.3.4.3.6 If there are data showing that (an) ingredient(s) may be corrosive or irritant at a concentration of < 1% (corrosive) or < 3% (irritant), the mixture should be classified accordingly (See also paragraph A.0.4.3, Use of cut-off values/concentration limits).

TABLE A.3.3 CONCENTRATION OF INGREDIENTS OF A MIXTURE CLASSIFIED AS SKIN CATEGORY 1 AND/OR EYE CATEGORY 1 OR 2 THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURES AS HAZARDOUS TO THE EYE		
Sum of Ingredients Classified as	Concentration Triggering Classification of a Mixture As	
	Irreversible Eye Effects	Reversible Eye Effects
	Category 1	Category 2
Eye or Skin Category 1	≥ 3%	≥ 1% but < 3%
Eye Category 2	-	≥ 10%
(10 x Eye Category 1) + Eye Category 2	-	≥ 10%
Skin Category 1 + Eye Category 1	≥ 3%	≥ 1% but < 3%
10 x (Skin Category 1 + Eye Category 1) + Eye Category 2	-	≥ 10%
Note: A mixture may be classified as Eye Category 2B in cases when all relevant ingredients are classified as Eye Category 2B.		

TABLE A.3.4 CONCENTRATION OF INGREDIENTS OF A MIXTURE FOR WHICH THE ADDITIVITY APPROACH DOES NOT APPLY, THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS HAZARDOUS TO THE EYE		
Ingredient	Concentration	Mixture Classified as: Eye
Acid with pH ≤ 2	≥ 1%	Category 1
Base with pH ≥ 11.5	≥ 1%	Category 1
Other corrosive (Category 1) ingredients for which additivity does not apply	≥ 1%	Category 1
Other irritant (Category 2) ingredients for which additivity does not apply, including acids and bases	≥ 3%	Category 2

A.4 RESPIRATORY OR SKIN SENSITIZATION

A.4.1 Definitions and general considerations

A.4.1.1 Respiratory sensitizer means a chemical that will lead to hypersensitivity of the airways following inhalation of the chemical.

Skin sensitizer means a chemical that will lead to an allergic response following skin contact.

A.4.1.2 For the purpose of this chapter, sensitization includes two phases: the first phase is induction of specialized immunological memory in an individual by exposure to an allergen. The second phase is elicitation, i.e., production of a cell-mediated or antibody-mediated allergic response by exposure of a sensitized individual to an allergen.

A.4.1.3 For respiratory sensitization, the pattern of induction followed by elicitation phases is shared in common with skin sensitization. For skin sensitization, an induction phase is required in which the immune system learns to react; clinical symptoms can then arise when subsequent exposure is sufficient to elicit a visible skin reaction (elicitation phase). As a consequence, predictive tests usually follow this pattern in which there is an induction phase, the response to which is measured by a standardized elicitation phase, typically involving a patch test. The local lymph node assay is the exception, directly measuring the induction response. Evidence of skin sensitization in humans normally is assessed by a diagnostic patch test.

A.4.1.4 Usually, for both skin and respiratory sensitization, lower levels are necessary for elicitation than are required for induction.

A.4.1.5 The hazard class "respiratory or skin sensitization" is differentiated into:

- (a) Respiratory sensitization; and
- (b) Skin sensitization

A.4.2 Classification criteria for substances

A.4.2.1 Respiratory sensitizers

A.4.2.1.1 Hazard categories

A.4.2.1.1.1 Effects seen in either humans or animals will normally justify classification in a weight of evidence approach for respiratory sensitizers. Substances may be allocated to one of the two sub-categories 1A or 1B using a weight of evidence approach in accordance with the criteria given in Table A.4.1 and on the basis of reliable and good quality evidence from human cases or epidemiological studies and/or observations from appropriate studies in experimental animals.

A.4.2.1.1.2 Where data are not sufficient for sub-categorization, respiratory sensitizers shall be classified in Category 1.

Category 1:	Respiratory Sensitizer
	A substance is classified as a respiratory sensitizer (a) if there is evidence in humans that the substance can lead to specific respiratory hypersensitivity and/or (b) if there are positive results from an appropriate animal test.
Sub-category 1A:	Substances showing a high frequency of occurrence in humans; or a probability of occurrence of a high sensitization rate in humans based on animal or other tests. ¹ Severity of reaction may also be considered.
Sub-category 1B:	Substances showing a low to moderate frequency of occurrence in humans; or a probability of occurrence of a low to moderate sensitization rate in humans based on animal or other tests. ¹ Severity of reaction may also be considered.

A.4.2.1.2 Human evidence

A.4.2.1.2.1 Evidence that a substance can lead to specific respiratory hypersensitivity will normally be based on human experience. In this context, hypersensitivity is normally seen as asthma, but other hypersensitivity reactions such as rhinitis/conjunctivitis and alveolitis are also considered. The condition will have the clinical character of an allergic reaction. However, immunological mechanisms do not have to be demonstrated.

A.4.2.1.2.2 When considering the human evidence, it is necessary that in addition to the evidence from the cases, the following be taken into account:

- (a) the size of the population exposed;
- (b) the extent of exposure.

A.4.2.1.2.3 The evidence referred to above could be:

- (a) clinical history and data from appropriate lung function tests related to exposure to the substance, confirmed by other supportive evidence which may include:
 - (i) in vivo immunological test (e.g., skin prick test);
 - (ii) in vitro immunological test (e.g., serological analysis);
 - (iii) studies that may indicate other specific hypersensitivity reactions where immunological mechanisms of action have not been proven, e.g., repeated low-level irritation, pharmacologically mediated effects;
 - (iv) a chemical structure related to substances known to cause respiratory hypersensitivity;
- (b) data from positive bronchial challenge tests with the substance conducted according to accepted guidelines for the determination of a specific hypersensitivity reaction.

A.4.2.1.2.4 Clinical history should include both medical and occupational history to determine a relationship between exposure to a specific substance and development of respiratory hypersensitivity. Relevant information includes aggravating factors both in the home and workplace, the onset and progress of the disease, family history and medical history of the patient in question. The medical history should also include a note of other allergic or airway disorders from childhood and smoking history.

A.4.2.1.2.5 The results of positive bronchial challenge tests are considered to provide sufficient evidence for classification on their own. It is, however, recognized that in practice many of the examinations listed above will already have been carried out.

A.4.2.1.3 Animal studies

A.4.2.1.3.1 Data from appropriate animal studies which may be indicative of the potential of a substance to cause sensitization by inhalation in humans may include:

- (a) measurements of Immunoglobulin E (IgE) and other specific immunological parameters, for example in mice
- (b) specific pulmonary responses in guinea pigs.

A.4.2.2 Skin sensitizers

A.4.2.2.1 Hazard categories

A.4.2.2.1.1 Effects seen in either humans or animals will normally justify classification in a weight of evidence approach for skin sensitizers. Substances may be allocated to one of the two sub-categories 1A or 1B using a weight of evidence approach in accordance with the criteria given in Table A.4.2 and on the basis of reliable and good quality evidence from human cases or epidemiological studies and/or observations from appropriate studies in experimental animals according to the guidance values provided in A.4.2.2.2.1 and A.4.2.2.3.2 for sub-category 1A and in A.4.2.2.2.2 and A.4.2.2.3.3 for sub-category 1B.

A.4.2.2.1.2 Where data are not sufficient for sub-categorization, skin sensitizers shall be classified in Category 1.

TABLE A.4.2 HAZARD CATEGORY AND SUB-CATEGORIES FOR SKIN SENSITIZERS	
Category 1:	Skin Sensitizer
	A substance is classified as a skin sensitizer (a) if there is evidence in humans that the substance can lead to sensitization by skin contact in a substantial number of persons, or (b) if there are positive results from an appropriate animal test.
Sub-category 1A:	Substances showing a high frequency of occurrence in humans and/or a high potency in animals can be presumed to have the potential to produce significant sensitization in humans. Severity of reaction may also be considered.
Sub-category 1B:	Substances showing a low to moderate frequency of occurrence in humans and/or a low to moderate potency in animals can be presumed to have the potential to produce sensitization in humans. Severity of reaction may also be considered.

A.4.2.2.2 Human evidence

A.4.2.2.2.1 Human evidence for sub-category 1A may include:

(a) positive responses at $\leq 500 \mu\text{g}/\text{cm}^2$ (Human Repeat Insult Patch Test (HRIPT), Human Maximization Test (HMT) – induction threshold);

(b) diagnostic patch test data where there is a relatively high and substantial incidence of reactions in a defined population in relation to relatively low exposure;

(c) other epidemiological evidence where there is a relatively high and substantial incidence of allergic contact dermatitis in relation to relatively low exposure.

A.4.2.2.2.2 Human evidence for sub-category 1B may include:

(a) positive responses at $> 500 \mu\text{g}/\text{cm}^2$ (HRIPT, HMT – induction threshold);

(b) diagnostic patch test data where there is a relatively low but substantial incidence of reactions in a defined population in relation to relatively high exposure;

(c) other epidemiological evidence where there is a relatively low but substantial incidence of allergic contact dermatitis in relation to relatively high exposure.

A.4.2.2.3 Animal studies

A.4.2.2.3.1 For Category 1, when an adjuvant type test method for skin sensitization is used, a response of at least 30% of the animals is considered as positive. For a non-adjuvant Guinea pig test method a response of at least 15% of the animals is considered positive. For Category 1, a stimulation index of three or more is considered a positive response in the local lymph node assay.

A.4.2.2.3.2 Animal test results for sub-category 1A can include data with values indicated in Table A.4.3 below:

TABLE A.4.3 ANIMAL TEST RESULTS FOR SUB-CATEGORY 1A	
Assay	Criteria
Local lymph node assay	EC3 value $\leq 2\%$
Guinea pig maximization test	$\geq 30\%$ responding at $\leq 0.1\%$ intradermal induction dose or $\geq 60\%$ responding at $> 0.1\%$ to $\leq 1\%$ intradermal induction dose
Buehler assay	$\geq 15\%$ responding at $\leq 0.2\%$ topical induction dose or $\geq 60\%$ responding at $> 0.2\%$ to $\leq 20\%$ topical induction dose
Note: EC3 refers to the estimated concentration of test chemical required to induce a stimulation index of 3 in the local lymph node assay.	

A.4.2.2.3.3 Animal test results for sub-category 1B can include data with values indicated in Table A.4.4 below:

TABLE A.4.4 ANIMAL TEST RESULTS FOR SUB-CATEGORY 1B	
Assay	Criteria
Local lymph node assay	EC3 value $> 2\%$
Guinea pig maximization test	$\geq 30\%$ to $< 60\%$ responding at $> 0.1\%$ to $\leq 1\%$ intradermal induction dose or $\geq 30\%$ responding at $> 1\%$ intradermal induction dose
Buehler assay	$\geq 15\%$ to $< 60\%$ responding at $> 0.2\%$ to $\leq 20\%$ topical induction dose or $\geq 15\%$ responding at $> 20\%$ topical induction dose
Note: EC3 refers to the estimated concentration of test chemical required to induce a stimulation index of 3 in the local lymph node assay.	

A.4.2.2.4 Specific considerations

A.4.2.2.4.1 For classification of a substance, evidence shall include one or more of the following using a weight of evidence approach:

- (a) Positive data from patch testing, normally obtained in more than one dermatology clinic;
- (b) Epidemiological studies showing allergic contact dermatitis caused by the substance. Situations in which a high proportion of those exposed exhibit characteristic symptoms are to be looked at with special concern, even if the number of cases is small;
- (c) Positive data from appropriate animal studies;
- (d) Positive data from experimental studies in man (See paragraph A.0.2.6 of this Appendix);
- (e) Well documented episodes of allergic contact dermatitis, normally obtained in more than one dermatology clinic;
- (f) Severity of reaction.

A.4.2.2.4.2 Evidence from animal studies is usually much more reliable than evidence from human exposure. However, in cases where evidence is available from both sources, and there is conflict between the results, the quality and reliability of the evidence from both sources must be assessed in order to resolve the question of classification on a case-by-case basis. Normally, human data are not generated in controlled experiments with volunteers for the purpose of hazard classification but rather as part of risk assessment to confirm lack of effects seen in animal tests. Consequently, positive human data on skin sensitization are usually derived from case-control or other, less defined studies. Evaluation of human data must, therefore, be carried out with caution as the frequency of cases reflect, in addition to the inherent properties of the substances, factors such as the exposure situation, bioavailability, individual predisposition and preventive measures taken. Negative human data should not normally be used to negate positive results from animal studies. For both animal and human data, consideration should be given to the impact of vehicle.

A.4.2.2.4.3 If none of the above-mentioned conditions are met, the substance need not be classified as a skin sensitizer. However, a combination of two or more indicators of skin sensitization, as listed below, may alter the decision. This shall be considered on a case-by-case basis.

- (a) Isolated episodes of allergic contact dermatitis;
- (b) Epidemiological studies of limited power, e.g., where chance, bias or confounders have not been ruled out fully with reasonable confidence;
- (c) Data from animal tests, performed according to existing guidelines, which do not meet the criteria for a positive result described in A.4.2.2.3, but which are sufficiently close to the limit to be considered significant;
- (d) Positive data from non-standard methods;
- (e) Positive results from close structural analogues.

A.4.2.2.4.4 Immunological contact urticaria

A.4.2.2.4.4.1 Substances meeting the criteria for classification as respiratory sensitizers may, in addition, cause immunological contact urticaria. Consideration shall be given to classifying these substances as skin sensitizers.

A.4.2.2.4.4.2 Substances which cause immunological contact urticaria without meeting the criteria for respiratory sensitizers shall be considered for classification as skin sensitizers.

A.4.2.2.4.4.3 There is no recognized animal model available to identify substances which cause immunological contact urticaria. Therefore, classification will normally be based on human evidence, similar to that for skin sensitization.

A.4.3 Classification criteria for mixtures

A.4.3.1 Classification of mixtures when data are available for the complete mixture

When reliable and good quality evidence, as described in the criteria for substances, from human experience or appropriate studies in experimental animals, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of these data. Care must be exercised in evaluating data on mixtures that the dose used does not render the results inconclusive.

A.4.3.2 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.4.3.2.1 Where the mixture itself has not been tested to determine its sensitizing properties, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following agreed bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation, Substantially similar mixtures, and Aerosols.

A.4.3.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

The mixture shall be classified as a respiratory or skin sensitizer when at least one ingredient has been classified as a respiratory or skin sensitizer and is present at or above the appropriate cut-off value/concentration limit for the specific endpoint as shown in Table A.4.5.

TABLE A.4.5 CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS EITHER RESPIRATORY SENSITIZERS OR SKIN SENSITIZERS THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE			
Ingredient Classified as:	Cut-Off Values/Concentration Limits Triggering Classification of a Mixture as:		
	Respiratory Sensitizer Category 1		Skin Sensitizer Category 1
	Solid/Liquid	Gas	All Physical States
Respiratory Sensitizer Category 1	≥ 0.1%	≥ 0.1%	-
Respiratory Sensitizer Sub-category 1A	≥ 0.1%	≥ 0.1%	-
Respiratory Sensitizer Sub-category 1B	≥ 0.1%	≥ 0.2%	-
Skin Sensitizer Category 1	-	-	≥ 0.1%
Skin Sensitizer Sub-category 1A	-	-	≥ 0.1%
Skin Sensitizer Sub-category 1B	-	-	≥ 1.0%

A.5 GERM CELL MUTAGENICITY

A.5.1 Definitions and general considerations

A.5.1.1 A mutation is defined as a permanent change in the amount or structure of the genetic material in a cell. The term mutation applies both to heritable genetic changes that may be manifested at the phenotypic level and to the underlying DNA modifications when known (including, for example, specific base pair changes and chromosomal translocations). The term mutagenic and mutagen will be used for agents giving rise to an increased occurrence of mutations in populations of cells and/or organisms.

A.5.1.2 The more general terms genotoxic and genotoxicity apply to agents or processes which alter the structure, information content, or segregation of DNA, including those which cause DNA damage by interfering with normal replication processes, or which in a non-physiological manner (temporarily) alter its replication. Genotoxicity test results are usually taken as indicators for mutagenic effects.

A.5.1.3 This hazard class is primarily concerned with chemicals that may cause mutations in the germ cells of humans that can be transmitted to the progeny. However, mutagenicity/genotoxicity tests in vitro and in mammalian somatic cells in vivo are also considered in classifying substances and mixtures within this hazard class.

A.5.2 Classification criteria for substances

A.5.2.1 The classification system provides for two different categories of germ cell mutagens to accommodate the weight of evidence available. The two-category system is described in the Figure A.5.1.

FIGURE A.5.1 HAZARD CATEGORIES FOR GERM CELL MUTAGENS	
CATEGORY 1:	Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans
Category 1A:	Substances known to induce heritable mutations in germ cells of humans Positive evidence from human epidemiological studies.
Category 1B:	Substances which should be regarded as if they induce heritable mutations in the germ cells of humans
	(a) Positive result(s) from in vivo heritable germ cell mutagenicity tests in mammals; or
	(b) Positive result(s) from in vivo somatic cell mutagenicity tests in mammals, in combination with some evidence that the substance has potential to cause mutations to germ cells. This supporting evidence may, for example, be derived from mutagenicity/genotoxicity tests in germ cells in vivo, or by demonstrating the ability of the substance or its metabolite(s) to interact with the genetic material of germ cells; or
	(c) Positive results from tests showing mutagenic effects in the germ cells of humans, without demonstration of transmission to progeny; for example, an increase in the frequency of aneuploidy in sperm cells of exposed people.
CATEGORY 2:	Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans Positive evidence obtained from experiments in mammals and/or in some cases from in vitro experiments, obtained from:
	(a) Somatic cell mutagenicity tests in vivo, in mammals; or
	(b) Other in vivo somatic cell genotoxicity tests which are supported by positive results from in vitro mutagenicity assays.
Note: Substances which are positive in in vitro mammalian mutagenicity assays, and which also show chemical structure activity relationship to known germ cell mutagens, should be considered for classification as Category 2 mutagens.	

A.5.2.2 Specific considerations for classification of substances as germ cell mutagens:

A.5.2.2.1 To arrive at a classification, test results are considered from experiments determining mutagenic and/or genotoxic effects in germ and/or somatic cells of exposed animals. Mutagenic and/or genotoxic effects determined in in vitro tests shall also be considered.

A.5.2.2.2 The system is hazard based, classifying chemicals on the basis of their intrinsic ability to induce mutations in germ cells. The scheme is, therefore, not meant for the (quantitative) risk assessment of chemical substances.

A.5.2.2.3 Classification for heritable effects in human germ cells is made on the basis of scientifically validated tests. Evaluation of the test results shall be done using expert judgment and all the available evidence shall be weighed for classification.

A.5.2.2.4 The classification of substances shall be based on the total weight of evidence available, using expert judgment. In those instances where a single well-conducted test is used for classification, it shall provide clear and unambiguously positive results. The relevance of the route of exposure used in the study of the substance compared to the route of human exposure should also be taken into account.

A.5.3 Classification criteria for mixtures

A.5.3.1 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.5.3.1.1 Classification of mixtures shall be based on the available test data for the individual ingredients of the mixture using cut-off values/concentration limits for the ingredients classified as germ cell mutagens.

A.5.3.1.2 The mixture will be classified as a mutagen when at least one ingredient has been classified as a Category 1A, Category 1B or Category 2 mutagen and is present at or above the appropriate cut-off value/concentration limit as shown in Table A.5.1 below for Category 1 and 2 respectively.

TABLE A.5.1 CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS GERM CELL MUTAGENS THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE		
Ingredient Classified as:	Cut-Off/Concentration Limits Triggering Classification of a Mixture as:	
	Category 1 Mutagen	Category 2 Mutagen
Category 1A/B mutagen	$\geq 0.1 \%$	-
Category 2 mutagen	-	$\geq 1.0 \%$

Note: The cut-off values/concentration limits in the table above apply to solids and liquids (w/w units) as well as gases (v/v units).

A.5.3.2 Classification of mixtures when data are available for the mixture itself

The classification may be modified on a case-by-case basis based on the available test data for the mixture as a whole. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g. statistical analysis, test sensitivity) of germ cell mutagenicity test systems.

A.5.3.3 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.5.3.3.1 Where the mixture itself has not been tested to determine its germ cell mutagenicity hazard, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, and Substantially similar mixtures.

A.5.4 Examples of scientifically validated test methods:

A.5.4.1 Examples of in vivo heritable germ cell mutagenicity tests are:

- (a) Rodent dominant lethal mutation test (OECD 478)
- (b) Mouse heritable translocation assay (OECD 485)
- (c) Mouse specific locus test

A.5.4.2 Examples of in vivo somatic cell mutagenicity tests are:

- (a) Mammalian bone marrow chromosome aberration test (OECD 475)
- (b) Mouse spot test (OECD 484)
- (c) Mammalian erythrocyte micronucleus test (OECD 474)

A.5.4.3 Examples of mutagenicity/genotoxicity tests in germ cells are:

- (a) Mutagenicity tests:
 - (i) Mammalian spermatogonial chromosome aberration test (OECD 483)
 - (ii) Spermatid micronucleus assay
- (b) Genotoxicity tests:
 - (i) Sister chromatid exchange analysis in spermatogonia
 - (ii) Unscheduled DNA synthesis test (UDS) in testicular cells

A.5.4.4 Examples of genotoxicity tests in somatic cells are:

- (a) Liver Unscheduled DNA Synthesis (UDS) in vivo (OECD 486)
- (b) Mammalian bone marrow Sister Chromatid Exchanges (SCE)

A.5.4.5 Examples of in vitro mutagenicity tests are:

- (a) In vitro mammalian chromosome aberration test (OECD 473)
- (b) In vitro mammalian cell gene mutation test (OECD 476)
- (c) Bacterial reverse mutation tests (OECD 471)

A.5.4.6 As new, scientifically validated tests arise, these may also be used in the total weight of evidence to be considered.

A.6 CARCINOGENICITY

A.6.1 Definitions

Carcinogen means a substance or a mixture of substances which induce cancer or increase its incidence. Substances and mixtures which have induced benign and malignant tumors in well-performed experimental studies on animals are considered also to be presumed or suspected human carcinogens unless there is strong evidence that the mechanism of tumor formation is not relevant for humans.

Classification of a substance or mixture as posing a carcinogenic hazard is based on its inherent properties and does not provide information on the level of the human cancer risk which the use of the substance or mixture may represent.

A.6.2 Classification criteria for substances

A.6.2.1 For the purpose of classification for carcinogenicity, substances are allocated to one of two categories based on strength of evidence and additional weight of evidence considerations. In certain instances, route-specific classification may be warranted.

FIGURE A.6.1 HAZARD CATEGORIES FOR CARCINOGENS	
CATEGORY 1:	Known or presumed human carcinogens The classification of a substance as a Category 1 carcinogen is done on the basis of epidemiological and/or animal data. This classification is further distinguished on the basis of whether the evidence for classification is largely from human data (Category 1A) or from animal data (Category 1B):
Category 1A:	Known to have carcinogenic potential for humans. Classification in this category is largely based on human evidence
Category 1B:	Presumed to have carcinogenic potential for humans. Classification in this category is largely based on animal evidence. The classification of a substance in Category 1A and 1B is based on strength of evidence together with weight of evidence considerations (See paragraph A.6.2.5). Such evidence may be derived from: <ul style="list-style-type: none">- human studies that establish a causal relationship between human exposure to a substance and the development of cancer (known human carcinogen); or- animal experiments for which there is sufficient evidence to demonstrate animal carcinogenicity (presumed human carcinogen). In addition, on a case by case basis, scientific judgment may warrant a decision of presumed human carcinogenicity derived from studies showing limited evidence of carcinogenicity in humans together with limited evidence of carcinogenicity in experimental animals.
CATEGORY 2:	Suspected human carcinogens The classification of a substance in Category 2 is done on the basis of evidence obtained from human and/or animal studies, but which is not sufficiently convincing to place the substance in Category 1A or B. This classification is based on strength of evidence together with weight of evidence considerations (See paragraph A.6.2.5). Such evidence may be from either limited evidence of carcinogenicity in human studies or from limited evidence of carcinogenicity in animal studies.
Other considerations:	Where the weight of evidence for the carcinogenicity of a substance does not meet the above criteria, any positive study conducted in accordance with established scientific principles, and which reports statistically significant findings regarding the carcinogenic potential of the substance, must be noted on the safety data sheet.

A.6.2.2 Classification as a carcinogen is made on the basis of evidence from reliable and acceptable methods, and is intended to be used for substances which have an intrinsic property to produce such toxic effects. The evaluations are to be based on all existing data, peer-reviewed published studies and additional data accepted by regulatory agencies.

A.6.2.3 Carcinogen classification is a one-step, criterion-based process that involves two interrelated determinations: evaluations of strength of evidence and consideration of all other relevant information to place substances with human cancer potential into hazard categories.

A.6.2.4 Strength of evidence involves the enumeration of tumors in human and animal studies and determination of their level of statistical significance. Sufficient human evidence demonstrates causality between human exposure and the development of cancer, whereas sufficient evidence in animals shows a causal relationship between the agent and an increased incidence of tumors. Limited evidence in humans is demonstrated by a positive association between exposure and cancer, but a causal relationship cannot be stated. Limited evidence in animals is provided when data suggest a carcinogenic effect, but are less than sufficient. (Guidance on consideration of important factors in the classification of carcinogenicity and a more detailed description of the terms "limited" and "sufficient" have been developed by the International Agency for Research on Cancer (IARC) and are provided in non-mandatory Appendix F.)

A.6.2.5 Weight of evidence: Beyond the determination of the strength of evidence for carcinogenicity, a number of other factors should be considered that influence the overall likelihood that an agent may pose a carcinogenic hazard in humans. The full list of factors that influence this determination is very lengthy, but some of the important ones are considered here.

A.6.2.5.1 These factors can be viewed as either increasing or decreasing the level of concern for human carcinogenicity. The relative emphasis accorded to each factor depends upon the amount and coherence of evidence bearing on each. Generally there is a requirement for more complete information to decrease than to increase the level of concern. Additional considerations should be used in evaluating the tumor findings and the other factors in a case-by-case manner.

A.6.2.5.2 Some important factors which may be taken into consideration, when assessing the overall level of concern are:

- (a) Tumor type and background incidence;
- (b) Multisite responses;
- (c) Progression of lesions to malignancy;
- (d) Reduced tumor latency;

Additional factors which may increase or decrease the level of concern include:

- (e) Whether responses are in single or both sexes;
- (f) Whether responses are in a single species or several species;
- (g) Structural similarity or not to a substance(s) for which there is good evidence of carcinogenicity;
- (h) Routes of exposure;
- (i) Comparison of absorption, distribution, metabolism and excretion between test animals and humans;
- (j) The possibility of a confounding effect of excessive toxicity at test doses; and,
- (k) Mode of action and its relevance for humans, such as mutagenicity, cytotoxicity with growth stimulation, mitogenesis, immunosuppression.

Mutagenicity: It is recognized that genetic events are central in the overall process of cancer development. Therefore evidence of mutagenic activity in vivo may indicate that a substance has a potential for carcinogenic effects.

A.6.2.5.3 A substance that has not been tested for carcinogenicity may in certain instances be classified in Category 1A, Category 1B, or Category 2 based on tumor data from a structural analogue together with substantial support from consideration of other important factors such as formation of common significant metabolites, e.g., for benzidine congener dyes.

A.6.2.5.4 The classification should also take into consideration whether or not the substance is absorbed by a given route(s); or whether there are only local tumors at the site of administration for the tested route(s), and adequate testing by other major route(s) show lack of carcinogenicity.

A.6.2.5.5 It is important that whatever is known of the physico-chemical, toxicokinetic and toxicodynamic properties of the substances, as well as any available relevant information on chemical analogues, i.e., structure activity relationship, is taken into consideration when undertaking classification.

A.6.3 Classification criteria for mixtures

A.6.3.1 The mixture shall be classified as a carcinogen when at least one ingredient has been classified as a Category 1 or Category 2 carcinogen and is present at or above the appropriate cut-off value/concentration limit as shown in Table A.6.1.

TABLE A.6.1 CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS CARCINOGEN THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE		
Ingredient Classified as:	Category 1 Carcinogen	Category 2 Carcinogen
Category 1 carcinogen	≥ 0.1 %	-
Category 2 carcinogen	-	≥ 0.1% (note 1)
Note: If a Category 2 carcinogen ingredient is present in the mixture at a concentration between 0.1% and 1%, information is required on the SDS for a product. However, a label warning is optional. If a Category 2 carcinogen ingredient is present in the mixture at a concentration of ≥ 1%, both an SDS and a label is required and the information must be included on each.		

A.6.3.2 Classification of mixtures when data are available for the complete mixture

A mixture may be classified based on the available test data for the mixture as a whole. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g., statistical analysis, test sensitivity) of carcinogenicity test systems.

A.6.3.3 Classification of mixtures when data are not available for the complete mixture: bridging principles

Where the mixture itself has not been tested to determine its carcinogenic hazard, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; and Substantially similar mixtures.

A.6.4 Classification of carcinogenicity

A.6.4.1 Chemical manufacturers, importers and employers evaluating chemicals may treat the following sources as establishing that a substance is a carcinogen or potential carcinogen for hazard communication purposes in lieu of applying the criteria described herein:

A.6.4.1.1 National Toxicology Program (NTP), "Report on Carcinogens" (latest edition);

A.6.4.1.2 International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (latest editions)

A.6.4.2 Where OSHA has included cancer as a health hazard to be considered by classifiers for a chemical covered by 29 CFR part 1910, Subpart Z, Toxic and Hazardous Substances, chemical manufacturers, importers, and employers shall classify the chemical as a carcinogen.

A.7 REPRODUCTIVE TOXICITY

A.7.1 Definitions and general considerations

A.7.1.1 Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring. Some reproductive toxic effects cannot be clearly assigned to either impairment of sexual function and fertility or to developmental toxicity. Nonetheless, chemicals with these effects shall be classified as reproductive toxicants.

For classification purposes, the known induction of genetically based inheritable effects in the offspring is addressed in Germ cell mutagenicity (See A.5).

A.7.1.2 Adverse effects on sexual function and fertility means any effect of chemicals that interferes with reproductive ability or sexual capacity. This includes, but is not limited to, alterations to the female and male reproductive system, adverse effects on onset of puberty, gamete production and transport, reproductive cycle normality, sexual behaviour, fertility, parturition, pregnancy outcomes, premature reproductive senescence, or modifications in other functions that are dependent on the integrity of the reproductive systems.

A.7.1.3 Adverse effects on development of the offspring means any effect of chemicals which interferes with normal development of the conceptus either before or after birth, which is induced during pregnancy or results from parental exposure. These effects can be manifested at any point in the life span of the organism. The major manifestations of developmental toxicity include death of the developing organism, structural abnormality, altered growth and functional deficiency.

A.7.1.4 Adverse effects on or via lactation are also included in reproductive toxicity, but for classification purposes, such effects are treated separately (See A.7.2.1).

A.7.2 Classification criteria for substances

A.7.2.1 For the purpose of classification for reproductive toxicity, substances shall be classified in one of two categories in accordance with Figure A.7.1(a). Effects on sexual function and fertility, and on development, shall be considered. In addition, effects on or via lactation shall be classified in a separate hazard category in accordance with Figure A.7.1(b).

FIGURE A.7.1(A) HAZARD CATEGORIES FOR REPRODUCTIVE TOXICANTS	
CATEGORY 1:	<p>Known or presumed human reproductive toxicant Substance shall be classified in Category 1 for reproductive toxicity when they are known to have produced an adverse effect on sexual function and fertility or on development in humans or when there is evidence from animal studies, possibly supplemented with other information, to provide a strong presumption that the substance has the capacity to interfere with reproduction in humans. The classification of a substance is further distinguished on the basis of whether the evidence for classification is primarily from human data (Category 1A) or from animal data (Category 1B).</p>
Category 1A:	<p>Known human reproductive toxicant The classification of a substance in this category is largely based on evidence from humans.</p>
Category 1B:	<p>Presumed human reproductive toxicant The classification of a substance in this category is largely based on evidence from experimental animals. Data from animal studies shall provide sufficient evidence of an adverse effect on sexual function and fertility or on development in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is considered not to be a secondary non-specific consequence of other toxic effects. However, when there is mechanistic information that raises doubt about the relevance of the effect for humans, classification in Category 2 may be more appropriate.</p>
CATEGORY 2:	<p>Suspected human reproductive toxicant Substances shall be classified in Category 2 for reproductive toxicity when there is some evidence from humans or experimental animals, possibly supplemented with other information, of an adverse effect on sexual function and fertility, or on development, in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is considered not to be a secondary non-specific consequence of the other toxic effects, and where the evidence is not sufficiently convincing to place the substance in Category 1. For instance, deficiencies in the study may make the quality of evidence less convincing, and in view of this, Category 2 would be the more appropriate classification.</p>

FIGURE A.7.1(B)	
HAZARD CATEGORY FOR EFFECTS ON OR VIA LACTATION	
Effects On Or Via Lactation	
Effects on or via lactation shall be classified in a separate single category. Chemicals that are absorbed by women and have been shown to interfere with lactation or that may be present (including metabolites) in breast milk in amounts sufficient to cause concern for the health of a breastfed child, shall be classified to indicate this property hazardous to breastfed babies. This classification shall be assigned on the basis of:	
(a)	absorption, metabolism, distribution and excretion studies that indicate the likelihood the substance would be present in potentially toxic levels in breast milk; and/or
(b)	results of one or two generation studies in animals which provide clear evidence of adverse effect in the offspring due to transfer in the milk or adverse effect on the quality of the milk; and/or
(c)	human evidence indicating a hazard to babies during the lactation period.

A.7.2.2 Basis of classification

A.7.2.2.1 Classification is made on the basis of the criteria, outlined above, an assessment of the total weight of evidence, and the use of expert judgment. Classification as a reproductive toxicant is intended to be used for substances which have an intrinsic, specific property to produce an adverse effect on reproduction and substances should not be so classified if such an effect is produced solely as a non-specific secondary consequence of other toxic effects.

A.7.2.2.2 In the evaluation of toxic effects on the developing offspring, it is important to consider the possible influence of maternal toxicity.

A.7.2.2.3 For human evidence to provide the primary basis for a Category 1A classification there must be reliable evidence of an adverse effect on reproduction in humans. Evidence used for classification shall be from well conducted epidemiological studies, if available, which include the use of appropriate controls, balanced assessment, and due consideration of bias or confounding factors. Less rigorous data from studies in humans may be sufficient for a Category 1A classification if supplemented with adequate data from studies in experimental animals, but classification in Category 1B may also be considered.

A.7.2.3 Weight of evidence

A.7.2.3.1 Classification as a reproductive toxicant is made on the basis of an assessment of the total weight of evidence using expert judgment. This means that all available information that bears on the determination of reproductive toxicity is considered together. Included is information such as epidemiological studies and case reports in humans and specific reproduction studies along with sub-chronic, chronic and special study results in animals that provide relevant information regarding toxicity to reproductive and related endocrine organs. Evaluation of substances chemically related to the material under study may also be included, particularly when information on the material is scarce. The weight given to the available evidence will be influenced by factors such as the quality of the studies, consistency of results, nature and severity of effects, level of statistical significance for intergroup differences, number of endpoints affected, relevance of route of administration to humans and freedom from bias. Both positive and negative results are considered together in a weight of evidence determination. However, a single, positive study performed according to good scientific principles and with statistically or biologically significant positive results may justify classification (See also A.7.2.2.3).

A.7.2.3.2 Toxicokinetic studies in animals and humans, site of action and mechanism or mode of action study results may provide relevant information, which could reduce or increase concerns about the hazard to human health. If it is conclusively demonstrated that the clearly identified mechanism or mode of action has no relevance for humans or when the toxicokinetic differences are so marked that it is certain that the hazardous property will not be expressed in humans then a chemical which produces an adverse effect on reproduction in experimental animals should not be classified.

A.7.2.3.3 In some reproductive toxicity studies in experimental animals the only effects recorded may be considered of low or minimal toxicological significance and classification may not necessarily be the outcome. These effects include, for example, small changes in semen parameters or in the incidence of spontaneous defects in the fetus, small changes in the proportions of common fetal variants such as are observed in skeletal examinations, or in fetal weights, or small differences in postnatal developmental assessments.

A.7.2.3.4 Data from animal studies shall provide sufficient evidence of specific reproductive toxicity in the absence of other systemic toxic effects. However, if developmental toxicity occurs together with other toxic effects in the dam (mother), the potential influence of the generalized adverse effects should be assessed to the extent possible. The preferred approach is to consider adverse effects in the embryo/fetus first, and then evaluate maternal toxicity, along with any other factors which are likely to have influenced these effects, as part of the weight of evidence. In general, developmental effects that are observed at maternally toxic doses should not be automatically discounted. Discounting developmental effects that are observed at maternally toxic doses can only be done on a case-by-case basis when a causal relationship is established or refuted.

A.7.2.3.5 If appropriate information is available it is important to try to determine whether developmental toxicity is due to a specific maternally mediated mechanism or to a non-specific secondary mechanism, like maternal stress and the disruption of homeostasis. Generally, the presence of maternal toxicity should not be used to negate findings of embryo/fetal effects, unless it can be clearly demonstrated that the effects are secondary non-specific effects. This is especially the case when the effects in the offspring are significant, e.g., irreversible effects such as structural malformations. In some situations it is reasonable to assume that reproductive toxicity is due to a secondary consequence of maternal toxicity and discount the effects, for example if the chemical is so toxic that dams fail to thrive and there is severe inanition; they are incapable of nursing pups; or they are prostrate or dying.

A.7.2.4 Maternal toxicity

A.7.2.4.1 Development of the offspring throughout gestation and during the early postnatal stages can be influenced by toxic effects in the mother either through non-specific mechanisms related to stress and the disruption of maternal homeostasis, or by specific maternally-mediated mechanisms. So, in the interpretation of the developmental outcome to decide classification for developmental effects it is important to consider the possible influence of maternal toxicity. This is a complex issue because of uncertainties surrounding the relationship between maternal toxicity and developmental outcome. Expert judgment and a weight of evidence approach, using all available studies, shall be used to determine the degree of influence to be attributed to maternal toxicity when interpreting the criteria for classification for developmental effects. The adverse effects in the embryo/fetus shall be first considered, and then maternal toxicity, along with any other factors which are likely to have influenced these effects, as weight of evidence, to help reach a conclusion about classification.

A.7.2.4.2 Based on pragmatic observation, it is believed that maternal toxicity may, depending on severity, influence development via non-specific secondary mechanisms, producing effects such as depressed fetal weight, retarded ossification, and possibly resorptions and certain malformations in some strains of certain species. However, the limited numbers of studies which have investigated the relationship between developmental effects and general maternal toxicity have failed to demonstrate a consistent, reproducible relationship across species.

Developmental effects which occur even in the presence of maternal toxicity are considered to be evidence of developmental toxicity, unless it can be unequivocally demonstrated on a case by case basis that the developmental effects are secondary to maternal toxicity. Moreover, classification shall be considered where there is a significant toxic effect in the offspring, e.g., irreversible effects such as structural malformations, embryo/fetal lethality, or significant post-natal functional deficiencies.

A.7.2.4.3 Classification shall not automatically be discounted for chemicals that produce developmental toxicity only in association with maternal toxicity, even if a specific maternally-mediated mechanism has been demonstrated. In such a case, classification in Category 2 may be considered more appropriate than Category 1. However, when a chemical is so toxic that maternal death or severe inanition results, or the dams (mothers) are prostrate and incapable of nursing the pups, it is reasonable to assume that developmental toxicity is produced solely as a secondary consequence of maternal toxicity and discount the developmental effects. Classification is not necessarily the outcome in the case of minor developmental changes, e.g., a small reduction in fetal/pup body weight or retardation of ossification when seen in association with maternal toxicity.

A.7.2.4.4 Some of the endpoints used to assess maternal toxicity are provided below. Data on these endpoints, if available, shall be evaluated in light of their statistical or biological significance and dose-response relationship.

(a) Maternal mortality: An increased incidence of mortality among the treated dams over the controls shall be considered evidence of maternal toxicity if the increase occurs in a dose-related manner and can be attributed to the systemic toxicity of the test material. Maternal mortality greater than 10% is considered excessive and the data for that dose level shall not normally be considered to need further evaluation.

(b) Mating index (Number of animals with seminal plugs or sperm/Number of mated x 100)

(c) Fertility index (Number of animals with implants/Number of matings x 100)

(d) Gestation length (If allowed to deliver)

(e) Body weight and body weight change: Consideration of the maternal body weight change and/or adjusted (corrected) maternal body weight shall be included in the evaluation of maternal toxicity whenever such data are available. The calculation of an adjusted (corrected) mean maternal body weight change, which is the difference between the initial and terminal body weight minus the gravid uterine weight (or alternatively, the sum of the weights of the fetuses), may indicate whether the effect is maternal or intrauterine. In rabbits, the body weight gain may not be a useful indicator of maternal toxicity because of normal fluctuations in body weight during pregnancy.

(f) Food and water consumption (if relevant): The observation of a significant decrease in the average food or water consumption in treated dams (mothers) compared to the control group may be useful in evaluating maternal toxicity, particularly when the test material is administered in the diet or drinking water. Changes in food or water consumption must be evaluated in conjunction with maternal body weights when determining if the effects noted are reflective of maternal toxicity or more simply, unpalatability of the test material in feed or water.

(g) Clinical evaluations (including clinical signs, markers, and hematology and clinical chemistry studies): The observation of increased incidence of significant clinical signs of toxicity in treated dams (mothers) relative to the control group is useful in evaluating maternal toxicity. If this is to be used as the basis for the assessment of maternal toxicity, the types, incidence, degree and duration of clinical signs shall be reported in the study. Clinical signs of maternal intoxication include, but are not limited to: coma, prostration, hyperactivity, loss of righting reflex, ataxia, or labored breathing.

(h) Post-mortem data: Increased incidence and/or severity of post-mortem findings may be indicative of maternal toxicity. This can include gross or microscopic pathological findings or organ weight data, including absolute organ weight, organ to body weight ratio, or organ to brain weight ratio. When supported by findings of adverse histopathological effects in the affected organ(s), the observation of a significant change in the average weight of suspected target organ(s) of treated dams (mothers), compared to those in the control group, may be considered evidence of maternal toxicity.

A.7.2.5 Animal and experimental data

A.7.2.5.1 A number of scientifically validated test methods are available, including methods for developmental toxicity testing (e.g., OECD Test Guideline 414, ICH Guideline S5A, 1993), methods for peri- and post-natal toxicity testing (e.g., ICH S5B, 1995), and methods for one or two-generation toxicity testing (e.g., OECD Test Guidelines 415, 416)

A.7.2.5.2 Results obtained from screening tests (e.g., OECD Guidelines 421 - Reproduction/ Developmental Toxicity Screening Test, and 422 - Combined Repeated Dose Toxicity Study with Reproduction/Development Toxicity Screening Test) can also be used to justify classification, although the quality of this evidence is less reliable than that obtained through full studies.

A.7.2.5.3 Adverse effects or changes, seen in short- or long-term repeated dose toxicity studies, which are judged likely to impair reproductive function and which occur in the absence of significant generalized toxicity, may be used as a basis for classification, e.g., histopathological changes in the gonads.

A.7.2.5.4 Evidence from in vitro assays, or non-mammalian tests, and from analogous substances using structure-activity relationship (SAR), can contribute to the procedure for classification. In all cases of this nature, expert judgment must be used to assess the adequacy of the data. Inadequate data shall not be used as a primary support for classification.

A.7.2.5.5 It is preferable that animal studies are conducted using appropriate routes of administration which relate to the potential route of human exposure. However, in practice, reproductive toxicity studies are commonly conducted using the oral route, and such studies will normally be suitable for evaluating the hazardous properties of the substance with respect to reproductive toxicity. However, if it can be conclusively demonstrated that the clearly identified mechanism or mode of action has no relevance for humans or when the toxicokinetic differences are so marked that it is certain that the hazardous property will not be expressed in humans then a substance which produces an adverse effect on reproduction in experimental animals should not be classified.

A.7.2.5.6 Studies involving routes of administration such as intravenous or intraperitoneal injection, which may result in exposure of the reproductive organs to unrealistically high levels of the test substance, or elicit local damage to the reproductive organs, e.g., by irritation, must be interpreted with extreme caution and on their own are not normally the basis for classification.

A.7.2.5.7 There is general agreement about the concept of a limit dose, above which the production of an adverse effect may be considered to be outside the criteria which lead to classification. Some test guidelines specify a limit dose, other test guidelines qualify the limit dose with a statement that higher doses may be necessary if anticipated human exposure is sufficiently high that an adequate margin of exposure would not be achieved. Also, due to species differences in toxicokinetics, establishing a specific limit dose may not be adequate for situations where humans are more sensitive than the animal model.

A.7.2.5.8 In principle, adverse effects on reproduction seen only at very high dose levels in animal studies (for example doses that induce prostration, severe inappetence, excessive mortality) do not normally lead to classification, unless other information is available, for example, toxicokinetics information indicating that humans may be more susceptible than animals, to suggest that classification is appropriate.

A.7.2.5.9 However, specification of the actual "limit dose" will depend upon the test method that has been employed to provide the test results.

A.7.3 Classification criteria for mixtures

A.7.3.1 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.7.3.1.1 The mixture shall be classified as a reproductive toxicant when at least one ingredient has been classified as a Category 1 or Category 2 reproductive toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.7.1 for Category 1 and 2, respectively.

A.7.3.1.2 The mixture shall be classified for effects on or via lactation when at least one ingredient has been classified for effects on or via lactation and is present at or above the appropriate cut-off value/concentration limit specified in Table A.7.1 for the additional category for effects on or via lactation.

TABLE A.7.1 CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS REPRODUCTIVE TOXICANTS OR FOR EFFECTS ON OR VIA LACTATION THAT TRIGGER CLASSIFICATION OF THE MIXTURE			
Ingredients Classified as:	Cut-Off Values/Concentration Limits Triggering Classification of a Mixture as:		
	Category 1 Reproductive Toxicant	Category 2 Reproductive Toxicant	Additional Category for Effects on or Via Lactation
Category 1 reproductive toxicant	≥ 0.1%	-	-
Category 2 reproductive toxicant	-	≥ 0.1%	-
Additional category for effects on or via lactation	-	-	≥ 0.1%

A.7.3.2 Classification of mixtures when data are available for the complete mixture

Available test data for the mixture as a whole may be used for classification on a case-by-case basis. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g., statistical analysis, test sensitivity) of reproduction test systems.

A.7.3.3 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.7.3.3.1 Where the mixture itself has not been tested to determine its reproductive toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, and Substantially similar mixtures.

A.8 SPECIFIC TARGET ORGAN TOXICITY SINGLE EXPOSURE

A.8.1 Definitions and general considerations

A.8.1.1 Specific target organ toxicity - single exposure, (STOT-SE) means specific, non-lethal target organ toxicity arising from a single exposure to a chemical. All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed and not specifically addressed in A.1 to A.7 and A.10 of this Appendix are included. Specific target organ toxicity following repeated exposure is classified in accordance with SPECIFIC TARGET ORGAN TOXICITY – REPEATED EXPOSURE (A.9 of this Appendix) and is therefore not included here.

A.8.1.2 Classification identifies the chemical as being a specific target organ toxicant and, as such, it presents a potential for adverse health effects in people who are exposed to it.

A.8.1.3 The adverse health effects produced by a single exposure include consistent and identifiable toxic effects in humans; or, in experimental animals, toxicologically significant changes which have affected the function or morphology of a tissue/organ, or have produced serious changes to the biochemistry or hematology of the organism, and these changes are relevant for human health. Human data is the primary source of evidence for this hazard class.

A.8.1.4 Assessment shall take into consideration not only significant changes in a single organ or biological system but also generalized changes of a less severe nature involving several organs.

A.8.1.5 Specific target organ toxicity can occur by any route that is relevant for humans, i.e., principally oral, dermal or inhalation.

A.8.1.6 The classification criteria for specific organ systemic toxicity single exposure are organized as criteria for substances Categories 1 and 2 (See A.8.2.1), criteria for substances Category 3 (See A.8.2.2) and criteria for mixtures (See A.8.3). See also Figure A.8.1.

A.8.2 Classification criteria for substances

A.8.2.1 Substances of Category 1 and Category 2

A.8.2.1.1 Substances shall be classified for immediate or delayed effects separately, by the use of expert judgment on the basis of the weight of all evidence available, including the use of recommended guidance values (See A.8.2.1.9). Substances shall then be classified in Category 1 or 2, depending upon the nature and severity of the effect(s) observed, in accordance with Figure A.8.1.

FIGURE A.8.1 HAZARD CATEGORIES FOR SPECIFIC TARGET ORGAN TOXICITY FOLLOWING SINGLE EXPOSURE					
CATEGORY 1:	<p>Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following single exposure</p> <p>Substances are classified in Category 1 for STOT-SE on the basis of:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">(a)</td> <td>reliable and good quality evidence from human cases or epidemiological studies; or</td> </tr> <tr> <td style="text-align: center;">(b)</td> <td>observations from appropriate studies in experimental animals in which significant and/or severe toxic effects of relevance to human health were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) to be used as part of weight-of-evidence evaluation.</td> </tr> </table>	(a)	reliable and good quality evidence from human cases or epidemiological studies; or	(b)	observations from appropriate studies in experimental animals in which significant and/or severe toxic effects of relevance to human health were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) to be used as part of weight-of-evidence evaluation.
(a)	reliable and good quality evidence from human cases or epidemiological studies; or				
(b)	observations from appropriate studies in experimental animals in which significant and/or severe toxic effects of relevance to human health were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) to be used as part of weight-of-evidence evaluation.				
CATEGORY 2:	<p>Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following single exposure</p> <p>Substances are classified in Category 2 for STOT-SE on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) in order to help in classification.</p> <p>In exceptional cases, human evidence can also be used to place a substance in Category 2 (See A.8.2.1.6).</p>				
CATEGORY 3:	<p>Transient target organ effects</p> <p>There are target organ effects for which a substance does not meet the criteria to be classified in Categories 1 or 2 indicated above. These are effects which adversely alter human function for a short duration after exposure and from which humans may recover in a reasonable period without leaving significant alteration of structure or function. This category only includes narcotic effects and respiratory tract irritation.</p> <p>Substances are classified specifically for these effects as discussed in A.8.2.2.</p>				
<p>Note: The primary target organ/system shall be identified where possible, and where this is not possible, the substance shall be identified as a general toxicant. The data shall be evaluated and, where possible, shall not include secondary effects (e.g., a hepatotoxicant can produce secondary effects in the nervous or gastrointestinal systems).</p>					

A.8.2.1.2 The relevant route(s) of exposure by which the classified substance produces damage shall be identified.

A.8.2.1.3 Classification is determined by expert judgment, on the basis of the weight of all evidence available including the guidance presented below.

A.8.2.1.4 Weight of evidence of all available data, including human incidents, epidemiology, and studies conducted in experimental animals is used to substantiate specific target organ toxic effects that merit classification.

A.8.2.1.5 The information required to evaluate specific target organ toxicity comes either from single exposure in humans (e.g., exposure at home, in the workplace or environmentally), or from studies conducted in experimental animals. The standard animal studies in rats or mice that provide this information are acute toxicity studies which can include clinical observations and detailed macroscopic and microscopic examination to enable the toxic effects on target tissues/organs to be identified. Results of acute toxicity studies conducted in other species may also provide relevant information.

A.8.2.1.6 In exceptional cases, based on expert judgment, it may be appropriate to place certain substances with human evidence of target organ toxicity in Category 2: (a) when the weight of human evidence is not sufficiently convincing to warrant Category 1 classification, and/or (b) based on the nature and severity of effects. Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the Category 2 classification. In other words, if there are also animal data available on the substance that warrant Category 1 classification, the chemical shall be classified as Category 1.

A.8.2.1.7 Effects considered to support classification for Category 1 and 2

A.8.2.1.7.1 Classification is supported by evidence associating single exposure to the substance with a consistent and identifiable toxic effect.

A.8.2.1.7.2 Evidence from human experience/incidents is usually restricted to reports of adverse health consequences, often with uncertainty about exposure conditions, and may not provide the scientific detail that can be obtained from well-conducted studies in experimental animals.

A.8.2.1.7.3 Evidence from appropriate studies in experimental animals can furnish much more detail, in the form of clinical observations, and macroscopic and microscopic pathological examination and this can often reveal hazards that may not be life-threatening but could indicate functional impairment. Consequently all available evidence, and evidence relevance to human health, must be taken into consideration in the classification process. Relevant toxic effects in humans and/or animals include, but are not limited to:

- (a) Morbidity resulting from single exposure;
- (b) Significant functional changes, more than transient in nature, in the respiratory system, central or peripheral nervous systems, other organs or other organ systems, including signs of central nervous system depression and effects on special senses (e.g., sight, hearing and sense of smell);
- (c) Any consistent and significant adverse change in clinical biochemistry, hematology, or urinalysis parameters;
- (d) Significant organ damage that may be noted at necropsy and/or subsequently seen or confirmed at microscopic examination;
- (e) Multi-focal or diffuse necrosis, fibrosis or granuloma formation in vital organs with regenerative capacity;
- (f) Morphological changes that are potentially reversible but provide clear evidence of marked organ dysfunction; and,
- (g) Evidence of appreciable cell death (including cell degeneration and reduced cell number) in vital organs incapable of regeneration.

A.8.2.1.8 Effects considered not to support classification for Category 1 and 2

Effects may be seen in humans and/or animals that do not justify classification. Such effects include, but are not limited to:

- (a) Clinical observations or small changes in bodyweight gain, food consumption or water intake that may have some toxicological importance but that do not, by themselves, indicate "significant" toxicity;
- (b) Small changes in clinical biochemistry, hematology or urinalysis parameters and/or transient effects, when such changes or effects are of doubtful or of minimal toxicological importance;
- (c) Changes in organ weights with no evidence of organ dysfunction;
- (d) Adaptive responses that are not considered toxicologically relevant; and,
- (e) Substance-induced species-specific mechanisms of toxicity, i.e., demonstrated with reasonable certainty to be not relevant for human health, shall not justify classification.

A.8.2.1.9 Guidance values to assist with classification based on the results obtained from studies conducted in experimental animals for Category 1 and 2

A.8.2.1.9.1 In order to help reach a decision about whether a substance shall be classified or not, and to what degree it shall be classified (Category 1 vs. Category 2), dose/concentration "guidance values" are provided for consideration of the dose/concentration which has been shown to produce significant health effects. The principal argument for proposing such guidance values is that all chemicals are potentially toxic and there has to be a reasonable dose/concentration above which a degree of toxic effect is acknowledged.

A.8.2.1.9.2 Thus, in animal studies, when significant toxic effects are observed that indicate classification, consideration of the dose/concentration at which these effects were seen, in relation to the suggested guidance values, provides useful information to help assess the need to classify (since the toxic effects are a consequence of the hazardous property(ies) and also the dose/concentration).

A.8.2.1.9.3 The guidance value (C) ranges for single-dose exposure which has produced a significant non-lethal toxic effect are those applicable to acute toxicity testing, as indicated in Table A.8.1.

TABLE A.8.1 GUIDANCE VALUE RANGES FOR SINGLE-DOSE EXPOSURES				
Route of Exposure	Units	Guidance Value Ranges For:		
		Category 1	Category 2	Category 3
Oral (rat)	mg/kg body weight	$C \leq 300$	$2000 \geq C > 300$	Guidance values do not apply
Dermal (rat or rabbit)	mg/kg body weight	$C \leq 1000$	$2000 \geq C > 1000$	
Inhalation (rat) gas	ppmV/4h	$C \leq 2500$	$20,000 \geq C > 2500$	
Inhalation (rat) vapor	mg/l/4h	$C \leq 10$	$20 \geq C > 10$	
Inhalation (rat) dust/mist/fume	mg/l/4h	$C \leq 1.0$	$5.0 \geq C > 1.0$	

A.8.2.1.9.4 The guidance values and ranges mentioned in Table A.8.1 are intended only for guidance purposes, i.e., to be used as part of the weight of evidence approach, and to assist with decisions about classification. They are not intended as strict demarcation values. Guidance values are not provided for Category 3 since this classification is primarily based on human data; animal data may be included in the weight of evidence evaluation.

A.8.2.1.9.5 Thus, it is feasible that a specific profile of toxicity occurs at a dose/concentration below the guidance value, e.g., < 2000 mg/kg body weight by the oral route, however the nature of the effect may result in the decision not to classify. Conversely, a specific profile of toxicity may be seen in animal studies occurring at above a guidance value, e.g., ≥ 2000 mg/kg body weight by the oral route, and in addition there is supplementary information from other sources, e.g., other single dose studies, or human case experience, which supports a conclusion that, in view of the weight of evidence, classification is the prudent action to take.

A.8.2.1.10 Other considerations

A.8.2.1.10.1 When a substance is characterized only by use of animal data the classification process includes reference to dose/concentration guidance values as one of the elements that contribute to the weight of evidence approach.

A.8.2.1.10.2 When well-substantiated human data are available showing a specific target organ toxic effect that can be reliably attributed to single exposure to a substance, the substance shall be classified. Positive human data, regardless of probable dose, predominates over animal data. Thus, if a substance is unclassified because specific target organ toxicity observed was considered not relevant or significant to humans, if subsequent human incident data become available showing a specific target organ toxic effect, the substance shall be classified.

A.8.2.1.10.3 A substance that has not been tested for specific target organ toxicity shall, where appropriate, be classified on the basis of data from a scientifically validated structure activity relationship and expert judgment-based extrapolation from a structural analogue that has previously been classified together with substantial support from consideration of other important factors such as formation of common significant metabolites.

A.8.2.2 Substances of Category 3

A.8.2.2.1 Criteria for respiratory tract irritation

The criteria for classifying substances as Category 3 for respiratory tract irritation are:

(a) Respiratory irritant effects (characterized by localized redness, edema, pruritis and/or pain) that impair function with symptoms such as cough, pain, choking, and breathing difficulties are included. It is recognized that this evaluation is based primarily on human data;

(b) Subjective human observations supported by objective measurements of clear respiratory tract irritation (RTI) (e.g., electrophysiological responses, biomarkers of inflammation in nasal or bronchoalveolar lavage fluids);

(c) The symptoms observed in humans shall also be typical of those that would be produced in the exposed population rather than being an isolated idiosyncratic reaction or response triggered only in individuals with hypersensitive airways. Ambiguous reports simply of "irritation" should be excluded as this term is commonly used to describe a wide range of sensations including those such as smell, unpleasant taste, a tickling sensation, and dryness, which are outside the scope of classification for respiratory tract irritation;

(d) There are currently no scientifically validated animal tests that deal specifically with RTI; however, useful information may be obtained from the single and repeated inhalation toxicity tests. For example, animal studies may provide useful information in terms of clinical signs of toxicity (dyspnoea, rhinitis etc) and histopathology (e.g., hyperemia, edema, minimal inflammation, thickened mucous layer) which are reversible and may be reflective of the characteristic clinical symptoms described above. Such animal studies can be used as part of weight of evidence evaluation; and,

(e) This special classification will occur only when more severe organ effects including the respiratory system are not observed as those effects would require a higher classification.

A.8.2.2.2 Criteria for narcotic effects

The criteria for classifying substances in Category 3 for narcotic effects are:

(a) Central nervous system depression including narcotic effects in humans such as drowsiness, narcosis, reduced alertness, loss of reflexes, lack of coordination, and vertigo are included. These effects can also be manifested as severe headache or nausea, and can lead to reduced judgment, dizziness, irritability, fatigue, impaired memory function, deficits in perception and coordination, reaction time, or sleepiness; and,

(b) Narcotic effects observed in animal studies may include lethargy, lack of coordination righting reflex, narcosis, and ataxia. If these effects are not transient in nature, then they shall be considered for classification as Category 1 or 2.

A.8.3 Classification criteria for mixtures

A.8.3.1 Mixtures are classified using the same criteria as for substances, or alternatively as described below. As with substances, mixtures may be classified for specific target organ toxicity following single exposure, repeated exposure, or both.

A.8.3.2 Classification of mixtures when data are available for the complete mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of this data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis, do not render the results inconclusive.

A.8.3.3 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.8.3.3.1 Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, or Aerosols.

A.8.3.4 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.8.3.4.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following single exposure, repeated exposure, or both when at least one ingredient has been classified as a Category 1 or Category 2 specific target organ toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.8.2 for Categories 1 and 2, respectively.

TABLE A.8.2 CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS A SPECIFIC TARGET ORGAN TOXICANT THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS CATEGORY 1 OR 2		
Ingredients Classified as:	Cut-Off Values/Concentration Limits Triggering Classification of a Mixture as:	
	Category 1	Category 2
Category 1: Target organ toxicant	≤ 1.0 %	-
Category 2: Target organ toxicant	-	≤ 1.0 %

A.8.3.4.2 These cut-off values and consequent classifications shall be applied equally and appropriately to both single- and repeated-dose target organ toxicants.

A.8.3.4.3 Mixtures shall be classified for either or both single and repeated dose toxicity independently.

A.8.3.4.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause target organ toxicity at < 1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

A.8.3.4.5 Care shall be exercised when extrapolating the toxicity of a mixture that contains Category 3 ingredient(s). A cut-off value/concentration limit of 20%, considered as an additive of all Category 3 ingredients for each hazard endpoint, is appropriate; however, this cut-off value/concentration limit may be higher or lower depending on the Category 3 ingredient(s) involved and the fact that some effects such as respiratory tract irritation may not occur below a certain concentration while other effects such as narcotic effects may occur below this 20% value. Expert judgment shall be exercised. Respiratory tract irritation and narcotic effects are to be evaluated separately in accordance with the criteria given in A.8.2.2. When conducting classifications for these hazards, the contribution of each ingredient should be considered additive, unless there is evidence that the effects are not additive.

A.9 SPECIFIC TARGET ORGAN TOXICITY REPEATED OR PROLONGED EXPOSURE

A.9.1 Definitions and general considerations

A.9.1.1 Specific target organ toxicity - repeated exposure (STOT-RE) means specific target organ toxicity arising from repeated exposure to a substance or mixture. All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed and not specifically addressed in A.1 to A.7 and A.10 of this Appendix are included. Specific target organ toxicity following a single-event exposure is classified in accordance with SPECIFIC TARGET ORGAN TOXICITY – SINGLE EXPOSURE (A.8 of this Appendix) and is therefore not included here.

A.9.1.2 Classification identifies the substance or mixture as being a specific target organ toxicant and, as such, it may present a potential for adverse health effects in people who are exposed to it.

A.9.1.3 These adverse health effects produced by repeated exposure include consistent and identifiable toxic effects in humans, or, in experimental animals, toxicologically significant changes which have affected the function or morphology of a tissue/organ, or have produced serious changes to the biochemistry or hematology of the organism and these changes are relevant for human health. Human data will be the primary source of evidence for this hazard class.

A.9.1.4 Assessment shall take into consideration not only significant changes in a single organ or biological system but also generalized changes of a less severe nature involving several organs.

A.9.1.5 Specific target organ toxicity can occur by any route that is relevant for humans, e.g., principally oral, dermal or inhalation.

A.9.2 Classification criteria for substances

A.9.2.1 Substances shall be classified as STOT - RE by expert judgment on the basis of the weight of all evidence available, including the use of recommended guidance values which take into account the duration of exposure and the dose/concentration which produced the effect(s), (See A.9.2.9). Substances shall be placed in one of two categories, depending upon the nature and severity of the effect(s) observed, in accordance with Figure A.9.1.

FIGURE A.9.1 HAZARD CATEGORIES FOR SPECIFIC TARGET ORGAN TOXICITY FOLLOWING REPEATED EXPOSURE					
CATEGORY 1:	<p>Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following repeated or prolonged exposure</p> <p>Substances are classified in Category 1 for specific target organ toxicity (repeated exposure) on the basis of:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">(a)</td> <td>reliable and good quality evidence from human cases or epidemiological studies; or,</td> </tr> <tr> <td style="text-align: center;">(b)</td> <td>observations from appropriate studies in experimental animals in which significant and/or severe toxic effects, of relevance to human health, were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) to be used as part of weight-of-evidence evaluation.</td> </tr> </table>	(a)	reliable and good quality evidence from human cases or epidemiological studies; or,	(b)	observations from appropriate studies in experimental animals in which significant and/or severe toxic effects, of relevance to human health, were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) to be used as part of weight-of-evidence evaluation.
(a)	reliable and good quality evidence from human cases or epidemiological studies; or,				
(b)	observations from appropriate studies in experimental animals in which significant and/or severe toxic effects, of relevance to human health, were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) to be used as part of weight-of-evidence evaluation.				
CATEGORY 2:	<p>Substances that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to be harmful to human health following repeated or prolonged exposure</p> <p>Substances are classified in Category 2 for specific target organ toxicity (repeated exposure) on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) in order to help in classification.</p> <p>In exceptional cases human evidence can also be used to place a substance in Category 2 (See A.9.2.6).</p>				
<p>Note: The primary target organ/system shall be identified where possible, or the substance shall be identified as a general toxicant. The data shall be carefully evaluated and, where possible, shall not include secondary effects (e.g., a hepatotoxicant can produce secondary effects in the nervous or gastro-intestinal systems).</p>					

A.9.2.2 The relevant route of exposure by which the classified substance produces damage shall be identified.

A.9.2.3 Classification is determined by expert judgment, on the basis of the weight of all evidence available including the guidance presented below.

A.9.2.4 Weight of evidence of all data, including human incidents, epidemiology, and studies conducted in experimental animals, is used to substantiate specific target organ toxic effects that merit classification.

A.9.2.5 The information required to evaluate specific target organ toxicity comes either from repeated exposure in humans, e.g., exposure at home, in the workplace or environmentally, or from studies conducted in experimental animals. The standard animal studies in rats or mice that provide this information are 28 day, 90 day or lifetime studies (up to 2 years) that include hematological, clinico-chemical and detailed macroscopic and microscopic examination to enable the toxic effects on target tissues/organs to be identified. Data from repeat dose studies performed in other species may also be used. Other long-term exposure studies, e.g., for carcinogenicity, neurotoxicity or reproductive toxicity, may also provide evidence of specific target organ toxicity that could be used in the assessment of classification.

A.9.2.6 In exceptional cases, based on expert judgment, it may be appropriate to place certain substances with human evidence of specific target organ toxicity in Category 2:

(a) when the weight of human evidence is not sufficiently convincing to warrant Category 1 classification, and/or

(b) based on the nature and severity of effects. Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the Category 2 classification. In other words, if there are also animal data available on the substance that warrant Category 1 classification, the substance shall be classified as Category 1.

A.9.2.7 Effects considered to support classification

A.9.2.7.1 Classification is supported by reliable evidence associating repeated exposure to the substance with a consistent and identifiable toxic effect.

A.9.2.7.2 Evidence from human experience/incidents is usually restricted to reports of adverse health consequences, often with uncertainty about exposure conditions, and may not provide the scientific detail that can be obtained from well-conducted studies in experimental animals.

A.9.2.7.3 Evidence from appropriate studies in experimental animals can furnish much more detail, in the form of clinical observations, hematology, clinical chemistry, macroscopic and microscopic pathological examination and this can often reveal hazards that may not be life-threatening but could indicate functional impairment. Consequently all available evidence, and relevance to human health, must be taken into consideration in the classification process. Relevant toxic effects in humans and/or animals include, but are not limited to:

(a) Morbidity or death resulting from repeated or long-term exposure. Morbidity or death may result from repeated exposure, even to relatively low doses/concentrations, due to bioaccumulation of the substance or its metabolites, or due to the overwhelming of the de-toxification process by repeated exposure;

(b) Significant functional changes in the central or peripheral nervous systems or other organ systems, including signs of central nervous system depression and effects on special senses (e.g., sight, hearing and sense of smell);

(c) Any consistent and significant adverse change in clinical biochemistry, hematology, or urinalysis parameters;

(d) Significant organ damage that may be noted at necropsy and/or subsequently seen or confirmed at microscopic examination;

(e) Multi-focal or diffuse necrosis, fibrosis or granuloma formation in vital organs with regenerative capacity;

(f) Morphological changes that are potentially reversible but provide clear evidence of marked organ dysfunction (e.g., severe fatty change in the liver); and,

(g) Evidence of appreciable cell death (including cell degeneration and reduced cell number) in vital organs incapable of regeneration.

A.9.2.8 Effects considered not to support classification

Effects may be seen in humans and/or animals that do not justify classification. Such effects include, but are not limited to:

(a) Clinical observations or small changes in bodyweight gain, food consumption or water intake that may have some toxicological importance but that do not, by themselves, indicate "significant" toxicity;

(b) Small changes in clinical biochemistry, hematology or urinalysis parameters and /or transient effects, when such changes or effects are of doubtful or of minimal toxicological importance;

(c) Changes in organ weights with no evidence of organ dysfunction;

(d) Adaptive responses that are not considered toxicologically relevant;

(e) Substance-induced species-specific mechanisms of toxicity, i.e., demonstrated with reasonable certainty to be not relevant for human health, shall not justify classification.

A.9.2.9 Guidance values to assist with classification based on the results obtained from studies conducted in experimental animals

A.9.2.9.1 In studies conducted in experimental animals, reliance on observation of effects alone, without reference to the duration of experimental exposure and dose/concentration, omits a fundamental concept of toxicology, i.e., all substances are potentially toxic, and what determines the toxicity is a function of the dose/concentration and the duration of exposure. In most studies conducted in experimental animals the test guidelines use an upper limit dose value.

A.9.2.9.2 In order to help reach a decision about whether a substance shall be classified or not, and to what degree it shall be classified (Category 1 vs. Category 2), dose/concentration "guidance values" are provided in Table A.9.1 for consideration of the dose/concentration which has been shown to produce significant health effects. The principal argument for proposing such guidance values is that all chemicals are potentially toxic and there has to be a reasonable dose/concentration above which a degree of toxic effect is acknowledged. Also, repeated-dose studies conducted in experimental animals are designed to produce toxicity at the highest dose used in order to optimize the test objective and so most studies will reveal some toxic effect at least at this highest dose. What is therefore to be decided is not only what effects have been produced, but also at what dose/concentration they were produced and how relevant is that for humans.

A.9.2.9.3 Thus, in animal studies, when significant toxic effects are observed that indicate classification, consideration of the duration of experimental exposure and the dose/concentration at which these effects were seen, in relation to the suggested guidance values, provides useful information to help assess the need to classify (since the toxic effects are a consequence of the hazardous property(ies) and also the duration of exposure and the dose/concentration).

A.9.2.9.4 The decision to classify at all can be influenced by reference to the dose/concentration guidance values at or below which a significant toxic effect has been observed.

A.9.2.9.5 The guidance values refer to effects seen in a standard 90-day toxicity study conducted in rats. They can be used as a basis to extrapolate equivalent guidance values for toxicity studies of greater or lesser duration, using dose/exposure time extrapolation similar to Haber's rule for inhalation, which states essentially that the effective dose is directly proportional to the exposure concentration and the duration of exposure. The assessment should be done on a case-by-case basis; for example, for a 28-day study the guidance values below would be increased by a factor of three.

A.9.2.9.6 Thus for Category 1 classification, significant toxic effects observed in a 90-day repeated-dose study conducted in experimental animals and seen to occur at or below the (suggested) guidance values (C) as indicated in Table A.9.1 would justify classification:

TABLE A.9.1 GUIDANCE VALUES TO ASSIST IN CATEGORY 1 CLASSIFICATION (APPLICABLE TO A 90-DAY STUDY)		
Route of Exposure	Units	Guidance Values (Dose/Concentration)
Oral (rat)	mg/kg body weight/day	C ≤ 10
Dermal (rat or rabbit)	mg/kg body weight/day	C ≤ 20
Inhalation (rat) gas	ppmV/6h/day	C ≤ 50
Inhalation (rat) vapor	mg/liter/6h/day	C ≤ 0.2
Inhalation (rat) dust/mist/fume	mg/liter/6h/day	C ≤ 0.02

A.9.2.9.7 For Category 2 classification, significant toxic effects observed in a 90-day repeated-dose study conducted in experimental animals and seen to occur within the (suggested) guidance value ranges as indicated in Table A.9.2 would justify classification:

**TABLE A.9.2
GUIDANCE VALUES TO ASSIST IN CATEGORY 2 CLASSIFICATION
(APPLICABLE TO A 90-DAY STUDY)**

Route of Exposure	Units	Guidance Values Range (Dose/Concentration)
Oral (rat)	mg/kg body weight/day	10 < C ≤ 100
Dermal (rat or rabbit)	mg/kg body weight/day	20 < C ≤ 200
Inhalation (rat) gas	ppmV/6h/day	50 < C ≤ 250
Inhalation (rat) vapor	mg/liter/6h/day	0.2 < C ≤ 1.0
Inhalation (rat) dust/mist/fume	mg/liter/6h/day	0.02 < C ≤ 0.2

A.9.2.9.8 The guidance values and ranges mentioned in A.2.9.9.6 and A.2.9.9.7 are intended only for guidance purposes, i.e., to be used as part of the weight of evidence approach, and to assist with decisions about classification. They are not intended as strict demarcation values.

A.9.2.9.9 Thus, it is possible that a specific profile of toxicity occurs in repeat-dose animal studies at a dose/concentration below the guidance value, e.g., < 100 mg/kg body weight/day by the oral route, however the nature of the effect, e.g., nephrotoxicity seen only in male rats of a particular strain known to be susceptible to this effect, may result in the decision not to classify. Conversely, a specific profile of toxicity may be seen in animal studies occurring at above a guidance value, e.g., ≥ 100 mg/kg body weight/day by the oral route, and in addition there is supplementary information from other sources, e.g., other long-term administration studies, or human case experience, which supports a conclusion that, in view of the weight of evidence, classification is prudent.

A.9.2.10 Other considerations

A.9.2.10.1 When a substance is characterized only by use of animal data the classification process includes reference to dose/concentration guidance values as one of the elements that contribute to the weight of evidence approach.

A.9.2.10.2 When well-substantiated human data are available showing a specific target organ toxic effect that can be reliably attributed to repeated or prolonged exposure to a substance, the substance shall be classified. Positive human data, regardless of probable dose, predominates over animal data. Thus, if a substance is unclassified because no specific target organ toxicity was seen at or below the dose/concentration guidance value for animal testing, if subsequent human incident data become available showing a specific target organ toxic effect, the substance shall be classified.

A.9.2.10.3 A substance that has not been tested for specific target organ toxicity may in certain instances, where appropriate, be classified on the basis of data from a scientifically validated structure activity relationship and expert judgment-based extrapolation from a structural analogue that has previously been classified together with substantial support from consideration of other important factors such as formation of common significant metabolites.

A.9.3 Classification criteria for mixtures

A.9.3.1 Mixtures are classified using the same criteria as for substances, or alternatively as described below. As with substances, mixtures may be classified for specific target organ toxicity following single exposure, repeated exposure, or both.

A.9.3.2 Classification of mixtures when data are available for the complete mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis, do not render the results inconclusive.

A.9.3.3 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.9.3.3.1 Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; Concentration of mixtures; Interpolation within one toxicity category; Substantially similar mixtures; and Aerosols.

A.9.3.4 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.9.3.4.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following single exposure, repeated exposure, or both when at least one ingredient has been classified as a Category 1 or Category 2 specific target organ toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.9.3 for Category 1 and 2 respectively.

TABLE A.9.3 CUT-OFF VALUE/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS A SPECIFIC TARGET ORGAN TOXICANT THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS CATEGORY 1 OR 2		
Ingredient Classified as:	Cut-Off Values/Concentration Limits Triggering Classification of a Mixture as:	
	Category 1	Category 2
Category 1: Target organ toxicant	≥ 1.0 %	-
Category 2: Target organ toxicant	-	≥ 1.0 %

A.9.3.4.2 These cut-off values and consequent classifications shall be applied equally and appropriately to both single- and repeated-dose target organ toxicants.

A.9.3.4.3 Mixtures shall be classified for either or both single- and repeated-dose toxicity independently.

A.9.3.4.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause specific target organ toxicity at < 1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

A.10 ASPIRATION HAZARD

A.10.1 Definitions and general and specific considerations

A.10.1.1 Aspiration means the entry of a liquid or solid chemical directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system.

A.10.1.2 Aspiration toxicity includes severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration.

A.10.1.3 Aspiration is initiated at the moment of inspiration, in the time required to take one breath, as the causative material lodges at the crossroad of the upper respiratory and digestive tracts in the laryngopharyngeal region.

A.10.1.4 Aspiration of a substance or mixture can occur as it is vomited following ingestion. This may have consequences for labeling, particularly where, due to acute toxicity, a recommendation may be considered to induce vomiting after ingestion. However, if the substance/mixture also presents an aspiration toxicity hazard, the recommendation to induce vomiting may need to be modified.

A.10.1.5 Specific considerations

A.10.1.5.1 The classification criteria refer to kinematic viscosity. The following provides the conversion between dynamic and kinematic viscosity:

$$\frac{\text{Dynamic viscosity (mPa}\cdot\text{s)}}{\text{Density (g/cm}^3\text{)}} = \text{Kinematic viscosity (mm}^2\text{/s)}$$

A.10.1.5.2 Although the definition of aspiration in A.10.1.1 includes the entry of solids into the respiratory system, classification according to (b) in table A.10.1 for Category 1 is intended to apply to liquid substances and mixtures only.

A.10.1.5.3 Classification of aerosol/mist products

Aerosol and mist products are usually dispensed in containers such as self-pressurized containers, trigger and pump sprayers. Classification for these products shall be considered if their use may form a pool of product in the mouth, which then may be aspirated. If the mist or aerosol from a pressurized container is fine, a pool may not be formed. On the other hand, if a pressurized container dispenses product in a stream, a pool may be formed that may then be aspirated. Usually, the mist produced by trigger and pump sprayers is coarse and therefore, a pool may be formed that then may be aspirated. When the pump mechanism may be removed and contents are available to be swallowed then the classification of the products should be considered.

A.10.2 Classification criteria for substances

TABLE A.10.1 CRITERIA FOR ASPIRATION TOXICITY	
Category	Criteria
Category 1: Chemicals known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazard	A substance shall be classified in Category 1:
	(a) If reliable and good quality human evidence indicates that it causes aspiration toxicity (See note); or
	(b) If it is a hydrocarbon and has a kinematic viscosity ≤ 20.5 mm ² /s, measured at 40° C.
Note: Examples of substances included in Category 1 are certain hydrocarbons, turpentine and pine oil.	

A.10.3 Classification criteria for mixtures

A.10.3.1 Classification when data are available for the complete mixture

A mixture shall be classified in Category 1 based on reliable and good quality human evidence.

A.10.3.2 Classification of mixtures when data are not available for the complete mixture: bridging principles

A.10.3.2.1 Where the mixture itself has not been tested to determine its aspiration toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazard of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; Concentration of mixtures; Interpolation within one toxicity category; and Substantially similar mixtures. For application of the dilution bridging principle, the concentration of aspiration toxicants shall not be less than 10%.

A.10.3.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

A.10.3.3.1 A mixture which contains $\geq 10\%$ of an ingredient or ingredients classified in Category 1, and has a kinematic viscosity ≤ 20.5 mm²/s, measured at 40 °C, shall be classified in Category 1.

A.10.3.3.2 In the case of a mixture which separates into two or more distinct layers, one of which contains $\geq 10\%$ of an ingredient or ingredients classified in Category 1 and has a kinematic viscosity ≤ 20.5 mm²/s, measured at 40 °C, then the entire mixture shall be classified in Category 1.

[77 FR 17790, March 26, 2012; 78 FR 9313, Feb. 8, 2013]

APPENDIX B
PHYSICAL CRITERIA (Mandatory)

B.1 EXPLOSIVES

B.1.1 Definitions and general considerations

B.1.1.1 An explosive chemical is a solid or liquid chemical which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic chemicals are included even when they do not evolve gases.

A pyrotechnic chemical is a chemical designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions.

An explosive item is an item containing one or more explosive chemicals.

A pyrotechnic item is an item containing one or more pyrotechnic chemicals.

An unstable explosive is an explosive which is thermally unstable and/or too sensitive for normal handling, transport, or use.

An intentional explosive is a chemical or item which is manufactured with a view to produce a practical explosive or pyrotechnic effect.

B.1.1.2 The class of explosives comprises:

(a) Explosive chemicals;

(b) Explosive items, except devices containing explosive chemicals in such quantity or of such a character that their inadvertent or accidental ignition or initiation shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise; and

(c) Chemicals and items not included under (a) and (b) above which are manufactured with the view to producing a practical explosive or pyrotechnic effect.

B.1.2 Classification criteria

Chemicals and items of this class shall be classified as unstable explosives or shall be assigned to one of the following six divisions depending on the type of hazard they present:

(a) Division 1.1 - Chemicals and items which have a mass explosion hazard (a mass explosion is one which affects almost the entire quantity present virtually instantaneously);

(b) Division 1.2 - Chemicals and items which have a projection hazard but not a mass explosion hazard;

(c) Division 1.3 - Chemicals and items which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard:

(i) Combustion of which gives rise to considerable radiant heat; or

(ii) Which burn one after another, producing minor blast or projection effects or both;

(d) Division 1.4 - Chemicals and items which present no significant hazard: chemicals and items which present only a small hazard in the event of ignition or initiation. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package;

(e) Division 1.5 - Very insensitive chemicals which have a mass explosion hazard: chemicals which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions;

(f) Division 1.6 - Extremely insensitive items which do not have a mass explosion hazard: items which contain only extremely insensitive detonating chemicals and which demonstrate a negligible probability of accidental initiation or propagation.

B.1.3 Additional classification considerations

B.1.3.1 Explosives shall be classified as unstable explosives or shall be assigned to one of the six divisions identified in B.1.2 in accordance with the three step procedure in Part I of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6). The first step is to ascertain whether the substance or mixture has explosive effects (Test Series 1). The second step is the acceptance procedure (Test Series 2 to 4) and the third step is the assignment to a hazard division (Test Series 5 to 7). The assessment whether a candidate for "ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives (ANE)" is insensitive enough for inclusion as an oxidizing liquid (See B.13) or an oxidizing solid (See B.14) is determined by Test Series 8 tests.

NOTE: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.1.3.2 Explosive properties are associated with the presence of certain chemical groups in a molecule which can react to produce very rapid increases in temperature or pressure. The screening procedure in B.1.3.1 is aimed at identifying the presence of such reactive groups and the potential for rapid energy release. If the screening procedure identifies the chemical as a potential explosive, the acceptance procedure (See section 10.3 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6)) is necessary for classification.

NOTE: Neither a Series 1 type (a) propagation of detonation test nor a Series 2 type (a) test of sensitivity to detonative shock is necessary if the exothermic decomposition energy of organic materials is less than 800 J/g.

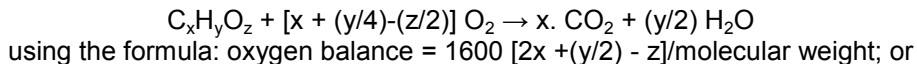
B.1.3.3 If a mixture contains any known explosives, the acceptance procedure is necessary for classification.

B.1.3.4 A chemical is not classified as explosive if:

(a) There are no chemical groups associated with explosive properties present in the molecule. Examples of groups which may indicate explosive properties are given in Table A6.1 in Appendix 6 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6); or

(b) The substance contains chemical groups associated with explosive properties which include oxygen and the calculated oxygen balance is less than -200.

The oxygen balance is calculated for the chemical reaction:



(c) The organic substance or a homogenous mixture of organic substances contains chemical groups associated with explosive properties but the exothermic decomposition energy is less than 500 J/g and the onset of exothermic decomposition is below 500°C (932°F). The exothermic decomposition energy may be determined using a suitable calorimetric technique; or

(d) For mixtures of inorganic oxidizing substances with organic material(s), the concentration of the inorganic oxidizing substance is:

(i) less than 15%, by mass, if the oxidizing substance is assigned to Category 1 or 2;

(ii) less than 30%, by mass, if the oxidizing substance is assigned to Category 3.

B.2 FLAMMABLE GASES

B.2.1 Definition

Flammable gas means a gas having a flammable range with air at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi).

B.2.2 Classification criteria

A flammable gas shall be classified in one of the two categories for this class in accordance with Table B.2.1:

Category	Criteria
1	Gases, which at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi):
	(a) are ignitable when in a mixture of 13% or less by volume in air; or
	(b) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit.
2	Gases, other than those of Category 1, which, at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi), have a flammable range while mixed in air.
NOTE: Aerosols should not be classified as flammable gases. See B.3.	

B.2.3 Additional classification considerations

Flammability shall be determined by tests or by calculation in accordance with ISO 10156 (incorporated by reference; See §1910.6). Where insufficient data are available to use this method, equivalent validated methods may be used.

B.3 FLAMMABLE AEROSOLS

B.3.1 Definition

Aerosol means any non-refillable receptacle containing a gas compressed, liquefied or dissolved under pressure, and fitted with a release device allowing the contents to be ejected as particles in suspension in a gas, or as a foam, paste, powder, liquid or gas.

B.3.2 Classification criteria

B.3.2.1 Aerosols shall be considered for classification as flammable if they contain any component which is classified as flammable in accordance with this Appendix, i.e.:

Flammable liquids (See B.6);

Flammable gases (See B.2);

Flammable solids (See B.7).

NOTE 1: Flammable components do not include pyrophoric, self-heating or water-reactive chemicals.

NOTE 2: Flammable aerosols do not fall additionally within the scope of flammable gases, flammable liquids, or flammable solids.

B.3.2.2 A flammable aerosol shall be classified in one of the two categories for this class in accordance with Table B.3.1.

TABLE B.3.1 CRITERIA FOR FLAMMABLE AEROSOLS	
Category	Criteria
1	Contains $\geq 85\%$ flammable components and the chemical heat of combustion is ≥ 30 kJ/g; or
	(a) For spray aerosols, in the ignition distance test, ignition occurs at a distance ≥ 75 cm (29.5 in), or
	(b) For foam aerosols, in the aerosol foam flammability test
	(i) The flame height is ≥ 20 cm (7.87 in) and the flame duration ≥ 2 s; or
	(ii) The flame height is ≥ 4 cm (1.57 in) and the flame duration ≥ 7 s.
2	Contains $> 1\%$ flammable components, or the heat of combustion is ≥ 20 kJ/g; and
	(a) For spray aerosols, in the ignition distance test, ignition occurs at a distance ≥ 15 cm (5.9 in), or in the enclosed space ignition test, the
	(i) Time equivalent is ≤ 300 s/m ³ ; or
	(ii) Deflagration density is ≤ 300 g/m ³
	(b) For foam aerosols, in the aerosol foam flammability test, the flame height is ≥ 4 cm and the flame duration is ≥ 2 s and it does not meet the criteria for Category 1
NOTE: Aerosols not submitted to the flammability classification procedures in this Appendix shall be classified as extremely flammable (Category 1).	

B.3.3 Additional classification considerations

B.3.3.1 To classify a flammable aerosol, data on its flammable components, on its chemical heat of combustion and, if applicable, the results of the aerosol foam flammability test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols) are necessary.

B.3.3.2 The chemical heat of combustion (ΔH_c), in kilojoules per gram (kJ/g), is the product of the theoretical heat of combustion (ΔH_{comb}), and a combustion efficiency, usually less than 1.0 (a typical combustion efficiency is 0.95 or 95%).

For a composite aerosol formulation, the chemical heat of combustion is the summation of the weighted heats of combustion for the individual components, as follows:

$\Delta H_c(\text{product}) = \sum_i^n [w_i\% \times \Delta H_c(i)]$
where:
ΔH_c = chemical heat of combustion (kJ/g);
$w_i\%$ = mass fraction of component i in the product;
$\Delta H_c(i)$ = specific heat of combustion (kJ/g) of component i in the product;
The chemical heats of combustion shall be found in literature, calculated or determined by tests (See ASTM D240-02, ISO 13943, Sections 86.1 to 86.3, and NFPA 30B (incorporated by reference; See §1910.6)).

B.3.3.3 The Ignition Distance Test, Enclosed Space Ignition Test and Aerosol Foam Flammability Test shall be performed in accordance with sub-sections 31.4, 31.5 and 31.6 of the of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6).

B.4 OXIDIZING GASES

B.4.1 Definition

Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

NOTE: "Gases which cause or contribute to the combustion of other material more than air does" means pure gases or gas mixtures with an oxidizing power greater than 23.5% (as determined by a method specified in ISO 10156 or 10156-2 (incorporated by reference, See §1910.6) or an equivalent testing method.)

B.4.2 Classification criteria

An oxidizing gas shall be classified in a single category for this class in accordance with Table B.4.1:

TABLE B.4.1 CRITERIA FOR OXIDIZING GASES	
Category	Criteria
1	Any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

B.4.3 Additional classification considerations

Classification shall be in accordance with tests or calculation methods as described in ISO 10156 (incorporated by reference; See §1910.6) and ISO 10156-2 (incorporated by reference; See §1910.6).

B.5 GASES UNDER PRESSURE

B.5.1 Definition

Gases under pressure are gases which are contained in a receptacle at a pressure of 200 kPa (29 psi) (gauge) or more, or which are liquefied or liquefied and refrigerated.

They comprise compressed gases, liquefied gases, dissolved gases and refrigerated liquefied gases.

B.5.2 Classification criteria

Gases under pressure shall be classified in one of four groups in accordance with Table B.5.1:

TABLE B.5.1 CRITERIA FOR GASES UNDER PRESSURE	
Group	Criteria
Compressed gas	A gas which when under pressure is entirely gaseous at -50°C (-58°F), including all gases with a critical temperature ¹ ≤ 50°C (-58°F).
Liquefied gas	A gas which when under pressure is partially liquid at temperatures above -50°C (-58°F). A distinction is made between:
	(a) High pressure liquefied gas: a gas with a critical temperature ¹ between -50°C (-58°F) and +65°C (149°F); and
	(b) Low pressure liquefied gas: a gas with a critical temperature ¹ above +65°C (149°F).
Refrigerated liquefied gas	A gas which is made partially liquid because of its low temperature.
Dissolved gas	A gas which when under pressure is dissolved in a liquid phase solvent.
¹ The critical temperature is the temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.	

B.6 FLAMMABLE LIQUIDS

B.6.1 Definition

Flammable liquid means a liquid having a flash point of not more than 93°C (199.4°F).

Flash point means the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid, as determined by a method identified in Section B.6.3.

B.6.2 Classification criteria

A flammable liquid shall be classified in one of four categories in accordance with Table B.6.1:

TABLE B.6.1 CRITERIA FOR FLAMMABLE LIQUIDS	
Category	Criteria
1	Flash point < 23°C (73.4°F) and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C (73.4°F) and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C (73.4°F) and ≤ 60°C (140°F)
4	Flash point > 60°C (140°F) and ≤ 93°C (199.4°F)

B.6.3 Additional classification considerations

The flash point shall be determined in accordance with ASTM D56-05, ASTM D3278, ASTM D3828, ASTM D93-08 (incorporated by reference; See §1910.6), or any other method specified in GHS Revision 3, Chapter 2.6.

The initial boiling point shall be determined in accordance with ASTM D86-07a or ASTM D1078 (incorporated by reference; See §1910.6).

B.7 FLAMMABLE SOLIDS

B.7.1 Definitions

Flammable solid means a solid which is a readily combustible solid, or which may cause or contribute to fire through friction.

Readily combustible solids are powdered, granular, or pasty chemicals which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

B.7.2 Classification criteria

B.7.2.1 Powdered, granular or pasty chemicals shall be classified as flammable solids when the time of burning of one or more of the test runs, performed in accordance with the test method described in the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), Part III, sub-section 33.2.1, is less than 45 s or the rate of burning is more than 2.2 mm/s (0.0866 in/s).

B.7.2.2 Powders of metals or metal alloys shall be classified as flammable solids when they can be ignited and the reaction spreads over the whole length of the sample in 10 min or less.

B.7.2.3 Solids which may cause fire through friction shall be classified in this class by analogy with existing entries (e.g., matches) until definitive criteria are established.

B.7.2.4 A flammable solid shall be classified in one of the two categories for this class using Method N.1 as described in Part III, sub-section 33.2.1 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.7.1:

TABLE B.7.1 CRITERIA FOR FLAMMABLE SOLIDS	
Category	Criteria
1	Burning rate test:
	Chemicals other than metal powders:
	(a) wetted zone does not stop fire; and
	(b) burning time <45 s or burning rate >2.2 mm/s
	Metal powders: burning time ≤ 5 min
2	Burning rate test:
	Chemicals other than metal powders:
	(a) wetted zone stops the fire for at least 4 min; and
	(b) burning time <45 s or burning rate >2.2 mm/s
	Metal powders: burning time >5 min and ≤ 10 min

NOTE: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.8 SELF-REACTIVE CHEMICALS

B.8.1 Definitions

Self-reactive chemicals are thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes chemicals classified under this section as explosives, organic peroxides, oxidizing liquids or oxidizing solids.

A self-reactive chemical is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

B.8.2 Classification criteria

B.8.2.1 A self-reactive chemical shall be considered for classification in this class unless:

- It is classified as an explosive according to B.1 of this appendix;
- It is classified as an oxidizing liquid or an oxidizing solid according to B.13 or B.14 of this appendix, except that a mixture of oxidizing substances which contains 5% or more of combustible organic substances shall be classified as a self-reactive chemical according to the procedure defined in B.8.2.2;
- It is classified as an organic peroxide according to B.15 of this appendix;
- Its heat of decomposition is less than 300 J/g; or
- Its self-accelerating decomposition temperature (SADT) is greater than 75°C (167°F) for a 50 kg (110 lb) package.

B.8.2.2 Mixtures of oxidizing substances, meeting the criteria for classification as oxidizing liquids or oxidizing solids, which contain 5% or more of combustible organic substances and which do not meet the criteria mentioned in B.8.2.1 (a), (c), (d) or (e), shall be subjected to the self-reactive chemicals classification procedure in B.8.2.3. Such a mixture showing the properties of a self-reactive chemical type B to F shall be classified as a self-reactive chemical.

B.8.2.3 Self-reactive chemicals shall be classified in one of the seven categories of "types A to G" for this class, according to the following principles:

(a) Any self-reactive chemical which can detonate or deflagrate rapidly, as packaged, will be defined as self-reactive chemical TYPE A;

(b) Any self-reactive chemical possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package will be defined as self-reactive chemical TYPE B;

(c) Any self-reactive chemical possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion will be defined as self-reactive chemical TYPE C;

(d) Any self-reactive chemical which in laboratory testing meets the criteria in (d)(i), (ii), or (iii) will be defined as self-reactive chemical TYPE D:

(i) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or

(ii) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or

(iii) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement;

(e) Any self-reactive chemical which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement will be defined as self-reactive chemical TYPE E;

(f) Any self-reactive chemical which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power will be defined as self-reactive chemical TYPE F;

(g) Any self-reactive chemical which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C (140°F) to 75°C (167°F) for a 50 kg (110 lb) package), and, for liquid mixtures, a diluent having a boiling point greater than or equal to 150°C (302°F) is used for desensitization will be defined as self-reactive chemical TYPE G. If the mixture is not thermally stable or a diluent having a boiling point less than 150°C (302°F) is used for desensitization, the mixture shall be defined as self-reactive chemical TYPE F.

B.8.3 Additional classification considerations

B.8.3.1 For purposes of classification, the properties of self-reactive chemicals shall be determined in accordance with test series A to H as described in Part II of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6).

B.8.3.2 Self-accelerating decomposition temperature (SADT) shall be determined in accordance with the UN ST/SG/AC.10, Part II, section 28 (incorporated by reference; See §1910.6).

B.8.3.3 The classification procedures for self-reactive substances and mixtures need not be applied if:

(a) There are no chemical groups present in the molecule associated with explosive or self-reactive properties; examples of such groups are given in Tables A6.1 and A6.2 in the Appendix 6 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6); or

(b) For a single organic substance or a homogeneous mixture of organic substances, the estimated SADT is greater than 75°C (167°F) or the exothermic decomposition energy is less than 300 J/g. The onset temperature and decomposition energy may be estimated using a suitable calorimetric technique (See 20.3.3.3 in Part II of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6)).

B.9 PYROPHORIC LIQUIDS

B.9.1 Definition

Pyrophoric liquid means a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

B.9.2 Classification criteria

A pyrophoric liquid shall be classified in a single category for this class using test N.3 in Part III, sub-section 33.3.1.5 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.9.1:

TABLE B.9.1 CRITERIA FOR PYROPHORIC LIQUIDS	
Category	Criteria
1	The liquid ignites within 5 min when added to an inert carrier and exposed to air, or it ignites or chars a filter paper on contact with air within 5 min.

B.9.3 Additional classification considerations

The classification procedure for pyrophoric liquids need not be applied when experience in production or handling shows that the chemical does not ignite spontaneously on coming into contact with air at normal temperatures (i.e., the substance is known to be stable at room temperature for prolonged periods of time (days)).

B.10 PYROPHORIC SOLIDS

B.10.1 Definition

Pyrophoric solid means a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

B.10.2 Classification criteria

A pyrophoric solid shall be classified in a single category for this class using test N.2 in Part III, sub-section 33.3.1.4 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.10.1:

TABLE B.10.1 CRITERIA FOR PYROPHORIC SOLIDS	
Category	Criteria
1	The solid ignites within 5 min of coming into contact with air.
NOTE: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.	

B.10.3 Additional classification considerations

The classification procedure for pyrophoric solids need not be applied when experience in production or handling shows that the chemical does not ignite spontaneously on coming into contact with air at normal temperatures (i.e., the chemical is known to be stable at room temperature for prolonged periods of time (days)).

B.11 SELF-HEATING CHEMICALS

B.11.1 Definition

A self-heating chemical is a solid or liquid chemical, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat; this chemical differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

NOTE: Self-heating of a substance or mixture is a process where the gradual reaction of that substance or mixture with oxygen (in air) generates heat. If the rate of heat production exceeds the rate of heat loss, then the temperature of the substance or mixture will rise which, after an induction time, may lead to self-ignition and combustion.

B.11.2 Classification criteria

B.11.2.1 A self-heating chemical shall be classified in one of the two categories for this class if, in tests performed in accordance with test method N.4 in Part III, sub-section 33.3.1.6 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), the result meets the criteria shown in Table B.11.1.

TABLE B.11.1 CRITERIA FOR SELF-HEATING CHEMICALS							
Category	Criteria						
1	A positive result is obtained in a test using a 25 mm sample cube at 140°C (284°F)						
2	A negative result is obtained in a test using a 25 mm cube sample at 140°C (284°F), a positive result is obtained in a test using a 100 mm sample cube at 140°C (284°F), and: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">(a)</td> <td>The unit volume of the chemical is more than 3 m³; or</td> </tr> <tr> <td style="text-align: center;">(b)</td> <td>A positive result is obtained in a test using a 100 mm cube sample at 120°C (248°F) and the unit volume of the chemical is more than 450 liters; or</td> </tr> <tr> <td style="text-align: center;">(c)</td> <td>A positive result is obtained in a test using a 100 mm cube sample at 100°C (212°F).</td> </tr> </table>	(a)	The unit volume of the chemical is more than 3 m ³ ; or	(b)	A positive result is obtained in a test using a 100 mm cube sample at 120°C (248°F) and the unit volume of the chemical is more than 450 liters; or	(c)	A positive result is obtained in a test using a 100 mm cube sample at 100°C (212°F).
(a)	The unit volume of the chemical is more than 3 m ³ ; or						
(b)	A positive result is obtained in a test using a 100 mm cube sample at 120°C (248°F) and the unit volume of the chemical is more than 450 liters; or						
(c)	A positive result is obtained in a test using a 100 mm cube sample at 100°C (212°F).						

B.11.2.2 Chemicals with a temperature of spontaneous combustion higher than 50°C (122°F) for a volume of 27 m³ shall not be classified as self-heating chemicals.

B.11.2.3 Chemicals with a spontaneous ignition temperature higher than 50°C (122°F) for a volume of 450 liters shall not be classified in Category 1 of this class.

B.11.3 Additional classification considerations

B.11.3.1 The classification procedure for self-heating chemicals need not be applied if the results of a screening test can be adequately correlated with the classification test and an appropriate safety margin is applied.

B.11.3.2 Examples of screening tests are:

(a) The Grever Oven test (VDI guideline 2263, part 1, 1990, Test methods for the Determination of the Safety Characteristics of Dusts) with an onset temperature 80°K above the reference temperature for a volume of 1 l;

(b) The Bulk Powder Screening Test (Gibson, N. Harper, D. J. Rogers, R. Evaluation of the fire and explosion risks in drying powders, Plant Operations Progress, 4 (3), 181-189, 1985) with an onset temperature 60°K above the reference temperature for a volume of 1 l.

B.12 CHEMICALS WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

B.12.1 Definition

Chemicals which, in contact with water, emit flammable gases are solid or liquid chemicals which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

B.12.2 Classification criteria

B.12.2.1 A chemical which, in contact with water, emits flammable gases shall be classified in one of the three categories for this class, using test N.5 in Part III, sub-section 33.4.1.4 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.12.1:

**TABLE B.12.1
CRITERIA FOR CHEMICALS WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES**

Category	Criteria
1	Any chemical which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 liters per kilogram of chemical over any one minute.
2	Any chemical which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 liters per kilogram of chemical per hour, and which does not meet the criteria for Category 1.
3	Any chemical which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 1 liter per kilogram of chemical per hour, and which does not meet the criteria for Categories 1 and 2.

NOTE: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.12.2.2 A chemical is classified as a chemical which, in contact with water, emits flammable gases if spontaneous ignition takes place in any step of the test procedure.

B.12.3 Additional classification considerations

The classification procedure for this class need not be applied if:

- (a) The chemical structure of the chemical does not contain metals or metalloids;
- (b) Experience in production or handling shows that the chemical does not react with water, (e.g., the chemical is manufactured with water or washed with water); or
- (c) The chemical is known to be soluble in water to form a stable mixture.

B.13 OXIDIZING LIQUIDS

B.13.1 Definition

Oxidizing liquid means a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

B.13.2 Classification criteria

An oxidizing liquid shall be classified in one of the three categories for this class using test O.2 in Part III, sub-section 34.4.2 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.13.1:

TABLE B.13.1 CRITERIA FOR OXIDIZING LIQUIDS	
Category	Criteria
1	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of chemical and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose;
2	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for Category 1 are not met;
3	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for Categories 1 and 2 are not met.

B.13.3 Additional classification considerations

B.13.3.1 For organic chemicals, the classification procedure for this class shall not be applied if:

- (a) The chemical does not contain oxygen, fluorine or chlorine; or
- (b) The chemical contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

B.13.3.2 For inorganic chemicals, the classification procedure for this class shall not be applied if the chemical does not contain oxygen or halogen atoms.

B.13.3.3 In the event of divergence between test results and known experience in the handling and use of chemicals which shows them to be oxidizing, judgments based on known experience shall take precedence over test results.

B.13.3.4 In cases where chemicals generate a pressure rise (too high or too low), caused by chemical reactions not characterizing the oxidizing properties of the chemical, the test described in Part III, sub-section 34.4.2 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6) shall be repeated with an inert substance (e.g., diatomite (kieselguhr)) in place of the cellulose in order to clarify the nature of the reaction.

B.14 OXIDIZING SOLIDS

B.14.1 Definition

Oxidizing solid means a solid which, while in itself is not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

B.14.2 Classification criteria

An oxidizing solid shall be classified in one of the three categories for this class using test O.1 in Part III, sub-section 34.4.1 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.14.1:

Category	Criteria
1	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose.
2	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for Category 1 are not met.
3	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for Categories 1 and 2 are not met.
NOTE 1: Some oxidizing solids may present explosion hazards under certain conditions (e.g., when stored in large quantities). For example, some types of ammonium nitrate may give rise to an explosion hazard under extreme conditions and the "Resistance to detonation test" (IMO: Code of Safe Practice for Solid Bulk Cargoes, 2005, Annex 3, Test 5) may be used to assess this hazard. When information indicates that an oxidizing solid may present an explosion hazard, it shall be indicated on the Safety Data Sheet.	
NOTE 2: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.	

B.14.3 Additional classification considerations

B.14.3.1 For organic chemicals, the classification procedure for this class shall not be applied if:

- (a) The chemical does not contain oxygen, fluorine or chlorine; or
- (b) The chemical contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

B.14.3.2 For inorganic chemicals, the classification procedure for this class shall not be applied if the chemical does not contain oxygen or halogen atoms.

B.14.3.3 In the event of divergence between test results and known experience in the handling and use of chemicals which shows them to be oxidizing, judgements based on known experience shall take precedence over test results.

B.15 ORGANIC PEROXIDES

B.15.1 Definition

B.15.1.1 Organic peroxide means a liquid or solid organic chemical which contains the bivalent -O-O- structure and as such is considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term organic peroxide includes organic peroxide mixtures containing at least one organic peroxide. Organic peroxides are thermally unstable chemicals, which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties:

- (a) Be liable to explosive decomposition;
- (b) Burn rapidly;
- (c) Be sensitive to impact or friction;
- (d) React dangerously with other substances.

B.15.1.2 An organic peroxide is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

B.15.2 Classification criteria

B.15.2.1 Any organic peroxide shall be considered for classification in this class, unless it contains:

- (a) Not more than 1.0% available oxygen from the organic peroxides when containing not more than 1.0% hydrogen peroxide; or
- (b) Not more than 0.5% available oxygen from the organic peroxides when containing more than 1.0% but not more than 7.0% hydrogen peroxide.

NOTE: The available oxygen content (%) of an organic peroxide mixture is given by the formula:

$16 \times \sum_i^n \left(\frac{n_i \times c_i}{m_i} \right)$
Where:
n_i = number of peroxygen groups per molecule of organic peroxide i ;
c_i = concentration (mass %) of organic peroxide i ;
m_i = molecular mass of organic peroxide i .

B.15.2.2 Organic peroxides shall be classified in one of the seven categories of "Types A to G" for this class, according to the following principles:

- (a) Any organic peroxide which, as packaged, can detonate or deflagrate rapidly shall be defined as organic peroxide TYPE A;
- (b) Any organic peroxide possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package shall be defined as organic peroxide TYPE B;
- (c) Any organic peroxide possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion shall be defined as organic peroxide TYPE C;
- (d) Any organic peroxide which in laboratory testing meets the criteria in (d)(i), (ii), or (iii) shall be defined as organic peroxide TYPE D:
 - (i) detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or
 - (ii) does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement;or
 - (iii) does not detonate or deflagrate at all and shows a medium effect when heated under confinement;
- (e) Any organic peroxide which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement shall be defined as organic peroxide TYPE E;
- (f) Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power shall be defined as organic peroxide TYPE F;

(g) Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C (140°F) or higher for a 50 kg (110 lb) package), and, for liquid mixtures, a diluent having a boiling point of not less than 150°C (302°F) is used for desensitization, shall be defined as organic peroxide TYPE G. If the organic peroxide is not thermally stable or a diluent having a boiling point less than 150°C (302°F) is used for desensitization, it shall be defined as organic peroxide TYPE F.

B.15.3 Additional classification considerations

B.15.3.1 For purposes of classification, the properties of organic peroxides shall be determined in accordance with test series A to H as described in Part II of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6).

B.15.3.2 Self-accelerating decomposition temperature (SADT) shall be determined in accordance with the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), Part II, section 28.

B.15.3.3 Mixtures of organic peroxides may be classified as the same type of organic peroxide as that of the most dangerous ingredient. However, as two stable ingredients can form a thermally less stable mixture, the SADT of the mixture shall be determined.

B.16 CORROSIVE TO METALS

B.16.1 Definition

A chemical which is corrosive to metals means a chemical which by chemical action will materially damage, or even destroy, metals.

B.16.2 Classification criteria

A chemical which is corrosive to metals shall be classified in a single category for this class, using the test in Part III, sub-section 37.4 of the UN ST/SG/AC.10 (incorporated by reference; See §1910.6), in accordance with Table B.16.1:

TABLE B.16.1 CRITERIA FOR CHEMICALS CORROSIVE TO METAL	
Category	Criteria
1	Corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm per year at a test temperature of 55°C (131°F) when tested on both materials.
NOTE: Where an initial test on either steel or aluminium indicates the chemical being tested is corrosive the follow-up test on the other metal is not necessary.	

B.16.3 Additional classification considerations

The specimen to be used for the test shall be made of the following materials:

- (a) For the purposes of testing steel, steel types S235JR+CR (1.0037 resp.St 37-2), S275J2G3+CR (1.0144 resp.St 44-3), ISO 3574, Unified Numbering System (UNS) G 10200, or SAE 1020;
- (b) For the purposes of testing aluminium: non-clad types 7075-T6 or AZ5GU-T6.

[77 FR 177817, March 26, 2012; 78 FR 9313, Feb. 8, 2013]

APPENDIX C
ALLOCATION OF LABEL ELEMENTS (Mandatory)

C.1 LABELS FOR EACH HAZARDOUS CHEMICAL

The label for each hazardous chemical shall include the product identifier used on the safety data sheet.

C.1.1 The labels on shipped containers shall also include the name, address, and telephone number of the chemical manufacturer, importer, or responsible party.

C.2 LABEL CLASSIFICATION FOR EACH HAZARDOUS CHEMICAL

The label for each hazardous chemical that is classified shall include the signal word, hazard statement(s), pictogram(s), and precautionary statement(s) specified in C.4 for each hazard class and associated hazard category, except as provided for in C.2.1 through C.2.4.

C.2.1 Precedence of Hazard Information

C.2.1.1 If the signal word "Danger" is included, the signal word "Warning" shall not appear;

C.2.1.2 If the skull and crossbones pictogram is included, the exclamation mark pictogram shall not appear where it is used for acute toxicity;

C.2.1.3 If the corrosive pictogram is included, the exclamation mark pictogram shall not appear where it is used for skin or eye irritation;

C.2.1.4 If the health hazard pictogram is included for respiratory sensitization, the exclamation mark pictogram shall not appear where it is used for skin sensitization or for skin or eye irritation.

C.2.2 Hazard Statement Text

C.2.2.1 The text of all applicable hazard statements shall appear on the label, except as otherwise specified. The information in italics shall be included as part of the hazard statement as provided. For example: "causes damage to organs (state all organs affected) through prolonged or repeated exposure (state route of exposure if no other routes of exposure cause the hazard)". Hazard statements may be combined where appropriate to reduce the information on the label and improve readability, as long as all of the hazards are conveyed as required.

C.2.2.2 If the chemical manufacturer, importer, or responsible party can demonstrate that all or part of the hazard statement is inappropriate to a specific substance or mixture, the corresponding statement may be omitted from the label.









C.2.3 Pictograms

C.2.3.1 Pictograms shall be in the shape of a square set at a point and shall include a black hazard symbol on a white background with a red frame sufficiently wide to be clearly visible. A square red frame set at a point without a hazard symbol is not a pictogram and is not permitted on the label.

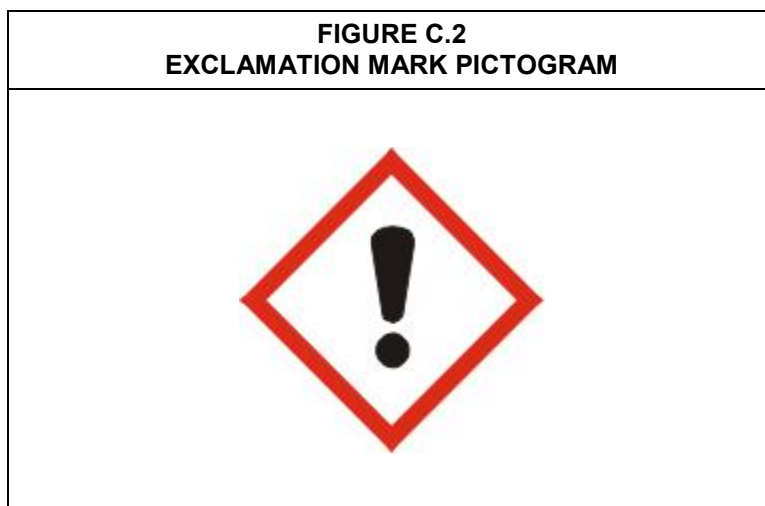
C.2.3.2 One of eight standard hazard symbols shall be used in each pictogram. The eight hazard symbols are depicted in Figure C.1. A pictogram using the exclamation mark symbol is presented in Figure C.2, for the purpose of illustration.

C.2.3.3 Where a pictogram required by the Department of Transportation under Title 49 of the Code of Federal Regulations appears on a shipped container, the pictogram specified in C.4 for the same hazard shall not appear.

**FIGURE C.1
HAZARD SYMBOLS AND CLASSES**

Flame	Flame Over Circle	Exclamation Mark	Exploding Bomb
 Flammables Self Reactives Pyrophorics Self-heating Emits Flammable Gas Organic Peroxides	 Oxidizers	 Irritant Dermal Sensitizer Acute Toxicity (harmful) Narcotic Effects Respiratory Tract Irritation	 Explosives Self Reactives Organic Peroxides
Corrosion	Gas Cylinder	Health Hazard	Skull and Crossbones
 Corrosives	 Gases Under Pressure	 Carcinogen Respiratory Sensitizer Reproductive Toxicity Target Organ Toxicity Mutagenicity Aspiration Toxicity	 Acute Toxicity (severe)

**FIGURE C.2
EXCLAMATION MARK PICTOGRAM**



C.2.4 Precautionary Statement Text

C.2.4.1 There are four types of precautionary statements presented, "prevention," "response," "storage," and "disposal." The core part of the precautionary statement is presented in bold print. This is the text, except as otherwise specified, that shall appear on the label. Where additional information is required, it is indicated in plain text.

C.2.4.2 When a backslash or diagonal mark (/) appears in the precautionary statement text, it indicates that a choice has to be made between the separated phrases. In such cases, the chemical manufacturer, importer, or responsible party can choose the most appropriate phrase(s). For example, "Wear protective gloves/protective clothing/eye protection/face protection" could read "wear eye protection".

C.2.4.3 When three full stops (...) appear in the precautionary statement text, they indicate that all applicable conditions are not listed. For example, in "Use explosion-proof electrical/ventilating/lighting/.../equipment", the use of "..." indicates that other equipment may need to be specified. In such cases, the chemical manufacturer, importer, or responsible party can choose the other conditions to be specified.

C.2.4.4 When text in italics is used in a precautionary statement, this indicates specific conditions applying to the use or allocation of the precautionary statement. For example, "Use explosion-proof electrical/ventilating/lighting/.../equipment" is only required for flammable solids "if dust clouds can occur". Text in italics is intended to be an explanatory, conditional note and is not intended to appear on the label.

C.2.4.5 Where square brackets ([]) appear around text in a precautionary statement, this indicates that the text in square brackets is not appropriate in every case and should be used only in certain circumstances. In these cases, conditions for use explaining when the text should be used are provided. For example, one precautionary statement states: "[In case of inadequate ventilation] wear respiratory protection." This statement is given with the condition for use "– text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use". This means that, if additional information is provided with the chemical explaining what type of ventilation would be adequate for safe use, the text in square brackets should be used and the statement would read: "In case of inadequate ventilation wear respiratory protection." However, if the chemical is supplied without such ventilation information, the text in square brackets should not be used, and the precautionary statement should read: "Wear respiratory protection."

C.2.4.6 Precautionary statements may be combined or consolidated to save label space and improve readability. For example, "Keep away from heat, sparks and open flame," "Store in a well-ventilated place" and "Keep cool" can be combined to read "Keep away from heat, sparks and open flame and store in a cool, well-ventilated place."

C.2.4.7 In most cases, the precautionary statements are independent (e.g., the phrases for explosive hazards do not modify those related to certain health hazards, and products that are classified for both hazard classes shall bear appropriate precautionary statements for both). Where a chemical is classified for a number of hazards, and the precautionary statements are similar, the most stringent shall be included on the label (this will be applicable mainly to preventive measures). An order of precedence may be imposed by the chemical manufacturer, importer or responsible party in situations where phrases concern "Response." Rapid action may be crucial. For example, if a chemical is carcinogenic and acutely toxic, rapid action may be crucial, and first aid measures for acute toxicity will take precedence over those for long-term effects. In addition, medical attention to delayed health effects may be required in cases of incidental exposure, even if not associated with immediate symptoms of intoxication.

C.2.4.8 If the chemical manufacturer, importer, or responsible party can demonstrate that a precautionary statement is inappropriate to a specific substance or mixture, the precautionary statement may be omitted from the label.


C.3 SUPPLEMENTARY HAZARD INFORMATION

C.3.1 To ensure that non-standardized information does not lead to unnecessarily wide variation or undermine the required information, supplementary information on the label is limited to when it provides further detail and does not contradict or cast doubt on the validity of the standardized hazard information.


C.3.2 Where the chemical manufacturer, importer, or distributor chooses to add supplementary information on the label, the placement of supplemental information shall not impede identification of information required by this section.

C.3.3 Where an ingredient with unknown acute toxicity is used in a mixture at a concentration $\geq 1\%$, and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required on the label.

C.4 REQUIREMENTS FOR SIGNAL WORDS, HAZARD STATEMENTS, PICTOGRAMS, AND PRECAUTIONARY STATEMENTS

C.4.1 ACUTE TOXICITY – ORAL (Classified in Accordance with Appendix A.1)			
Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
1	Danger	Fatal if swallowed	
2	Danger	Fatal if swallowed	
Precautionary statements			
Prevention	Response	Storage	Disposal
Wash ...thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. Do not eat, drink or smoke when using this product.	If swallowed: Immediately call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - if immediate administration of antidote is required. Rinse mouth.	Store locked up.	Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).


**C.4.1
ACUTE TOXICITY – ORAL (CONTINUED)
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
3	Danger	Toxic if swallowed	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Wash ... thoroughly after handling.</p> <p>... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Do not eat, drink or smoke when using this product.</p>	<p>If swallowed: Immediately call a poison center/ doctor/...</p> <p>... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p> <p>Specific treatment (see ... on this label)</p> <p>... Reference to supplemental first aid instruction. - if immediate administration of antidote is required.</p> <p>Rinse mouth.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to...</p> <p>... in accordance with local/regional/national /international regulations (to be specified).</p>


**C.4.1
ACUTE TOXICITY – ORAL (CONTINUED)
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
4	Warning	Harmful if swallowed	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. Do not eat, drink or smoke when using this product.</p>	<p>If swallowed: Call a poison center/ doctor/..... /if you feel unwell. ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Rinse mouth.</p>		<p>Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).</p>


**C.4.2
ACUTE TOXICITY – DERMAL
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
1	Danger	Fatal in contact with skin	
2	Danger	Fatal in contact with skin	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Do not get in eyes, on skin, or on clothing.</p> <p>Wash ... thoroughly after handling. ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Do not eat, drink or smoke when using this product.</p> <p>Wear protective gloves/protective clothing. Chemical manufacturer, importer, or distributor to specify type of equipment. If on skin:</p>	<p>Wash with plenty of water/... ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate.</p> <p>Immediately call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p> <p>Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - if immediate measures such as specific cleansing agent is advised.</p> <p>Take off immediately all contaminated clothing and wash it before reuse.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).</p>


**C.4.2
ACUTE TOXICITY - DERMAL (CONTINUED)
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
3	Danger	Toxic in contact with skin	

Precautionary statements


Prevention	Response	Storage	Disposal
<p>Wear protective gloves/protective clothing. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin: Wash with plenty of water/... ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate.</p> <p>Call a poison center/ doctor/... if you feel unwell. ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p> <p>Specific treatment (see ... on this label)... Reference to supplemental first aid instruction. - if measures such as specific cleansing agent is advised.</p> <p>Take off immediately all contaminated clothing and wash it before reuse.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


**C.4.2
ACUTE TOXICITY – DERMAL (CONTINUED)
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
4	Warning	Harmful in contact with skin	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Wear protective gloves/protective clothing Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin: Wash with plenty of water/... ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. Call a poison center/doctor/..... /if you feel unwell. ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - if measures such as specific cleansing agent is advised. Take off contaminated clothing and wash it before reuse.</p>		<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>

C.4.3 ACUTE TOXICITY – INHALATION (Classified in Accordance with Appendix A.1)			
Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
1	Danger	Fatal if inhaled	
2	Danger	Fatal if inhaled	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. Use only outdoors or in a well-ventilated area. [In case of inadequate ventilation] wear respiratory protection. Chemical manufacturer, importer, or distributor to specify equipment. - Text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use.</p>	<p>If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Specific treatment is urgent (see ... on this label) ... Reference to supplemental first aid instruction. - if immediate administration of antidote is required.</p>	<p>Store in a well-ventilated place. Keep container tightly closed. - if product is volatile as to generate hazardous atmosphere. Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


C.4.3 ACUTE TOXICITY – INHALATION (CONTINUED) (Classified in Accordance with Appendix A.1)			
Hazard category	Signal word	Hazard statement	Pictogram Skull and crossbones
3	Danger	Toxic if inhaled	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. Use only outdoors or in a well-ventilated area.</p>	<p>If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - if immediate specific measures are required.</p>	<p>Store in a well-ventilated place. Keep container tightly closed. - if product is volatile so as to generate hazardous atmosphere. Store locked up.</p>	<p>Dispose of content/container to... ... in accordance with local/regional/national /international regulations (to be specified).</p>


**C.4.3
ACUTE TOXICITY – INHALATION (CONTINUED)
(Classified in Accordance with Appendix A.1)**

Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
4	Warning	Harmful if inhaled	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. Use only outdoors or in a well-ventilated area.</p>	<p>If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor/... if you feel unwell. ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p>		

C.4.4 SKIN CORROSION/IRRITATION (Classified in Accordance with Appendix A.2)			
Hazard category	Signal word	Hazard statement	Pictogram Corrosion
1A to 1C	Danger	Causes severe skin burns and eye damage	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Do not breathe dusts or mists. - if inhalable particles of dusts or mists may occur during use. Wash ...thoroughly after handling. ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. Wear protective gloves/protective clothing/eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - Manufacturer, importer, or distributor may specify a cleansing agent if appropriate. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).</p>

C.4.4 SKIN CORROSION/IRRITATION (CONTINUED) (Classified in Accordance with Appendix A.2)			
Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
2	Warning	Causes skin irritation	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Wear protective gloves. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin: Wash with plenty of water/... ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate.</p> <p>Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - Manufacturer, importer, or distributor may specify a cleansing agent if appropriate.</p> <p>If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse.</p>		


**C.4.5
EYE DAMAGE/IRRITATION
(Classified in Accordance with Appendix A.3)**

Hazard category	Signal word	Hazard statement	Pictogram Corrosion
1	Danger	Causes serious eye damage	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Wear eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p>		

**C.4.5
EYE DAMAGE/IRRITATION (CONTINUED)
(Classified in Accordance with Appendix A.3)**


Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
2A	Warning	Causes serious eye irritation	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Wear eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.</p>		

C.4.5 EYE DAMAGE/IRRITATION (CONTINUED) (Classified in Accordance with Appendix A.3)			
Hazard category	Signal word	Hazard statement	Pictogram No Pictogram
2B	Warning	Causes eye irritation	
Precautionary statements			
Prevention	Response	Storage	Disposal
Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.	If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.		


**C.4.6
SENSITIZATION – RESPIRATORY
(Classified in Accordance with Appendix A.4)**

Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1 (including both sub-categories 1A and 1B)	Danger	May cause allergy or asthma symptoms or breathing difficulties if inhaled	

Precautionary statements


Prevention	Response	Storage	Disposal
<p>Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. [In case of inadequate ventilation] wear respiratory protection. Chemical manufacturer, importer, or distributor to specify equipment - Text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use.</p>	<p>If inhaled: If breathing is difficult, remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p>		<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


**C.4.7
SENSITIZATION – SKIN
(Classified in Accordance with Appendix A.4)**

Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
1 (including both sub-categories 1A and 1B)	Warning	May cause an allergic skin reaction	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions.</p> <p>Contaminated work clothing must not be allowed out of the workplace.</p> <p>Wear protective gloves. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin: Wash with plenty of water/... ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate.</p> <p>If skin irritation or rash occurs: Get medical advice/attention.</p> <p>Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - Manufacturer, importer, or distributor may specify a cleansing agent if appropriate.</p> <p>Wash contaminated clothing before reuse.</p>		<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>

C.4.8 GERM CELL MUTAGENICITY (Classified in Accordance with Appendix A.5)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1A and 1B	Danger	May cause genetic defects <...>	
2	Warning	Suspected of causing genetic defects <...>	
		(state route of exposure if no other routes of exposure cause the hazard)	
Precautionary statements			
Prevention	Response	Storage	Disposal
Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	If exposed or concerned: Get medical advice/attention.	Store locked up.	Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).

C.4.9 CARCINOGENICITY (Classified in Accordance with Appendix A.6)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1A and 1B	Danger	May cause cancer <...>	
2	Warning	Suspected of causing cancer <...>	
		(state route of exposure if no other routes of exposure cause the hazard)	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment, as required.</p>	<p>If exposed or concerned: Get medical advice/attention.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>
<p>Note: If a Category 2 carcinogen ingredient is present in the mixture at a concentration between 0.1% and 1%, information is required on the SDS for a product; however, a label warning is optional. If a Category 2 carcinogen ingredient is present in the mixture at a concentration of $\geq 1\%$, both an SDS and a label is required and the information must be included on each.</p>			

**C.4.10
TOXIC TO REPRODUCTION
(Classified in Accordance with Appendix A.7)**


Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1A and 1B	Danger	May damage fertility or the unborn child <...> <<...>>	
2	Warning	Suspected of damaging fertility or the unborn child <...> <<...>>	
-	-	(state specific effect if known)	
-	-	(state route of exposure if no other routes of exposure cause the hazard)	

Precautionary statements


Prevention	Response	Storage	Disposal
Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	If exposed or concerned: Get medical advice/attention.	Store locked up.	Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).

**C.4.10
TOXIC TO REPRODUCTION (CONTINUED)
(Classified in Accordance with Appendix A.7)
(EFFECTS ON OR VIA LACTATION)**

Hazard category	Signal word	Hazard statement	Pictogram
No designated number	No signal word	May cause harm to breast-fed children	No Pictogram
(See Table A.7.1 in Appendix A.7)			
Precautionary statements			
Prevention	Response	Storage	Disposal
Obtain special instructions before use. Do not breathe dusts or mists. - if inhalable particles of dusts or mists may occur during use. Avoid contact during pregnancy/ while nursing. Wash ... thoroughly after handling. ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. Do not eat, drink or smoke when using this product.	If exposed or concerned: Get medical advice/attention.		

C.4.11 SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (Classified in Accordance with Appendix A.8)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1	Danger	Causes damage to organs <...> <<...>>	
-	-	<...> (or state all organs affected if known)	
-	-	<<...>> (state route of exposure if no other routes of exposure cause the hazard)	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions.</p> <p>Wash ...thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Do not eat, drink or smoke when using this product.</p>	<p>If exposed: Call a poison center/ doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p> <p>Specific treatment (see ... on this label) ... Reference to supplemental first aid instruction. - if immediate measures are required.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national /international regulations (to be specified).</p>


C.4.11
SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (CONTINUED)
(Classified in Accordance with Appendix A.8)

Hazard category	Signal word	Hazard statement	Pictogram Health hazard
2	Warning	May cause damage to organs <...> <<...>>	
-	-	<...> (or state all organs affected, if known)	
-	-	<<...>> (state route of exposure if no other routes of exposure cause the hazard)	

Precautionary statements


Prevention	Response	Storage	Disposal
<p>Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions.</p> <p>Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.</p> <p>Do not eat, drink or smoke when using this product.</p>	<p>If exposed or concerned: Call a poison center/doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p>	<p>Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


**C.4.11
 SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (CONTINUED)
 (Classified in Accordance with Appendix A.8)**


Hazard category	Signal word	Hazard statement	Pictogram Exclamation mark
3	Warning	May cause respiratory irritation; or	
-	-	May cause drowsiness or dizziness	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. Use only outdoors or in a well-ventilated area.</p>	<p>If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor/.../ if you feel unwell. ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.</p>	<p>Store in a well-ventilated place. Keep container tightly closed. - if product is volatile so as to generate hazardous atmosphere. Store locked up.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


C.4.12 SPECIFIC TARGET ORGAN TOXICITY (Repeated Exposure) (Classified in Accordance with Appendix A.9)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1	Danger	Causes damage to organs <...> through prolonged or repeated exposure <<...>>	
-	-	<...> (state all organs affected, if known)	
-	-	<<...>> (state route of exposure if no other routes of exposure cause the hazard)	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. Wash ... thoroughly after handling. ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. Do not eat, drink or smoke when using this product.</p>	<p>Get medical advice/attention if you feel unwell.</p>		<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>

C.4.12 SPECIFIC TARGET ORGAN TOXICITY (Repeated Exposure) (CONTINUED) (Classified in Accordance with Appendix A.9)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
2	Warning	May cause damage to organs <...> through prolonged or repeated exposure <<...>>	
-	-	<...> (state all organs affected, if known)	
-	-	<<...>> (state route of exposure if no other routes of exposure cause the hazard)	
Precautionary statements			
Prevention	Response	Storage	Disposal
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions.	Get medical advice/attention if you feel unwell.		Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).

C.4.13 ASPIRATION HAZARD (Classified in Accordance with Appendix A.10)			
Hazard category	Signal word	Hazard statement	Pictogram Health hazard
1	Danger	May be fatal if swallowed and enters airways	
Precautionary statements			
Prevention	Response	Storage	Disposal
	If swallowed: Immediately call a poison center/doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. Do NOT induce vomiting.	Store locked up.	Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).

C.4.14 EXPLOSIVES (Classified in Accordance with Appendix B.1)			
Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb
Unstable explosive	Danger	Unstable explosive	
Precautionary statements			
Prevention	Response	Storage	Disposal
Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear personal protective equipment/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	Explosion risk in case of fire. Do NOT fight fire when fire reaches explosives. Evacuate area.	Storein accordance with local/regional/national/international regulations (to be specified).	Dispose of contents/container toin accordance with local/regional/national/international regulations (to be specified).

**C.4.14
EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)**


Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb
Division 1.1	Danger	Explosive; mass explosion hazard	
Division 1.2	Danger	Explosive; severe projection hazard	
Division 1.3	Danger	Explosive; fire, blast or projection	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep wetted with... ... Chemical manufacturer, importer, or distributor to specify appropriate material. - if drying out increases explosion hazard, except as needed for manufacturing or operating processes (e.g., nitrocellulose). Ground/bond container and receiving equipment. - if the explosive is electrostatically sensitive. Do not subject to grinding/shock/.../friction. ...Chemical manufacturer, importer, or distributor to specify applicable rough handling. Wear face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: evacuate area. Explosion risk in case of fire. Do NOT fight fire when fire reaches explosives.</p>	<p>Storein accordance with local / regional/ national/ international regulations (to be specified).</p>	<p>Dispose of contents/container to in accordance with local/ regional/ national/ international regulations (to be specified).</p>

Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.

**C.4.14
EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)**

Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb ¹
Division 1.4	Warning	Fire or projection hazard	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).</p> <p>Ground/bond container and receiving equipment. - if the explosive is electrostatically sensitive.</p> <p>Do not subject to grinding/shock/.../friction. Chemical manufacturer, importer, or distributor to specify applicable rough handling.</p> <p>Wear face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Evacuate area. Explosion risk in case of fire. - except if explosives are 1.4S ammunition and components thereof.</p> <p>Do NOT fight fire when fire reaches explosives. Fight fire with normal precautions from a reasonable distance - if explosives are 1.4S ammunition and components thereof.</p>	<p>Storein accordance with local/regional/national/international regulations (to be specified).</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.¹


C.4.14 EXPLOSIVES (CONTINUED) (Classified in Accordance with Appendix B.1)			
Hazard category	Signal word	Hazard statement	Pictogram
Division 1.5	Danger	May mass explode in fire	No Pictogram
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).</p> <p>Keep wetted with... ... Chemical manufacturer, importer, or distributor to specify appropriate material. - if drying out increases explosion hazard, except as needed for manufacturing or operating processes (e.g., nitrocellulose).</p> <p>Ground/bond container and receiving equipment - if the explosive is electrostatically sensitive.</p> <p>Do not subject to grinding/shock/.../friction. ...Chemical manufacturer, importer, or distributor to specify applicable rough handling.</p> <p>Wear face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Evacuate area. Explosion risk in case of fire. Do NOT fight fire when fire reaches explosives.</p>	<p>Storein accordance with local/regional/national/international regulations (to be specified).</p>	<p>Dispose of contents/container to in accordance with local/regional/national/international regulations (to be specified).</p>
<p>Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.</p>			


C.4.14 EXPLOSIVES (CONTINUED) (Classified in Accordance with Appendix B.1)			
Hazard category	Signal word	Hazard statement	Pictogram
Division 1.6	No signal word	No hazard statement	No Pictogram
Precautionary statements			
Prevention	Response	Storage	Disposal
None assigned	None assigned	None assigned	None assigned
Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.			

C.4.15 FLAMMABLE GASES (Classified in Accordance with Appendix B.2)			
Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Extremely flammable gas	
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).	Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.	Store in well-ventilated place.	


C.4.15 FLAMMABLE GASES (CONTINUED) (Classified in Accordance with Appendix B.2)			
Hazard category	Signal word	Hazard statement	Pictogram
2	Warning	Flammable gas	No Pictogram
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s).	Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.	Store in well-ventilated place.	

C.4.16 FLAMMABLE AEROSOLS (Classified in Accordance with Appendix B.3)			
Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Extremely flammable aerosol	
2	Warning	Flammable aerosol	
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s). Do not spray on an open flame or other ignition source. Pressurized container: Do not pierce or burn, even after use.		Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.	


C.4.17 OXIDIZING GASES (Classified in Accordance with Appendix B.4)			
Hazard category	Signal word	Hazard statement	Pictogram Flame over circle
1	Danger	May cause or intensify fire; oxidizer	
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep/Store away from clothing/... /combustible materials. ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. Keep reduction valves/valves and fittings free from oil and grease.	In case of fire: Stop leak if safe to do so.	Store in well-ventilated place.	

C.4.18 GASES UNDER PRESSURE (Classified in Accordance with Appendix B.5)			
Hazard category	Signal word	Hazard statement	Pictogram Gas cylinder
Compressed gas	Warning	Contains gas under pressure; may explode if heated	
Liquefied gas	Warning	Contains gas under pressure; may explode if heated	
Dissolved gas	Warning	Contains gas under pressure; may explode if heated	
Precautionary statements			
Prevention	Response	Storage	Disposal
		Protect from sunlight. Store in a well-ventilated place.	

**C.4.18
GASES UNDER PRESSURE (CONTINUED)
(Classified in Accordance with Appendix B.5)**

Hazard category	Signal word	Hazard statement	Pictogram Gas cylinder
Refrigerated liquefied gas	Warning	Contains refrigerated gas; may cause cryogenic burns or injury	
Precautionary statements			
Prevention	Response	Storage	Disposal
Wear cold insulating gloves/ face shield/ eye protection.	Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/ attention.	Store in well-ventilated place.	

**C.4.19
FLAMMABLE LIQUIDS
(Classified in Accordance with Appendix B.6)**


Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Extremely flammable liquid and vapor	
2	Danger	Highly flammable liquid and vapor	
3	Warning	Flammable liquid and vapor	


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces.– No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep container tightly closed. Ground/Bond container and receiving equipment - if electrostatically sensitive material is for reloading. - if product is volatile so as to generate hazardous atmosphere. Use explosion-proof electrical/ventilating/lighting/.../equipment. ... Chemical manufacturer, importer, or distributor to specify other equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/ eye protection/ face protection Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. In case of fire: Use ... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>	<p>Store in a well-ventilated place. Keep cool.</p>	<p>Dispose of contents/ container to... ... in accordance with local/regional/ national/ international regulations (to be specified).</p>



**C.4.19
FLAMMABLE LIQUIDS (CONTINUED)
(Classified in Accordance with Appendix B.6)**

Hazard category	Signal word	Hazard statement	Pictogram
4	Warning	Combustible liquid	No Pictogram
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep away from flames and hot surfaces. – No smoking. Wear protective gloves/ eye protection/ face protection Chemical manufacturer, importer, or distributor to specify type of equipment.	In case of fire: Use ... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.	Store in a well-ventilated place. Keep cool.	Dispose of contents/container to... in accordance with local/regional/ national/international regulations (to be specified).

C.4.20 FLAMMABLE SOLIDS (Classified in Accordance with Appendix B.7)			
Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Flammable solid	
2	Warning	Flammable solid	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).</p> <p>Ground/Bond container and receiving equipment. - if electrostatically sensitive material is for reloading.</p> <p>Use explosion-proof electrical/ventilating / lighting/... /equipment. ... Chemical manufacturer, importer, or distributor to specify other equipment. - if dust clouds can occur.</p> <p>Wear protective gloves/ eye protection/ face protection Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>		


C.4.21 SELF-REACTIVE SUBSTANCES AND MIXTURES (Classified in Accordance with Appendix B.8)			
Hazard category	Signal word	Hazard statement	Pictogram Flame
Type A	Danger	Heating may cause an explosion	Exploding bomb 
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).</p> <p>Keep/Store away from clothing/... /combustible materials. ... Chemical manufacturer, importer, or distributor to specify other incompatible materials.</p> <p>Keep only in original container.</p> <p>Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p> <p>In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.</p>	<p>Store in a well-ventilated place. Keep cool. Store at temperatures not exceeding ...°C/...°F. ... Chemical manufacturer, importer, or distributor to specify temperature.</p> <p>Store away from other materials.</p>	<p>Dispose of contents/container to... ... in accordance with local/regional/ national/international regulations (to be specified).</p>

**C.4.21
SELF-REACTIVE SUBSTANCES AND MIXTURES (CONTINUED)
(Classified in Accordance with Appendix B.8)**


Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb and flame	
Type B	Danger	Heating may cause a fire or explosion		

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).</p> <p>Keep/Store away from clothing/.../combustible materials. ... Chemical manufacturer, importer, or distributor to specify other incompatible materials.</p> <p>Keep only in original container. Wear protective gloves/eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use ... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p> <p>In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.</p>	<p>Store in a well-ventilated place. Keep cool. Store at temperatures not exceeding ...°C/...°F. ... Chemical manufacturer, importer, or distributor to specify temperature.</p> <p>Store away from other materials.</p>	<p>Dispose of contents/container to... ...in accordance with local/regional/national/international regulations (to be specified).</p>

C.4.21 SELF-REACTIVE SUBSTANCES AND MIXTURES(CONTINUED) (Classified in Accordance with Appendix B.8)			
Hazard category	Signal word	Hazard statement	Pictogram
Type C	Danger	Heating may cause a fire	
Type D	Danger	Heating may cause a fire	
Type E	Warning	Heating may cause a fire	
Type F	Warning	Heating may cause a fire	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep/Store away from clothing/... /combustible materials. ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. Keep only in original container. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>	<p>Store in a well-ventilated place. Keep cool. Store at temperatures not exceeding °C/...°F. ...Chemical manufacturer, importer, or distributor to specify temperature. Store away from other materials.</p>	<p>Dispose of contents /container to... ...in accordance with local/regional/ national/international regulations (to be specified).</p>


**C.4.22
PYROPHORIC LIQUIDS
(Classified in Accordance with Appendix B.9)**

Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Catches fire spontaneously if exposed to air	

Precautionary statements


Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s). Do not allow contact with air. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>If on skin: Immerse in cool water/wrap with wet bandages In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>	<p>Store contents under Chemical manufacturer, importer, or distributor to specify appropriate liquid or inert gas.</p>	

**C.4.23
PYROPHORIC SOLIDS
(Classified in Accordance with Appendix B.10)**


Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Catches fire spontaneously if exposed to air	

Precautionary statements


Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Do not allow contact with air. Wear protective gloves/eye protection/face protection Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages. In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>	<p>Store contents underChemical manufacturer, importer, or distributor to specify appropriate liquid or inert gas.</p>	

C.4.24 SELF-HEATING SUBSTANCES AND MIXTURES (Classified in Accordance with Appendix B.11)			
Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	Self-heating; may catch fire	
2	Warning	Self-heating in large quantities; may catch fire	
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep cool. Protect from sunlight. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.		Maintain air gap between stacks/ pallets. Store bulk masses greater than ... kg/...lbs at temperatures not exceeding ...C/...°F. ... Chemical manufacturer, importer, or distributor to specify mass and temperature. Store away from other materials.	


C.4.25
SUBSTANCES AND MIXTURES WHICH, IN CONTACT WITH WATER,
EMIT FLAMMABLE GASES
(Classified in Accordance with Appendix B.12)

Hazard category	Signal word	Hazard statement	Pictogram Flame
1	Danger	In contact with water releases flammable gases, which may ignite spontaneously	
2	Danger	In contact with water releases flammable gas	
Precautionary statements			
Prevention	Response	Storage	Disposal
Do not allow contact with water. Handle under inert gas. Protect from moisture. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.	Brush off loose particles from skin and immerse in cool water/wrap in wet bandages. In case of fire: Use ... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.	Store in a dry place. Store in a closed container.	Dispose of contents /container to... ...in accordance with local/regional/ national/international regulations (to be specified).

**C.4.25
SUBSTANCES AND MIXTURES WHICH, IN CONTACT WITH WATER,
EMIT FLAMMABLE GASES (CONTINUED)
(Classified in Accordance with Appendix B.12)**

Hazard category	Signal word	Hazard statement	Pictogram Flame
3	Warning	In contact with water releases flammable gas	
Precautionary statements			
Prevention	Response	Storage	Disposal
Handle under inert gas. Protect from moisture. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.	In case of fire: Use ... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.	Store in a dry place. Store in a closed container.	Dispose of contents/container to... ...in accordance with local/regional/ national/ international regulations (to be specified).


**C.4.26
OXIDIZING LIQUIDS
(Classified in Accordance with Appendix B.13)**

Hazard category	Signal word	Hazard statement	Pictogram Flame over circle
1	Danger	May cause fire or explosion; strong oxidizer	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat. Keep/Store away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles/... ... Chemical manufacturer, importer, or distributor to specify other incompatible materials. Wear protective gloves / eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment. Wear fire/flame resistant/retardant clothing.</p>	<p>If on clothing: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion. In case of fire: Use... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>		<p>Dispose of contents/ container to... ...in accordance with local/regional/ national/international regulations (to be specified).</p>


**C.4.26
OXIDIZING LIQUIDS (CONTINUED)
(Classified in Accordance with Appendix B.13)**

Hazard category	Signal word	Hazard statement	Pictogram Flame over circle
2	Danger	May intensify fire; oxidizer	
3	Warning	May intensify fire; oxidizer	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat. Keep/Store away from clothing/.../combustible materials. ...Chemical manufacturer, importer, or distributor to specify other incompatible materials.</p> <p>Take any precaution to avoid mixing with combustibles/... ... Chemical manufacturer, importer, or distributor to specify other incompatible materials.</p> <p>Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>		<p>Dispose of contents /container to... ...in accordance with local/regional/ national/international regulations (to be specified).</p>


**C.4.27
OXIDIZING SOLIDS
(Classified in Accordance with Appendix B.14)**

Hazard category	Signal word	Hazard statement	Pictogram Flame over circle
1	Danger	May cause fire or explosion; strong oxidizer	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat. Keep away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles/... ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment. Wear fire/flame resistant/retardant clothing.</p>	<p>If on clothing: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion. In case of fire: Use... to extinguish ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>		<p>Dispose of contents /container to... ...in accordance with local/regional/ national/international regulations (to be specified).</p>


C.4.27
OXIDIZING SOLIDS (CONTINUED)
 (Classified in Accordance with Appendix B.14)

Hazard category	Signal word	Hazard statement	Pictogram Flame over circle
2	Danger	May intensify fire; oxidizer	
3	Warning	May intensify fire; oxidizer	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat. Keep/Store away from clothing/... /combustible materials. ... Chemical manufacturer, importer, or distributor to specify incompatible materials.</p> <p>Take any precaution to avoid mixing with combustibles/... ...Chemical manufacturer, importer, or distributor to specify other incompatible materials.</p> <p>Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>	<p>In case of fire: Use... to extinguish. ... Chemical manufacturer, importer, or distributor to specify appropriate media. - if water increases risk.</p>		<p>Dispose of contents /container to... ... in accordance with local/regional/ national/international regulations (to be specified).</p>



C.4.28
ORGANIC PEROXIDES
 (Classified in Accordance with Appendix B.15)

Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb
Type A	Danger	Heating may cause an explosion	

Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces.- No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep/Store away from clothing/... /combustible materials. ... Chemical manufacturer, importer, or distributor to specify incompatible materials. Keep only in original container. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>		<p>Store at temperatures not exceeding °C/...°F. Keep cool. ... Chemical manufacturer, importer, or distributor to specify temperature. Protect from sunlight. Store away from other materials.</p>	<p>Dispose of contents /container to... ... in accordance with local/regional/ national/international regulations (to be specified).</p>


C.4.28
ORGANIC PEROXIDES (CONTINUED)
 (Classified in Accordance with Appendix B.15)

Hazard category	Signal word	Hazard statement	Pictogram Exploding bomb and flame	
Type B	Danger	Heating may cause an explosion		


Precautionary statements

Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep /Store away from clothing/... /combustible materials. ... Chemical manufacturer, importer, or distributor to specify incompatible materials. Keep only in original container. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>		<p>Store at temperatures not exceeding ...°C/...°F. Keep cool. Chemical manufacturer, importer, or distributor to specify temperature. Protect from sunlight. Store away from other materials.</p>	<p>Dispose of contents /container to... ... in accordance with local/regional/national/international regulations (to be specified).</p>


C.4.28
ORGANIC PEROXIDES (CONTINUED)
 (Classified in Accordance with Appendix B.15)

Hazard category	Signal word	Hazard statement	Pictogram Flame
Type C	Danger	Heating may cause a fire	
Type D	Danger	Heating may cause a fire	
Type E	Warning	Heating may cause a fire	
Type F	Warning	Heating may cause a fire	
Precautionary statements			
Prevention	Response	Storage	Disposal
<p>Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). Keep /Store away from clothing/... /combustible materials. ... Chemical manufacturer, importer, or distributor to specify incompatible materials. Keep only in original container. Wear protective gloves/ eye protection/ face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.</p>		<p>Store at temperatures not exceeding °C/...°F. Keep cool. Chemical manufacturer, importer, or distributor to specify temperature. Protect from sunlight. Store away from other materials.</p>	<p>Dispose of contents /container to... ... in accordance with local/regional/ national/international regulations (to be specified).</p>

**C.4.29
CORROSIVE TO METALS
(Classified in Accordance with Appendix B.16)**

Hazard category	Signal word	Hazard statement	Pictogram Corrosion
1	Warning	May be corrosive to metals	
Precautionary statements			
Prevention	Response	Storage	Disposal
Keep only in original container.	Absorb spillage to prevent material damage.	Store in corrosive resistant/... container with a resistant inner liner. ... Chemical manufacturer, importer, or distributor to specify other compatible materials.	

**C.4.30
LABEL ELEMENTS FOR OSHA DEFINED HAZARDS**

Hazard category	Signal word	Hazard statement	Pictogram Flame
Pyrophoric Gas	Danger	Catches fire spontaneously if exposed to air	

Hazard category	Signal word	Hazard statement	Pictogram
Simple Asphyxiant	Warning	May displace oxygen and cause rapid suffocation	No Pictogram

Hazard category	Signal word	Hazard statement	Pictogram
Combustible Dust ²	Warning	May form combustible dust concentrations in air	No Pictogram

1 Except no pictogram is required for explosives that are 1.4S small arms ammunition and components thereof. Labels for 1.4S small arms ammunition and components shall include appropriate precautionary statements.

2 The chemical manufacturer or importer shall label chemicals that are shipped in dust form, and present a combustible dust hazard in that form when used downstream, under paragraph (f)(1); 2) the chemical manufacturer or importer shipping chemicals that are in a form that is not yet a dust must provide a label to customers under paragraph (f)(4) if, under normal conditions of use, the chemicals are processed in a downstream workplace in such a way that they present a combustible dust hazard; and 3) the employer shall follow the workplace labeling requirements under paragraph (f)(6) where combustible dust hazards are present

[61 FR 9227, March 7, 1996; 77 FR 17824, March 26, 2012]

**APPENDIX D
SAFETY DATA SHEETS (MANDATORY)**

A safety data sheet (SDS) shall include the information specified in Table D.1 under the section number and heading indicated for sections 1-11 and 16. If no relevant information is found for any given subheading within a section, the SDS shall clearly indicate that no applicable information is available. Sections 12-15 may be included in the SDS, but are not mandatory.

Table D.1 Minimum Information for an SDS	
Heading	Subheading
1. Identification	(a) Product identifier used on the label;
	(b) Other means of identification;
	(c) Recommended use of the chemical and restrictions on use;
	(d) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party;
	(e) Emergency phone number.
2. Hazard(s) identification	(a) Classification of the chemical in accordance with paragraph (d) of §1910.1200;
	(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of §1910.1200. (Hazard symbols may be provided as graphical reproductions in black and white or the name of the symbol, e.g., flame, skull and crossbones);
	(c) Describe any hazards not otherwise classified that have been identified during the classification process;
	(d) Where an ingredient with unknown acute toxicity is used in a mixture at a concentration = 1% and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required.
3. Composition/ information on ingredients	Except as provided for in paragraph (i) of §1910.1200 on trade secrets:
	For Substances
	(a) Chemical name;
	(b) Common name and synonyms;
	(c) CAS number and other unique identifiers;
	(d) Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance.
	For Mixtures
	In addition to the information required for substances:
	(a) The chemical name and concentration (exact percentage) or concentration ranges of all ingredients which are classified as health hazards in accordance with paragraph (d) of §1910.1200 and
	(1) are present above their cut-off/concentration limits; or
	(2) present a health risk below the cut-off/concentration limits.
(2) present a health risk below the cut-off/concentration limits.	

**Table D.1
Minimum Information for an SDS**

Heading	Subheading
	<p>(b) The concentration (exact percentage) shall be specified unless a trade secret claim is made in accordance with paragraph (i) of §1910.1200, when there is batch-to-batch variability in the production of a mixture, or for a group of substantially similar mixtures (See A.0.5.1.2) with similar chemical composition. In these cases, concentration ranges may be used.</p> <p>For All Chemicals Where a Trade Secret is Claimed</p>
3. Composition/ information on ingredients (continued)	Where a trade secret is claimed in accordance with paragraph (i) of §1910.1200, a statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.
4. First-aid measures	<p>(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion;</p> <p>(b) Most important symptoms/effects, acute and delayed.</p> <p>(c) Indication of immediate medical attention and special treatment needed, if necessary.</p>
5. Fire-fighting measures	<p>(a) Suitable (and unsuitable) extinguishing media.</p> <p>(b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products).</p> <p>(c) Special protective equipment and precautions for fire-fighters.</p>
6. Accidental release measures	<p>(a) Personal precautions, protective equipment, and emergency procedures.</p> <p>(b) Methods and materials for containment and cleaning up.</p>
7. Handling and storage	<p>(a) Precautions for safe handling.</p> <p>(b) Conditions for safe storage, including any incompatibilities.</p>
8. Exposure controls/personal protection	<p>(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.</p> <p>(b) Appropriate engineering controls.</p> <p>(c) Individual protection measures, such as personal protective equipment.</p>
9. Physical and chemical properties	<p>(a) Appearance (physical state, color, etc.);</p> <p>(b) Odor;</p> <p>(c) Odor threshold;</p> <p>(d) pH;</p> <p>(e) Melting point/freezing point;</p> <p>(f) Initial boiling point and boiling range;</p> <p>(g) Flash point;</p> <p>(h) Evaporation rate;</p>

**Table D.1
Minimum Information for an SDS**

Heading	Subheading
	(i) Flammability (solid, gas); (j) Upper/lower flammability or explosive limits; (k) Vapor pressure; (l) Vapor density; (m) Relative density; (n) Solubility(ies); (o) Partition coefficient: n-octanol/water; (p) Auto-ignition temperature; (q) Decomposition temperature; (r) Viscosity.
10. Tability and reactivity	(a) Reactivity; (b) Chemical stability; (c) Possibility of hazardous reactions; (d) Conditions to avoid (e.g., static discharge, shock, or vibration); (e) Incompatible materials; (f) Hazardous decomposition products.
11. Toxicological information	Description of the various toxicological (health) effects and the available data used to identify those effects, including: (a) Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); (b) Symptoms related to the physical, chemical and toxicological characteristics; (c) Delayed and immediate effects and also chronic effects from short- and long-term exposure; (d) Numerical measures of toxicity (such as acute toxicity estimates). (e) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA.
12. Ecological information (Non-mandatory)	(a) Ecotoxicity (aquatic and terrestrial, where available); (b) Persistence and degradability; (c) Bioaccumulative potential; (d) Mobility in soil; (e) Other adverse effects (such as hazardous to the ozone layer).

**Table D.1
Minimum Information for an SDS**

Heading	Subheading
13. Disposal considerations (Non-mandatory)	Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.
14. Transport information (Non-mandatory)	(a) UN number;
	(b) UN proper shipping name;
	(c) Transport hazard class(es);
	(d) Packing group, if applicable;
	(e) Environmental hazards (e.g., Marine pollutant (Yes/No));
	(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code);
	(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises.
15. Regulatory information (Non-mandatory)	Safety, health and environmental regulations specific for the product in question.
16. Other information, including date of preparation or last revision	The date of preparation of the SDS or the last change to it.

[77 FR 17884, March 26, 2012]

APPENDIX E
DEFINITION OF "TRADE SECRET" (MANDATORY)

The following is a reprint of the Restatement of Torts section 757, comment b (1939):

b. Definition of trade secret. A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. It differs from other secret information in a business (see s759 of the Restatement of Torts which is not included in this Appendix) in that it is not simply information as to single or ephemeral events in the conduct of the business, as, for example, the amount or other terms of a secret bid for a contract or the salary of certain employees, or the security investments made or contemplated, or the date fixed for the announcement of a new policy or for bringing out a new model or the like. A trade secret is a process or device for continuous use in the operations of the business. Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business, such as a code for determining discounts, rebates or other concessions in a price list or catalogue, or a list of specialized customers, or a method of bookkeeping or other office management.

Secrecy. The subject matter of a trade secret must be secret. Matters of public knowledge or of general knowledge in an industry cannot be appropriated by one as his secret. Matters which are completely disclosed by the goods which one markets cannot be his secret. Substantially, a trade secret is known only in the particular business in which it is used. It is not requisite that only the proprietor of the business know it. He may, without losing his protection, communicate it to employees involved in its use. He may likewise communicate it to others pledged to secrecy. Others may also know of it independently, as, for example, when they have discovered the process or formula by independent invention and are keeping it secret. Nevertheless, a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information. An exact definition of a trade secret is not possible. Some factors to be considered in determining whether given information is one's trade secret are: (1) The extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.

Novelty and prior art. A trade secret may be a device or process which is patentable; but it need not be that. It may be a device or process which is clearly anticipated in the prior art or one which is merely a mechanical improvement that a good mechanic can make. Novelty and invention are not requisite for a trade secret as they are for patentability. These requirements are essential to patentability because a patent protects against unlicensed use of the patented device or process even by one who discovers it properly through independent research. The patent monopoly is a reward to the inventor. But such is not the case with a trade secret. Its protection is not based on a policy of rewarding or otherwise encouraging the development of secret processes or devices. The protection is merely against breach of faith and reprehensible means of learning another's secret. For this limited protection it is not appropriate to require also the kind of novelty and invention which is a requisite of patentability. The nature of the secret is, however, an important factor in determining the kind of relief that is appropriate against one who is subject to liability under the rule stated in this Section. Thus, if the secret consists of a device or process which is a novel invention, one who acquires the secret wrongfully is ordinarily enjoined from further use of it and is required to account for the profits derived from his past use. If, on the other hand, the secret consists of mechanical improvements that a good mechanic can make without resort to the secret, the wrongdoer's liability may be limited to damages, and an injunction against future use of the improvements made with the aid of the secret may be inappropriate.

[52 FR 31877, Aug. 24, 1987; 52 FR 46080, Dec. 4, 1987; 53 FR 15035, Apr. 27, 1988; 54 FR 6888, Feb. 15, 1989; 54 FR 24334, June 7, 1989; 59 FR 6170, Feb. 9, 1994; 59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 5507, Feb. 13, 1996; 61 FR 9227, March 7, 1996; 77 FR 17786, March 26, 2012]

APPENDIX F

GUIDANCE FOR HAZARD CLASSIFICATIONS RE: CARCINOGENICITY (NON-MANDATORY)

The mandatory criteria for classification of a chemical for carcinogenicity under HCS (§ 1910.1200) are found in Appendix A.6 to this section. This non-mandatory Appendix provides additional guidance on hazard classification for carcinogenicity. Part A of Appendix F includes background guidance provided by GHS based on the Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006). Part B provides IARC classification information. Part C provides background guidance from the National Toxicology Program (NTP) "Report on Carcinogens" (RoC), and Part D is a table that compares GHS carcinogen hazard categories to carcinogen classifications under IARC and NTP, allowing classifiers to be able to use information from IARC and NTP RoC carcinogen classifications to complete their classifications under the GHS, and thus the HCS.

PART A: BACKGROUND GUIDANCE¹

As noted in Footnote 6 of Appendix A.6. to this section, the GHS includes as guidance for classifiers information taken from the Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006), providing guidance on the evaluation of the strength and evidence of carcinogenic risks to humans. This guidance also discusses some additional considerations in classification and an approach to analysis, rather than hard-and-fast rules. Part A is consistent with Appendix A.6, and should help in evaluating information to determine carcinogenicity.

Carcinogenicity in humans:

The evidence relevant to carcinogenicity from studies in humans is classified into one of the following categories:

(a) Sufficient evidence of carcinogenicity: A causal relationship has been established between exposure to the agent and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence.

(b) Limited evidence of carcinogenicity: A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

Carcinogenicity in experimental animals:

The evidence relevant to carcinogenicity in experimental animals is classified into one of the following categories:

(a) Sufficient evidence of carcinogenicity: A causal relationship has been established between the agent and an increased incidence of malignant neoplasms or of an appropriate combination of benign and malignant neoplasms in two or more species of animals or two or more independent studies in one species carried out at different times or in different laboratories or under different protocols. An increased incidence of tumors in both sexes of a single species in a well-conducted study, ideally conducted under Good Laboratory Practices, can also provide sufficient evidence.

Exceptionally, a single study in one species and sex might be considered to provide sufficient evidence of carcinogenicity when malignant neoplasms occur to an unusual degree with regard to incidence, site, type of tumor or age at onset, or when there are strong findings of tumors at multiple sites.

(b) Limited evidence of carcinogenicity: The data suggest a carcinogenic effect but are limited for making a definitive evaluation because, e.g. the evidence of carcinogenicity is restricted to a single experiment; there are unresolved questions regarding the adequacy of the design, conduct or interpretation of the studies; the agent increases the incidence only of benign neoplasms or lesions of uncertain neoplastic potential; or the evidence of carcinogenicity is restricted to studies that demonstrate only promoting activity in a narrow range of tissues or organs.

Guidance on How To Consider Important Factors in Classification of Carcinogenicity (See Reference Section)

The weight of evidence analysis called for in GHS and the HCS (§ 1910.1200) is an integrative approach that considers important factors in determining carcinogenic potential along with the strength of evidence analysis. The IPCS "Conceptual Framework for Evaluating a Mode of Action for Chemical Carcinogenesis" (2001), International Life Sciences Institute (ILSI) "Framework for Human Relevance Analysis of Information on Carcinogenic Modes of Action" (Meek, et al., 2003; Cohen et al., 2003, 2004), and Preamble to the IARC Monographs (2006; Section B.6. (Scientific Review and Evaluation; Evaluation and Rationale)) provide a basis for systematic assessments that may be performed in a consistent fashion.

The IPCS also convened a panel in 2004 to further develop and clarify the human relevance framework. However, the above documents are not intended to dictate answers, nor provide lists of criteria to be checked off.

Mode of Action

Various documents on carcinogen assessment all note that mode of action in and of itself, or consideration of comparative metabolism, should be evaluated on a case-by-case basis and are part of an analytic evaluative approach. One must look closely at any mode of action in animal experiments, taking into consideration comparative toxicokinetics/toxicodynamics between the animal test species and humans to determine the relevance of the results to humans. This may lead to the possibility of discounting very specific effects of certain types of substances. Life stage-dependent effects on cellular differentiation may also lead to qualitative differences between animals and humans. Only if a mode of action of tumor development is conclusively determined not to be operative in humans may the carcinogenic evidence for that tumor be discounted. However, a weight of evidence evaluation for a substance calls for any other tumorigenic activity to be evaluated, as well.

Responses in Multiple Animal Experiments

Positive responses in several species add to the weight of evidence that a substance is a carcinogen. Taking into account all of the factors listed in A.6.2.5.2 and more, such chemicals with positive outcomes in two or more species would be provisionally considered to be classified in GHS Category 1B until human relevance of animal results are assessed in their entirety. It should be noted, however, that positive results for one species in at least two independent studies, or a single positive study showing unusually strong evidence of malignancy may also lead to Category 1B.

Responses Are in One Sex or Both Sexes

Any case of gender-specific tumors should be evaluated in light of the total tumorigenic response to the substance observed at other sites (multi-site responses or incidence above background) in determining the carcinogenic potential of the substance.

If tumors are seen only in one sex of an animal species, the mode of action should be carefully evaluated to see if the response is consistent with the postulated mode of action. Effects seen only in one sex in a test species may be less convincing than effects seen in both sexes, unless there is a clear patho-physiological difference consistent with the mode of action to explain the single sex response.

Confounding Effects of Excessive Toxicity or Localized Effects

Tumors occurring only at excessive doses associated with severe toxicity generally have doubtful potential for carcinogenicity in humans. In addition, tumors occurring only at sites of contact and/or only at excessive doses need to be carefully evaluated for human relevance for carcinogenic hazard. For example, forestomach tumors, following administration by gavage of an irritating or corrosive, non-mutagenic chemical, may be of questionable relevance. However, such determinations must be evaluated carefully in justifying the carcinogenic potential for humans; any occurrence of other tumors at distant sites must also be considered.

Tumor Type, Reduced Tumor Latency

Unusual tumor types or tumors occurring with reduced latency may add to the weight of evidence for the carcinogenic potential of a substance, even if the tumors are not statistically significant.

Toxicokinetic behavior is normally assumed to be similar in animals and humans, at least from a qualitative perspective. On the other hand, certain tumor types in animals may be associated with toxicokinetics or toxicodynamics that are unique to the animal species tested and may not be predictive of carcinogenicity in humans. Very few such examples have been agreed internationally. However, one example is the lack of human relevance of kidney tumors in male rats associated with compounds causing $[\alpha]_2\text{u}$ -globulin nephropathy (IARC, Scientific Publication N[deg] 147²). Even when a particular tumor type may be discounted, expert judgment must be used in assessing the total tumor profile in any animal experiment.

PART B: INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC)³

IARC Carcinogen Classification Categories:

Group 1: The agent is carcinogenic to humans

This category is used when there is sufficient evidence of carcinogenicity in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Group 2:

This category includes agents for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost sufficient, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals. Agents are assigned to either Group 2A (probably carcinogenic to humans) or Group 2B (possibly carcinogenic to humans) on the basis of epidemiological and experimental evidence of carcinogenicity and mechanistic and other relevant data. The terms probably carcinogenic and possibly carcinogenic have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with probably carcinogenic signifying a higher level of evidence than possibly carcinogenic.

Group 2A: The agent is probably carcinogenic to human.

This category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. In some cases, an agent may be classified in this category when there is inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of limited evidence of carcinogenicity in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

Group 2B: The agent is possibly carcinogenic to humans.

This category is used for agents for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. It may also be used when there is inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent for which there is inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

PART C: NATIONAL TOXICOLOGY PROGRAM (NTP), "REPORT ON CARCINOGENS", BACKGROUND GUIDANCE**NTP Listing Criteria⁴:**

The criteria for listing an agent, substance, mixture, or exposure circumstance in the Report on Carcinogens (RoC) are as follows:

Known To Be A Human Carcinogen: There is sufficient evidence of carcinogenicity from studies in humans⁵ that indicates a causal relationship between exposure to the agent, substance, or mixture, and human cancer.

Reasonably Anticipated To Be A Human Carcinogen: There is limited evidence of carcinogenicity from studies in humans that indicates that a causal interpretation is credible, but that alternative explanations, such as chance, bias, or confounding factors, could not adequately be excluded,

or

there is sufficient evidence of carcinogenicity from studies in experimental animals that indicates there is an increased incidence of malignant and/or a combination of malignant and benign tumors in multiple species or at multiple tissue sites, or by multiple routes of exposure, or to an unusual degree with regard to incidence, site, or type of tumor, or age at onset,

or

there is less than sufficient evidence of carcinogenicity in humans or laboratory animals; however, the agent, substance, or mixture belongs to a well-defined, structurally-related class of substances whose members are listed in a previous Report on Carcinogens as either known to be a human carcinogen or reasonably anticipated to be a human carcinogen, or there is convincing relevant information that the agent acts through mechanisms indicating it would likely cause cancer in humans.

Conclusions regarding carcinogenicity in humans or experimental animals are based on scientific judgment, with consideration given to all relevant information. Relevant information includes, but is not limited to, dose response, route of exposure, chemical structure, metabolism, pharmacokinetics, sensitive sub-populations, genetic effects, or other data relating to mechanism of action or factors that may be unique to a given substance. For example, there may be substances for which there is evidence of carcinogenicity in laboratory animals, but there are compelling data indicating that the agent acts through mechanisms that do not operate in humans and would therefore not reasonably be anticipated to cause cancer in humans.

PART D: TABLE RELATING APPROXIMATE EQUIVALENCES AMONG IARC, NTP ROC, AND GHS CARCINOGENICITY CLASSIFICATIONS

The following table may be used to perform hazard classifications for carcinogenicity under the HCS (§ 1910.1200). It relates the approximated GHS hazard categories for carcinogenicity to the classifications provided by IARC and NTP, as described in Parts B and C of this Appendix.

APPROXIMATE EQUIVALENCES AMONG CARCINOGEN CLASSIFICATION SCHEMES		
IARC	GHS	NTP RoC
Group 1	Category 1A	Known
Group 2A	Category 1B	Reasonably Anticipated (See Note 1)
Group 2B	Category 2	Reasonably Anticipated (See Note 1)
Note 1:		
1. Limited evidence of carcinogenicity from studies in humans (corresponding to IARC 2A/GHS 1B);		
2. Sufficient evidence of carcinogenicity from studies in experimental animals (again, essentially corresponding to IARC 2A/GHS 1B);		
3. Less than sufficient evidence of carcinogenicity in humans or laboratory animals; however:		
a. The agent, substance, or mixture belongs to a well-defined, structurally-related class of substances whose members are listed in a previous RoC as either "Known" or "Reasonably Anticipated" to be a human carcinogen, or		
b. There is convincing relevant information that the agent acts through mechanisms indicating it would likely cause cancer in humans.		

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1	The text of Appendix F, Part A, on the IARC Monographs, is paraphrased from the 2006 Preamble to the "Monographs on the Evaluation of Carcinogenic Risks to Humans"; the Classifier is referred to the full IARC Preamble for the complete text. The text is not part of the agreed GHS text on the harmonized system developed by the OECD Task Force-HCL.
2	While most international agencies do not consider kidney tumors coincident with α 2u-globulin nephropathy to be a predictor of risk in humans, this view is not universally held. (See: Doi et al., 2007).
3	Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006).
4	See: http://ntp.niehs.nih.gov/go/15209
5	This evidence can include traditional cancer epidemiology studies, data from clinical studies, and/or data derived from the study of tissues or cells from humans exposed to the substance in question that can be useful for evaluating whether a relevant cancer mechanism is operating in people.

[77 FR 17885, March 26, 2012; 78 FR 9313, Feb. 8, 2013]

§1910.1201

RETENTION OF DOT MARKINGS, PLACARDS, AND LABELS (General Industry)

(a) Any employer who receives a package of hazardous material which is required to be marked, labeled or placarded in accordance with the U. S. Department of Transportation's Hazardous Materials Regulations (49 CFR Parts 171 through 180) shall retain those markings, labels and placards on the package until the packaging is sufficiently cleaned of residue and purged of vapors to remove any potential hazards.

(b) Any employer who receives a freight container, rail freight car, motor vehicle, or transport vehicle that is required to be marked or placarded in accordance with the Hazardous Materials Regulations shall retain those markings and placards on the freight container, rail freight car, motor vehicle or transport vehicle until the hazardous materials which require the marking or placarding are sufficiently removed to prevent any potential hazards.

(c) Markings, placards and labels shall be maintained in a manner that ensures that they are readily visible.

(d) For non-bulk packages which will not be reshipped, the provisions of this section are met if a label or other acceptable marking is affixed in accordance with the Hazard Communication Standard (29 CFR 1910.1200).

(e) For the purposes of this section, the term "hazardous material" and any other terms not defined in this section have the same definition as in the Hazardous Materials Regulations (49 CFR Parts 171 through 180).

[59 FR 36695, July 19, 1994]

§1926.61

RETENTION OF DOT MARKINGS, PLACARDS, AND LABELS. (Construction)

Note: The requirements applicable to construction work under this section are identical to those set forth at 1910.1201 of this chapter.

[59 FR 36695, July 19, 1994; 61 FR 31427, June 20, 1996]

§1928.21

APPLICABILITY OF STANDARDS IN 29 CFR PART 1910. (Agriculture)

(a) The following standards in part 1910 of this Chapter shall apply to agricultural operations:

- (1) Temporary labor camps - 1910.142;
- (2) Storage and handling of anhydrous ammonia - 1910.111(a) and (b);
- (3) Logging Operations - 1910.266;
- (4) Slow-moving vehicles - 1910.145.
- (5) Hazard communication - 1910.1200.
- (6) Cadmium - 1910.1027.
- (7) Retention of DOT markings, placards and labels - 1910.1201.

(b) Except to the extent specified in paragraph (a) of this section, the standards contained in Subparts B through T and Subpart Z of part 1910 of this title do not apply to agricultural operations.

(Section 1928.21 contains a collection of information which has been approved by the Office of Management and Budget under OMB Control No. 1218-0072)

[40 FR 18257, Apr. 25, 1975, as amended at 42 FR 38569, July 29, 1977; 52 FR 31886, Aug. 24, 1987; 59 FR 6184, Feb. 9, 1994; 59 FR 36700, July 19, 1994; 59 FR 51748, Oct. 12, 1994; 61 FR 5510, Feb. 13, 1996; 61 FR 9255, March 7, 1996]

To obtain the below posters go to the MIOSHA website: www.michigan.gov/miosha or call or write to the following division:

Department of Licensing and Regulatory Affairs
 Michigan Occupational Safety and Health Administration (MIOSHA)
 Consultation Education and Training Division (CET)
 P.O. Box 30643
 Lansing, Michigan 48909-8143
 (517) 322-1809

MIOSHA/CET #2105 Poster – Safety Data Sheets Location

This Workplace Covered by the Michigan Right To Know Law

Employers must make available for employees in a readily accessible manner, Safety Data Sheets (SDS)* for those hazardous chemicals in their workplace.

Employees cannot be discharged or discriminated against for exercising their rights including the request for information on hazardous chemicals.

Employees must be notified and given direction (by employer posting) for locating Safety Data Sheets and the receipt of new or revised SDS(s).

*When the employer has not provided a SDS, employees may request assistance in obtaining SDS from the:

Michigan Department of Licensing and Regulatory Affairs
 Michigan Occupational Safety & Health Administration
 General Industry Safety & Health Division
 (517) 322-1831
 Construction Safety & Health Division
 (517) 322-1856
www.michigan.gov/miosha
 MIOSHA/CET #2105 (Rev. 01/13)

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 LICENSING AND REGULATORY AFFAIRS
 CUSTOMER DRIVEN. BUSINESS MINDED.

SDS(s) For This Workplace Are Located At

Location(s)

Location(s)

Person(s) responsible for SDS(s)

Phone

LARA is an equal opportunity employer/program.

MIOSHA/CET #2106 Poster - New or Revised Safety Data Sheets

As Required by the Michigan Right To Know Law

TO BE POSTED THROUGHOUT THE WORKPLACE NEXT TO THE SAFETY DATA SHEETS (SDS) LOCATION POSTERS

New or Revised SDS

New or Revised	Receipt Date	Posting Date	Location of New or Revised SDS

LARA
 LICENSING AND REGULATORY AFFAIRS
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Michigan Department of Licensing and Regulatory Affairs
 Michigan Occupational Safety & Health Administration
 Consultation Education & Training Division
 (517) 322-1809

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For further information visit our website at:
www.michigan.gov/miosha



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PO Box 30643
Lansing, Michigan 48909-8143
Ph: 517-284-7740

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Notice of Alleged Occupational Safety and Health Hazards - Instructions/Handling

For the General Public:

The Department of Licensing and Regulatory Affairs has developed this NOTICE in order to promptly and efficiently investigate the nature and extent of the conditions, that you feel are creating a hazard to safety or health or otherwise violate Michigan's Occupational Safety and Health Act Standards. This NOTICE is not intended to constitute the exclusive means by which a complaint may be filed.

Section 28(1) of Michigan's Occupational Safety and Health Act (Act 154, P.A. 1974) describes the procedures by which complaints may be filed and the actions that will be taken by the Department. An employee or employee representative who believes that a violation of a safety or health standard exists that threatens physical harm to an employee, or that an imminent danger exists, may request an inspection by giving written notice of the condition to the department. The notice shall be reduced to writing, and shall set forth with reasonable detail the grounds for the complaint. Upon receipt of a complaint and if the department determines there are reasonable grounds for the complaint, the department shall conduct an inspection. A copy of the complaint shall be provided to the employer or his agent not later than at the time of the inspection. Upon the request of the person giving the notice, his or her name and the names of employees referred to therein shall not appear in the copy or on the record which is published, released, or made available. If the department determines that there are no reasonable grounds to believe that an inspection should be conducted, it shall notify, in writing, the complainant of its determination.

Sections 65(1) and (2) make it unlawful for an employer to discharge or in any manner discriminate against an employee for filing a complaint with the Department or exercising any other rights provided by the act. Any employee who believes that they have been discharged or otherwise discriminated against by a person in violation of this section may file a complaint with the department alleging the discrimination within 30 days after the violation occurs.

INSTRUCTIONS:

Complete the form as accurately as possible. Describe each hazard you think exists in as much detail as you can. If the hazards described in your complaint are not all in the same area, please identify where each hazard can be found at the worksite. If there is any particular evidence that supports your suspicion that a hazard exists (for instance, a recent accident or physical symptoms of employees at your site), include the information in your description. If you need more space than is provided on the form, continue on another sheet of paper and attach.

If your complaint issues are mostly related to construction safety or health mail or fax the completed form to:

- Michigan Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health Administration (MIOSHA)
Construction Safety and Health Division
P.O. Box 30645
Lansing, MI 48909-8145
TELEPHONE: (517) 284-7680
FAX: (517) 284-7685

If your complaint issues are mostly related to general industry safety or health, mail or fax the completed form to:

- Michigan Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health Administration (MIOSHA)
General Industry Safety and Health Division
P.O. Box 30644
Lansing, MI 48909-8144
TELEPHONE: (517) 284-7750
FAX: (517) 284-7755

NOTE: It is unlawful to make any false statement, representation or certification in any document filed pursuant to the Michigan Occupational Safety and Health Act of 1974, as amended. Violations can be punished by a fine of not more than \$10,000, or by imprisonment of not more than six months, or by both (Section 35(7)).



General Industry Safety and Health

Construction Safety and Health

NOTICE OF ALLEGED SAFETY OR HEALTH HAZARDS

Complaint Number: _____

Establishment Name:			
Site Address: (Street, City, State, Zip)	Site Phone:		Site Fax:
Mailing Address: (if different from site)	Mail Phone:		Mail Fax:
Management Official:		Telephone:	
Type of Business:			

HAZARD DESCRIPTION/LOCATION. Briefly describe the hazards you believe exist. Include the approximate number of employees exposed to or threatened by each hazard. Specify the particular building or worksite where the alleged violation exists.

Has this conditions been brought to the attention of:	<input type="checkbox"/> Employer	<input type="checkbox"/> Other government agency (specify)
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Please indicate your desire:	<input type="checkbox"/> I do NOT want my name revealed to the employer.
	<input type="checkbox"/> I want my name revealed to the employer.

The undersigned believes that a violation of an occupational safety or health standard exists which is a job safety or health hazard at the establishment named on this form.	Check ONE box.	
	<input type="checkbox"/> Current employee	<input type="checkbox"/> Federal Safety and Health Committee
	<input type="checkbox"/> Representative of employees	<input type="checkbox"/> Other (specify):
	<input type="checkbox"/> Former employee, last date worked: month: day: year:	

Complainant Name:		Telephone:	
Signature:		Date:	

If you wish to receive a copy of the results of this complaint, please provide your mailing address below.
 Please mail the results to this address (Street, City, State, Zip):

If you are an authorized representative of employees affected by this complaint, please state the name of the organization that you represent and your title.

Organization Name:		Your Title:	
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DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

Filed with the Secretary of State on February 1, 1995 (as amended May 14, 1997) (**as amended May 5, 2015**)

These rules become effective immediately upon filing with the Secretary of State unless adopted under section 33, 44, or 45a(6) of 1969 PA 306.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of licensing and regulatory affairs by sections 16 and 21 of 1974 PA 154, and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4, and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.18602 of the Michigan Administrative Code is amended and R 408.18605 of the Code is added, as follows:

PART 86. ELECTRIC POWER GENERATION, TRANSMISSION, AND DISTRIBUTION

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R 408.18601. Scope.

Rule 8601. These rules establish the work practices to be used during the operation and maintenance of electrical power generation, transmission, and distribution facilities. These rules apply to all of the following:

- (a) Enclosed spaces.
- (b) Hazardous energy control.
- (c) Working near energized parts.
- (d) Grounding for employee protection.
- (e) Underground and overhead installations.
- (f) Line clearance tree trimming.
- (g) Substations and generating plants.
- (h) Other conditions and equipment unique to the generation, transmission and distribution of electric energy.

R 408.18602 Adoption of federal standard.

Rule 8602. (1) The provisions of 29 C.F.R. §1910.269, "Electric Power Generation, Transmission, and Distribution" and appendices, except as amended in this rule, are adopted by reference in these rules.

(2) A reference to C.F.R. §1910.5 "Applicability of standards," means Michigan Occupational Safety and Health Act (MIOSHA) 1974 PA 154, MCL 408.1001 to 408.1094.

(3) A reference to C.F.R. §1910.12 "Construction work," means Michigan Occupational Safety and Health Act (MIOSHA) 1974 PA 154, MCL 408.1001 to 408.1094.

(4) A reference to C.F.R. §1910.25 "Portable wood ladders," means General Industry Safety Standard Part 4 "Portable Ladders," as referenced in R 408.18605.

(5) A reference to C.F.R. §1910.26 "Portable metal ladders," means General Industry Safety Standard Part 4 "Portable Ladders," as referenced in R 408.18605.

(6) A reference to C.F.R. §1910.67 "Vehicle-mounted elevating and rotating work platforms," means General Industry Safety Standard Part 58 "Aerial Work Platforms," as referenced in R 408.18605.

(7) A reference to C.F.R. §1910.97 "Nonionizing radiation," means Occupational Health Standard Part 382 "Nonionizing Radiation," as referenced in R 408.18605.

(8) A reference to C.F.R. §1910.135 "Head protection," means General Industry Safety Standard Part 33 "Personal Protective Equipment," as referenced in R 408.18605.

(9) A reference to C.F.R. §1910.141 "Sanitation," means Occupational Health Standard Part 474 "Sanitation," as referenced in R 408.18605.

(10) A reference to C.F.R. §1910.145 "Specifications for accident prevention signs and tags," means General Industry Safety Standard Part 37 "Accident Prevention Signs and Tags," as referenced in R 408.18605.

(11) A reference to C.F.R. §1910.146 "Permit-required confined space," means General Industry Safety Standard Part 90 "Permit-Required Confined Spaces," as referenced in R 408.18605.

(12) A reference to C.F.R. §1910.147 "Control of hazardous energy - lockout," means General Industry Safety Standard Part 85 "The Control of Hazardous Energy Sources," as referenced in R 408.18605.

(13) A reference to C.F.R. §1910.151 "Medical services and first aid," means Occupational Health Standard Part 472 "Medical Services and First Aid," as referenced in R 408.18605.

(14) A reference to C.F.R. §1910.243 "Guarding of portable powered tools," means General Industry Safety Standard Part 38 "Hand and Portable Powered Tools," as referenced in R 408.18605.

(15) A reference to C.F.R. §1910.266 "Logging operations," means General Industry Safety Standard Part 51 "Logging," as referenced in R 408.18605.

(16) A reference to C.F.R. §1910.302 "Electric utilization systems," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(17) A reference to C.F.R. §1910.303 "General," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(18) A reference to C.F.R. §1910.304 "Wiring design and protection," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(19) A reference to C.F.R. §1910.305 "Wiring methods, components, and equipment for general use," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(20) A reference to C.F.R. §1910.306 "Specific purpose equipment and installations," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(21) A reference to C.F.R. §1910.307 "Hazardous (classified) locations," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(22) A reference to C.F.R. §1910.308 "Special systems," means General Industry Safety Standard Part 39 "Design Safety Standards for Electrical Systems," as referenced in R 408.18605.

(23) A reference to C.F.R. §1910.331 "Scope," means General Industry Safety Standard Part 40 "Electrical Safety-Related Work Practices," as referenced in R 408.18605.

(24) A reference to C.F.R. §1910.332 "Training," means General Industry Safety Standard Part 40 "Electrical Safety-Related Work Practices," as referenced in R 408.18605.

(25) A reference to C.F.R. §1910.333 "Selection and use of work practices," means General Industry Safety Standard Part 40 "Electrical Safety-Related Work Practices," as referenced in R 408.18605.

(26) A reference to C.F.R. §1910.334 "Use of equipment," means General Industry Safety Standard Part 40 "Electrical Safety-Related Work Practices," as referenced in R 408.18605.

(27) A reference to C.F.R. §1910.335 “Safeguards for personnel protection,” means General Industry Safety Standard Part 40 “Electrical Safety-Related Work Practices,” as referenced in R 408.18605.

(28) A reference to C.F.R. §1910.1200 “Hazard Communication,” means General Industry Safety Standard Part 92 “Hazard Communication,” and Occupational Health Standard Part 430 “Hazard Communication,” as referenced in R 408.18605.

(29) A reference to C.F.R. Part 1910 Subpart D, “Walking – Working Surfaces,” means all of the following MIOSHA standards:

(a) General Industry Safety Standard Part 2 “Floor and Wall Openings, Stairways, and Skylights,” as referenced in R 408.18605.

(b) General Industry Safety Standard Part 3 “Fixed Ladders,” as referenced in R 408.18605.

(c) General Industry Safety Standard Part 4 “Portable Ladders,” as referenced in R 408.18605.

(d) General Industry Safety Standard Part 5 “Scaffolding,” as referenced in R 408.18605.

(30) A reference to C.F.R. Part 1910 Subpart I, “Personal Protective Equipment,” means General Industry Safety Standard Part 33 “Personal Protective Equipment,” as referenced in R 408.18605.

(31) A reference to C.F.R. Part 1910 Subpart G, “Occupational Health and Environmental Control,” means all of the following MIOSHA standards:

(a) Occupational Health Standard Part 380 “Occupational Noise Exposure in General Industry,” as referenced in R 408.18605.

(b) Occupational Health Standard Part 382 “Nonionizing Radiation,” as referenced in R 408.18605.

(c) Occupational Health Standard Part 520 “Ventilation Control,” as referenced in R 408.18605.

(32) A reference to C.F.R. Part 1910 Subpart N, “Materials Handling and Storage,” means all of the following MIOSHA standards:

(a) General Industry Safety Standard Part 1 “General Provisions,” as referenced in R 408.18605.

(b) General Industry Safety Standard Part 13 “Derricks,” as referenced in R 408.18605.

(c) General Industry Safety Standard Part 18 “Overhead and Gantry Cranes,” as referenced in R 408.18605.

(d) General Industry Safety Standard Part 19 “Crawler, Locomotive and Truck Cranes,” as referenced in R 408.18605.

(e) General Industry Safety Standard Part 20 “Underhung Cranes and Monorail Systems,” as referenced in R 408.18605.

(f) General Industry Safety Standard Part 21 “Powered Industrial Trucks,” as referenced in R 408.18605.

(g) General Industry Safety Standard Part 49 “Slings,” as referenced in R 408.18605.

(h) General Industry Safety Standard Part 59 “Helicopters,” as referenced in R 408.18605.

(i) General Industry Safety Standard Part 72 “Automotive Service Operations,” as referenced in R 408.18605.

(33) A reference to C.F.R. Part 1910 Subpart S, “Electrical,” means both of the following MIOSHA standards:

(a) General Industry Safety Standard Part 39 “Design Safety Standards for Electrical Systems,” as referenced in R 408.18605.

(b) General Industry Safety Standard Part 40 “Electrical Safety-Related Work Practices,” as referenced in R 408.18605.

(34) A reference to C.F.R. Part 1910 Subpart Z “Toxic and Hazardous Substances,” means Occupational Health Standard Part 301 “Air Contaminants for General Industry,” as referenced in R 408.18605.

(35) A reference to C.F.R. §1926.54 “Nonionizing radiation,” means Occupational Health Standard Part 681 “Radiation of Construction: Ionizing and Nonionizing,” as referenced in R 408.18605.

(36) A reference to C.F.R. §1926.100 “Head protection,” means Construction Safety Standard Part 6 “Personal Protective Equipment,” as referenced in R 408.18605.

(37) A reference to C.F.R. §1926.200 “Accident prevention signs and tags,” means Construction Safety Standard Part 22 “Signals, Signs, Tags, and Barricades,” as referenced in R 408.18605.

(38) A reference to C.F.R. §1926.502 “Fall protection systems criteria and practices,” means Construction Safety Standard Part 45 “Fall Protection,” as referenced in R 408.18605.

(39) A reference to C.F.R. §1926.960 “Definitions applicable to Subpart V Power Transmission and Distribution,” means Construction Safety Standard Part 16 “Power Transmission and Distribution,” as referenced in R 408.18605.

(40) A reference to C.F.R. Part 1926 Subpart M “Fall Protection,” means Construction Safety Standard Part 45 “Fall Protection,” as referenced in R 408.18605.

(41) A reference to C.F.R. Part 1926 Subpart P “Excavations,” means Construction Safety Standard Part 9 “Excavation, Trenching, and Shoring,” as referenced in R 408.18605.

(42) A reference to C.F.R. Part 1926 Subpart W “Rollover Protective Structures; Overhead Protection,” means Construction Safety Standard Part 13 “Mobile Equipment,” as referenced in R 408.18605.

R 408.18605 Adopted and referenced standards.

Rule 8605. (1) The provisions of 29 C.F.R. §1910.269 “Electric Power Generation, Transmission, and Distribution” as revised April 11, 2014, are adopted by reference in these rules, except as noted in R 408.18602. This standard is available from the United States Department of Labor, Occupational Safety and Health Administration website: www.osha.gov, at no charge as of the time of adoption of these rules.

(2) The standard adopted in these rules is available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 7150 Harris Drive, Lansing, Michigan, 48909-8143.

(3) Copies of the standard adopted in these rules may be obtained from the publisher or may be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

(4) The Michigan occupational safety and health standards (MIOSHA) referenced in these rules are available at up to 5 copies of these standards at no charge from the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 7150 Harris Drive, P.O. Box 30643, Lansing, MI, 48909-8143 or via the internet at website: www.michigan.gov/miohastandards. For quantities greater than 5, the cost, at the time of adoption of these rules, is 4 cents per page.

(5) The following MIOSHA construction safety standards (CS) are referenced in these rules:

(a) CS Part 6 “Personal Protective Equipment,” R 408.40601 to R 408.40641.

(b) CS Part 9 “Excavation, Trenching, and Shoring,” R 408.40901 to R 408.40953.

(c) CS Part 13 “Mobile Equipment,” R 408.41301.

(d) CS Part 16 “Power Transmission and Distribution,” R 408.41601 to R 408.41658.

(e) CS Part 22 “Signals, Signs, Tags, and Barricades,” R 408.42201 to R 408.42243.

(f) CS Part 45 “Fall Protection,” R 408.44501 to R 408.44502.

(6) The following MIOSHA general industry safety standards (GI) are referenced in these rules:

(a) GI Part 1 “General Provisions,” R 408.10001 to R 408.10098.

(b) GI Part 2 “Floor and Wall Openings Stairways and Skylights,” R 408.10201 to R 408.10241.

(c) GI Part 3 “Fixed Ladders,” R 408.10301 to R 408.10372.

(d) GI Part 4 “Portable Ladders,” R 408.10401 to R 408.10456.

(e) GI Part 5 “Scaffolding,” R 408.10501 to R 408.10592.

(f) GI Part 13 “Derricks,” R 408.11301.

(g) GI Part 18 “Overhead and Gantry Cranes,” R 408.11801 to R 408.11875.

(h) GI Part 19 “Crawler, Locomotive and Truck Cranes,” R 408.11901 to R 408.11972.

(i) GI Part 20 “Underhung Cranes and Monorail Systems,” R 408.12001 to R 408.12045.

(j) GI Part 21 “Powered Industrial Trucks,” R 408.12101 to R 408.12193.

(k) GI Part 33 “Personal Protective Equipment,” R 408.13301 to R 408.13398.

(l) GI Part 37 “Accident Prevention Signs and Tags,” R 408.13701 to R 408.13736.

(m) GI Part 38 “Hand and Portable Powered Tools,” R 408.13801 to R 408.13882.

(n) GI Part 39 “Design Safety Standards for Electrical Systems,” R 408.13901 to R 408.13902.

(o) GI Part 40 “Electrical Safety-Related Work Practices,” R 408.14001 to R 408.14009.

(p) GI Part 49 “Slings,” R 408.14901 to R 408.14965.

(q) GI Part 51 “Logging,” R 408.15101 to R 408.15181.

(r) GI Part 58 “Aerial Work Platforms,” R 408.15801 to R 408.15842.

(s) GI Part 59 “Helicopters,” R 408.15901 to R 408.15931.

(t) GI Part 72 “Automotive Service Operations,” R 408.17201 to R 408.17253.

(u) GI Part 85 “The Control of Hazardous Energy Sources,” R 408.18501 to R 408.18599.

(v) GI Part 90 “Permit-Required Confined Spaces,” R 408.19001 to R 408.19002.

(w) GI Part 92 “Hazard Communication,” R 408.19201 to R 408.19204.

(7) The following MIOSHA occupational health standards (OH) are referenced in these rules:

(a) OH Part 301 “Air Contaminants for General Industry,” R 325.51101 to R 325.51108.

(b) OH Part 380 “Occupational Noise Exposure in General Industry,” R 325.60101 to R 325.60128.

(c) OH Part 382 “Nonionizing Radiation,” R 325.60701 to R 325.60704.

(d) OH Part 430 “Hazard Communication,” R 325.77001 to R 325.77004.

(e) OH Part 472 “Medical Services and First Aid,” R 325.47201.

(f) OH Part 474 “Sanitation,” R 325.47401 to R 325.47427.

(g) OH Part 520 “Ventilation Control,” R 325.52001 to R 325.52012.

(h) OH Part 681 “Radiation of Construction: Ionizing and Nonionizing,” R 325.68101 to R 325.68102.

(8) The appendices to these rules are informational only and are not intended to create any additional obligations or requirements not otherwise imposed by these rules or to detract from any established obligations or requirements.

1910.269 ELECTRIC POWER GENERATION, TRANSMISSION, AND DISTRIBUTION

1910.269(a) General

1910.269(a)(1) Application.

1910.269(a)(1)(i) This section covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to:

1910.269(a)(1)(i)(A) Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering that are accessible only to qualified employees;

Note to paragraph (a)(1)(i)(A): The types of installations covered by this paragraph include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. Subpart S of this part covers supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only. (See paragraph (a)(1)(i)(B) of this section.)

1910.269(a)(1)(i)(B) Other installations at an electric power generating station, as follows:

1910.269(a)(1)(i)(B)(1) Fuel and ash handling and processing installations, such as coal conveyors,

1910.269(a)(1)(i)(B)(2) Water and steam installations, such as penstocks, pipelines, and tanks, providing a source of energy for electric generators, and

1910.269(a)(1)(i)(B)(3) Chlorine and hydrogen systems;

1910.269(a)(1)(i)(C) Test sites where employees perform electrical testing involving temporary measurements associated with electric power generation, transmission, and distribution in laboratories, in the field, in substations, and on lines, as opposed to metering, relaying, and routine line work;

1910.269(a)(1)(i)(D) Work on, or directly associated with, the installations covered in paragraphs (a)(1)(i)(A) through (a)(1)(i)(C) of this section; and

1910.269(a)(1)(i)(E) Line-clearance tree-trimming operations, as follows:

1910.269(a)(1)(i)(E)(1) Entire § 1910.269 of this part, except paragraph (r)(1) of this section, applies to line-clearance tree-trimming operations performed by qualified employees (those who are knowledgeable in the construction and operation of the electric power generation, transmission, or distribution equipment involved, along with the associated hazards).

1910.269(a)(1)(i)(E)(2) Paragraphs (a)(2), (a)(3), (b), (c), (g), (k), (p), and (r) of this section apply to line-clearance tree-trimming operations performed by line-clearance tree trimmers who are not qualified employees.

1910.269(a)(1)(ii) Notwithstanding paragraph (a)(1)(i) of this section, § 1910.269 of this part does not apply:

1910.269(a)(1)(ii)(A) To construction work, as defined in § 1910.12 of this part, except for line-clearance tree-trimming operations and work involving electric power generation installations as specified in § 1926.950(a)(3) of this chapter; or

1910.269(a)(1)(ii)(B) To electrical installations, electrical safety-related work practices, or electrical maintenance considerations covered by Subpart S of this part.

Note 1 to paragraph (a)(1)(ii)(B): The Occupational Safety and Health Administration considers work practices conforming to §§ 1910.332 through 1910.335 as complying with the electrical safety-related work-practice requirements of § 1910.269 identified in Table 1 of Appendix A-2 to this section, provided that employers are performing the work on a generation or distribution installation meeting §§ 1910.303 through 1910.308. This table also identifies provisions in § 1910.269 that apply to work by qualified persons directly on, or associated with, installations of electric power generation, transmission, and distribution lines or equipment, regardless of compliance with §§ 1910.332 through 1910.335.

Note 2 to paragraph (a)(1)(ii)(B): The Occupational Safety and Health Administration considers work practices performed by qualified persons and conforming to § 1910.269 as complying with §§ 1910.333(c) and 1910.335.

1910.269(a)(1)(iii) This section applies in addition to all other applicable standards contained in this Part 1910. Employers covered under this section are not exempt from complying with other applicable provisions in Part 1910 by the operation of § 1910.5(c). Specific references in this section to other sections of Part 1910 are for emphasis only.

1910.269(a)(2) Training.

1910.269(a)(2)(i) All employees performing work covered by this section shall be trained as follows:

1910.269(a)(2)(i)(A) Each employee shall be trained in, and familiar with, the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to his or her job assignments.

1910.269(a)(2)(i)(B) Each employee shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole-top and manhole rescue), that are not specifically addressed by this section but that are related to his or her work and are necessary for his or her safety.

1910.269(a)(2)(i)(C) The degree of training shall be determined by the risk to the employee for the hazard involved.

1910.269(a)(2)(ii) Each qualified employee shall also be trained and competent in:

1910.269(a)(2)(ii)(A) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,

1910.269(a)(2)(ii)(B) The skills and techniques necessary to determine the nominal voltage of exposed live parts,

- 1910.269(a)(2)(ii)(C) The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed and the skills and techniques necessary to maintain those distances,
- 1910.269(a)(2)(ii)(D) The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment, and
- 1910.269(a)(2)(ii)(E) The recognition of electrical hazards to which the employee may be exposed and the skills and techniques necessary to control or avoid these hazards.
- Note to paragraph (a)(2)(ii): For the purposes of this section, a person must have the training required by paragraph (a)(2)(ii) of this section to be considered a qualified person.
- 1910.269(a)(2)(iii) Each line-clearance tree trimmer who is not a qualified employee shall also be trained and competent in:
- 1910.269(a)(2)(iii)(A) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,
- 1910.269(a)(2)(iii)(B) The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
- 1910.269(a)(2)(iii)(C) The minimum approach distances specified in this section corresponding to the voltages to which the employee will be exposed and the skills and techniques necessary to maintain those distances.
- 1910.269(a)(2)(iv) The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that each employee is complying with the safety-related work practices required by this section.
- 1910.269(a)(2)(v) An employee shall receive additional training (or retraining) under any of the following conditions:
- 1910.269(a)(2)(v)(A) If the supervision or annual inspections required by paragraph (a)(2)(iv) of this section indicate that the employee is not complying with the safety-related work practices required by this section, or
- 1910.269(a)(2)(v)(B) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or
- 1910.269(a)(2)(v)(C) If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.
- Note to paragraph (a)(2)(v)(C): The Occupational Safety and Health Administration considers tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.
- 1910.269(a)(2)(vi) The training required by paragraph (a)(2) of this section shall be of the classroom or on-the-job type.
- 1910.269(a)(2)(vii) The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.
- 1910.269(a)(2)(viii) The employer shall ensure that each employee has demonstrated proficiency in the work practices involved before that employee is considered as having completed the training required by paragraph (a)(2) of this section.
- Note 1 to paragraph (a)(2)(viii): Though they are not required by this paragraph, employment records that indicate that an employee has successfully completed the required training are one way of keeping track of when an employee has demonstrated proficiency.
- Note 2 to paragraph (a)(2)(viii): For an employee with previous training, an employer may determine that that employee has demonstrated the proficiency required by this paragraph using the following process:
- (1) Confirm that the employee has the training required by paragraph (a)(2) of this section,
 - (2) Use an examination or interview to make an initial determination that the employee understands the relevant safety-related work practices before he or she performs any work covered by this section, and
 - (3) Supervise the employee closely until that employee has demonstrated proficiency as required by this paragraph.
- 1910.269(a)(3) Information transfer.**
- 1910.269(a)(3)(i) Before work begins, the host employer shall inform contract employers of:
- 1910.269(a)(3)(i)(A) The characteristics of the host employer's installation that are related to the safety of the work to be performed and are listed in paragraphs (a)(4)(i) through (a)(4)(v) of this section;
- Note to paragraph (a)(3)(i)(A): This paragraph requires the host employer to obtain information listed in paragraphs (a)(4)(i) through (a)(4)(v) of this section if it does not have this information in existing records.
- 1910.269(a)(3)(i)(B) Conditions that are related to the safety of the work to be performed, that are listed in paragraphs (a)(4)(vi) through (a)(4)(viii) of this section, and that are known to the host employer;
- Note to paragraph (a)(3)(i)(B): For the purposes of this paragraph, the host employer need only provide information to contract employers that the host employer can obtain from its existing records through the exercise of reasonable diligence. This paragraph does not require the host employer to make inspections of worksite conditions to obtain this information.
- 1910.269(a)(3)(i)(C) Information about the design and operation of the host employer's installation that the contract employer needs to make the assessments required by this section; and

Note to paragraph (a)(3)(i)(C): This paragraph requires the host employer to obtain information about the design and operation of its installation that contract employers need to make required assessments if it does not have this information in existing records.

1910.269(a)(3)(i)(D) Any other information about the design and operation of the host employer's installation that is known by the host employer, that the contract employer requests, and that is related to the protection of the contract employer's employees.

Note to paragraph (a)(3)(i)(D): For the purposes of this paragraph, the host employer need only provide information to contract employers that the host employer can obtain from its existing records through the exercise of reasonable diligence. This paragraph does not require the host employer to make inspections of worksite conditions to obtain this information.

1910.269(a)(3)(ii) Contract employers shall comply with the following requirements:

1910.269(a)(3)(ii)(A) The contract employer shall ensure that each of its employees is instructed in the hazardous conditions relevant to the employee's work that the contract employer is aware of as a result of information communicated to the contract employer by the host employer under paragraph (a)(3)(i) of this section.

1910.269(a)(3)(ii)(B) Before work begins, the contract employer shall advise the host employer of any unique hazardous conditions presented by the contract employer's work.

1910.269(a)(3)(ii)(C) The contract employer shall advise the host employer of any unanticipated hazardous conditions found during the contract employer's work that the host employer did not mention under paragraph (a)(3)(i) of this section. The contract employer shall provide this information to the host employer within 2 working days after discovering the hazardous condition.

1910.269(a)(3)(iii) The contract employer and the host employer shall coordinate their work rules and procedures so that each employee of the contract employer and the host employer is protected as required by this section.

1910.269(a)(4) Existing characteristics and conditions.

Existing characteristics and conditions of electric lines and equipment that are related to the safety of the work to be performed shall be determined before work on or near the lines or equipment is started. Such characteristics and conditions include, but are not limited to:

1910.269(a)(4)(i) The nominal voltages of lines and equipment,

1910.269(a)(4)(ii) The maximum switching-transient voltages,

1910.269(a)(4)(iii) The presence of hazardous induced voltages,

1910.269(a)(4)(iv) The presence of protective grounds and equipment grounding conductors,

1910.269(a)(4)(v) The locations of circuits and equipment, including electric supply lines, communication lines, and fire-protective signaling circuits,

1910.269(a)(4)(vi) The condition of protective grounds and equipment grounding conductors,

1910.269(a)(4)(vii) The condition of poles, and

1910.269(a)(4)(viii) Environmental conditions relating to safety.

1910.269(b) Medical services and first aid.

The employer shall provide medical services and first aid as required in § 1910.151. In addition to the requirements of § 1910.151, the following requirements also apply:

1910.269(b)(1) First-aid training.

When employees are performing work on, or associated with, exposed lines or equipment energized at 50 volts or more, persons with first-aid training shall be available as follows:

1910.269(b)(1)(i) For field work involving two or more employees at a work location, at least two trained persons shall be available. However, for line-clearance tree trimming operations performed by line-clearance tree trimmers who are not qualified employees, only one trained person need be available if all new employees are trained in first aid within 3 months of their hiring dates.

1910.269(b)(1)(ii) For fixed work locations such as substations, the number of trained persons available shall be sufficient to ensure that each employee exposed to electric shock can be reached within 4 minutes by a trained person. However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), each employee at the work location shall be a trained employee.

1910.269(b)(2) First-aid supplies.

First-aid supplies required by § 1910.151(b) shall be placed in weatherproof containers if the supplies could be exposed to the weather.

1910.269(b)(3) First-aid kits.

The employer shall maintain each first-aid kit, shall ensure that it is readily available for use, and shall inspect it frequently enough to ensure that expended items are replaced. The employer also shall inspect each first aid kit at least once per year.

1910.269(c) Job briefing.

1910.269(c)(1) Before each job.

1910.269(c)(1)(i) In assigning an employee or a group of employees to perform a job, the employer shall provide the employee in charge of the job with all available information that relates to the determination of existing characteristics and conditions required by paragraph (a)(4) of this section.

1910.269(c)(1)(ii) The employer shall ensure that the employee in charge conducts a job briefing that meets paragraphs (c)(2), (c)(3), and (c)(4) of this section with the employees involved before they start each job.

1910.269(c)(2) Subjects to be covered.

The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy-source controls, and personal protective equipment requirements.

1910.269(c)(3) Number of briefings.

1910.269(c)(3)(i) If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift.

1910.269(c)(3)(ii) Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

1910.269(c)(4) Extent of briefing.

1910.269(c)(4)(i) A brief discussion is satisfactory if the work involved is routine and if the employees, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job.

1910.269(c)(4)(ii) A more extensive discussion shall be conducted:

1910.269(c)(4)(ii)(A) If the work is complicated or particularly hazardous, or

1910.269(c)(4)(ii)(B) If the employee cannot be expected to recognize and avoid the hazards involved in the job.

Note to paragraph (c)(4): The briefing must address all the subjects listed in paragraph (c)(2) of this section.

1910.269(c)(5) Working alone.

An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

1910.269(d) Hazardous energy control (lockout/tagout) procedures.

1910.269(d)(1) Application.

The provisions of paragraph (d) of this section apply to the use of lockout/tagout procedures for the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. Locking and tagging procedures for the deenergizing of electric energy sources which are used exclusively for purposes of transmission and distribution are addressed by paragraph (m) of this section.

Note to paragraph (d)(1): Installations in electric power generation facilities that are not an integral part of, or inextricably commingled with, power generation processes or equipment are covered under § 1910.147 and Subpart S of this part.

1910.269(d)(2) General.

1910.269(d)(2)(i) The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

1910.269(d)(2)(ii) The employer's energy control program under paragraph (d)(2) of this section shall meet the following requirements:

1910.269(d)(2)(ii)(A) If an energy isolating device is not capable of being locked out, the employer's program shall use a tagout system.

1910.269(d)(2)(ii)(B) If an energy isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:

1910.269(d)(2)(ii)(B)(1) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.

1910.269(d)(2)(ii)(B)(2) In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

- 1910.269(d)(2)(ii)(C) After November 1, 1994, whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.
- 1910.269(d)(2)(iii) Procedures shall be developed, documented, and used for the control of potentially hazardous energy covered by paragraph (d) of this section.
- 1910.269(d)(2)(iv) The procedure shall clearly and specifically outline the scope, purpose, responsibility, authorization, rules, and techniques to be applied to the control of hazardous energy, and the measures to enforce compliance including, but not limited to, the following:
- 1910.269(d)(2)(iv)(A) A specific statement of the intended use of this procedure;
- 1910.269(d)(2)(iv)(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;
- 1910.269(d)(2)(iv)(C) Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices and the responsibility for them; and
- 1910.269(d)(2)(iv)(D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.
- 1910.269(d)(2)(v) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the provisions of paragraph (d) of this section are being followed.
- 1910.269(d)(2)(v)(A) The periodic inspection shall be performed by an authorized employee who is not using the energy control procedure being inspected.
- 1910.269(d)(2)(v)(B) The periodic inspection shall be designed to identify and correct any deviations or inadequacies.
- 1910.269(d)(2)(v)(C) If lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.
- 1910.269(d)(2)(v)(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (d)(2)(vii) of this section.
- 1910.269(d)(2)(v)(E) The employer shall certify that the inspections required by paragraph (d)(2)(v) of this section have been accomplished. The certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing the inspection.
- Note to paragraph (d)(2)(v)(E): If normal work schedule and operation records demonstrate adequate inspection activity and contain the required information, no additional certification is required.
- 1910.269(d)(2)(vi) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are acquired by employees. The training shall include the following:
- 1910.269(d)(2)(vi)(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of energy available in the workplace, and in the methods and means necessary for energy isolation and control.
- 1910.269(d)(2)(vi)(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.
- 1910.269(d)(2)(vi)(C) All other employees whose work operations are or may be in an area where energy control procedures may be used shall be instructed about the procedures and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.
- 1910.269(d)(2)(vii) When tagout systems are used, employees shall also be trained in the following limitations of tags:
- 1910.269(d)(2)(vii)(A) Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.
- 1910.269(d)(2)(vii)(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- 1910.269(d)(2)(vii)(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
- 1910.269(d)(2)(vii)(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
- 1910.269(d)(2)(vii)(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- 1910.269(d)(2)(vii)(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.
- 1910.269(d)(2)(viii) Retraining shall be provided by the employer as follows:

- 1910.269(d)(2)(viii)(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment, or processes that present a new hazard or whenever there is a change in the energy control procedures.
- 1910.269(d)(2)(viii)(B) Retraining shall also be conducted whenever a periodic inspection under paragraph (d)(2)(v) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in an employee's knowledge or use of the energy control procedures.
- 1910.269(d)(2)(viii)(C) The retraining shall reestablish employee proficiency and shall introduce new or revised control methods and procedures, as necessary.
- 1910.269(d)(2)(ix) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

1910.269(d)(3) Protective materials and hardware.

- 1910.269(d)(3)(i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing, or blocking of machines or equipment from energy sources.
- 1910.269(d)(3)(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only devices used for controlling energy; may not be used for other purposes; and shall meet the following requirements:
- 1910.269(d)(3)(ii)(A) Lockout devices and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected
- 1910.269(d)(3)(ii)(A)(1) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.
- 1910.269(d)(3)(ii)(A)(2) Tagout devices shall be so constructed as not to deteriorate when used in corrosive environments.
- 1910.269(d)(3)(ii)(B) Lockout devices and tagout devices shall be standardized within the facility in at least one of the following criteria: color, shape, size. Additionally, in the case of tagout devices, print and format shall be standardized.
- 1910.269(d)(3)(ii)(C) Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or metal cutting tools.
- 1910.269(d)(3)(ii)(D) Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.
- 1910.269(d)(3)(ii)(E) Each lockout device or tagout device shall include provisions for the identification of the employee applying the device.
- 1910.269(d)(3)(ii)(F) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Note to paragraph (d)(3)(ii)(F): For specific provisions covering accident prevention tags, see § 1910.145.

1910.269(d)(4) Energy isolation.

Lockout and tagout device application and removal may only be performed by the authorized employees who are performing the servicing or maintenance.

1910.269(d)(5) Notification.

Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout or tagout devices. Notification shall be given before the controls are applied and after they are removed from the machine or equipment.

Note to paragraph (d)(5): See also paragraph (d)(7) of this section, which requires that the second notification take place before the machine or equipment is reenergized.

1910.269(d)(6) Lockout/tagout application.

The established procedures for the application of energy control (the lockout or tagout procedures) shall include the following elements and actions, and these procedures shall be performed in the following sequence:

- 1910.269(d)(6)(i) Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.
- 1910.269(d)(6)(ii) The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown shall be used to avoid any additional or increased hazards to employees as a result of the equipment stoppage.
- 1910.269(d)(6)(iii) All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from energy sources.
- 1910.269(d)(6)(iv) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

- 1910.269(d)(6)(iv)(A) Lockout devices shall be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position.
- 1910.269(d)(6)(iv)(B) Tagout devices shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.
- 1910.269(d)(6)(iv)(B)(1) Where tagout devices are used with energy isolating devices designed with the capability of being locked out, the tag attachment shall be fastened at the same point at which the lock would have been attached.
- 1910.269(d)(6)(iv)(B)(2) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.
- 1910.269(d)(6)(v) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe.
- 1910.269(d)(6)(vi) If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed or until the possibility of such accumulation no longer exists.
- 1910.269(d)(6)(vii) Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergizing of the machine or equipment have been accomplished. If normally energized parts will be exposed to contact by an employee while the machine or equipment is deenergized, a test shall be performed to ensure that these parts are deenergized.

1910.269(d)(7) Release from lockout/tagout.

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employees to ensure the following:

- 1910.269(d)(7)(i) The work area shall be inspected to ensure that nonessential items have been removed and that machine or equipment components are operationally intact.
- 1910.269(d)(7)(ii) The work area shall be checked to ensure that all employees have been safely positioned or removed.
- 1910.269(d)(7)(iii) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout devices have been removed.
- 1910.269(d)(7)(iv) Each lockout or tagout device shall be removed from each energy isolating device by the authorized employee who applied the lockout or tagout device. However, if that employee is not available to remove it, the device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides a degree of safety equivalent to that provided by the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:
 - 1910.269(d)(7)(iv)(A) Verification by the employer that the authorized employee who applied the device is not at the facility;
 - 1910.269(d)(7)(iv)(B) Making all reasonable efforts to contact the authorized employee to inform him or her that his or her lockout or tagout device has been removed; and
 - 1910.269(d)(7)(iv)(C) Ensuring that the authorized employee has this knowledge before he or she resumes work at that facility.

1910.269(d)(8) Additional requirements.

- 1910.269(d)(8)(i) If the lockout or tagout devices must be temporarily removed from energy isolating devices and the machine or equipment must be energized to test or position the machine, equipment, or component thereof, the following sequence of actions shall be followed:
 - 1910.269(d)(8)(i)(A) Clear the machine or equipment of tools and materials in accordance with paragraph (d)(7)(i) of this section;
 - 1910.269(d)(8)(i)(B) Remove employees from the machine or equipment area in accordance with paragraphs (d)(7)(ii) and (d)(7)(iii) of this section;
 - 1910.269(d)(8)(i)(C) Remove the lockout or tagout devices as specified in paragraph (d)(7)(iv) of this section;
 - 1910.269(d)(8)(i)(D) Energize and proceed with the testing or positioning; and
 - 1910.269(d)(8)(i)(E) Deenergize all systems and reapply energy control measures in accordance with paragraph (d)(6) of this section to continue the servicing or maintenance.
- 1910.269(d)(8)(ii) When servicing or maintenance is performed by a crew, craft, department, or other group, they shall use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Group lockout or tagout devices shall be used in accordance with the procedures required by paragraphs (d)(2)(iii) and (d)(2)(iv) of this section including, but not limited to, the following specific requirements:
 - 1910.269(d)(8)(ii)(A) Primary responsibility shall be vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

- 1910.269(d)(8)(ii)(B) Provision shall be made for the authorized employee to ascertain the exposure status of all individual group members with regard to the lockout or tagout of the machine or equipment;
 - 1910.269(d)(8)(ii)(C) When more than one crew, craft, department, or other group is involved, assignment of overall job-associated lockout or tagout control responsibility shall be given to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and
 - 1910.269(d)(8)(ii)(D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.
 - 1910.269(d)(8)(iii) Procedures shall be used during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout device protection between off-going and on-coming employees, to minimize their exposure to hazards from the unexpected energizing or start-up of the machine or equipment or from the release of stored energy.
 - 1910.269(d)(8)(iv) Whenever outside servicing personnel are to be engaged in activities covered by paragraph (d) of this section, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures, and each employer shall ensure that his or her personnel understand and comply with restrictions and prohibitions of the energy control procedures being used.
 - 1910.269(d)(8)(v) If energy isolating devices are installed in a central location and are under the exclusive control of a system operator, the following requirements apply:
 - 1910.269(d)(8)(v)(A) The employer shall use a procedure that affords employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.
 - 1910.269(d)(8)(v)(B) The system operator shall place and remove lockout and tagout devices in place of the authorized employee under paragraphs (d)(4), (d)(6)(iv), and (d)(7)(iv) of this section.
 - 1910.269(d)(8)(v)(C) Provisions shall be made to identify the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an authorized employee requesting removal or transfer of a lockout or tagout device is the one responsible for it before the device is removed or transferred.
- Note to paragraph (d): Lockout and tagging procedures that comply with paragraphs (c) through (f) of § 1910.147 will also be deemed to comply with paragraph (d) of this section if the procedures address the hazards covered by paragraph (d) of this section.

1910.269(e) Enclosed spaces.

This paragraph covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if the employer makes a determination that the ventilation system is operating to protect employees before they enter the space. This paragraph applies to routine entry into enclosed spaces in lieu of the permit space entry requirements contained in paragraphs (d) through (k) of § 1910.146. If, after the employer takes the precautions given in paragraphs (e) and (t) of this section, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with an entrant's escape from the space, then entry into the enclosed space shall meet the permit-space entry requirements of paragraphs (d) through (k) of § 1910.146.

- 1910.269(e)(1) Safe work practices. The employer shall ensure the use of safe work practices for entry into, and work in, enclosed spaces and for rescue of employees from such spaces.
- 1910.269(e)(2) Training. Each employee who enters an enclosed space or who serves as an attendant shall be trained in the hazards of enclosed-space entry, in enclosed-space entry procedures, and in enclosed-space rescue procedures.
- 1910.269(e)(3) Rescue equipment. Employers shall provide equipment to ensure the prompt and safe rescue of employees from the enclosed space.
- 1910.269(e)(4) Evaluating potential hazards. Before any entrance cover to an enclosed space is removed, the employer shall determine whether it is safe to do so by checking for the presence of any atmospheric pressure or temperature differences and by evaluating whether there might be a hazardous atmosphere in the space. Any conditions making it unsafe to remove the cover shall be eliminated before the cover is removed.

Note to paragraph (e)(4): The determination called for in this paragraph may consist of a check of the conditions that might foreseeably be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. An evaluation also needs to be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen-deficient or flammable atmosphere, to develop within the space.

- 1910.269(e)(5) Removing covers. When covers are removed from enclosed spaces, the opening shall be promptly guarded by a railing, temporary cover, or other barrier designed to prevent an accidental fall through the opening and to protect employees working in the space from objects entering the space.
- 1910.269(e)(6) Hazardous atmosphere. Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the permit-required confined spaces standard in § 1910.146.

1910.269(e)(7) Attendants. While work is being performed in the enclosed space, an attendant with first-aid training shall be immediately available outside the enclosed space to provide assistance if a hazard exists because of traffic patterns in the area of the opening used for entry. The attendant is not precluded from performing other duties outside the enclosed space if these duties do not distract the attendant from: monitoring employees within the space or ensuring that it is safe for employees to enter and exit the space.

Note to paragraph (e)(7): See paragraph (t) of this section for additional requirements on attendants for work in manholes and vaults.

1910.269(e)(8) Calibration of test instruments. Test instruments used to monitor atmospheres in enclosed spaces shall be kept in calibration and shall have a minimum accuracy of ± 10 percent.

1910.269(e)(9) Testing for oxygen deficiency. Before an employee enters an enclosed space, the atmosphere in the enclosed space shall be tested for oxygen deficiency with a direct-reading meter or similar instrument, capable of collection and immediate analysis of data samples without the need for offsite evaluation. If continuous forced-air ventilation is provided, testing is not required provided that the procedures used ensure that employees are not exposed to the hazards posed by oxygen deficiency.

1910.269(e)(10) Testing for flammable gases and vapors. Before an employee enters an enclosed space, the internal atmosphere shall be tested for flammable gases and vapors with a direct-reading meter or similar instrument capable of collection and immediate analysis of data samples without the need for off-site evaluation. This test shall be performed after the oxygen testing and ventilation required by paragraph (e)(9) of this section demonstrate that there is sufficient oxygen to ensure the accuracy of the test for flammability.

1910.269(e)(11) Ventilation, and monitoring for flammable gases or vapors. If flammable gases or vapors are detected or if an oxygen deficiency is found, forced-air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable gases and vapors from accumulating. A continuous monitoring program to ensure that no increase in flammable gas or vapor concentration above safe levels occurs may be followed in lieu of ventilation if flammable gases or vapors are initially detected at safe levels.

Note to paragraph (e)(11): See the definition of "hazardous atmosphere" for guidance in determining whether a specific concentration of a substance is hazardous.

1910.269(e)(12) Specific ventilation requirements. If continuous forced-air ventilation is used, it shall begin before entry is made and shall be maintained long enough for the employer to be able to demonstrate that a safe atmosphere exists before employees are allowed to enter the work area. The forced-air ventilation shall be so directed as to ventilate the immediate area where employees are present within the enclosed space and shall continue until all employees leave the enclosed space.

1910.269(e)(13) Air supply. The air supply for the continuous forced-air ventilation shall be from a clean source and may not increase the hazards in the enclosed space.

1910.269(e)(14) Open flames. If open flames are used in enclosed spaces, a test for flammable gases and vapors shall be made immediately before the open flame device is used and at least once per hour while the device is used in the space. Testing shall be conducted more frequently if conditions present in the enclosed space indicate that once per hour is insufficient to detect hazardous accumulations of flammable gases or vapors.

Note to paragraph (e)(14): See the definition of "hazardous atmosphere" for guidance in determining whether a specific concentration of a substance is hazardous.

Note to paragraph (e): Entries into enclosed spaces conducted in accordance with the permit-space entry requirements of paragraphs (d) through (k) of § 1910.146 are considered as complying with paragraph (e) of this section.

1910.269(f) Excavations.

Excavation operations shall comply with Subpart P of Part 1926 of this chapter.

1910.269(g) Personal protective equipment.

1910.269(g)(1) General.

Personal protective equipment shall meet the requirements of Subpart I of this part.

Note to paragraph (g)(1) of this section: Paragraph (h) of § 1910.132 sets employer payment obligations for the personal protective equipment required by this section, including, but not limited to, the fall protection equipment required by paragraph (g)(2) of this section, the electrical protective equipment required by paragraph (l)(3) of this section, and the flame-resistant and arc-rated clothing and other protective equipment required by paragraph (l)(8) of this section.

1910.269(g)(2) Fall protection.

1910.269(g)(2)(i) Personal fall arrest systems shall meet the requirements of Subpart M of Part 1926 of this chapter.

1910.269(g)(2)(ii) Personal fall arrest equipment used by employees who are exposed to hazards from flames or electric arcs, as determined by the employer under paragraph (l)(8)(i) of this section, shall be capable of

passing a drop test equivalent to that required by paragraph (g)(2)(iii)(L) of this section after exposure to an electric arc with a heat energy of 40±5 cal/cm².

1910.269(g)(2)(iii) Body belts and positioning straps for work-positioning equipment shall meet the following requirements:

1910.269(g)(2)(iii)(A) Hardware for body belts and positioning straps shall meet the following requirements:

1910.269(g)(2)(iii)(A)(1) Hardware shall be made of drop-forged steel, pressed steel, formed steel, or equivalent material.

1910.269(g)(2)(iii)(A)(2) Hardware shall have a corrosion-resistant finish.

1910.269(g)(2)(iii)(A)(3) Hardware surfaces shall be smooth and free of sharp edges.

1910.269(g)(2)(iii)(B) Buckles shall be capable of withstanding an 8.9-kilonewton (2,000-pound-force) tension test with a maximum permanent deformation no greater than 0.4 millimeters (0.0156 inches).

1910.269(g)(2)(iii)(C) D rings shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tensile test without cracking or breaking.

1910.269(g)(2)(iii)(D) Snaphooks shall be capable of withstanding a 22-kilonewton (5,000-pound-force) tension test without failure.

Note to paragraph (g)(2)(iii)(D): Distortion of the snap-hook sufficient to release the keeper is considered to be tensile failure of a snap-hook.

1910.269(g)(2)(iii)(E) Top grain leather or leather substitute may be used in the manufacture of body belts and positioning straps; however, leather and leather substitutes may not be used alone as a load-bearing component of the assembly.

1910.269(g)(2)(iii)(F) Plied fabric used in positioning straps and in load-bearing parts of body belts shall be constructed in such a way that no raw edges are exposed and the plies do not separate.

1910.269(g)(2)(iii)(G) Positioning straps shall be capable of withstanding the following tests:

1910.269(g)(2)(iii)(G)(1) A dielectric test of 819.7 volts, AC, per centimeter (25,000 volts per foot) for 3 minutes without visible deterioration;

1910.269(g)(2)(iii)(G)(2) A leakage test of 98.4 volts, AC, per centimeter (3,000 volts per foot) with a leakage current of no more than 1 mA;

Note to paragraphs (g)(2)(iii)(G)(1) and (g)(2)(iii)(G)(2): Positioning straps that pass direct-current tests at equivalent voltages are considered as meeting this requirement.

1910.269(g)(2)(iii)(G)(3) Tension tests of 20 kilo-newtons (4,500 pounds-force) for sections free of buckle holes and of 15 kilo-newtons (3,500 pounds-force) for sections with buckle holes;

1910.269(g)(2)(iii)(G)(4) A buckle-tear test with a load of 4.4 kilo-newtons (1,000 pounds-force); and

1910.269(g)(2)(iii)(G)(5) A flammability test in accordance with Table R-2.

TABLE R-2 FLAMMABILITY TEST	
Test method	Criteria for passing the test
Vertically suspend a 500-mm (19.7-inch) length of strapping supporting a 100-kg (220.5-lb) weight.	Any flames on the positioning strap shall self extinguish. The positioning strap shall continue to support the 100-kg (220.5-lb) mass.
Use a butane or propane burner with a 76-mm (3-inch) flame.	
Direct the flame to an edge of the strapping at a distance of 25 mm (1 inch).	
Remove the flame after 5 seconds.	
Wait for any flames on the positioning strap to stop burning.	

1910.269(g)(2)(iii)(H) The cushion part of the body belt shall contain no exposed rivets on the inside and shall be at least 76 millimeters (3 inches) in width.

1910.269(g)(2)(iii)(I) Tool loops shall be situated on the body of a body belt so that the 100 millimeters (4 inches) of the body belt that is in the center of the back, measuring from D ring to D ring, is free of tool loops and any other attachments.

1910.269(g)(2)(iii)(J) Copper, steel, or equivalent liners shall be used around the bars of D rings to prevent wear between these members and the leather or fabric enclosing them.

- 1910.269(g)(2)(iii)(K) Snaphooks shall be of the locking type meeting the following requirements:
- 1910.269(g)(2)(iii)(K)(1) The locking mechanism shall first be released, or a destructive force shall be placed on the keeper, before the keeper will open.
- 1910.269(g)(2)(iii)(K)(2) A force in the range of 6.7 N (1.5 lbf) to 17.8 N (4 lbf) shall be required to release the locking mechanism.
- 1910.269(g)(2)(iii)(K)(3) With the locking mechanism released and with a force applied on the keeper against the face of the nose, the keeper may not begin to open with a force of 11.2 N (2.5 lbf) or less and shall begin to open with a maximum force of 17.8 N (4 lbf).
- 1910.269(g)(2)(iii)(L) Body belts and positioning straps shall be capable of withstanding a drop test as follows:
- 1910.269(g)(2)(iii)(L)(1) The test mass shall be rigidly constructed of steel or equivalent material with a mass of 100 kg (220.5 lbm). For work-positioning equipment used by employees weighing more than 140 kg (310 lbm) fully equipped, the test mass shall be increased proportionately (that is, the test mass must equal the mass of the equipped worker divided by 1.4).
- 1910.269(g)(2)(iii)(L)(2) For body belts, the body belt shall be fitted snugly around the test mass and shall be attached to the test structure anchorage point by means of a wire rope.
- 1910.269(g)(2)(iii)(L)(3) For positioning straps, the strap shall be adjusted to its shortest length possible to accommodate the test and connected to the test-structure anchorage point at one end and to the test mass on the other end.
- 1910.269(g)(2)(iii)(L)(4) The test mass shall be dropped an unobstructed distance of 1 meter (39.4 inches) from a supporting structure that will sustain minimal deflection during the test.
- 1910.269(g)(2)(iii)(L)(5) Body belts shall successfully arrest the fall of the test mass and shall be capable of supporting the mass after the test.
- 1910.269(g)(2)(iii)(L)(6) Positioning straps shall successfully arrest the fall of the test mass without breaking, and the arrest force may not exceed 17.8 kilo-newtons (4,000 pounds-force). Additionally, snap-hooks on positioning straps may not distort to such an extent that the keeper would release.
- Note to paragraph (g)(2)(iii) of this section: When used by employees weighing no more than 140 kg (310 lbm) fully equipped, body belts and positioning straps that conform to American Society of Testing and Materials Standard Specifications for Personal Climbing Equipment, ASTM F887-12e1, are deemed to be in compliance with paragraph (g)(2)(iii) of this section.
- 1910.269(g)(2)(iv) The following requirements apply to the care and use of personal fall protection equipment.
- 1910.269(g)(2)(iv)(A) Work-positioning equipment shall be inspected before use each day to determine that the equipment is in safe working condition. Work-positioning equipment that is not in safe working condition may not be used.
- Note to paragraph (g)(2)(iv)(A): Appendix F to this section contains guidelines for inspecting work-positioning equipment.
- 1910.269(g)(2)(iv)(B) Personal fall arrest systems shall be used in accordance with § 1926.502(d).
- Note to paragraph (g)(2)(iv)(B): Fall protection equipment rigged to arrest falls is considered a fall arrest system and must meet the applicable requirements for the design and use of those systems. Fall protection equipment rigged for work positioning is considered work-positioning equipment and must meet the applicable requirements for the design and use of that equipment.
- 1910.269(g)(2)(iv)(C) The employer shall ensure that employees use fall protection systems as follows:
- 1910.269(g)(2)(iv)(C)(1) Each employee working from an aerial lift shall use a fall restraint system or a personal fall arrest system. Paragraph (c)(2)(v) of § 1910.67 does not apply.
- 1910.269(g)(2)(iv)(C)(2) Except as provided in paragraph (g)(2)(iv)(C)(3) of this section, each employee in elevated locations more than 1.2 meters (4 feet) above the ground on poles, towers, or similar structures shall use a personal fall arrest system, work-positioning equipment, or fall restraint system, as appropriate, if the employer has not provided other fall protection meeting Subpart D of this part.
- 1910.269(g)(2)(iv)(C)(3) Until March 31, 2015, a qualified employee climbing or changing location on poles, towers, or similar structures need not use fall protection equipment, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing. On and after April 1, 2015, each qualified employee climbing or changing location on poles, towers, or similar structures must use fall protection equipment unless the employer can demonstrate that climbing or changing location with fall protection is infeasible or creates a greater hazard than climbing or changing location without it.
- Note 1 to paragraphs (g)(2)(iv)(C)(2) and (g)(2)(iv)(C)(3): These paragraphs apply to structures that support overhead electric power transmission and distribution lines and equipment. They do not apply to portions of buildings, such as loading docks, or to electric equipment, such as transformers and capacitors. Subpart D of this part contains the duty to provide fall protection associated with walking and working surfaces.
- Note 2 to paragraphs (g)(2)(iv)(C)(2) and (g)(2)(iv)(C)(3): Until the employer ensures that employees are proficient in climbing and the use of fall protection under paragraph (a)(2)(viii) of this section, the employees are not considered "qualified employees" for the purposes of paragraphs (g)(2)(iv)(C)(2) and

(g)(2)(iv)(C)(3) of this section. These paragraphs require unqualified employees (including trainees) to use fall protection any time they are more than 1.2 meters (4 feet) above the ground.

1910.269(g)(2)(iv)(D) On and after April 1, 2015, work positioning systems shall be rigged so that an employee can free fall no more than 0.6 meters (2 feet).

1910.269(g)(2)(iv)(E) Anchorages for work-positioning equipment shall be capable of supporting at least twice the potential impact load of an employee's fall, or 13.3 kilo-newtons (3,000 pounds-force), whichever is greater.

Note to paragraph (g)(2)(iv)(E): Wood-pole fall-restriction devices meeting American Society of Testing and Materials Standard Specifications for Personal Climbing Equipment, ASTM F887-12e1, are deemed to meet the anchorage-strength requirement when they are used in accordance with manufacturers' instructions.

1910.269(g)(2)(iv)(F) Unless the snap-hook is a locking type and designed specifically for the following connections, snap-hooks on work-positioning equipment may not be engaged:

1910.269(g)(2)(iv)(F)(1) Directly to webbing, rope, or wire rope;

1910.269(g)(2)(iv)(F)(2) To each other;

1910.269(g)(2)(iv)(F)(3) To a D ring to which another snap-hook or other connector is attached;

1910.269(g)(2)(iv)(F)(4) To a horizontal lifeline; or

1910.269(g)(2)(iv)(F)(5) To any object that is incompatibly shaped or dimensioned in relation to the snap-hook such that accidental disengagement could occur should the connected object sufficiently depress the snap-hook keeper to allow release of the object.

1910.269(h) Portable ladders and platforms.

1910.269(h)(1) General.

Requirements for portable ladders contained in Subpart D of this part apply in addition to the requirements of paragraph (h) of this section, except as specifically noted in paragraph (h)(2) of this section.

1910.269(h)(2) Special ladders and platforms.

Portable ladders used on structures or conductors in conjunction with overhead line work need not meet § 1910.25(d)(2)(i) and (d)(2)(iii) or § 1910.26(c)(3)(iii). Portable ladders and platforms used on structures or conductors in conjunction with overhead line work shall meet the following requirements:

1910.269(h)(2)(i) In the configurations in which they are used, portable ladders and platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.

1910.269(h)(2)(ii) Portable ladders and platforms may not be loaded in excess of the working loads for which they are designed.

1910.269(h)(2)(iii) Portable ladders and platforms shall be secured to prevent them from becoming dislodged.

1910.269(h)(2)(iv) Portable ladders and platforms may be used only in applications for which they are designed.

1910.269(h)(3) Conductive ladders.

Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used when the employer demonstrates that nonconductive ladders would present a greater hazard to employees than conductive ladders.

1910.269(i) Hand and portable power equipment.

1910.269(i)(1) General.

Paragraph (i)(2) of this section applies to electric equipment connected by cord and plug. Paragraph (i)(3) of this section applies to portable and vehicle-mounted generators used to supply cord- and plug-connected equipment. Paragraph (i)(4) of this section applies to hydraulic and pneumatic tools.

1910.269(i)(2) Cord- and plug-connected equipment.

Cord- and plug-connected equipment not covered by Subpart S of this part shall comply with one of the following instead of § 1910.243(a)(5):

1910.269(i)(2)(i) The equipment shall be equipped with a cord containing an equipment grounding conductor connected to the equipment frame and to a means for grounding the other end of the conductor (however, this option may not be used where the introduction of the ground into the work environment increases the hazard to an employee); or

1910.269(i)(2)(ii) The equipment shall be of the double-insulated type conforming to Subpart S of this part; or

1910.269(i)(2)(iii) The equipment shall be connected to the power supply through an isolating transformer with an ungrounded secondary of not more than 50 volts.

1910.269(i)(3) Portable and vehicle-mounted generators.

Portable and vehicle mounted generators used to supply cord- and plug-connected equipment covered by paragraph (i)(2) of this section shall meet the following requirements:

1910.269(i)(3)(i) The generator may only supply equipment located on the generator or the vehicle and cord- and plug connected equipment through receptacles mounted on the generator or the vehicle.

1910.269(i)(3)(ii) The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.

1910.269(i)(3)(iii) For vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.
1910.269(i)(3)(iv) Any neutral conductor shall be bonded to the generator frame.

1910.269(i)(4) Hydraulic and pneumatic tools.

1910.269(i)(4)(i) Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.

Note to paragraph (i)(4)(i): If any hazardous defects are present, no operating pressure is safe, and the hydraulic or pneumatic equipment involved may not be used. In the absence of defects, the maximum rated operating pressure is the maximum safe pressure.

1910.269(i)(4)(ii) A hydraulic or pneumatic tool used where it may contact exposed energized parts shall be designed and maintained for such use.

1910.269(i)(4)(iii) The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against loss of insulating value, for the voltage involved, due to the formation of a partial vacuum in the hydraulic line.

Note to paragraph (i)(4)(iii): Use of hydraulic lines that do not have check valves and that have a separation of more than 10.7 meters (35 feet) between the oil reservoir and the upper end of the hydraulic system promotes the formation of a partial vacuum.

1910.269(i)(4)(iv) A pneumatic tool used on energized electric lines or equipment, or used where it may contact exposed live parts, shall provide protection against the accumulation of moisture in the air supply.

1910.269(i)(4)(v) Pressure shall be released before connections are broken, unless quick-acting, self-closing connectors are used.

1910.269(i)(4)(vi) Employers must ensure that employees do not use any part of their bodies to locate, or attempt to stop, a hydraulic leak.

1910.269(i)(4)(vii) Hoses may not be kinked.

1910.269(j) Live-line tools.

1910.269(j)(1) Design of tools.

Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

1910.269(j)(1)(i) If the tool is made of fiberglass-reinforced plastic (FRP), it shall withstand 328,100 volts per meter (100,000 volts per foot) of length for 5 minutes, or

Note to paragraph (j)(1)(i): Live-line tools using rod and tube that meet ASTM F711-02 (2007), Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools, are deemed to comply with paragraph (j)(1) of this section.

1910.269(j)(1)(ii) If the tool is made of wood, it shall withstand 246,100 volts per meter (75,000 volts per foot) of length for 3 minutes, or

1910.269(j)(1)(iii) The tool shall withstand other tests that the employer can demonstrate are equivalent.

1910.269(j)(2) Condition of tools.

1910.269(j)(2)(i) Each liveline tool shall be wiped clean and visually inspected for defects before use each day.

1910.269(j)(2)(ii) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested according to paragraph (j)(2)(iii) of this section before being returned to service.

1910.269(j)(2)(iii) Live-line tools used for primary employee protection shall be removed from service every 2 years, and whenever required under paragraph (j)(2)(ii) of this section, for examination, cleaning, repair, and testing as follows:

1910.269(j)(2)(iii)(A) Each tool shall be thoroughly examined for defects.

1910.269(j)(2)(iii)(B) If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.

1910.269(j)(2)(iii)(C) The tool shall be tested in accordance with paragraphs (j)(2)(iii)(D) and (j)(2)(iii)(E) of this section under the following conditions:

1910.269(j)(2)(iii)(C)(1) After the tool has been repaired or refinished; and

1910.269(j)(2)(iii)(C)(2) After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail during use.

1910.269(j)(2)(iii)(D) The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.

1910.269(j)(2)(iii)(E) The voltage applied during the tests shall be as follows:

1910.269(j)(2)(iii)(E)(1) 246,100 volts per meter (75,000 volts per foot) of length for 1 minute if the tool is made of fiberglass, or

1910.269(j)(2)(iii)(E)(2) 164,000 volts per meter (50,000 volts per foot) of length for 1 minute if the tool is made of wood, or

1910.269(j)(2)(iii)(E)(3) Other tests that the employer can demonstrate are equivalent.

Note to paragraph (j)(2): Guidelines for the examination, cleaning, repairing, and inservice testing of live-line tools are specified in the Institute of Electrical and Electronics Engineers' IEEE Guide for Maintenance Methods on Energized Power Lines, IEEE Std 516-2009.

1910.269(k) Materials handling and storage.

1910.269(k)(1) General.

Materials handling and storage shall comply with applicable material-handling and material-storage requirements in this part, including those in Subpart N of this part.

1910.269(k)(2) Materials storage near energized lines or equipment.

1910.269(k)(2)(i) In areas to which access is not restricted to qualified persons only, materials or equipment may not be stored closer to energized lines or exposed energized parts of equipment than the following distances, plus a distance that provides for the maximum sag and side swing of all conductors and for the height and movement of material-handling equipment:

1910.269(k)(2)(i)(A) For lines and equipment energized at 50 kilovolts or less, the distance is 3.05 meters (10 feet).
1910.269(k)(2)(i)(B) For lines and equipment energized at more than 50 kilovolts, the distance is 3.05 meters (10 feet) plus 0.10 meter (4 inches) for every 10 kilovolts over 50 kilovolts.

1910.269(k)(2)(ii) In areas restricted to qualified employees, materials may not be stored within the working space about energized lines or equipment.

Note to paragraph (k)(2)(ii): Paragraphs (u)(1) and (v)(3) of this section specify the size of the working space.

1910.269(l) Working on or near exposed energized parts.

This paragraph applies to work on exposed live parts, or near enough to them to expose the employee to any hazard they present.

1910.269(l)(1) General.

1910.269(l)(1)(i) Only qualified employees may work on or with exposed energized lines or parts of equipment.

1910.269(l)(1)(ii) Only qualified employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more.

1910.269(l)(1)(iii) Electric lines and equipment shall be considered and treated as energized unless they have been deenergized in accordance with paragraph (d) or (m) of this section.

1910.269(l)(2) At least two employees.

1910.269(l)(2)(i) Except as provided in paragraph (l)(2)(ii) of this section, at least two employees shall be present while any employees perform the following types of work:

1910.269(l)(2)(i)(A) Installation, removal, or repair of lines energized at more than 600 volts,

1910.269(l)(2)(i)(B) Installation, removal, or repair of deenergized lines if an employee is exposed to contact with other parts energized at more than 600 volts,

1910.269(l)(2)(i)(C) Installation, removal, or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with parts energized at more than 600 volts,

1910.269(l)(2)(i)(D) Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts, and

1910.269(l)(2)(i)(E) Other work that exposes an employee to electrical hazards greater than, or equal to, the electrical hazards posed by operations listed specifically in paragraphs (l)(2)(i)(A) through (l)(2)(i)(D) of this section.

1910.269(l)(2)(ii) Paragraph (l)(2)(i) of this section does not apply to the following operations:

1910.269(l)(2)(ii)(A) Routine circuit switching, when the employer can demonstrate that conditions at the site allow safe performance of this work,

1910.269(l)(2)(ii)(B) Work performed with live-line tools when the position of the employee is such that he or she is neither within reach of, nor otherwise exposed to contact with, energized parts, and

1910.269(l)(2)(ii)(C) Emergency repairs to the extent necessary to safeguard the general public.

1910.269(l)(3) Minimum approach distances.

1910.269(l)(3)(i) The employer shall establish minimum approach distances no less than the distances computed by Table R-3 for ac systems or Table R-8 for dc systems.

1910.269(l)(3)(ii) No later than April 1, 2015, for voltages over 72.5 kilovolts, the employer shall determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis or assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table R-9. When the employer uses portable protective gaps to control the maximum transient overvoltage, the value of the maximum anticipated per-unit transient overvoltage, phase-to-ground, must provide for five standard deviations between the statistical sparkover voltage of the gap and the statistical withstand voltage corresponding to the electrical component of the minimum approach distance. The employer shall make any engineering analysis conducted to determine maximum anticipated per unit transient overvoltage available upon request to employees and to the Assistant Secretary or designee for examination and copying.

Note to paragraph (l)(3)(ii): See Appendix B to this section for information on how to calculate the maximum anticipated per-unit transient overvoltage, phase-to-ground, when the employer uses portable protective gaps to reduce maximum transient over-voltages.

1910.269(l)(3)(iii) The employer shall ensure that no employee approaches or takes any conductive object closer to exposed energized parts than the employer's established minimum approach distance, unless:

1910.269(l)(3)(iii)(A) The employee is insulated from the energized part (rubber insulating gloves or rubber insulating gloves and sleeves worn in accordance with paragraph (l)(4) of this section constitutes insulation of the employee from the energized part upon which the employee is working provided that the employee has control of the part in a manner sufficient to prevent exposure to uninsulated portions of the employee's body), or

1910.269(l)(3)(iii)(B) The energized part is insulated from the employee and from any other conductive object at a different potential, or

1910.269(l)(3)(iii)(C) The employee is insulated from any other exposed conductive object in accordance with the requirements for live-line barehand work in paragraph (q)(3) of this section.

1910.269(l)(4) Type of insulation

1910.269(l)(4)(i) When an employee uses rubber insulating gloves as insulation from energized parts (under paragraph (l)(3)(iii)(A) of this section), the employer shall ensure that the employee also uses rubber insulating sleeves. However, an employee need not use rubber insulating sleeves if:

1910.269(l)(4)(i)(A) Exposed energized parts on which the employee is not working are insulated from the employee; and

1910.269(l)(4)(i)(B) When installing insulation for purposes of paragraph (l)(4)(i)(A) of this section, the employee installs the insulation from a position that does not expose his or her upper arm to contact with other energized parts.

1910.269(l)(4)(ii) When an employee uses rubber insulating gloves or rubber insulating gloves and sleeves as insulation from energized parts (under paragraph (l)(3)(iii)(A) of this section), the employer shall ensure that the employee:

1910.269(l)(4)(ii)(A) Puts on the rubber insulating gloves and sleeves in a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (l)(3)(i) of this section; and

1910.269(l)(4)(ii)(B) Does not remove the rubber insulating gloves and sleeves until he or she is in a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (l)(3)(i) of this section.

1910.269(l)(5) Working position.

1910.269(l)(5)(i) The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee's.

1910.269(l)(5)(ii) When an employee performs work near exposed parts energized at more than 600 volts, but not more than 72.5 kilovolts, and is not wearing rubber insulating gloves, being protected by insulating equipment covering the energized parts, performing work using live-line tools, or performing live-line barehand work under paragraph (q)(3) of this section, the employee shall work from a position where he or she cannot reach into the minimum approach distance, established by the employer under paragraph (l)(3)(i) of this section.

1910.269(l)(6) Making connections.

The employer shall ensure that employees make connections as follows:

1910.269(l)(6)(i) In connecting deenergized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the deenergized part;

1910.269(l)(6)(ii) When disconnecting equipment or lines from an energized circuit by means of a conducting wire or device, an employee shall remove the source end first; and

1910.269(l)(6)(iii)

When lines or equipment are connected to or disconnected from energized circuits, an employee shall keep loose conductors away from exposed energized parts.

1910.269(l)(7) Conductive articles.

When an employee performs work within reaching distance of exposed energized parts of equipment, the employer shall ensure that the employee removes or renders nonconductive all exposed conductive articles, such as keychains or watch chains, rings, or wrist watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.

1910.269(l)(8) Protection from flames and electric arcs.

1910.269(l)(8)(i) The employer shall assess the workplace to identify employees exposed to hazards from flames or from electric arcs.

1910.269(l)(8)(ii) For each employee exposed to hazards from electric arcs, the employer shall make a reasonable estimate of the incident heat energy to which the employee would be exposed.

Note 1 to paragraph (I)(8)(ii): Appendix E to this section provides guidance on estimating available heat energy. The Occupational Safety and Health Administration will deem employers following the guidance in Appendix E to this section to be in compliance with paragraph (I)(8)(ii) of this section. An employer may choose a method of calculating incident heat energy not included in Appendix E to this section if the chosen method reasonably predicts the incident energy to which the employee would be exposed.

Note 2 to paragraph (I)(8)(ii): This paragraph does not require the employer to estimate the incident heat energy exposure for every job task performed by each employee. The employer may make broad estimates that cover multiple system areas provided the employer uses reasonable assumptions about the energy-exposure distribution throughout the system and provided the estimates represent the maximum employee exposure for those areas. For example, the employer could estimate the heat energy just outside a substation feeding a radial distribution system and use that estimate for all jobs performed on that radial system.

1910.269(I)(8)(iii) The employer shall ensure that each employee who is exposed to hazards from flames or electric arcs does not wear clothing that could melt onto his or her skin or that could ignite and continue to burn when exposed to flames or the heat energy estimated under paragraph (I)(8)(ii) of this section.

Note to paragraph (I)(8)(iii) of this section: This paragraph prohibits clothing made from acetate, nylon, polyester, rayon and polypropylene, either alone or in blends, unless the employer demonstrates that the fabric has been treated to withstand the conditions that may be encountered by the employee or that the employee wears the clothing in such a manner as to eliminate the hazard involved.

1910.269(I)(8)(iv) The employer shall ensure that the outer layer of clothing worn by an employee, except for clothing not required to be arc rated under paragraphs (I)(8)(v)(A) through (I)(8)(v)(E) of this section, is flame resistant under any of the following conditions:

1910.269(I)(8)(iv)(A) The employee is exposed to contact with energized circuit parts operating at more than 600 volts,

1910.269(I)(8)(iv)(B) An electric arc could ignite flammable material in the work area that, in turn, could ignite the employee's clothing,

1910.269(I)(8)(iv)(C) Molten metal or electric arcs from faulted conductors in the work area could ignite the employee's clothing, or

Note to paragraph (I)(8)(iv)(C): This paragraph does not apply to conductors that are capable of carrying, without failure, the maximum available fault current for the time the circuit protective devices take to interrupt the fault.

1910.269(I)(8)(iv)(D) The incident heat energy estimated under paragraph (I)(8)(ii) of this section exceeds 2.0 cal/cm².

1910.269(I)(8)(v) The employer shall ensure that each employee exposed to hazards from electric arcs wears protective clothing and other protective equipment with an arc rating greater than or equal to the heat energy estimated under paragraph (I)(8)(ii) of this section whenever that estimate exceeds 2.0 cal/cm². This protective equipment shall cover the employee's entire body, except as follows:

1910.269(I)(8)(v)(A) Arc-rated protection is not necessary for the employee's hands when the employee is wearing rubber insulating gloves with protectors or, if the estimated incident energy is no more than 14 cal/cm², heavy-duty leather work gloves with a weight of at least 407 gm/m² (12 oz/yd²),

1910.269(I)(8)(v)(B) Arc-rated protection is not necessary for the employee's feet when the employee is wearing heavy-duty work shoes or boots,

1910.269(I)(8)(v)(C) Arc-rated protection is not necessary for the employee's head when the employee is wearing head protection meeting § 1910.135 if the estimated incident energy is less than 9 cal/cm² for exposures involving single-phase arcs in open air or 5 cal/cm² for other exposures,

1910.269(I)(8)(v)(D) The protection for the employee's head may consist of head protection meeting § 1910.135 and a faceshield with a minimum arc rating of 8 cal/cm² if the estimated incident-energy exposure is less than 13 cal/cm² for exposures involving single-phase arcs in open air or 9 cal/cm² for other exposures, and

1910.269(I)(8)(v)(E) For exposures involving single-phase arcs in open air, the arc rating for the employee's head and face protection may be 4 cal/cm² less than the estimated incident energy.

Note to paragraph (I)(8): See Appendix E to this section for further information on the selection of appropriate protection.

1910.269(I)(8)(vi) Dates.

1910.269(I)(8)(vi)(A) The obligation in paragraph (I)(8)(ii) of this section for the employer to make reasonable estimates of incident energy commences January 1, 2015.

1910.269(I)(8)(vi)(B) The obligation in paragraph (I)(8)(iv)(D) of this section for the employer to ensure that the outer layer of clothing worn by an employee is flame-resistant when the estimated incident heat energy exceeds 2.0 cal/cm² commences April 1, 2015.

1910.269(I)(8)(vi)(C) The obligation in paragraph (I)(8)(v) of this section for the employer to ensure that each employee exposed to hazards from electric arcs wears the required arc-rated protective equipment commences April 1, 2015.

1910.269(l)(9) Fuse handling.

When an employee must install or remove fuses with one or both terminals energized at more than 300 volts, or with exposed parts energized at more than 50 volts, the employer shall ensure that the employee uses tools or gloves rated for the voltage. When an employee installs or removes expulsion-type fuses with one or both terminals energized at more than 300 volts, the employer shall ensure that the employee wears eye protection meeting the requirements of Subpart I of this part, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel.

1910.269(l)(10) Covered (non-insulated) conductors.

The requirements of this section that pertain to the hazards of exposed live parts also apply when an employee performs work in proximity to covered (non-insulated) wires.

1910.269(l)(11) Non-current-carrying metal parts.

Non-current-carrying metal parts of equipment or devices, such as transformer cases and circuit-breaker housings, shall be treated as energized at the highest voltage to which these parts are exposed, unless the employer inspects the installation and determines that these parts are grounded before employees begin performing the work.

1910.269(l)(12) Opening and closing circuits under load.

1910.269(l)(12)(i) The employer shall ensure that devices used by employees to open circuits under load conditions are designed to interrupt the current involved.

1910.269(l)(12)(ii) The employer shall ensure that devices used by employees to close circuits under load conditions are designed to safely carry the current involved.

TABLE R-3 AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE	
[The minimum approach distance (MAD; in meters) shall conform to the following equations.]	
For phase-to-phase system voltages of 50 V to 300 V: ¹ MAD = avoid contact	
For phase-to-phase system voltages of 301 V to 5 kV: ¹ MAD = M + D, where D = 0.02 m M = 0.31 m for voltages up to 750 V and 0.61 m otherwise	the electrical component of the minimum approach distance. the inadvertent movement factor.
For phase-to-phase system voltages of 5.1 kV to 72.5 kV: ^{1 4} MAD = M + AD, where M = 0.61 m A = the applicable value from Table R-5 D = the value from Table R-4 corresponding to the voltage and exposure or the value of the electrical component of the minimum approach distance calculated using the method provided in Appendix B to this section.	the inadvertent movement factor.
	the altitude correction factor.
	the electrical component of the minimum approach distance.
For phase-to-phase system voltages of more than 72.5 kV, nominal: ^{2 4} MAD = 0.3048(C + a)V _{L-G} T ^A + M, where C = 0.01 for phase-to-ground exposures that the employer can demonstrate consist only of air across the approach distance (gap), 0.01 for phase-to-phase exposures if the employer can demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap, or 0.011 otherwise V _{L-G} = phase-to-ground rms voltage, in kV T = maximum anticipated per-unit transient overvoltage; for phase-to-ground exposures, T equals T _{L-G} , the maximum per-unit transient overvoltage, phase-to-ground, determined by the employer under paragraph (l)(3)(ii) of this section; for phase-to-phase exposures, T equals 1.35T _{L-G} + 0.45 A = altitude correction factor from Table R-5 M = 0.31 m, the inadvertent movement factor a = saturation factor, as follows:	

TABLE R-3 AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE					
[The minimum approach distance (MAD; in meters) shall conform to the following equations.]					
Phase-to-Ground Exposures					
$V_{Peak} = T_{L-G}V_{L-G}\sqrt{2}$	635 kV or less	635.1 to 915 kV	915.1 to 1,050 kV	More than 1,050 kV	
A	0	$(V_{Peak}-635) / 140,000$	$(V_{Peak}-645) / 135,000$	$(V_{Peak}-675) / 125,000$	
Phase-to-Phase Exposures ³					
$V_{Peak} = (1.35T_{L-G} + 0.45) V_{L-G}\sqrt{2}$	630 kV or less	630.1 to 848 kV	848.1 to 1,131 kV	1,131.1 to 1,485 kV	More than 1,485 kV
a	0	$(V_{Peak}-630) / 155,000$	$(V_{Peak}-633.6) / 152,207$	$(V_{Peak}-628) / 153,846$	$(V_{Peak}-350.5) / 203,666$
1 Employers may use the minimum approach distances in Table R-6. If the worksite is at an elevation of more than 900 meters (3,000 feet), see footnote 1 to Table R-6.					
2 Employers may use the minimum approach distances in Table R-7, except that the employer may not use the minimum approach distances in Table R-7 for phase-to-phase exposures if an insulated tool spans the gap or if any large conductive object is in the gap. If the worksite is at an elevation of more than 900 meters (3,000 feet), see footnote 1 to Table R-7. Employers may use the minimum approach distances in Table 14 through Table 21 in Appendix B to this section, which calculated MAD for various values of T, provided the employer follows the notes to those tables.					
3 Use the equations for phase-to-ground exposures (with V _{Peak} for phase-to-phase exposures) unless the employer can demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap.					
4 Until March 31, 2015, employers may use the minimum approach distances in Table 6 through Table 13 in Appendix B to this section.					

TABLE R-4 ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE AT 5.1 TO 72.5 KV		
[D; In meters]		
Nominal voltage (kV) phase-to-phase	Phase-to-ground exposure	Phase-to-phase exposure
	D (m)	D (m)
5.1 to 15.0	0.04	0.07
15.1 to 36.0	0.16	0.28
36.1 to 46.0	0.23	0.37
46.1 to 72.5	0.39	0.59

Altitude above sea level (m)	A
0 to 900	1.00
901 to 1,200	1.02
1,201 to 1,500	1.05
1,501 to 1,800	1.08
1,801 to 2,100	1.11
2,101 to 2,400	1.14
2,401 to 2,700	1.17
2,701 to 3,000	1.20
3,001 to 3,600	1.25
3,601 to 4,200	1.30
4,201 to 4,800	1.35
4,801 to 5,400	1.39
5,401 to 6,000 .	1.44

Nominal voltage (kV) phase-to-phase	Distance			
	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
0.50 to 0.300 2	Avoid Contact		Avoid Contact	
0.301 to 0.750 2	0.33	1.09	0.33	1.09
0.751 to 5.0	0.63	2.07	0.63	2.07
5.1 to 15.0	0.65	2.14	0.68	2.24
15.1 to 36.0	0.77	2.53	0.89	2.92
36.1 to 46.0	0.84	2.76	0.98	3.22
46.1 to 72.5	1.00	3.29	1.20	3.94
<p>1 Employers may use the minimum approach distances in this table provided the worksite is at an elevation of 900 meters (3,000 feet) or less. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table R-5 corresponding to the altitude of the work.</p>				
<p>2 For single-phase systems, use voltage-to-ground.</p>				

**TABLE R-7
ALTERNATIVE MINIMUM APPROACH DISTANCES FOR VOLTAGES
OF MORE THAN 72.5 KV 1 2 3**

Voltage range phase to phase (kV)	Phase-to-ground exposure		Phase-to-phase exposure	
	M	ft	m	ft
72.6 to 121.0	1.13	3.71	1.42	4.66
121.1 to 145.0	1.30	4.27	1.64	5.38
145.1 to 169.0	1.46	4.79	1.94	6.36
169.1 to 242.0	2.01	6.59	3.08	10.10
242.1 to 362.0	3.41	11.19	5.52	18.11
362.1 to 420.0	4.25	13.94	6.81	22.34
420.1 to 550.0	5.07	16.63	8.24	27.03
550.1 to 800.0	6.88	22.57	11.38	37.34

1 Employers may use the minimum approach distances in this table provided the worksite is at an elevation of 900 meters (3,000 feet) or less. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table R-5 corresponding to the altitude of the work.

2 Employers may use the phase-to-phase minimum approach distances in this table provided that no insulated tool spans the gap and no large conductive object is in the gap.

3 The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.

**TABLE R-8
DC LIVE-LINE MINIMUM APPROACH DISTANCE WITH OVERVOLTAGE FACTOR ¹
[In meters]**

Maximum anticipated per-unit transient overvoltage	Distance (m) maximum line-to-ground voltage (kV)				
	250	400	500	600	750
1.5 or less	1.12	1.60	2.06	2.62	3.61
1.6	1.17	1.69	2.24	2.86	3.98
1.7	1.23	1.82	2.42	3.12	4.37
1.8.	1.28	1.95	2.62	3.39	4.79

1 The distances specified in this table are for air, bare-hand, and live-line tool conditions. If employees will be working at elevations greater than 900 meters (3,000 feet) above mean sea level, the employer shall determine minimum approach distances by multiplying the distances in this table by the correction factor in Table R-5 corresponding to the altitude of the work.

TABLE R-9 ASSUMED MAXIMUM PER-UNIT TRANSIENT OVERVOLTAGE		
Voltage range (kV)	Type of current (ac or dc)	Assumed maximum per-unit transient overvoltage
72.6 to 420.0	ac	3.5
420.1 to 550.0	ac	3.0
550.1 to 800.0	ac	2.5
250 to 750	dc	1.8

1910.269(m) Deenergizing lines and equipment for employee protection.

1910.269(m)(1) Application.

Paragraph (m) of this section applies to the deenergizing of transmission and distribution lines and equipment for the purpose of protecting employees. See paragraph (d) of this section for requirements on the control of hazardous energy sources used in the generation of electric energy. Conductors and parts of electric equipment that have been deenergized under procedures other than those required by paragraph (d) or (m) of this section, as applicable, shall be treated as energized.

1910.269(m)(2) General.

1910.269(m)(2)(i) If a system operator is in charge of the lines or equipment and their means of disconnection, the employer shall designate one employee in the crew to be in charge of the clearance and shall comply with all of the requirements of paragraph (m)(3) of this section in the order specified.

1910.269(m)(2)(ii) If no system operator is in charge of the lines or equipment and their means of disconnection, the employer shall designate one employee in the crew to be in charge of the clearance and to perform the functions that the system operator would otherwise perform under paragraph (m) of this section. All of the requirements of paragraph (m)(3) of this section apply, in the order specified, except as provided in paragraph (m)(2)(iii) of this section.

1910.269(m)(2)(iii) If only one crew will be working on the lines or equipment and if the means of disconnection is accessible and visible to, and under the sole control of, the employee in charge of the clearance, paragraphs (m)(3)(i), (m)(3)(iii), and (m)(3)(v) of this section do not apply. Additionally, the employer does not need to use the tags required by the remaining provisions of paragraph (m)(3) of this section.

1910.269(m)(2)(iv) If two or more crews will be working on the same lines or equipment, then:

1910.269(m)(2)(iv)(A) The crews shall coordinate their activities under paragraph (m) of this section with a single employee in charge of the clearance for all of the crews and follow the requirements of paragraph (m) of this section as if all of the employees formed a single crew, or

1910.269(m)(2)(iv)(B) Each crew shall independently comply with paragraph (m) of this section and, if there is no system operator in charge of the lines or equipment, shall have separate tags and coordinate deenergizing and reenergizing the lines and equipment with the other crews.

1910.269(m)(2)(v) The employer shall render any disconnecting means that are accessible to individuals outside the employer's control (for example, the general public) inoperable while the disconnecting means are open for the purpose of protecting employees.

1910.269(m)(3) Deenergizing lines and equipment.

1910.269(m)(3)(i) The employee that the employer designates pursuant to paragraph (m)(2) of this section as being in charge of the clearance shall make a request of the system operator to deenergize the particular section of line or equipment. The designated employee becomes the employee in charge (as this term is used in paragraph (m)(3) of this section) and is responsible for the clearance.

1910.269(m)(3)(ii) The employer shall ensure that all switches, disconnectors, jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be deenergized are open. The employer shall render such means inoperable, unless its design does not so permit, and then ensure that such means are tagged to indicate that employees are at work.

1910.269(m)(3)(iii) The employer shall ensure that automatically and remotely controlled switches that could cause the opened disconnecting means to close are also tagged at the points of control. The employer shall render the automatic or remote control feature inoperable, unless its design does not so permit.

1910.269(m)(3)(iv) The employer need not use the tags mentioned in paragraphs (m)(3)(ii) and (m)(3)(iii) of this section on a network protector for work on the primary feeder for the network protector's associated network transformer when the employer can demonstrate all of the following conditions:

1910.269(m)(3)(iv)(A) Every network protector is maintained so that it will immediately trip open if closed when a primary conductor is deenergized;

1910.269(m)(3)(iv)(B) Employees cannot manually place any network protector in a closed position without the use of tools, and any manual override position is blocked, locked, or otherwise disabled; and

- 1910.269(m)(3)(iv)(C) The employer has procedures for manually overriding any network protector that incorporate provisions for determining, before anyone places a network protector in a closed position, that: The line connected to the network protector is not deenergized for the protection of any employee working on the line; and (if the line connected to the network protector is not deenergized for the protection of any employee working on the line) the primary conductors for the network protector are energized.
- 1910.269(m)(3)(v) Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.
- 1910.269(m)(3)(vi) After the applicable requirements in paragraphs (m)(3)(i) through (m)(3)(v) of this section have been followed and the system operator gives a clearance to the employee in charge, the employer shall ensure that the lines and equipment are deenergized by testing the lines and equipment to be worked with a device designed to detect voltage.
- 1910.269(m)(3)(vii) The employer shall ensure the installation of protective grounds as required by paragraph (n) of this section.
- 1910.269(m)(3)(viii) After the applicable requirements of paragraphs (m)(3)(i) through (m)(3)(vii) of this section have been followed, the lines and equipment involved may be considered deenergized.
- 1910.269(m)(3)(ix) To transfer the clearance, the employee in charge (or the employee's supervisor if the employee in charge must leave the worksite due to illness or other emergency) shall inform the system operator and employees in the crew; and the new employee in charge shall be responsible for the clearance.
- 1910.269(m)(3)(x) To release a clearance, the employee in charge shall:
- 1910.269(m)(3)(x)(A) Notify each employee under that clearance of the pending release of the clearance;
- 1910.269(m)(3)(x)(B) Ensure that all employees under that clearance are clear of the lines and equipment;
- 1910.269(m)(3)(x)(C) Ensure that all protective grounds protecting employees under that clearance have been removed; and
- 1910.269(m)(3)(x)(D) Report this information to the system operator and then release the clearance.
- 1910.269(m)(3)(xi) Only the employee in charge who requested the clearance may release the clearance, unless the employer transfers responsibility under paragraph (m)(3)(ix) of this section.
- 1910.269(m)(3)(xii) No one may remove tags without the release of the associated clearance as specified under paragraphs (m)(3)(x) and (m)(3)(xi) of this section.
- 1910.269(m)(3)(xiii) The employer shall ensure that no one initiates action to reenergize the lines or equipment at a point of disconnection until all protective grounds have been removed, all crews working on the lines or equipment release their clearances, all employees are clear of the lines and equipment, and all protective tags are removed from that point of disconnection.

1910.269(n) Grounding for the protection of employees.

1910.269(n)(1) Application.

Paragraph (n) of this section applies to grounding of generation, transmission, and distribution lines and equipment for the purpose of protecting employees. Paragraph (n)(4) of this section also applies to protective grounding of other equipment as required elsewhere in this section.

Note to paragraph (n)(1): This paragraph covers grounding of generation, transmission, and distribution lines and equipment when this section requires protective grounding and whenever the employer chooses to ground such lines and equipment for the protection of employees.

1910.269(n)(2) General.

For any employee to work transmission and distribution lines or equipment as deenergized, the employer shall ensure that the lines or equipment are deenergized under the provisions of paragraph (m) of this section and shall ensure proper grounding of the lines or equipment as specified in paragraphs (n)(3) through (n)(8) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards to employees than working without grounds, the lines and equipment may be treated as deenergized provided that the employer establishes that all of the following conditions apply:

- 1910.269(n)(2)(i) The employer ensures that the lines and equipment are deenergized under the provisions of paragraph (m) of this section.
- 1910.269(n)(2)(ii) There is no possibility of contact with another energized source.
- 1910.269(n)(2)(iii) The hazard of induced voltage is not present.

1910.269(n)(3) Equipotential zone.

Temporary protective grounds shall be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent each employee from being exposed to hazardous differences in electric potential.

Note to paragraph (n)(3): Appendix C to this section contains guidelines for establishing the equipotential zone required by this paragraph. The Occupational Safety and Health Administration will deem grounding practices meeting these guidelines as complying with paragraph (n)(3) of this section.

1910.269(n)(4) Protective grounding equipment.

1910.269(n)(4)(i) Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.

1910.269(n)(4)(ii) Protective grounding equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

1910.269(n)(4)(iii) Protective grounds shall have an impedance low enough so that they do not delay the operation of protective devices in case of accidental energizing of the lines or equipment.

Note to paragraph (n)(4): American Society for Testing and Materials Standard Specifications for Temporary Protective Grounds to Be Used on De-Energized Electric Power Lines and Equipment, ASTM F855-09, contains guidelines for protective grounding equipment. The Institute of Electrical Engineers Guide for Protective Grounding of Power Lines, IEEE Std 1048-2003, contains guidelines for selecting and installing protective grounding equipment.

1910.269(n)(5) Testing.

The employer shall ensure that, unless a previously installed ground is present, employees test lines and equipment and verify the absence of nominal voltage before employees install any ground on those lines or that equipment.

1910.269(n)(6) Connecting and removing grounds.

1910.269(n)(6)(i) The employer shall ensure that, when an employee attaches a ground to a line or to equipment, the employee attaches the ground-end connection first and then attaches the other end by means of a live-line tool. For lines or equipment operating at 600 volts or less, the employer may permit the employee to use insulating equipment other than a live-line tool if the employer ensures that the line or equipment is not energized at the time the ground is connected or if the employer can demonstrate that each employee is protected from hazards that may develop if the line or equipment is energized.

1910.269(n)(6)(ii) The employer shall ensure that, when an employee removes a ground, the employee removes the grounding device from the line or equipment using a live-line tool before he or she removes the ground-end connection. For lines or equipment operating at 600 volts or less, the employer may permit the employee to use insulating equipment other than a live-line tool if the employer ensures that the line or equipment is not energized at the time the ground is disconnected or if the employer can demonstrate that each employee is protected from hazards that may develop if the line or equipment is energized.

1910.269(n)(7) Additional precautions.

The employer shall ensure that, when an employee performs work on a cable at a location remote from the cable terminal, the cable is not grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.

1910.269(n)(8) Removal of grounds for test.

The employer may permit employees to remove grounds temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment, shall isolate each employee from any hazards involved, and shall implement any additional measures necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

1910.269(o) Testing and test facilities.

1910.269(o)(1) Application.

Paragraph (o) of this section provides for safe work practices for high-voltage and high-power testing performed in laboratories, shops, and substations, and in the field and on electric transmission and distribution lines and equipment. It applies only to testing involving interim measurements using high voltage, high power, or combinations of high voltage and high power, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.

Note to paragraph (o)(1): OSHA considers routine inspection and maintenance measurements made by qualified employees to be routine line work not included in the scope of paragraph (o) of this section, provided that the hazards related to the use of intrinsic high-voltage or high-power sources require only the normal precautions associated with routine work specified in the other paragraphs of this section. Two typical examples of such excluded test work procedures are "phasing-out" testing and testing for a "no-voltage" condition.

1910.269(o)(2) General requirements.

1910.269(o)(2)(i) The employer shall establish and enforce work practices for the protection of each worker from the hazards of high-voltage or high-power testing at all test areas, temporary and permanent. Such work practices shall include, as a minimum, test area safeguarding, grounding, the safe use of measuring and control circuits, and a means providing for periodic safety checks of field test areas.

1910.269(o)(2)(ii) The employer shall ensure that each employee, upon initial assignment to the test area, receives training in safe work practices, with retraining provided as required by paragraph (a)(2) of this section.

1910.269(o)(3) Safeguarding of test areas.

1910.269(o)(3)(i) The employer shall provide safeguarding within test areas to control access to test equipment or to apparatus under test that could become energized as part of the testing by either direct or inductive coupling and to prevent accidental employee contact with energized parts.

- 1910.269(o)(3)(ii) The employer shall guard permanent test areas with walls, fences, or other barriers designed to keep employees out of the test areas.
- 1910.269(o)(3)(iii) In field testing, or at a temporary test site not guarded by permanent fences and gates, the employer shall ensure the use of one of the following means to prevent employees without authorization from entering:
 - 1910.269(o)(3)(iii)(A) Distinctively colored safety tape supported approximately waist high with safety signs attached to it,
 - 1910.269(o)(3)(iii)(B) A barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in paragraph (o)(3)(iii)(A) of this section, or
 - 1910.269(o)(3)(iii)(C) One or more test observers stationed so that they can monitor the entire area.
- 1910.269(o)(3)(iv) The employer shall ensure the removal of the safeguards required by paragraph (o)(3)(iii) of this section when employees no longer need the protection afforded by the safeguards.

1910.269(o)(4) Grounding practices.

- 1910.269(o)(4)(i) The employer shall establish and implement safe grounding practices for the test facility.
- 1910.269(o)(4)(i)(A) The employer shall maintain at ground potential all conductive parts accessible to the test operator while the equipment is operating at high voltage.
- 1910.269(o)(4)(i)(B) Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until tests demonstrate that they are deenergized.
- 1910.269(o)(4)(ii) The employer shall ensure either that visible grounds are applied automatically, or that employees using properly insulated tools manually apply visible grounds, to the high-voltage circuits after they are deenergized and before any employee performs work on the circuit or on the item or apparatus under test. Common ground connections shall be solidly connected to the test equipment and the apparatus under test.
- 1910.269(o)(4)(iii) In high-power testing, the employer shall provide an isolated ground-return conductor system designed to prevent the intentional passage of current, with its attendant voltage rise, from occurring in the ground grid or in the earth. However, the employer need not provide an isolated ground-return conductor if the employer can demonstrate that both of the following conditions exist:
 - 1910.269(o)(4)(iii)(A) The employer cannot provide an isolated ground-return conductor due to the distance of the test site from the electric energy source, and
 - 1910.269(o)(4)(iii)(B) The employer protects employees from any hazardous step and touch potentials that may develop during the test

Note to paragraph (o)(4)(iii)(B): See Appendix C to this section for information on measures that employers can take to protect employees from hazardous step and touch potentials.

- 1910.269(o)(4)(iv) For tests in which using the equipment grounding conductor in the equipment power cord to ground the test equipment would result in greater hazards to test personnel or prevent the taking of satisfactory measurements, the employer may use a ground clearly indicated in the test set-up if the employer can demonstrate that this ground affords protection for employees equivalent to the protection afforded by an equipment grounding conductor in the power supply cord.
- 1910.269(o)(4)(v) The employer shall ensure that, when any employee enters the test area after equipment is deenergized, a ground is placed on the high-voltage terminal and any other exposed terminals.
- 1910.269(o)(4)(v)(A) Before any employee applies a direct ground, the employer shall discharge high capacitance equipment through a resistor rated for the available energy.
- 1910.269(o)(4)(v)(B) A direct ground shall be applied to the exposed terminals after the stored energy drops to a level at which it is safe to do so.
- 1910.269(o)(4)(vi) If the employer uses a test trailer or test vehicle in field testing, its chassis shall be grounded. The employer shall protect each employee against hazardous touch potentials with respect to the vehicle, instrument panels, and other conductive parts accessible to employees with bonding, insulation, or isolation.

1910.269(o)(5) Control and measuring circuits.

- 1910.269(o)(5)(i) The employer may not run control wiring, meter connections, test leads, or cables from a test area unless contained in a grounded metallic sheath and terminated in a grounded metallic enclosure or unless the employer takes other precautions that it can demonstrate will provide employees with equivalent safety.
- 1910.269(o)(5)(ii) The employer shall isolate meters and other instruments with accessible terminals or parts from test personnel to protect against hazards that could arise should such terminals and parts become energized during testing. If the employer provides this isolation by locating test equipment in metal compartments with viewing windows, the employer shall provide interlocks to interrupt the power supply when someone opens the compartment cover.
- 1910.269(o)(5)(iii) The employer shall protect temporary wiring and its connections against damage, accidental interruptions, and other hazards. To the maximum extent possible, the employer shall keep signal, control, ground, and power cables separate from each other.

1910.269(o)(5)(iv) If any employee will be present in the test area during testing, a test observer shall be present. The test observer shall be capable of implementing the immediate deenergizing of test circuits for safety purposes.

1910.269(o)(6) Safety check.

1910.269(o)(6)(i) Safety practices governing employee work at temporary or field test areas shall provide, at the beginning of each series of tests, for a routine safety check of such test areas.

1910.269(o)(6)(ii) The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:

1910.269(o)(6)(ii)(A) Barriers and safeguards are in workable condition and placed properly to isolate hazardous areas;

1910.269(o)(6)(ii)(B) System test status signals, if used, are in operable condition;

1910.269(o)(6)(ii)(C) Clearly marked test-power disconnects are readily available in an emergency;

1910.269(o)(6)(ii)(D) Ground connections are clearly identifiable;

1910.269(o)(6)(ii)(E) Personal protective equipment is provided and used as required by Subpart I of this part and by this section; and

1910.269(o)(6)(ii)(F) Proper separation between signal, ground, and power cables.

1910.269(p) Mechanical equipment.

1910.269(p)(1) General requirements.

1910.269(p)(1)(i) The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection before use on each shift.

Note to paragraph (p)(1)(i): Critical safety components of mechanical elevating and rotating equipment are components for which failure would result in free fall or free rotation of the boom.

1910.269(p)(1)(ii) No motor vehicle or earthmoving or compacting equipment having an obstructed view to the rear may be operated on off-highway jobsites where any employee is exposed to the hazards created by the moving vehicle, unless:

1910.269(p)(1)(ii)(A) The vehicle has a reverse signal alarm audible above the surrounding noise level, or

1910.269(p)(1)(ii)(B) The vehicle is backed up only when a designated employee signals that it is safe to do so.

1910.269(p)(1)(iii) Rubber-tired self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type tractors, crawler-type loaders, and motor graders, with or without attachments, shall have rollover protective structures that meet the requirements of Subpart W of Part 1926 of this chapter.

1910.269(p)(1)(iv) The operator of an electric line truck may not leave his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee (including the operator) is endangered.

1910.269(p)(2) Outriggers.

1910.269(p)(2)(i) Mobile equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set, except as provided in paragraph (p)(2)(iii) of this section.

1910.269(p)(2)(ii) Outriggers may not be extended or retracted outside of the clear view of the operator unless all employees are outside the range of possible equipment motion.

1910.269(p)(2)(iii) If the work area or the terrain precludes the use of outriggers, the equipment may be operated only within its maximum load ratings specified by the equipment manufacturer for the particular configuration of the equipment without outriggers.

1910.269(p)(3) Applied loads.

Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the mechanical equipment is being used

1910.269(p)(4) Operations near energized lines or equipment.

1910.269(p)(4)(i) Mechanical equipment shall be operated so that the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, are maintained from exposed energized lines and equipment. However, the insulated portion of an aerial lift operated by a qualified employee in the lift is exempt from this requirement if the applicable minimum approach distance is maintained between the uninsulated portions of the aerial lift and exposed objects having a different electrical potential.

1910.269(p)(4)(ii) A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and provide timely warnings before the minimum approach distance required by paragraph (p)(4)(i) of this section is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

1910.269(p)(4)(iii) If, during operation of the mechanical equipment, that equipment could become energized, the operation also shall comply with at least one of paragraphs (p)(4)(iii)(A) through (p)(4)(iii)(C) of this section.

1910.269(p)(4)(iii)(A) The energized lines or equipment exposed to contact shall be covered with insulating protective material that will withstand the type of contact that could be made during the operation.

1910.269(p)(4)(iii)(B) The mechanical equipment shall be insulated for the voltage involved. The mechanical equipment shall be positioned so that its uninsulated portions cannot approach the energized lines or equipment any closer than the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section.

1910.269(p)(4)(iii)(C) Each employee shall be protected from hazards that could arise from mechanical equipment contact with energized lines or equipment. The measures used shall ensure that employees will not be exposed to hazardous differences in electric potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that could arise if the mechanical equipment contacts the energized line or equipment, the measures used shall include all of the following techniques:

1910.269(p)(4)(iii)(C)(1) Using the best available ground to minimize the time the lines or electric equipment remain energized,

1910.269(p)(4)(iii)(C)(2) Bonding mechanical equipment together to minimize potential differences,

1910.269(p)(4)(iii)(C)(3) Providing ground mats to extend areas of equipotential, and

1910.269(p)(4)(iii)(C)(4) Employing insulating protective equipment or barricades to guard against any remaining hazardous electrical potential differences.

Note to paragraph (p)(4)(iii)(C): Appendix C to this section contains information on hazardous step and touch potentials and on methods of protecting employees from hazards resulting from such potentials.

1910.269(q) Overhead lines and live-line barehand work.

This paragraph provides additional requirements for work performed on or near overhead lines and equipment and for live-line barehand work.

1910.269(q)(1) General.

1910.269(q)(1)(i) Before allowing employees to subject elevated structures, such as poles or towers, to such stresses as climbing or the installation or removal of equipment may impose, the employer shall ascertain that the structures are capable of sustaining the additional or unbalanced stresses. If the pole or other structure cannot withstand the expected loads, the employer shall brace or otherwise support the pole or structure so as to prevent failure.

Note to paragraph (q)(1)(i): Appendix D to this section contains test methods that employers can use in ascertaining whether a wood pole is capable of sustaining the forces imposed by an employee climbing the pole. This paragraph also requires the employer to ascertain that the pole can sustain all other forces imposed by the work employees will perform.

1910.269(q)(1)(ii) When a pole is set, moved, or removed near an exposed energized overhead conductor, the pole may not contact the conductor.

1910.269(q)(1)(iii) When a pole is set, moved, or removed near an exposed energized overhead conductor, the employer shall ensure that each employee wears electrical protective equipment or uses insulated devices when handling the pole and that no employee contacts the pole with uninsulated parts of his or her body.

1910.269(q)(1)(iv) To protect employees from falling into holes used for placing poles, the employer shall physically guard the holes, or ensure that employees attend the holes, whenever anyone is working nearby.

1910.269(q)(2) Installing and removing overhead lines.

The following provisions apply to the installation and removal of overhead conductors or cable (overhead lines).

1910.269(q)(2)(i) When lines that employees are installing or removing can contact energized parts, the employer shall use the tension-stringing method, barriers, or other equivalent measures to minimize the possibility that conductors and cables the employees are installing or removing will contact energized power lines or equipment.

1910.269(q)(2)(ii) For conductors, cables, and pulling and tensioning equipment, the employer shall provide the protective measures required by paragraph (p)(4)(iii) of this section when employees are installing or removing a conductor or cable close enough to energized conductors that any of the following failures could energize the pulling or tensioning equipment or the conductor or cable being installed or removed:

1910.269(q)(2)(ii)(A) Failure of the pulling or tensioning equipment,

1910.269(q)(2)(ii)(B) Failure of the conductor or cable being pulled, or

1910.269(q)(2)(ii)(C) Failure of the previously installed lines or equipment.

1910.269(q)(2)(iii) If the conductors that employees are installing or removing cross over energized conductors in excess of 600 volts and if the design of the circuit interrupting devices protecting the lines so permits, the employer shall render inoperable the automatic-reclosing feature of these devices.

1910.269(q)(2)(iv) Before employees install lines parallel to existing energized lines, the employer shall make a determination of the approximate voltage to be induced in the new lines, or work shall proceed on the assumption that the induced voltage is hazardous. Unless the employer can demonstrate that the lines that employees are installing are not subject to the induction of a hazardous voltage or unless the lines are treated as energized, temporary protective grounds shall be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent exposure of each employee to hazardous differences in electric potential.

Note 1 to paragraph (q)(2)(iv): If the employer takes no precautions to protect employees from hazards associated with involuntary reactions from electric shock, a hazard exists if the induced voltage is sufficient to pass a current of 1 milliampere through a 500-ohm resistor. If the employer protects employees from injury due to involuntary reactions from electric shock, a hazard exists if the resultant current would be more than 6 milliamperes.

Note 2 to paragraph (q)(2)(iv): Appendix C to this section contains guidelines for protecting employees from hazardous differences in electric potential as required by this paragraph.

1910.269(q)(2)(v) Reel-handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.

1910.269(q)(2)(vi) The employer shall ensure that employees do not exceed load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists.

1910.269(q)(2)(vii) The employer shall repair or replace defective pulling lines and accessories.

1910.269(q)(2)(viii) The employer shall ensure that employees do not use conductor grips on wire rope unless the manufacturer specifically designed the grip for this application.

1910.269(q)(2)(ix) The employer shall ensure that employees maintain reliable communications, through two-way radios or other equivalent means, between the reel tender and the pulling-rig operator.

1910.269(q)(2)(x) Employees may operate the pulling rig only when it is safe to do so.

Note to paragraph (q)(2)(x): Examples of unsafe conditions include: employees in locations prohibited by paragraph (q)(2)(xi) of this section, conductor and pulling line hang-ups, and slipping of the conductor grip.

1910.269(q)(2)(xi) While a power-driven device is pulling the conductor or pulling line and the conductor or pulling line is in motion, the employer shall ensure that employees are not directly under overhead operations or on the crossarm, except as necessary for the employees to guide the stringing sock or board over or through the stringing sheave.

1910.269(q)(3) Live-line barehand work.

In addition to other applicable provisions contained in this section, the following requirements apply to live-line barehand work:

1910.269(q)(3)(i) Before an employee uses or supervises the use of the live-line barehand technique on energized circuits, the employer shall ensure that the employee completes training conforming to paragraph (a)(2) of this section in the technique and in the safety requirements of paragraph (q)(3) of this section.

1910.269(q)(3)(ii) Before any employee uses the live-line barehand technique on energized high-voltage conductors or parts, the employer shall ascertain the following information in addition to information about other existing conditions required by paragraph (a)(4) of this section:

1910.269(q)(3)(ii)(A) The nominal voltage rating of the circuit on which employees will perform the work,

1910.269(q)(3)(ii)(B) The clearances to ground of lines and other energized parts on which employees will perform the work, and

1910.269(q)(3)(ii)(C) The voltage limitations of equipment employees will use.

1910.269(q)(3)(iii) The employer shall ensure that the insulated equipment, insulated tools, and aerial devices and platforms used by employees are designed, tested, and made for live-line barehand work.

1910.269(q)(3)(iv) The employer shall ensure that employees keep tools and equipment clean and dry while they are in use.

1910.269(q)(3)(v) The employer shall render inoperable the automatic-reclosing feature of circuit-interrupting devices protecting the lines if the design of the devices permits.

1910.269(q)(3)(vi) The employer shall ensure that employees do not perform work when adverse weather conditions would make the work hazardous even after the employer implements the work practices required by this section. Additionally, employees may not perform work when winds reduce the phase-to-phase or phase-to-ground clearances at the work location below the minimum approach distances specified in paragraph (q)(3)(xiv) of this section, unless insulating guards cover the grounded objects and other lines and equipment.

Note to paragraph (q)(3)(vi): Thunderstorms in the vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that make live-line barehand work too hazardous to perform safely even after the employer implements the work practices required by this section.

1910.269(q)(3)(vii) The employer shall provide and ensure that employees use a conductive bucket liner or other conductive device for bonding the insulated aerial device to the energized line or equipment.

1910.269(q)(3)(vii)(A) The employee shall be connected to the bucket liner or other conductive device by the use of conductive shoes, leg clips, or other means.

1910.269(q)(3)(vii)(B) Where differences in potentials at the worksite pose a hazard to employees, the employer shall provide electrostatic shielding designed for the voltage being worked.

1910.269(q)(3)(viii) The employer shall ensure that, before the employee contacts the energized part, the employee bonds the conductive bucket liner or other conductive device to the energized conductor by means of a positive connection. This connection shall remain attached to the energized conductor until the employee completes the work on the energized circuit.

1910.269(q)(3)(ix) Aerial lifts used for live-line barehand work shall have dual controls (lower and upper) as follows:

- 1910.269(q)(3)(ix)(A) The upper controls shall be within easy reach of the employee in the bucket. On a two-bucket-type lift, access to the controls shall be within easy reach of both buckets.
- 1910.269(q)(3)(ix)(B) The lower set of controls shall be near the base of the boom and shall be designed so that they can override operation of the equipment at any time.
- 1910.269(q)(3)(x) Lower (ground-level) lift controls may not be operated with an employee in the lift except in case of emergency.
- 1910.269(q)(3)(xi) The employer shall ensure that, before employees elevate an aerial lift into the work position, the employees check all controls (ground level and bucket) to determine that they are in proper working condition.
- 1910.269(q)(3)(xii) The employer shall ensure that, before employees elevate the boom of an aerial lift, the employees ground the body of the truck or barricade the body of the truck and treat it as energized.
- 1910.269(q)(3)(xiii) The employer shall ensure that employees perform a boom-current test before starting work each day, each time during the day when they encounter a higher voltage, and when changed conditions indicate a need for an additional test.
- 1910.269(q)(3)(xiii)(A) This test shall consist of placing the bucket in contact with an energized source equal to the voltage to be encountered for a minimum of 3 minutes.
- 1910.269(q)(3)(xiii)(B) The leakage current may not exceed 1 microampere per kilovolt of nominal phase-to-ground voltage.
- 1910.269(q)(3)(xiii)(C) The employer shall immediately suspend work from the aerial lift when there is any indication of a malfunction in the equipment.
- 1910.269(q)(3)(xiv) The employer shall ensure that employees maintain the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, from all grounded objects and from lines and equipment at a potential different from that to which the live-line barehand equipment is bonded, unless insulating guards cover such grounded objects and other lines and equipment.
- 1910.269(q)(3)(xv) The employer shall ensure that, while an employee is approaching, leaving, or bonding to an energized circuit, the employee maintains the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, between the employee and any grounded parts, including the lower boom and portions of the truck and between the employee and conductive objects energized at different potentials.
- 1910.269(q)(3)(xvi) While the bucket is alongside an energized bushing or insulator string, the employer shall ensure that employees maintain the phase-to ground minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, between all parts of the bucket and the grounded end of the bushing or insulator string or any other grounded surface.
- 1910.269(q)(3)(xvii) The employer shall ensure that employees do not use handlines between the bucket and the boom or between the bucket and the ground. However, employees may use nonconductive-type handlines from conductor to ground if not supported from the bucket. The employer shall ensure that no one uses ropes used for live-line barehand work for other purposes.
- 1910.269(q)(3)(xviii) The employer shall ensure that employees do not pass uninsulated equipment or material between a pole or structure and an aerial lift while an employee working from the bucket is bonded to an energized part.
- 1910.269(q)(3)(xix) A nonconductive measuring device shall be readily accessible to employees performing live-line barehand work to assist them in maintaining the required minimum approach distance.

1910.269(q)(4) Towers and structures.

The following requirements apply to work performed on towers or other structures that support overhead lines.

- 1910.269(q)(4)(i) The employer shall ensure that no employee is under a tower or structure while work is in progress, except when the employer can demonstrate that such a working position is necessary to assist employees working above.
- 1910.269(q)(4)(ii) The employer shall ensure that employees use tag lines or other similar devices to maintain control of tower sections being raised or positioned, unless the employer can demonstrate that the use of such devices would create a greater hazard to employees.
- 1910.269(q)(4)(iii) The employer shall ensure that employees do not detach the loadline from a member or section until they safely secure the load.
- 1910.269(q)(4)(iv) The employer shall ensure that, except during emergency restoration procedures, employees discontinue work when adverse weather conditions would make the work hazardous in spite of the work practices required by this section.

Note to paragraph (q)(4)(iv): Thunderstorms in the vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that make this work too hazardous to perform even after the employer implements the work practices required by this section.

1910.269(r) Line-clearance tree trimming operations.

This paragraph provides additional requirements for line-clearance tree-trimming operations and for equipment used in these operations.

1910.269(r)(1) Electrical hazards.

This paragraph does not apply to qualified employees.

1910.269(r)(1)(i) Before an employee climbs, enters, or works around any tree, a determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage.

1910.269(r)(1)(ii) There shall be a second line-clearance tree trimmer within normal (that is, unassisted) voice communication under any of the following conditions:

1910.269(r)(1)(ii)(A) If a line-clearance tree trimmer is to approach more closely than 3.05 meters (10 feet) to any conductor or electric apparatus energized at more than 750 volts or

1910.269(r)(1)(ii)(B) If branches or limbs being removed are closer to lines energized at more than 750 volts than the distances listed in Table R-5, Table R-6, Table R-7, and Table R-8 or

1910.269(r)(1)(ii)(C) If roping is necessary to remove branches or limbs from such conductors or apparatus.

1910.269(r)(1)(iii) Line-clearance tree trimmers shall maintain the minimum approach distances from energized conductors given in Table R-5, Table R-6, Table R-7, and Table R-8.

1910.269(r)(1)(iv) Branches that are contacting exposed energized conductors or equipment or that are within the distances specified in Table R-5, Table R-6, Table R-7, and Table R-8 may be removed only through the use of insulating equipment.

Note to paragraph (r)(1)(iv): A tool constructed of a material that the employer can demonstrate has insulating qualities meeting paragraph (j)(1) of this section is considered as insulated under paragraph (r)(1)(iv) of this section if the tool is clean and dry.

1910.269(r)(1)(v) Ladders, platforms, and aerial devices may not be brought closer to an energized part than the distances listed in Table R-5, Table R-6, Table R-7, and Table R-8.

1910.269(r)(1)(vi) Line-clearance tree-trimming work may not be performed when adverse weather conditions make the work hazardous in spite of the work practices required by this section. Each employee performing line-clearance tree trimming work in the aftermath of a storm or under similar emergency conditions shall be trained in the special hazards related to this type of work.

Note to paragraph (r)(1)(vi): Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make line-clearance tree trimming work too hazardous to perform safely.

1910.269(r)(2) Brush chippers.

1910.269(r)(2)(i) Brush chippers shall be equipped with a locking device in the ignition system.

1910.269(r)(2)(ii) Access panels for maintenance and adjustment of the chipper blades and associated drive train shall be in place and secure during operation of the equipment.

1910.269(r)(2)(iii) Brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper of length sufficient to prevent employees from contacting the blades or knives of the machine during operation.

1910.269(r)(2)(iv) Trailer chippers detached from trucks shall be chocked or otherwise secured.

1910.269(r)(2)(v) Each employee in the immediate area of an operating chipper feed table shall wear personal protective equipment as required by Subpart I of this part.

1910.269(r)(3) Sprayers and related equipment.

1910.269(r)(3)(i) Walking and working surfaces of sprayers and related equipment shall be covered with slip-resistant material. If slipping hazards cannot be eliminated, slip-resistant footwear or handrails and stair rails meeting the requirements of Subpart D of this part may be used instead of slip-resistant material.

1910.269(r)(3)(ii) Equipment on which employees stand to spray while the vehicle is in motion shall be equipped with guardrails around the working area. The guardrail shall be constructed in accordance with Subpart D of this part.

1910.269(r)(4) Stump cutters.

1910.269(r)(4)(i) Stump cutters shall be equipped with enclosures or guards to protect employees.

1910.269(r)(4)(ii) Each employee in the immediate area of stump grinding operations including the stump cutter operator shall wear personal protective equipment as required by Subpart I of this part.

1910.269(r)(5) Gasoline-engine power saws.

Gasoline-engine power saw operations shall meet the requirements of § 1910.266(e) and the following:

1910.269(r)(5)(i) Each power saw weighing more than 6.8 kilograms (15 pounds, service weight) that is used in trees shall be supported by a separate line, except when work is performed from an aerial lift and except during topping or removing operations where no supporting limb will be available.

1910.269(r)(5)(ii) Each power saw shall be equipped with a control that will return the saw to idling speed when released.

1910.269(r)(5)(iii) Each power saw shall be equipped with a clutch and shall be so adjusted that the clutch will not engage the chain drive at idling speed.

1910.269(r)(5)(iv) A power saw shall be started on the ground or where it is otherwise firmly supported. Drop starting of saws over 6.8 kilograms (15 pounds), other than chain saws, is permitted outside of the bucket of an aerial lift only if the area below the lift is clear of personnel.

Note to paragraph (r)(5)(iv): Paragraph (e)(2)(vi) of § 1910.266 prohibits drop starting of chain saws.

1910.269(r)(5)(v) A power saw engine may be started and operated only when all employees other than the operator are clear of the saw.

1910.269(r)(5)(vi) A power saw may not be running when the saw is being carried up into a tree by an employee.

1910.269(r)(5)(vii) Power saw engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

1910.269(r)(6) Backpack power units for use in pruning and clearing.

1910.269(r)(6)(i) While a backpack power unit is running, no one other than the operator may be within 3.05 meters (10 feet) of the cutting head of a brush saw.

1910.269(r)(6)(ii) A backpack power unit shall be equipped with a quick shutoff switch readily accessible to the operator.

1910.269(r)(6)(iii) Backpack power unit engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

1910.269(r)(7) Rope.

1910.269(r)(7)(i) Climbing ropes shall be used by employees working aloft in trees. These ropes shall have a minimum diameter of 12 millimeters (0.5 inch) with a minimum breaking strength of 10.2 kilo-newtons (2,300 pounds). Synthetic rope shall have elasticity of not more than 7 percent.

1910.269(r)(7)(ii) Rope shall be inspected before each use and, if unsafe (for example, because of damage or defect), may not be used.

1910.269(r)(7)(iii) Rope shall be stored away from cutting edges and sharp tools. Rope contact with corrosive chemicals, gas, and oil shall be avoided.

1910.269(r)(7)(iv) When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils.

1910.269(r)(7)(v) Rope ends shall be secured to prevent their unraveling.

1910.269(r)(7)(vi) Climbing rope may not be spliced to effect repair.

1910.269(r)(7)(vii) A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved may not be used near exposed energized lines.

1910.269(r)(8) Fall protection.

Each employee shall be tied in with a climbing rope and safety saddle when the employee is working above the ground in a tree, unless he or she is ascending into the tree.

1910.269(s) Communication facilities.

1910.269(s)(1) Microwave transmission.

1910.269(s)(1)(i) The employer shall ensure that no employee looks into an open waveguide or antenna connected to an energized microwave source.

1910.269(s)(1)(ii) If the electromagnetic-radiation level within an accessible area associated with microwave communications systems exceeds the radiation-protection guide specified by § 1910.97(a)(2), the employer shall post the area with warning signs containing the warning symbol described in § 1910.97(a)(3). The lower half of the warning symbol shall include the following statements, or ones that the employer can demonstrate are equivalent: "Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering."

1910.269(s)(1)(iii) When an employee works in an area where the electromagnetic radiation could exceed the radiation protection guide, the employer shall institute measures that ensure that the employee's exposure is not greater than that permitted by that guide. Such measures may include administrative and engineering controls and personal protective equipment.

1910.269(s)(2) Power-line carrier.

The employer shall ensure that employees perform power-line carrier work, including work on equipment used for coupling carrier current to power line conductors, in accordance with the requirements of this section pertaining to work on energized lines.

1910.269(t) Underground electrical installations.

This paragraph provides additional requirements for work on underground electrical installations.

1910.269(t)(1) Access.

The employer shall ensure that employees use a ladder or other climbing device to enter and exit a manhole or subsurface vault exceeding 1.22 meters (4 feet) in depth. No employee may climb into or out of a manhole or vault by stepping on cables or hangers.

1910.269(t)(2) Lowering equipment into manholes.

1910.269(t)(2)(i) Equipment used to lower materials and tools into manholes or vaults shall be capable of supporting the weight to be lowered and shall be checked for defects before use.

1910.269(t)(2)(ii) Before anyone lowers tools or material into the opening for a manhole or vault, each employee working in the manhole or vault shall be clear of the area directly under the opening.

1910.269(t)(3) Attendants for manholes and vaults.

1910.269(t)(3)(i) While work is being performed in a manhole or vault containing energized electric equipment, an employee with first-aid training shall be available on the surface in the immediate vicinity of the manhole or vault entrance to render emergency assistance.

1910.269(t)(3)(ii) Occasionally, the employee on the surface may briefly enter a manhole or vault to provide nonemergency assistance.

Note 1 to paragraph (t)(3)(ii): Paragraph (e)(7) of this section may also require an attendant and does not permit this attendant to enter the manhole or vault.

Note 2 to paragraph (t)(3)(ii): Paragraph (l)(1)(ii) of this section requires employees entering manholes or vaults containing unguarded, uninsulated energized lines or parts of electric equipment operating at 50 volts or more to be qualified.

1910.269(t)(3)(iii) For the purpose of inspection, housekeeping, taking readings, or similar work, an employee working alone may enter, for brief periods of time, a manhole or vault where energized cables or equipment are in service if the employer can demonstrate that the employee will be protected from all electrical hazards.

1910.269(t)(3)(iv) The employer shall ensure that employees maintain reliable communications, through two-way radios or other equivalent means, among all employees involved in the job.

1910.269(t)(4) Duct rods.

The employer shall ensure that, if employees use duct rods, the employees install the duct rods in the direction presenting the least hazard to employees. The employer shall station an employee at the far end of the duct line being rodded to ensure that the employees maintain the required minimum approach distances.

1910.269(t)(5) Multiple cables.

When multiple cables are present in a work area, the employer shall identify the cable to be worked by electrical means, unless its identity is obvious by reason of distinctive appearance or location or by other readily apparent means of identification. The employer shall protect cables other than the one being worked from damage.

1910.269(t)(6) Moving cables.

Except when paragraph (t)(7)(ii) of this section permits employees to perform work that could cause a fault in an energized cable in a manhole or vault, the employer shall ensure that employees inspect energized cables to be moved for abnormalities.

1910.269(t)(7) Protection against faults.

1910.269(t)(7)(i) Where a cable in a manhole or vault has one or more abnormalities that could lead to a fault or be an indication of an impending fault, the employer shall deenergize the cable with the abnormality before any employee may work in the manhole or vault, except when service-load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole or vault provided the employer protects them from the possible effects of a failure using shields or other devices that are capable of containing the adverse effects of a fault. The employer shall treat the following abnormalities as indications of impending faults unless the employer can demonstrate that the conditions could not lead to a fault: Oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints swollen beyond normal tolerance.

1910.269(t)(7)(ii) If the work employees will perform in a manhole or vault could cause a fault in a cable, the employer shall deenergize that cable before any employee works in the manhole or vault, except when service-load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole or vault provided the employer protects them from the possible effects of a failure using shields or other devices that are capable of containing the adverse effects of a fault.

1910.269(t)(8) Sheath continuity.

When employees perform work on buried cable or on cable in a manhole or vault, the employer shall maintain metallic-sheath continuity, or the cable sheath shall be treated as energized.

1910.269(u) Substations.

This paragraph provides additional requirements for substations and for work performed in them.

1910.269(u)(1) Access and working space.

The employer shall provide and maintain sufficient access and working space about electric equipment to permit ready and safe operation and maintenance of such equipment by employees.

Note to paragraph (u)(1): American National Standard National Electrical Safety Code, ANSI/IEEE C2-2012 contains guidelines for the dimensions of access and working space about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (u)(1) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (u)(1) of this section based on the following criteria:

- (1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made,
- (2) Whether the configuration of the installation enables employees to maintain the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, while the employees are working on exposed, energized parts, and
- (3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by access and working space meeting ANSI/IEEE C2-2012.

1910.269(u)(2) Draw-out-type circuit breakers.

The employer shall ensure that, when employees remove or insert draw-out-type circuit breakers, the breaker is in the open position. The employer shall also render the control circuit inoperable if the design of the equipment permits.

1910.269(u)(3) Substation fences.

Conductive fences around substations shall be grounded. When a substation fence is expanded or a section is removed, fence sections shall be isolated, grounded, or bonded as necessary to protect employees from hazardous differences in electric potential.

Note to paragraph (u)(3): IEEE Std 80-2000, IEEE Guide for Safety in AC Substation Grounding, contains guidelines for protection against hazardous differences in electric potential.

1910.269(u)(4) Guarding of rooms and other spaces containing electric supply equipment.

1910.269(u)(4)(i) Rooms and other spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (u)(4)(ii) through (u)(4)(v) of this section under the following conditions:

1910.269(u)(4)(i)(A) If exposed live parts operating at 50 to 150 volts to ground are within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space,

1910.269(u)(4)(i)(B) If live parts operating at 151 to 600 volts to ground and located within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space are guarded only by location, as permitted under paragraph (u)(5)(i) of this section, or

1910.269(u)(4)(i)(C) If live parts operating at more than 600 volts to ground are within the room or other space, unless:

1910.269(u)(4)(i)(C)(1) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

1910.269(u)(4)(i)(C)(2) The live parts are installed at a height, above ground and any other working surface, that provides protection at the voltage on the live parts corresponding to the protection provided by a 2.4-meter (8-foot) height at 50 volts.

1910.269(u)(4)(ii) Fences, screens, partitions, or walls shall enclose the rooms and other spaces so as to minimize the possibility that unqualified persons will enter.

1910.269(u)(4)(iii) Unqualified persons may not enter the rooms or other spaces while the electric supply lines or equipment are energized.

1910.269(u)(4)(iv) The employer shall display signs at entrances to the rooms and other spaces warning unqualified persons to keep out.

1910.269(u)(4)(v) The employer shall keep each entrance to a room or other space locked, unless the entrance is under the observation of a person who is attending the room or other space for the purpose of preventing unqualified employees from entering.

1910.269(u)(5) Guarding of energized parts.

1910.269(u)(5)(i) The employer shall provide guards around all live parts operating at more than 150 volts to ground without an insulating covering unless the location of the live parts gives sufficient clearance (horizontal, vertical, or both) to minimize the possibility of accidental employee contact.

Note to paragraph (u)(5)(i): American National Standard National Electrical Safety Code, ANSI/IEEE C2-2002 contains guidelines for the dimensions of clearance distances about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (u)(5)(i) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (u)(5)(i) of this section based on the following criteria:

- (1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made,

- (2) Whether each employee is isolated from energized parts at the point of closest approach; and
- (3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by horizontal and vertical clearances meeting ANSI/IEEE C2-2002.

1910.269(u)(5)(ii) Except for fuse replacement and other necessary access by qualified persons, the employer shall maintain guarding of energized parts within a compartment during operation and maintenance functions to prevent accidental contact with energized parts and to prevent dropped tools or other equipment from contacting energized parts.

1910.269(u)(5)(iii) Before guards are removed from energized equipment, the employer shall install barriers around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

1910.269(u)(6) Substation entry.

1910.269(u)(6)(i) Upon entering an attended substation, each employee, other than employees regularly working in the station, shall report his or her presence to the employee in charge of substation activities to receive information on special system conditions affecting employee safety.

1910.269(u)(6)(ii) The job briefing required by paragraph (c) of this section shall cover information on special system conditions affecting employee safety, including the location of energized equipment in or adjacent to the work area and the limits of any deenergized work area.

1910.269(v) Power generation.

This paragraph provides additional requirements and related work practices for power generating plants.

1910.269(v)(1) Interlocks and other safety devices.

1910.269(v)(1)(i) Interlocks and other safety devices shall be maintained in a safe, operable condition.

1910.269(v)(1)(ii) No interlock or other safety device may be modified to defeat its function, except for test, repair, or adjustment of the device.

1910.269(v)(2) Changing brushes.

Before exciter or generator brushes are changed while the generator is in service, the exciter or generator field shall be checked to determine whether a ground condition exists. The brushes may not be changed while the generator is energized if a ground condition exists.

1910.269(v)(3) Access and working space.

The employer shall provide and maintain sufficient access and working space about electric equipment to permit ready and safe operation and maintenance of such equipment by employees.

Note to paragraph (v)(3) of this section: American National Standard National Electrical Safety Code, ANSI/IEEE C2-2012 contains guidelines for the dimensions of access and working space about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (v)(3) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (v)(3) of this section based on the following criteria:

(1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made;

(2) Whether the configuration of the installation enables employees to maintain the minimum approach distances, established by the employer under paragraph (l)(3)(i) of this section, while the employees are working on exposed, energized parts, and;

(3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by access and working space meeting ANSI/IEEE C2-2012.

1910.269(v)(4) Guarding of rooms and other spaces containing electric supply equipment.

1910.269(v)(4)(i) Rooms and other spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (v)(4)(ii) through (v)(4)(v) of this section under the following conditions:

1910.269(v)(4)(i)(A) If exposed live parts operating at 50 to 150 volts to ground are within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space,

1910.269(v)(4)(i)(B) If live parts operating at 151 to 600 volts to ground and located within 2.4 meters (8 feet) of the ground or other working surface inside the room or other space are guarded only by location, as permitted under paragraph (v)(5)(i) of this section, or

1910.269(v)(4)(i)(C) If live parts operating at more than 600 volts to ground are within the room or other space, unless:

1910.269(v)(4)(i)(C)(1) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

1910.269(v)(4)(i)(C)(2) The live parts are installed at a height, above ground and any other working surface, that provides protection at the voltage on the live parts corresponding to the protection provided by a 2.4-meter (8-foot) height at 50 volts.

- 1910.269(v)(4)(ii) Fences, screens, partitions, or walls shall enclose the rooms and other spaces so as to minimize the possibility that unqualified persons will enter.
- 1910.269(v)(4)(iii) Unqualified persons may not enter the rooms or other spaces while the electric supply lines or equipment are energized.
- 1910.269(v)(4)(iv) The employer shall display signs at entrances to the rooms and other spaces warning unqualified persons to keep out.
- 1910.269(v)(4)(v) The employer shall keep each entrance to a room or other space locked, unless the entrance is under the observation of a person who is attending the room or other space for the purpose of preventing unqualified employees from entering.

1910.269(v)(5) Guarding of energized parts.

- 1910.269(v)(5)(i) The employer shall provide guards around all live parts operating at more than 150 volts to ground without an insulating covering unless the location of the live parts gives sufficient clearance (horizontal, vertical, or both) to minimize the possibility of accidental employee contact.

Note to paragraph (v)(5)(i): American National Standard National Electrical Safety Code, ANSI/IEEE C2-2002 contains guidelines for the dimensions of clearance distances about electric equipment in substations. Installations meeting the ANSI provisions comply with paragraph (v)(5)(i) of this section. The Occupational Safety and Health Administration will determine whether an installation that does not conform to this ANSI standard complies with paragraph (v)(5)(i) of this section based on the following criteria:

- (1) Whether the installation conforms to the edition of ANSI C2 that was in effect when the installation was made;
 - (2) Whether each employee is isolated from energized parts at the point of closest approach; and
 - (3) Whether the precautions taken when employees perform work on the installation provide protection equivalent to the protection provided by horizontal and vertical clearances meeting ANSI/IEEE C2-2002.
- 1910.269(v)(5)(ii) Except for fuse replacement and other necessary access by qualified persons, the employer shall maintain guarding of energized parts within a compartment during operation and maintenance functions to prevent accidental contact with energized parts and to prevent dropped tools or other equipment from contacting energized parts.
 - 1910.269(v)(5)(iii) Before guards are removed from energized equipment, the employer shall install barriers around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

1910.269(v)(6) Water or steam spaces.

The following requirements apply to work in water and steam spaces associated with boilers:

- 1910.269(v)(6)(i) A designated employee shall inspect conditions before work is permitted and after its completion. Eye protection, or full face protection if necessary, shall be worn at all times when condenser, heater, or boiler tubes are being cleaned.
- 1910.269(v)(6)(ii) Where it is necessary for employees to work near tube ends during cleaning, shielding shall be installed at the tube ends.

1910.269(v)(7) Chemical cleaning of boilers and pressure vessels.

The following requirements apply to chemical cleaning of boilers and pressure vessels:

- 1910.269(v)(7)(i) Areas where chemical cleaning is in progress shall be cordoned off to restrict access during cleaning. If flammable liquids, gases, or vapors or combustible materials will be used or might be produced during the cleaning process, the following requirements also apply:
 - 1910.269(v)(7)(i)(A) The area shall be posted with signs restricting entry and warning of the hazards of fire and explosion; and
 - 1910.269(v)(7)(i)(B) Smoking, welding, and other possible ignition sources are prohibited in these restricted areas.
- 1910.269(v)(7)(ii) The number of personnel in the restricted area shall be limited to those necessary to accomplish the task safely.
- 1910.269(v)(7)(iii) There shall be ready access to water or showers for emergency use.

Note to paragraph (v)(7)(iii): See § 1910.141 for requirements that apply to the water supply and to washing facilities.

- 1910.269(v)(7)(iv) Employees in restricted areas shall wear protective equipment meeting the requirements of Subpart I of this part and including, but not limited to, protective clothing, boots, goggles, and gloves.

1910.269(v)(8) Chlorine systems.

- 1910.269(v)(8)(i) Chlorine system enclosures shall be posted with signs restricting entry and warning of the hazard to health and the hazards of fire and explosion.

Note to paragraph (v)(8)(i): See Subpart Z of this part for requirements necessary to protect the health of employees from the effects of chlorine.

- 1910.269(v)(8)(ii) Only designated employees may enter the restricted area. Additionally, the number of personnel shall be limited to those necessary to accomplish the task safely.
- 1910.269(v)(8)(iii) Emergency repair kits shall be available near the shelter or enclosure to allow for the prompt repair of leaks in chlorine lines, equipment, or containers.

1910.269(v)(8)(iv) Before repair procedures are started, chlorine tanks, pipes, and equipment shall be purged with dry air and isolated from other sources of chlorine.

1910.269(v)(8)(v) The employer shall ensure that chlorine is not mixed with materials that would react with the chlorine in a dangerously exothermic or other hazardous manner.

1910.269(v)(9) Boilers.

1910.269(v)(9)(i) Before internal furnace or ash hopper repair work is started, overhead areas shall be inspected for possible falling objects. If the hazard of falling objects exists, overhead protection such as planking or nets shall be provided.

1910.269(v)(9)(ii) When opening an operating boiler door, employees shall stand clear of the opening of the door to avoid the heat blast and gases which may escape from the boiler.

1910.269(v)(10) Turbine generators.

1910.269(v)(10)(i) Smoking and other ignition sources are prohibited near hydrogen or hydrogen sealing systems, and signs warning of the danger of explosion and fire shall be posted.

1910.269(v)(10)(ii) Excessive hydrogen makeup or abnormal loss of pressure shall be considered as an emergency and shall be corrected immediately.

1910.269(v)(10)(iii) A sufficient quantity of inert gas shall be available to purge the hydrogen from the largest generator.

1910.269(v)(11) Coal and ash handling.

1910.269(v)(11)(i) Only designated persons may operate railroad equipment.

1910.269(v)(11)(ii) Before a locomotive or locomotive crane is moved, a warning shall be given to employees in the area.

1910.269(v)(11)(iii) Employees engaged in switching or dumping cars may not use their feet to line up drawheads.

1910.269(v)(11)(iv) Drawheads and knuckles may not be shifted while locomotives or cars are in motion.

1910.269(v)(11)(v) When a railroad car is stopped for unloading, the car shall be secured from displacement that could endanger employees.

1910.269(v)(11)(vi) An emergency means of stopping dump operations shall be provided at railcar dumps.

1910.269(v)(11)(vii) The employer shall ensure that employees who work in coal- or ash- handling conveyor areas are trained and knowledgeable in conveyor operation and in the requirements of paragraphs (v)(11)(viii) through (v)(11)(xii) of this section.

1910.269(v)(11)(viii) Employees may not ride a coal or ash-handling conveyor belt at any time. Employees may not cross over the conveyor belt, except at walkways, unless the conveyor's energy source has been deenergized and has been locked out or tagged in accordance with paragraph (d) of this section

1910.269(v)(11)(ix) A conveyor that could cause injury when started may not be started until personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start.

1910.269(v)(11)(x) If a conveyor that could cause injury when started is automatically controlled or is controlled from a remote location, an audible device shall be provided that sounds an alarm that will be recognized by each employee as a warning that the conveyor will start and that can be clearly heard at all points along the conveyor where personnel may be present. The warning device shall be actuated by the device starting the conveyor and shall continue for a period of time before the conveyor starts that is long enough to allow employees to move clear of the conveyor system. A visual warning may be used in place of the audible device if the employer can demonstrate that it will provide an equally effective warning in the particular circumstances involved. However if the employer can demonstrate that the system's function would be seriously hindered by the required time delay, warning signs may be provided in place of the audible warning device. If the system was installed before January 31, 1995, warning signs may be provided in place of the audible warning device until such time as the conveyor or its control system is rebuilt or rewired. These warning signs shall be clear, concise, and legible and shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. These warning signs shall be provided along the conveyor at areas not guarded by position or location.

1910.269(v)(11)(xi) Remotely and automatically controlled conveyors, and conveyors that have operating stations which are not manned or which are beyond voice and visual contact from drive areas, loading areas, transfer points, and other locations on the conveyor path not guarded by location, position, or guards shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices. However, if the employer can demonstrate that the design, function, and operation of the conveyor do not expose an employee to hazards, an emergency stop device is not required.

1910.269(v)(11)(xi)(A) Emergency stop devices shall be easily identifiable in the immediate vicinity of such locations.

1910.269(v)(11)(xi)(B) An emergency stop device shall act directly on the control of the conveyor involved and may not depend on the stopping of any other equipment.

1910.269(v)(11)(xi)(C) Emergency stop devices shall be installed so that they cannot be overridden from other locations.

1910.269(v)(11)(xii) Where coal-handling operations may produce a combustible atmosphere from fuel sources or from flammable gases or dust, sources of ignition shall be eliminated or safely controlled to prevent ignition of the combustible atmosphere.

Note to paragraph (v)(11)(xii): Locations that are hazardous because of the presence of combustible dust are classified as Class II hazardous locations. See § 1910.307.

1910.269(v)(11)(xiii) An employee may not work on or beneath overhanging coal in coal bunkers, coal silos, or coal storage areas, unless the employee is protected from all hazards posed by shifting coal.

1910.269(v)(11)(xiv) An employee entering a bunker or silo to dislodge the contents shall wear a body harness with lifeline attached. The lifeline shall be secured to a fixed support outside the bunker and shall be attended at all times by an employee located outside the bunker or facility.

1910.269(v)(12) Hydro-plants and equipment.

Employees working on or close to water gates, valves, intakes, forebays, flumes, or other locations where increased or decreased water flow or levels may pose a significant hazard shall be warned and shall vacate such dangerous areas before water flow changes are made.

1910.269(w) Special conditions.

1910.269(w)(1) Capacitors.

The following additional requirements apply to work on capacitors and on lines connected to capacitors.

Note to paragraph (w)(1): See paragraphs (m) and (n) of this section for requirements pertaining to the deenergizing and grounding of capacitor installations.

1910.269(w)(1)(i) Before employees work on capacitors, the employer shall disconnect the capacitors from energized sources and short circuit the capacitors. The employer shall ensure that the employee short circuiting the capacitors waits at least 5 minutes from the time of disconnection before applying the short circuit.

1910.269(w)(1)(ii) Before employees handle the units, the employer shall short circuit each unit in series-parallel capacitor banks between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the employer shall bond the racks to ground.

1910.269(w)(1)(iii) The employer shall short circuit any line connected to capacitors before the line is treated as deenergized.

1910.269(w)(2) Current transformer secondaries.

The employer shall ensure that employees do not open the secondary of a current transformer while the transformer is energized. If the employer cannot deenergize the primary of the current transformer before employees perform work on an instrument, a relay, or other section of a current transformer secondary circuit, the employer shall bridge the circuit so that the current transformer secondary does not experience an open-circuit condition.

1910.269(w)(3) Series street-lighting.

1910.269(w)(3)(i) If the open-circuit voltage exceeds 600 volts, the employer shall ensure that employees work on series street-lighting circuits in accordance with paragraph (q) or (t) of this section, as appropriate.

1910.269(w)(3)(ii) Before any employee opens a series loop, the employer shall deenergize the street-lighting transformer and isolate it from the source of supply or shall bridge the loop to avoid an open-circuit condition.

1910.269(w)(4) Illumination.

The employer shall provide sufficient illumination to enable the employee to perform the work safely.

1910.269(w)(5) Protection against drowning.

1910.269(w)(5)(i) Whenever an employee may be pulled or pushed, or might fall, into water where the danger of drowning exists, the employer shall provide the employee with, and shall ensure that the employee uses, a U.S. Coast Guard approved personal flotation device.

1910.269(w)(5)(ii) The employer shall maintain each personal flotation device in safe condition and shall inspect each personal flotation device frequently enough to ensure that it does not have rot, mildew, water saturation, or any other condition that could render the device unsuitable for use.

1910.269(w)(5)(iii) An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is available.

1910.269(w)(6) Employee protection in public work areas.

1910.269(w)(6)(i) Traffic-control signs and traffic-control devices used for the protection of employees shall meet § 1926.200(g)(2) of this chapter.

1910.269(w)(6)(ii) Before employees begin work in the vicinity of vehicular or pedestrian traffic that may endanger them, the employer shall place warning signs or flags and other traffic-control devices in conspicuous locations to alert and channel approaching traffic.

1910.269(w)(6)(iii) The employer shall use barricades where additional employee protection is necessary.

1910.269(w)(6)(iv) The employer shall protect excavated areas with barricades.

1910.269(w)(6)(v) The employer shall display warning lights prominently at night.

1910.269(w)(7) Backfeed.

When there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of paragraph (l) of this section apply if employees will work the lines or equipment as energized, and the requirements of paragraphs (m) and (n) of this section apply if employees will work the lines or equipment as deenergized.

1910.269(w)(8) Lasers.

The employer shall install, adjust, and operate laser equipment in accordance with § 1926.54 of this chapter.

1910.269(w)(9) Hydraulic fluids.

Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

1910.269(x) Definitions.

Affected employee. An employee whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.

Attendant. An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

Authorized employee. An employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Automatic circuit recloser. A self-controlled device for automatically interrupting and reclosing an alternating-current circuit, with a predetermined sequence of opening and reclosing followed by resetting, hold closed, or lockout.

Barricade. A physical obstruction such as tapes, cones, or A-frame type wood or metal structures that provides a warning about, and limits access to, a hazardous area.

Barrier. A physical obstruction that prevents contact with energized lines or equipment or prevents unauthorized access to a work area.

Bond. The electrical interconnection of conductive parts designed to maintain a common electric potential.

Bus. A conductor or a group of conductors that serve as a common connection for two or more circuits.

Bushing. An insulating structure that includes a through conductor or that provides a passageway for such a conductor, and that, when mounted on a barrier, insulates the conductor from the barrier for the purpose of conducting current from one side of the barrier to the other.

Cable. A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

Cable sheath. A conductive protective covering applied to cables.

Note to the definition of "cable sheath": A cable sheath may consist of multiple layers one or more of which is conductive.

Circuit. A conductor or system of conductors through which an electric current is intended to flow.

Clearance (between objects). The clear distance between two objects measured surface to surface.

Clearance (for work). Authorization to perform specified work or permission to enter a restricted area.

Communication lines. (See Lines; (1) Communication lines.)

Conductor. A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.

Contract employer. An employer, other than a host employer, that performs work covered by this section under contract.

Covered conductor. A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

Current-carrying part. A conducting part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

Deenergized. Free from any electrical connection to a source of potential difference and from electric charge; not having a potential that is different from the potential of the earth.

Note to the definition of "deenergized": The term applies only to current-carrying parts, which are sometimes energized (alive).

Designated employee (designated person). An employee (or person) who is assigned by the employer to perform specific duties under the terms of this section and who has sufficient knowledge of the construction and operation of the equipment, and the hazards involved, to perform his or her duties safely.

Electric line truck. A truck used to transport personnel, tools, and material for electric supply line work.

Electric supply equipment. Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

Electric supply lines. (See Lines; (2) Electric supply lines.)

Electric utility. An organization responsible for the installation, operation, or maintenance of an electric supply system.

Enclosed space. A working space, such as a manhole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, and that, under normal conditions, does not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions.

Note to the definition of "enclosed space": The Occupational Safety and Health Administration does not consider spaces that are enclosed but not designed for employee entry under normal operating conditions to be enclosed spaces for the purposes of this section. Similarly, the Occupational Safety and Health Administration does not consider spaces that are enclosed and that are expected to contain a hazardous atmosphere to be enclosed spaces for the purposes of this section. Such spaces meet the definition of permit spaces in § 1910.146, and entry into them must conform to that standard.

Energized (alive, live). Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of earth in the vicinity.

Energy isolating device. A physical device that prevents the transmission or release of energy, including, but not limited to, the following: a manually operated electric circuit breaker, a disconnect switch, a manually operated switch, a slide gate, a slip blind, a line valve, blocks, and any similar device with a visible indication of the position of the device. (Push buttons, selector switches, and other control-circuit-type devices are not energy isolating devices.)

Energy source. Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to employees.

Entry (as used in paragraph (e) of this section). The action by which a person passes through an opening into an enclosed space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Equipment (electric),. A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as part of or in connection with an electrical installation.

Exposed, Exposed to contact (as applied to energized parts). Not isolated or guarded.

Fall restraint system. A fall protection system that prevents the user from falling any distance.

First-aid training. Training in the initial care, including cardiopulmonary resuscitation (which includes chest compressions, rescue breathing, and, as appropriate, other heart and lung resuscitation techniques), performed by a person who is not a medical practitioner, of a sick or injured person until definitive medical treatment can be administered.

Ground. A conducting connection, whether planned or unplanned, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded. Connected to earth or to some conducting body that serves in place of the earth.

Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or inadvertent contact by persons or objects.

Note to the definition of "guarded": Wires that are insulated, but not otherwise protected, are not guarded.

Hazardous atmosphere. An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from an enclosed space), injury, or acute illness from one or more of the following causes:

- (1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
- (2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note to the definition of "hazardous atmosphere" (2): This concentration may be approximated as a condition in which the dust obscures vision at a distance of 1.52 meters (5 feet) or less.

- (3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
- (4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note to the definition of "hazardous atmosphere" (4): An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

- (5) Any other atmospheric condition that is immediately dangerous to life or health.

Note to the definition of "hazardous atmosphere" (5): For air contaminants for which the Occupational Safety and Health Administration has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, § 1910.1200, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

High-power tests. Tests in which the employer uses fault currents, load currents, magnetizing currents, and line-dropping currents to test equipment, either at the equipment's rated voltage or at lower voltages.

High-voltage tests. Tests in which the employer uses voltages of approximately 1,000 volts as a practical minimum and in which the voltage source has sufficient energy to cause injury.

High wind. A wind of such velocity that one or more of the following hazards would be present:

- (1) The wind could blow an employee from an elevated location,
- (2) The wind could cause an employee or equipment handling material to lose control of the material, or
- (3) The wind would expose an employee to other hazards not controlled by the standard involved.

Note to the definition of "high wind": The Occupational Safety and Health Administration normally considers winds exceeding 64.4 kilometers per hour (40 miles per hour), or 48.3 kilometers per hour (30 miles per hour) if the work involves material handling, as meeting this criteria, unless the employer takes precautions to protect employees from the hazardous effects of the wind.

Host employer. An employer that operates, or that controls the operating procedures for, an electric power generation, transmission, or distribution installation on which a contract employer is performing work covered by this section.

Note to the definition of "host employer": The Occupational Safety and Health Administration will treat the electric utility or the owner of the installation as the host employer if it operates or controls operating procedures for the installation. If the electric utility or installation owner neither operates nor controls operating procedures for the installation, the Occupational Safety and Health Administration will treat the employer that the utility or owner has contracted with to operate or control the operating procedures for the installation as the host employer. In no case will there be more than one host employer.

Immediately dangerous to life or health (IDLH). Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note to the definition of "immediately dangerous to life or health": Some materials-hydrogen fluoride gas and cadmium vapor, for example-may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health

Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Note to the definition of "insulated": When any object is said to be insulated, it is understood to be insulated for the conditions to which it normally is subjected. Otherwise, it is, for the purpose of this section, uninsulated.

Insulation (cable). Material relied upon to insulate the conductor from other conductors or conducting parts or from ground.

Isolated. Not readily accessible to persons unless special means for access are used.

Line-clearance tree trimmer. An employee who, through related training or on-the-job experience or both, is familiar with the special techniques and hazards involved in line-clearance tree trimming.

Note 1 to the definition of "line-clearance tree trimmer": An employee who is regularly assigned to a line-clearance tree-trimming crew and who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a line-clearance tree trimmer is considered to be a line-clearance tree trimmer for the performance of those duties.

Note 2 to the definition of "line-clearance tree trimmer": A line-clearance tree trimmer is not considered to be a "qualified employee" under this section unless he or she has the training required for a qualified employee under paragraph (a)(2)(ii) of this section. However, under the electrical safety-related work practices standard in Subpart S of this part, a line-clearance tree trimmer is considered to be a "qualified employee". Tree trimming performed by such "qualified employees" is not subject to the electrical safety-related work practice requirements contained in §§ 1910.331 through 1910.335 of this part. (See also the note following § 1910.332(b)(3) of this part for information regarding the training an employee must have to be considered a qualified employee under §§ 1910.331 through 1910.335 of this part.)

Line-clearance tree trimming. The pruning, trimming, repairing, maintaining, removing, or clearing of trees, or the cutting of brush, that is within the following distance of electric supply lines and equipment:

- (1) For voltages to ground of 50 kilovolts or less-3.05 meters (10 feet);
- (2) For voltages to ground of more than 50 kilovolts-3.05 meters (10 feet) plus 0.10 meters (4 inches) for every 10 kilovolts over 50 kilovolts.

Lines. (1) Communication lines. The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment.

Note to the definition of "communication lines": Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming to this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

(2) Electric supply lines. Conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts are always supply lines within this section, and those of less than 400 volts are considered as supply lines, if so run and operated throughout.

Manhole. A subsurface enclosure that personnel may enter and that is used for installing, operating, and maintaining submersible equipment or cable.

Minimum approach distance. The closest distance an employee may approach an energized or a grounded object.

Note to the definition of "minimum approach distance": Paragraph (l)(3)(i) of this section requires employers to establish minimum approach distances.

Personal fall arrest system. A system used to arrest an employee in a fall from a working level.

Qualified employee (qualified person). An employee (person) knowledgeable in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

Note 1 to the definition of "qualified employee (qualified person)": An employee must have the training required by (a)(2)(ii) of this section to be a qualified employee.

Note 2 to the definition of "qualified employee (qualified person)": Except under (g)(2)(iv)(C)(2) and (g)(2)(iv)(C)(3) of this section, an employee who is undergoing on-the-job training and who has demonstrated, in the course of such training, an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is a qualified person for the performance of those duties.

Statistical sparkover voltage. A transient overvoltage level that produces a 97.72-percent probability of sparkover (that is, two standard deviations above the voltage at which there is a 50-percent probability of sparkover).

Statistical withstand voltage. A transient overvoltage level that produces a 0.14-percent probability of sparkover (that is, three standard deviations below the voltage at which there is a 50-percent probability of sparkover).

Switch. A device for opening and closing or for changing the connection of a circuit. In this section, a switch is manually operable, unless otherwise stated.

System operator. A qualified person designated to operate the system or its parts.

Vault. An enclosure, above or below ground, that personnel may enter and that is used for installing, operating, or maintaining equipment or cable.

Vented vault. A vault that has provision for air changes using exhaust flue stacks and low-level air intakes operating on pressure and temperature differentials that provide for airflow that precludes a hazardous atmosphere from developing.

Voltage. The effective (root mean square, or rms) potential difference between any two conductors or between a conductor and ground. This section expresses voltages in nominal values, unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

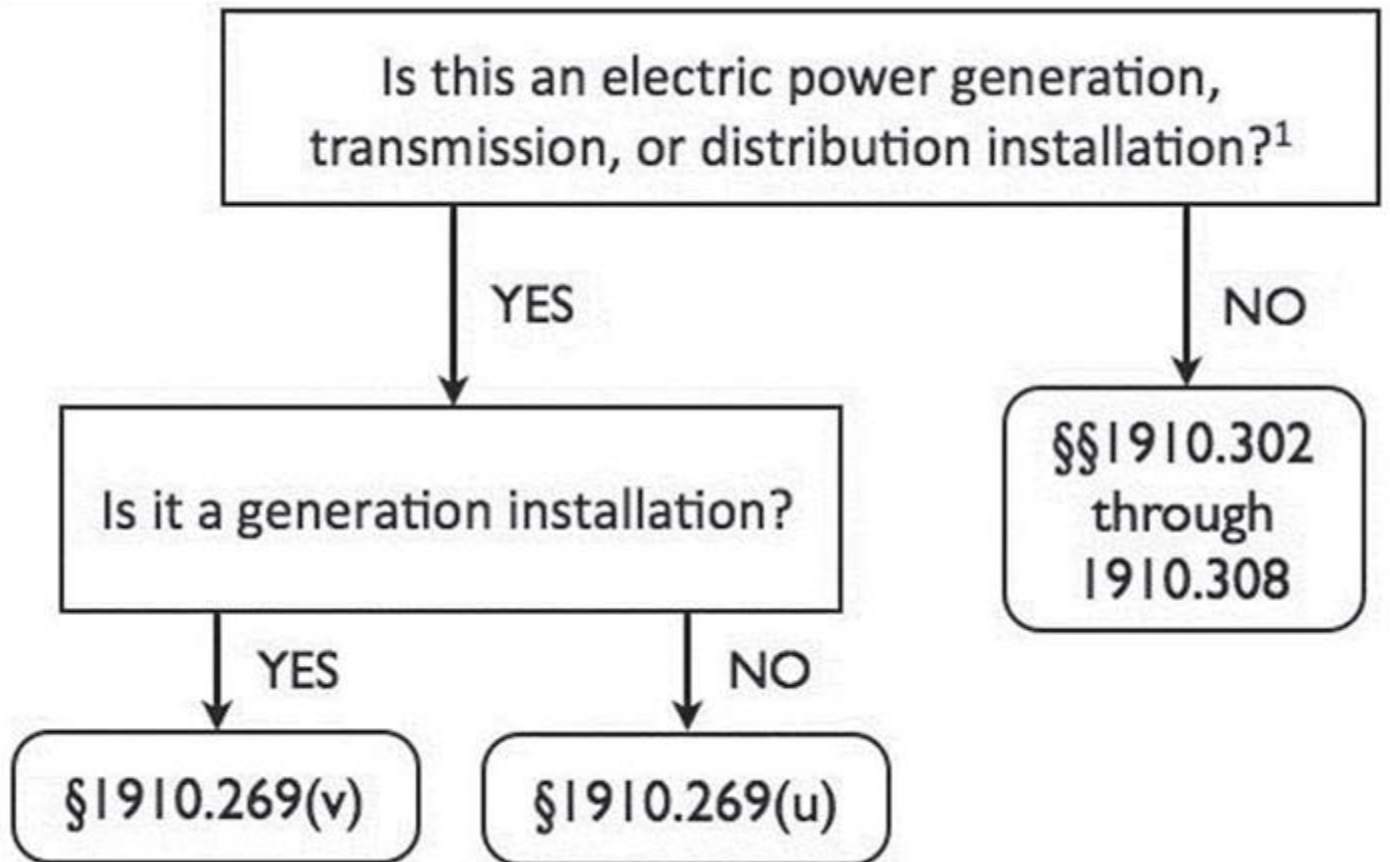
Work-positioning equipment. A body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a utility pole or tower leg, and work with both hands free while leaning.

[59 FR 40672, Aug. 9, 1994; 59 FR 51672, Oct. 12, 1994; 79 FR 20633-20659, July 10, 2014; 79 FR 56960, September 24, 2014]

APPENDIX A - FLOW CHARTS

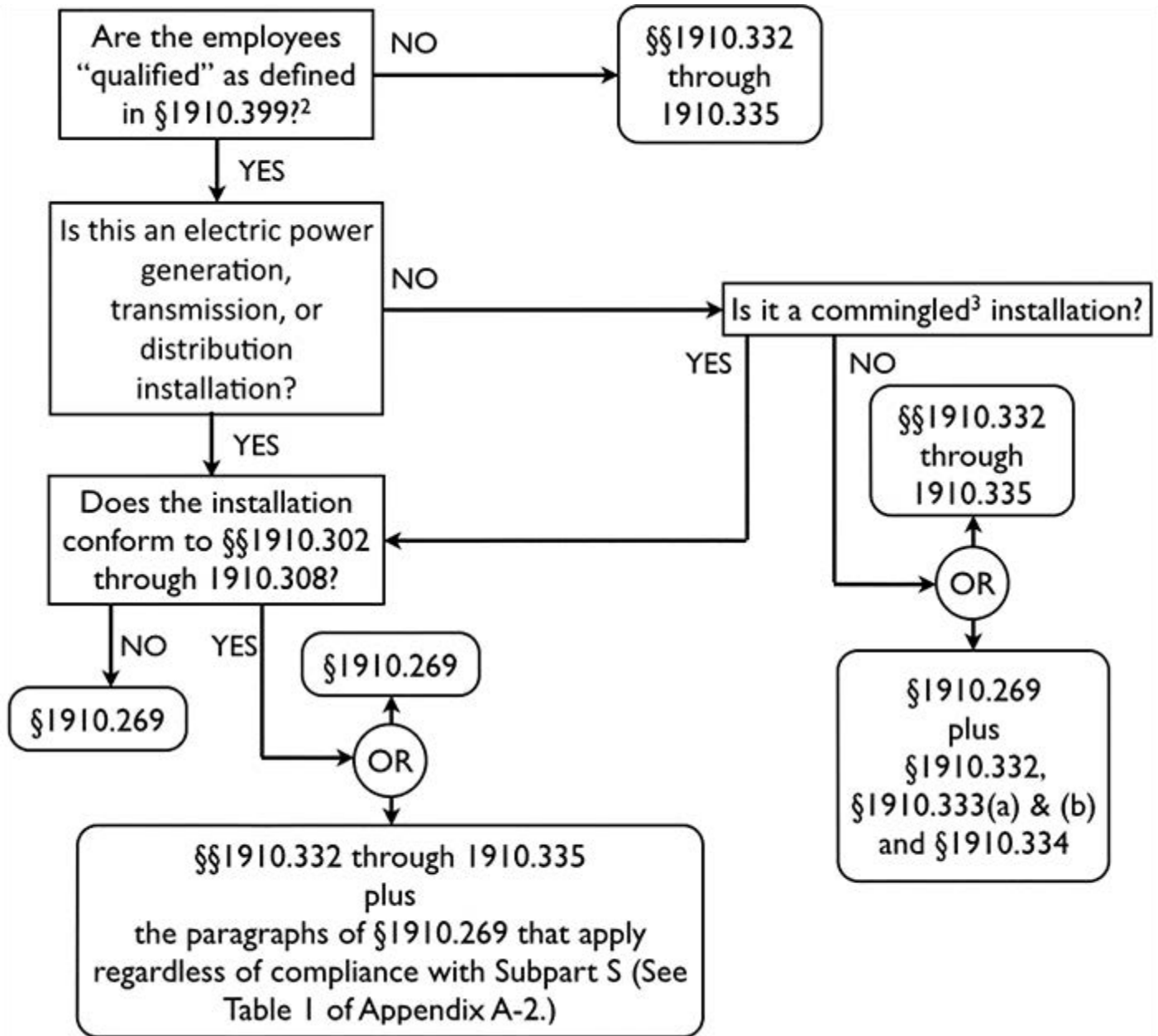
This appendix presents information, in the form of flow charts, that illustrates the scope and application of § 1910.269. This appendix addresses the interface between § 1910.269 and Subpart S of this Part (Electrical), between § 1910.269 and § 1910.146 (Permit-required confined spaces), and between § 1910.269 and § 1910.147 (The control of hazardous energy (lockout/tagout)). These flow charts provide guidance for employers trying to implement the requirements of § 1910.269 in combination with other General Industry Standards contained in Part 1910. Employers should always consult the relevant standards, in conjunction with this appendix, to ensure compliance with all applicable requirements.

Appendix A-1 to §1910.269 -- Application of §1910.269 and Subpart S of this Part to Electrical Installations.



¹ This chart applies to electrical installation design requirements only. See Appendix A-2 for electrical safety-related work practices. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposed only is not considered an electric power generation installation.

Appendix A-2 to §1910.269 -- Application of §1910.269 and Subpart S of this Part to Electrical Safety-Related Work Practices¹.



¹ This flowchart applies only to the electrical safety-related work practice and training requirements in § 1910.269 and §§ 1910.332 through 1910.335.

² See §§ 1910.269(a)(1)(ii)(B) and 1910.331(b) and (c)(1)

³ This means commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

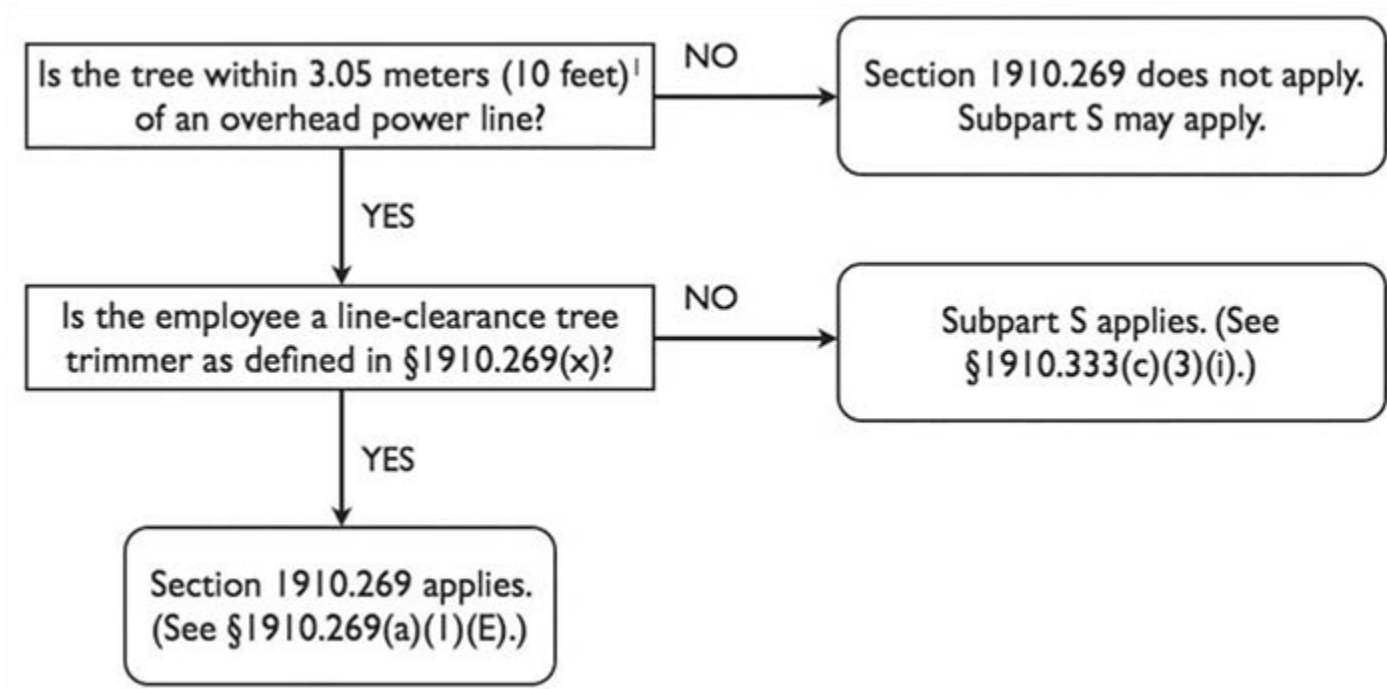
**Table 1.
Electrical Safety-Related Work Practices in §1910.269**

Compliance with Subpart S Will comply with These Paragraphs of §1910.269¹	Paragraphs that Apply Regardless of Compliance with Subpart S²
(d), electric-shock hazards only	(a)(2), (a)(3) and (a)(4).
(h)(3)	(b)
(i)(2) and (i)(3)	(c)
(k).	(d), for other than electric-shock hazards.
(l)(1) through (l)(5), (l)(7), and (l)(10) through (l)(12)	(e)
(m)	(f)
(p)(4)	(g)
(s)(2)	(h)(1) and (h)(2).
(u)(1) and (u)(3) through (u)(5)	(i)(4)
(v)(3) through (v)(5)	(j)
(w)(1) and (w)(7).	(l)(6), (l)(8) and (l)(9). (n) (o) (p)(1) through (p)(3). (q) (r) (s)(1) (t) (u)(2) and (u)(6) (v)(1), (v)(2), and (v)(6) through (v)(12) (w)(2) through (w)(6), (w)(8), and (w)(9).

¹ If the electrical installation meets the requirements of §§ 1910.302 through 1910.308 of this part, then the electrical installation and any associated electrical safety-related work practices conforming to §§ 1910.332 through 1910.335 of this part are considered to comply with these provisions of § 1910.269 of this part.

² These provisions include electrical safety and other requirements that must be met regardless of compliance with subpart S of this part.

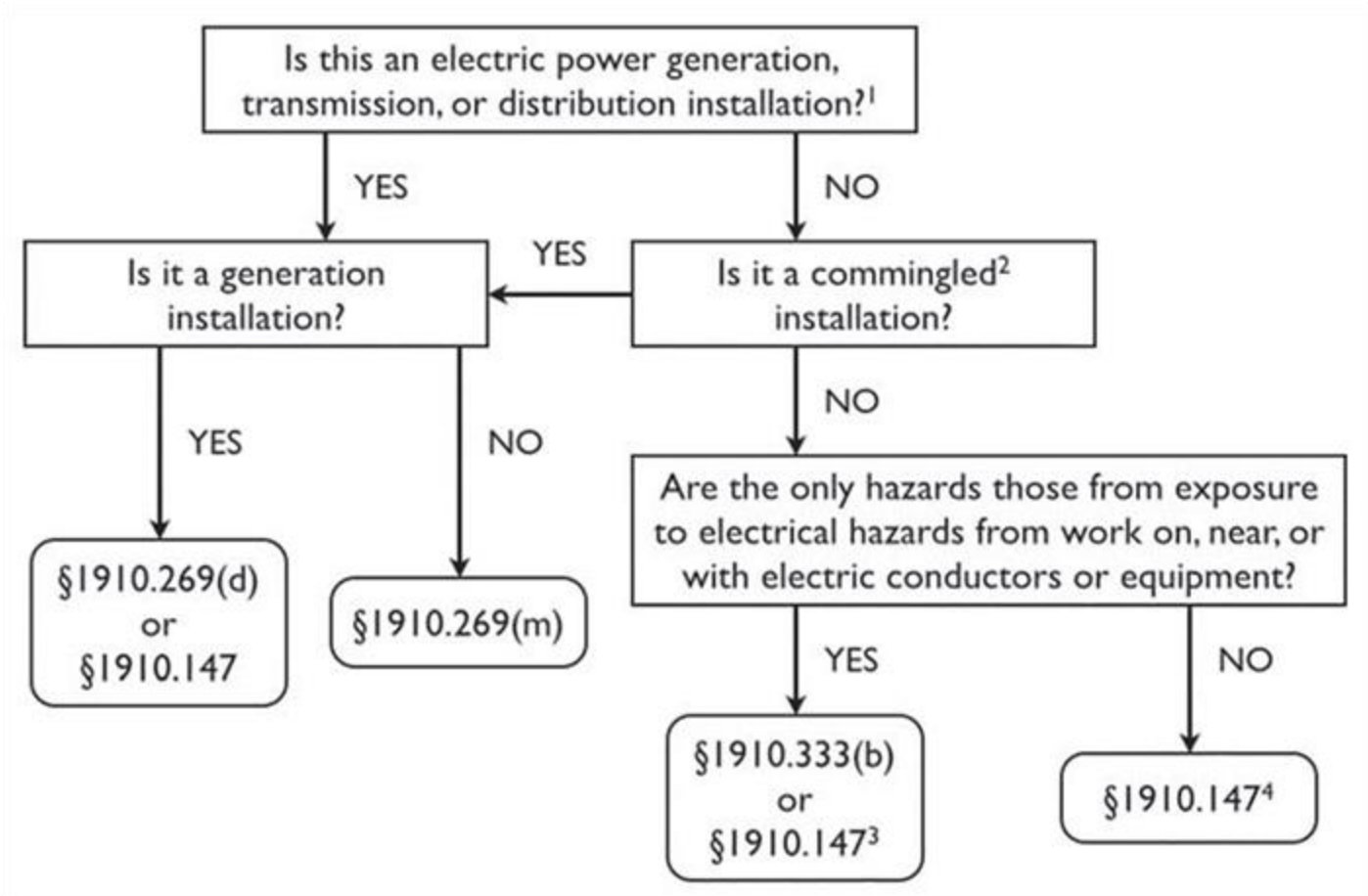
Appendix A-3 to §1910.269 -- Application of §1910.269 and Subpart S of this Part to Tree-Trimming Operations.



¹ 3.05 meters (10 feet) plus 0.10 meters (4 inches for every 10 kilovolts over 50 kilovolts).

Note: Paragraph (t) of § 1910.269 contains additional requirements for work in manholes and underground vaults.

Appendix A-4 to §1910.269 -- Application of §§1910.147, 1910.269 and 1910.333 to Hazardous Energy Control Procedures (Lockout/Tagout).

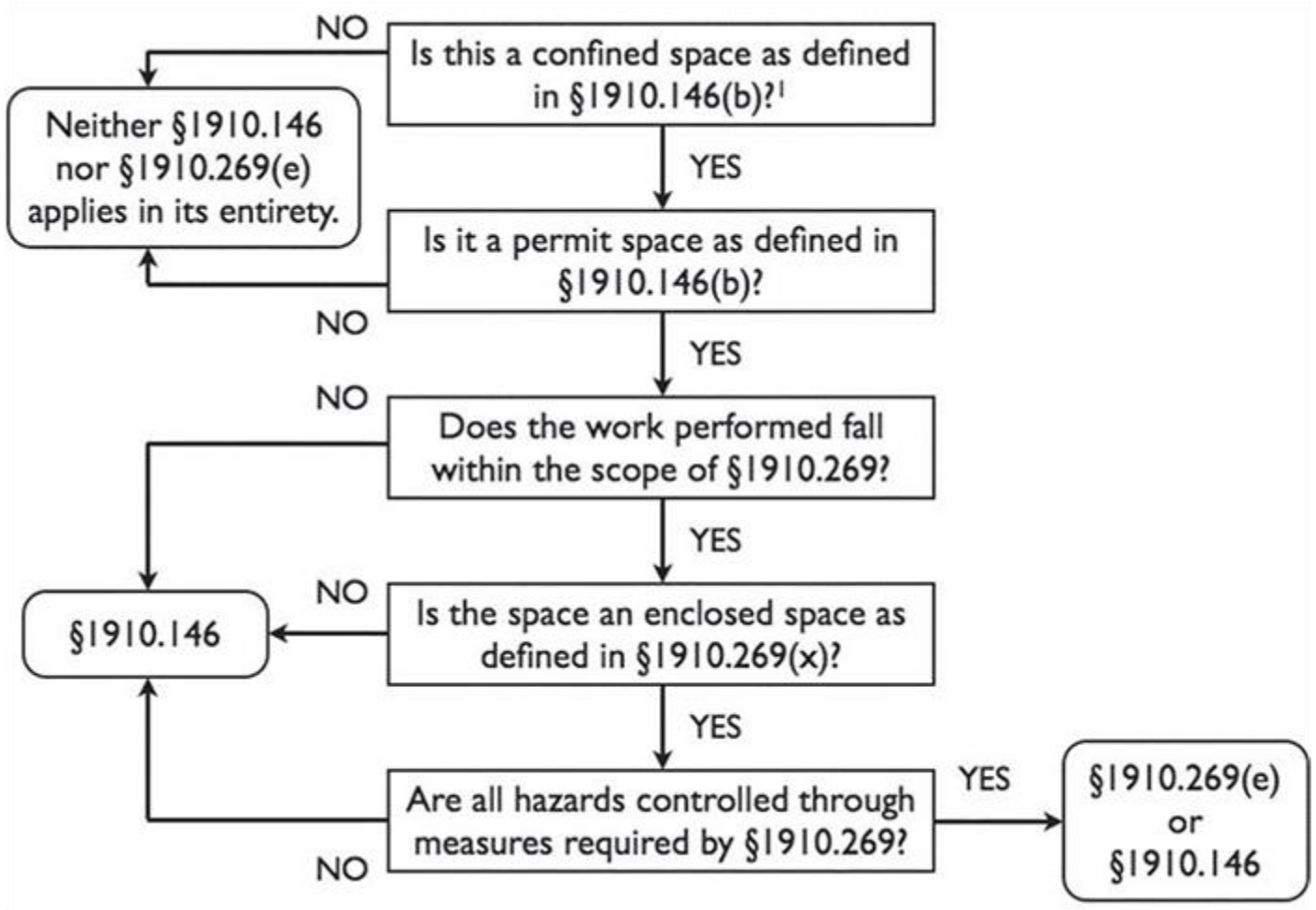


¹ If a generation, transmission, or distribution installation conforms to §§ 1910.302 through 1910.308, the lockout and tagging procedures of § 1910.333(b) may be followed for electric-shock hazards.

² This means commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

³ Paragraphs (b)(2)(iii)(D) and (b)(2)(iv)(B) of § 1910.333 still apply.

⁴ Paragraph (b) of § 1910.333 applies to any electrical hazards from work on, near, or with electric conductors and equipment.



¹ See § 1910.146(c) for general non-entry requirements that apply to all confined spaces.

APPENDIX B - WORKING ON EXPOSED ENERGIZED PARTS

I. Introduction

Electric utilities design electric power generation, transmission, and distribution installations to meet National Electrical Safety Code (NESC), ANSI C2, requirements. Electric utilities also design transmission and distribution lines to limit line outages as required by system reliability criteria 1 and to withstand the maximum over-voltages impressed on the system. Conditions such as switching surges, faults, and lightning can cause over-voltages. Electric utilities generally select insulator design and lengths and the clearances to structural parts so as to prevent outages from contaminated line insulation and during storms. Line insulator lengths and structural clearances have, over the years, come closer to the minimum approach distances used by workers. As minimum approach distances and structural clearances converge, it is increasingly important that system designers and system operating and maintenance personnel understand the concepts underlying minimum approach distances.

The information in this appendix will assist employers in complying with the minimum approach-distance requirements contained in § 1910.269(l)(3) and (q)(3). Employers must use the technical criteria and methodology presented in this appendix in establishing minimum approach distances in accordance with § 1910.269(l)(3)(i) and Table R-3 and Table R-8. This appendix provides essential background information and technical criteria for the calculation of the required minimum approach distances for live-line work on electric power generation, transmission, and distribution installations.

Unless an employer is using the maximum transient over-voltages specified in Table R-9 for voltages over 72.5 kilovolts, the employer must use persons knowledgeable in the techniques discussed in this appendix, and competent in the field of electric transmission and distribution system design, to determine the maximum transient overvoltage.

II. General

A. Definitions.

The following definitions from § 1910.269(x) relate to work on or near electric power generation, transmission, and distribution lines and equipment and the electrical hazards they present.

Exposed. . . . Not isolated or guarded.

Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or inadvertent contact by persons or objects.

Note to the definition of "guarded": Wires that are insulated, but not otherwise protected, are not guarded.

Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Note to the definition of "insulated": When any object is said to be insulated, it is understood to be insulated for the conditions to which it normally is subjected. Otherwise, it is, for the purpose of this section, uninsulated.

Isolated. Not readily accessible to persons unless special means for access are used.

Statistical sparkover voltage. A transient overvoltage level that produces a 97.72-percent probability of sparkover (that is, two standard deviations above the voltage at which there is a 50-percent probability of sparkover).

Statistical withstand voltage. A transient overvoltage level that produces a 0.14-percent probability of sparkover (that is, three standard deviations below the voltage at which there is a 50-percent probability of sparkover).

B. Installations energized at 50 to 300 volts.

The hazards posed by installations energized at 50 to 300 volts are the same as those found in many other workplaces. That is not to say that there is no hazard, but the complexity of electrical protection required does not compare to that required for high-voltage systems. The employee must avoid contact with the exposed parts, and the protective equipment used (such as rubber insulating gloves) must provide insulation for the voltages involved.

C. Exposed energized parts over 300 volts AC.

Paragraph (l)(3)(i) of § 1910.269 requires the employer to establish minimum approach distances no less than the distances computed by Table R-3 for ac systems so that employees can work safely without risk of sparkover.²

Unless the employee is using electrical protective equipment, air is the insulating medium between the employee and energized parts. The distance between the employee and an energized part must be sufficient for the air to withstand the maximum transient overvoltage that can reach the worksite under the working conditions and practices the employee is using. This distance is the minimum air insulation distance, and it is equal to the electrical component of the minimum approach distance.

Normal system design may provide or include a means (such as lightning arrestors) to control maximum anticipated transient over-voltages, or the employer may use temporary devices (portable protective gaps) or measures (such as preventing automatic circuit breaker reclosing) to achieve the same result. Paragraph (I)(3)(ii) of § 1910.269 requires the employer to determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis or assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table R-9, which specifies the following maximums for ac systems:

72.6 to 420.0 kilovolts-3.5 per unit

420.1 to 550.0 kilovolts-3.0 per unit

550.1 to 800.0 kilovolts-2.5 per unit

See paragraph IV.A.2, later in this appendix, for additional discussion of maximum transient over-voltages.

D. Types of exposures.

Employees working on or near energized electric power generation, transmission, and distribution systems face two kinds of exposures: Phase-to-ground and phase-to-phase. The exposure is phase-to-ground: (1) With respect to an energized part, when the employee is at ground potential or (2) with respect to ground, when an employee is at the potential of the energized part during live-line barehand work. The exposure is phase-to-phase, with respect to an energized part, when an employee is at the potential of another energized part (at a different potential) during live-line barehand work.

III. Determination of Minimum Approach Distances for AC Voltages Greater Than 300 Volts

A. Voltages of 301 to 5,000 volts.

Test data generally forms the basis of minimum air insulation distances. The lowest voltage for which sufficient test data exists is 5,000 volts, and these data indicate that the minimum air insulation distance at that voltage is 20 millimeters (1 inch). Because the minimum air insulation distance increases with increasing voltage, and, conversely, decreases with decreasing voltage, an assumed minimum air insulation distance of 20 millimeters will protect against sparkover at voltages of 301 to 5,000 volts. Thus, 20 millimeters is the electrical component of the minimum approach distance for these voltages.

B. Voltages of 5.1 to 72.5 kilovolts.

For voltages from 5.1 to 72.5 kilovolts, the Occupational Safety and Health Administration bases the methodology for calculating the electrical component of the minimum approach distance on Institute of Electrical and Electronic Engineers (IEEE) Standard 4-1995, Standard Techniques for High-Voltage Testing. Table 1 lists the critical sparkover distances from that standard as listed in IEEE Std 516-2009, IEEE Guide for Maintenance Methods on Energized Power Lines.

TABLE 1 SPARKOVER DISTANCE FOR ROD-TO-ROD GAP	
60 Hz Rod-to-Rod sparkover (kV peak)	Gap spacing from IEEE Std 4-1995 (cm)
25	2
36	3
46	4
53	5
60	6
70	8
79	10
86	12
95	14
104	16
112	18
120	20
143	25
167	30
192	35
218	40
243	45
270	50
322	60
Source: IEEE Std 516-2009.	
To use this table to determine the electrical component of the minimum approach distance, the employer must determine the peak phase-to-ground transient overvoltage and select a gap from the table that corresponds to that voltage as a withstand voltage rather than a critical sparkover voltage. To calculate the electrical component of the minimum approach distance for voltages between 5 and 72.5 kilovolts, use the following procedure:	
1. Divide the phase-to-phase voltage by the square root of 3 to convert it to a phase-to-ground voltage.	
2. Multiply the phase-to-ground voltage by the square root of 2 to convert the rms value of the voltage to the peak phase-to-ground voltage.	
3. Multiply the peak phase-to-ground voltage by the maximum per-unit transient overvoltage, which, for this voltage range, is 3.0, as discussed later in this appendix. This is the maximum phase-to-ground transient overvoltage, which corresponds to the withstand voltage for the relevant exposure. ³	
4. Divide the maximum phase-to-ground transient overvoltage by 0.85 to determine the corresponding critical sparkover voltage. (The critical sparkover voltage is 3 standard deviations (or 15 percent) greater than the withstand voltage.)	
5. Determine the electrical component of the minimum approach distance from Table 1 through interpolation.	

Table 2 illustrates how to derive the electrical component of the minimum approach distance for voltages from 5.1 to 72.5 kilovolts, before the application of any altitude correction factor, as explained later.

TABLE 2 CALCULATING THE ELECTRICAL COMPONENT OF MAD 751 V TO 72.5 KV				
Step	Maximum system phase-to-phase voltage (kV)			
	15	36	46	72.5
1. Divide by $\sqrt{3}$	8.7	20.8	26.6	41.9
2. Multiply by $\sqrt{2}$	12.2	29.4	37.6	59.2
3. Multiply by 3.0	36.7	88.2	112.7	177.6
4. Divide by 0.85	43.2	103.7	132.6	208.9
5. Interpolate from Table 1.	$3+(7.2/10)*1$	$14+(8.7/9)*2$	$20+(12.6/23)*5$	$35+(16.9/26)*5$
Electrical component of MAD (cm)	3.72	15.93	22.74	38.25

C. Voltages of 72.6 to 800 kilovolts.

For voltages of 72.6 kilovolts to 800 kilovolts, this section bases the electrical component of minimum approach distances, before the application of any altitude correction factor, on the following formula:

Equation 1-For Voltages of 72.6 kV to 800 kV	
D	$= 0.3048(C + a) V_{L-G}T$
Where:	
D	= Electrical component of the minimum approach distance in air in meters;
C	= a correction factor associated with the variation of gap sparkover with voltage;
a	= A factor relating to the saturation of air at system voltages of 345 kilovolts or higher; 4
V_{L-G}	= Maximum system line-to-ground rms voltage in kilovolts-it should be the "actual" maximum, or the normal highest voltage for the range (for example, 10 percent above the nominal voltage); and
T	= Maximum transient overvoltage factor in per unit.
In Equation 1, C is 0.01: (1) For phase-to-ground exposures that the employer can demonstrate consist only of air across the approach distance (gap) and (2) for phase-to-phase exposures if the employer can demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap. Otherwise, C is 0.011.	
In Equation 1, the term a varies depending on whether the employee's exposure is phase-to-ground or phase-to-phase and on whether objects are in the gap. The employer must use the equations in Table 3 to calculate a. Sparkover test data with insulation spanning the gap form the basis for the equations for phase-to-ground exposures, and sparkover test data with only air in the gap form the basis for the equations for phase-to-phase exposures. The phase-to-ground equations result in slightly higher values of a, and, consequently, produce larger minimum approach distances, than the phase-to-phase equations for the same value of V_{Peak} .	

TABLE 3 EQUATIONS FOR CALCULATING THE SURGE FACTOR, a			
Phase-to-ground exposures			
$V_{Peak} = TL-GVL-G \sqrt{2}$	635 kV or less 0	635.1 to 915 kV ($V_{Peak}-635$) /140,000	915.1 to 1,050 kV ($V_{Peak}-645$) /135,000
a			
$V_{Peak} = TL-GVL-G\sqrt{2}$	More than 1,050 kV		
a	($V_{Peak}-675$)/125,000		
Phase-to-phase exposures 1			
$V_{Peak} = (1.35T_{L-G} + 0.45)V_{L-G}\sqrt{2}$	630 kV or less 0	630.1 to 848 kV ($V_{Peak}-630$) /155,000	848.1 to 1,131 kV ($V_{Peak}-633.6$) /152,207
a			
$V_{Peak} = (1.35TL-G + 0.45)VL-G\sqrt{2}$	1,131.1 to 1,485 kV ($V_{Peak}-628$) /153,846	More than 1,485 kV ($V_{Peak}-350.5$)/203,666	
a			
1 Use the equations for phase-to-ground exposures (with V_{Peak} for phase-to-phase exposures) unless the employer can demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap.			

In Equation 1, T is the maximum transient overvoltage factor in per unit. As noted earlier, § 1910.269(l)(3)(ii) requires the employer to determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis or assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table R-9. For phase-to-ground exposures, the employer uses this value, called T_{L-G} , as T in Equation 1. IEEE Std 516-2009 provides the following formula to calculate the phase-to-phase maximum transient overvoltage, T_{L-L} , from T_{L-G} :

$$T_{L-L} = 1.35T_{L-G} + 0.45$$

For phase-to-phase exposures, the employer uses this value as T in Equation 1.

D. Provisions for inadvertent movement.

The minimum approach distance must include an "adder" to compensate for the inadvertent movement of the worker relative to an energized part or the movement of the part relative to the worker. This "adder" must account for this possible inadvertent movement and provide the worker with a comfortable and safe zone in which to work. Employers must add the distance for inadvertent movement (called the "ergonomic component of the minimum approach distance") to the electrical component to determine the total safe minimum approach distances used in live-line work.

The Occupational Safety and Health Administration based the ergonomic component of the minimum approach distance on response time-distance analysis. This technique uses an estimate of the total response time to a hazardous incident and converts that time to the distance traveled. For example, the driver of a car takes a given amount of time to respond to a "stimulus" and stop the vehicle. The elapsed time involved results in the car's traveling some distance before coming to a complete stop. This distance depends on the speed of the car at the time the stimulus appears and the reaction time of the driver.

In the case of live-line work, the employee must first perceive that he or she is approaching the danger zone. Then, the worker responds to the danger and must decelerate and stop all motion toward the energized part. During the time it takes to stop, the employee will travel some distance. This is the distance the employer must add to the electrical component of the minimum approach distance to obtain the total safe minimum approach distance.

At voltages from 751 volts to 72.5 kilovolts,⁵ The electrical component of the minimum approach distance is smaller than the ergonomic component. At 72.5 kilovolts, the electrical component is only a little more than 0.3 meters (1 foot). An ergonomic component of the minimum approach distance must provide for all the worker's unanticipated movements. At these voltages, workers generally use rubber insulating gloves; however, these gloves protect only a worker's hands and arms. Therefore, the energized object must be at a safe approach distance to protect the worker's face. In this case, 0.61 meters (2 feet) is a sufficient and practical ergonomic component of the minimum approach distance.

For voltages between 72.6 and 800 kilovolts, employees must use different work practices during energized line work. Generally, employees use live-line tools (hot sticks) to perform work on energized equipment. These tools, by design, keep the energized part at a constant distance from the employee and, thus, maintain the appropriate minimum approach distance automatically.

The location of the worker and the type of work methods the worker is using also influence the length of the ergonomic component of the minimum approach distance. In this higher voltage range, the employees use work methods that more tightly control their movements than when the workers perform work using rubber insulating gloves. The worker, therefore, is farther from the energized line or equipment and must be more precise in his or her movements just to perform the work. For these reasons, this section adopts an ergonomic component of the minimum approach distance of 0.31 m (1 foot) for voltages between 72.6 and 800 kilovolts.

Table 4 summarizes the ergonomic component of the minimum approach distance for various voltage ranges.

TABLE 4 ERGONOMIC COMPONENT OF MINIMUM APPROACH DISTANCE		
Voltage range (kV)	Distance	
	m	ft
0.301 to 0.750	0.31	1.0
0.751 to 72.5	0.61	2.0
72.6 to 800	0.31	1.0

Note: The employer must add this distance to the electrical component of the minimum approach distance to obtain the full minimum approach distance.

The ergonomic component of the minimum approach distance accounts for errors in maintaining the minimum approach distance (which might occur, for example, if an employee misjudges the length of a conductive object he or she is holding), and for errors in judging the minimum approach distance. The ergonomic component also accounts for inadvertent movements by the employee, such as slipping. In contrast, the working position selected to properly maintain the minimum approach distance must account for all of an employee's reasonably likely movements and still permit the employee to adhere to the applicable minimum approach distance. (See Figure 1.) Reasonably likely movements include an employee's adjustments to tools, equipment, and working positions and all movements needed to perform the work. For example, the employee should be able to perform all of the following actions without straying into the minimum approach distance:

- Adjust his or her hardhat,
- maneuver a tool onto an energized part with a reasonable amount of overreaching or underreaching,
- reach for and handle tools, material, and equipment passed to him or her, and
- adjust tools, and replace components on them, when necessary during the work procedure.

The training of qualified employees required under § 1910.269(a)(2), and the job planning and briefing required under §1910.269(c), must address selection of a proper working position.

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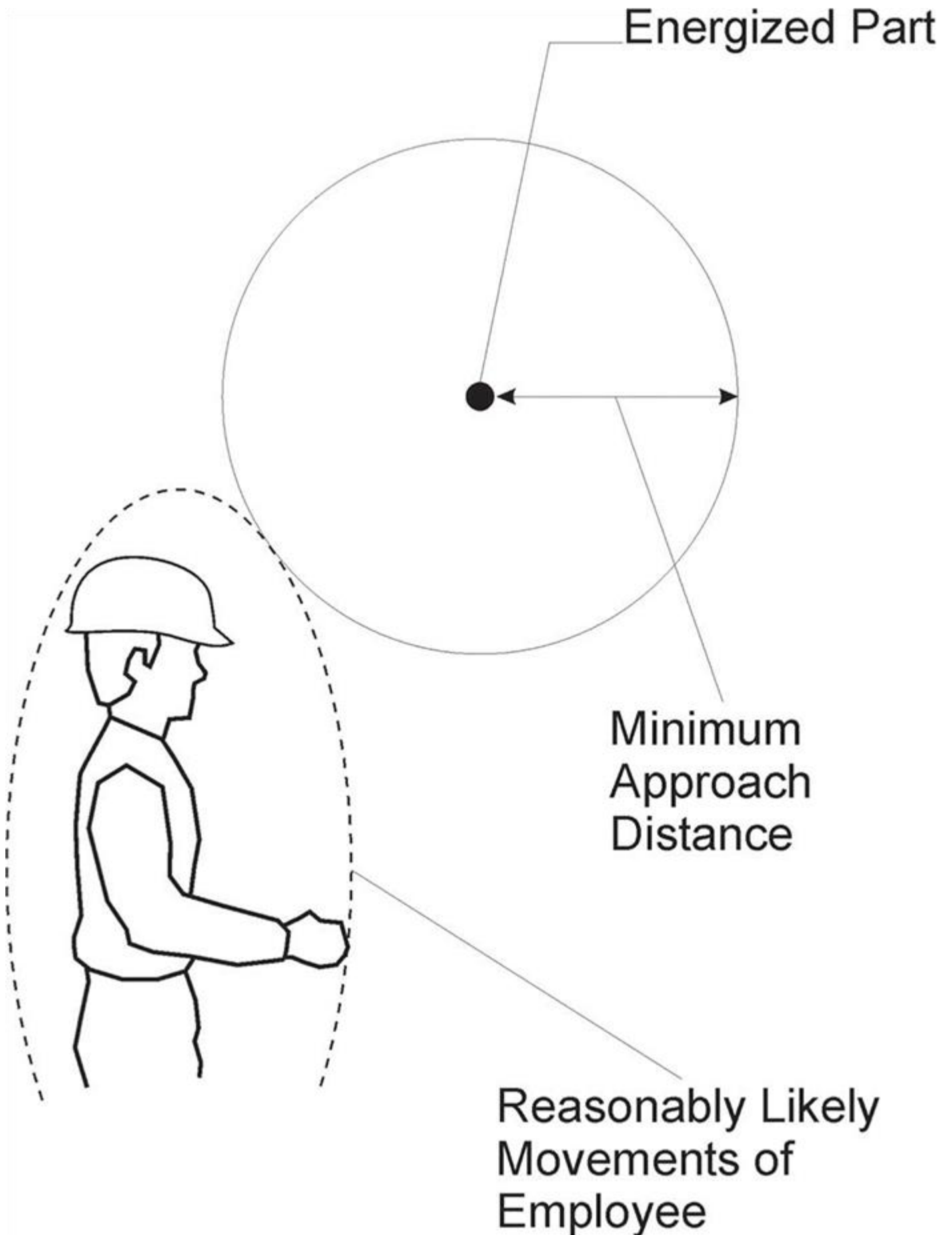


Figure 1 - Maintaining the Minimum Approach Distance

E. Miscellaneous correction factors.

Changes in the air medium that forms the insulation influences the strength of an air gap. A brief discussion of each factor follows.

1. Dielectric strength of air. The dielectric strength of air in a uniform electric field at standard atmospheric conditions is approximately 3 kilovolts per millimeter.⁶
The pressure, temperature, and humidity of the air, the shape, dimensions, and separation of the electrodes, and the characteristics of the applied voltage (wave shape) affect the disruptive gradient.
2. Atmospheric effect. The empirically determined electrical strength of a given gap is normally applicable at standard atmospheric conditions (20 °C, 101.3 kilopascals, 11 grams/cubic centimeter humidity). An increase in the density (humidity) of the air inhibits sparkover for a given air gap. The combination of temperature and air pressure that results in the lowest gap sparkover voltage is high temperature and low pressure. This combination of conditions is not likely to occur. Low air pressure, generally associated with high humidity, causes increased electrical strength. An average air pressure generally correlates with low humidity. Hot and dry working conditions normally result in reduced electrical strength. The equations for minimum approach distances in Table R-3 assume standard atmospheric conditions.
3. Altitude. The reduced air pressure at high altitudes causes a reduction in the electrical strength of an air gap. An employer must increase the minimum approach distance by about 3 percent per 300 meters (1,000 feet) of increased altitude for altitudes above 900 meters (3,000 feet). Table R-5 specifies the altitude correction factor that the employer must use in calculating minimum approach distances.

IV. Determining Minimum Approach Distances

A. Factors Affecting Voltage Stress at the Worksite

1. System voltage (nominal). The nominal system voltage range determines the voltage for purposes of calculating minimum approach distances. The employer selects the range in which the nominal system voltage falls, as given in the relevant table, and uses the highest value within that range in per unit calculations.
2. Transient over-voltages. Operation of switches or circuit breakers, a fault on a line or circuit or on an adjacent circuit, and similar activities may generate transient over-voltages on an electrical system. Each overvoltage has an associated transient voltage wave shape. The wave shape arriving at the site and its magnitude vary considerably.

In developing requirements for minimum approach distances, the Occupational Safety and Health Administration considered the most common wave shapes and the magnitude of transient over-voltages found on electric power generation, transmission, and distribution systems. The equations in Table R-3 for minimum approach distances use per-unit maximum transient over-voltages, which are relative to the nominal maximum voltage of the system. For example, a maximum transient overvoltage value of 3.0 per unit indicates that the highest transient overvoltage is 3.0 times the nominal maximum system voltage.

3. Typical magnitude of over-voltages. Table 5 lists the magnitude of typical transient over-voltages.

TABLE 5 MAGNITUDE OF TYPICAL TRANSIENT OVER-VOLTAGES	
Cause	Magnitude (per unit)
Energized 200-mile line without closing resistors	3.5
Energized 200-mile line with one-step closing resistor	2.1
Energized 200-mile line with multistep resistor	2.5
Reclosing with trapped charge one-step resistor	2.2
Opening surge with single restrike	3.0
Fault initiation unfaulted phase	2.1
Fault initiation adjacent circuit	2.5
Fault clearing	1.7 to 1.9

4. Standard deviation-air-gap withstand. For each air gap length under the same atmospheric conditions, there is a statistical variation in the breakdown voltage. The probability of breakdown against voltage has a normal (Gaussian) distribution. The standard deviation of this distribution varies with the wave shape, gap geometry, and atmospheric conditions. The withstand voltage of the air gap is three standard deviations (3s) below the critical sparkover voltage. (The critical sparkover voltage is the crest value of the impulse wave that, under specified conditions, causes sparkover 50 percent of the time. An impulse wave of three standard deviations below this value, that is, the withstand voltage, has a probability of sparkover of approximately 1 in 1,000.)
5. Broken Insulators. Tests show reductions in the insulation strength of insulator strings with broken skirts. Broken units may lose up to 70 percent of their withstand capacity. Because an employer cannot determine the insulating capability of a broken unit without testing it, the employer must consider damaged units in an insulator to have no insulating value. Additionally, the presence of a live-line tool alongside an insulator string with broken units may further reduce the overall insulating strength. The number of good units that must be present in a string for it to be "insulated" as defined by § 1910.269(x) depends on the maximum overvoltage possible at the worksite.

B. Minimum Approach Distances Based on Known, Maximum-Anticipated Per-Unit Transient Overvoltages

1. Determining the minimum approach distance for AC systems. Under § 1910.269(l)(3)(ii), the employer must determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis or must assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table R-9. When the employer conducts an engineering analysis of the system and determines that the maximum transient overvoltage is lower than specified by Table R-9, the employer must ensure that any conditions assumed in the analysis, for example, that employees block reclosing on a circuit or install portable protective gaps, are present during energized work. To ensure that these conditions are present, the employer may need to institute new livework procedures reflecting the conditions and limitations set by the engineering analysis.
2. Calculation of reduced approach distance values. An employer may take the following steps to reduce minimum approach distances when the maximum transient overvoltage on the system (that is, the maximum transient overvoltage without additional steps to control over-voltages) produces unacceptably large minimum approach distances:
 - Step 1. Determine the maximum voltage (with respect to a given nominal voltage range) for the energized part.
 - Step 2. Determine the technique to use to control the maximum transient overvoltage. (See paragraphs IV.C and IV.D of this appendix.) Determine the maximum transient overvoltage that can exist at the worksite with that form of control in place and with a confidence level of 3s. This voltage is the withstand voltage for the purpose of calculating the appropriate minimum approach distance.
 - Step 3. Direct employees to implement procedures to ensure that the control technique is in effect during the course of the work.
 - Step 4. Using the new value of transient overvoltage in per unit, calculate the required minimum approach distance from Table R-3.

C. Methods of Controlling Possible Transient Overvoltage Stress Found on a System

1. Introduction. There are several means of controlling over-voltages that occur on transmission systems. For example, the employer can modify the operation of circuit breakers or other switching devices to reduce switching transient over-voltages. Alternatively, the employer can hold the overvoltage to an acceptable level by installing surge arresters or portable protective gaps on the system. In addition, the employer can change the transmission system to minimize the effect of switching operations. Section 4.8 of IEEE Std 516-2009 describes various ways of controlling, and thereby reducing, maximum transient over-voltages.
2. Operation of circuit breakers.⁷ The maximum transient overvoltage that can reach the worksite is often the result of switching on the line on which employees are working. Disabling automatic reclosing during energized line work, so that the line will not be reenergized after being opened for any reason, limits the maximum switching surge overvoltage to the larger of the opening surge or the greatest possible fault-generated surge, provided that the devices (for example, insertion resistors) are operable and will function to limit the transient overvoltage and that circuit breaker restrikes do not occur. The employer must ensure the proper functioning of insertion resistors and other overvoltage-limiting devices when the employer's engineering analysis assumes their proper operation to limit the overvoltage level. If the employer cannot disable the reclosing feature (because of system operating conditions), other methods of controlling the switching surge level may be necessary.

Transient surges on an adjacent line, particularly for double circuit construction, may cause a significant overvoltage on the line on which employees are working. The employer's engineering analysis must account for coupling to adjacent lines.

3. Surge arresters. The use of modern surge arresters allows a reduction in the basic impulse-insulation levels of much transmission system equipment. The primary function of early arresters was to protect the system insulation from the effects of lightning. Modern arresters not only dissipate lightning-caused transients, but may also control many other system transients caused by switching or faults.

The employer may use properly designed arresters to control transient over-voltages along a transmission line and thereby reduce the requisite length of the insulator string and possibly the maximum transient overvoltage on the line.⁸

4. Switching Restrictions. Another form of overvoltage control involves establishing switching restrictions, whereby the employer prohibits the operation of circuit breakers until certain system conditions are present. The employer restricts switching by using a tagging system, similar to that used for a permit, except that the common term used for this activity is a "hold-off" or "restriction." These terms indicate that the restriction does not prevent operation, but only modifies the operation during the livework activity.

D. Minimum Approach Distance Based on Control of Maximum Transient Overvoltage at the Worksite

When the employer institutes control of maximum transient overvoltage at the worksite by installing portable protective gaps, the employer may calculate the minimum approach distance as follows:

Step 1. Select the appropriate withstand voltage for the protective gap based on system requirements and an acceptable probability of gap sparkover.⁹

Step 2. Determine a gap distance that provides a withstand voltage 10 greater than or equal to the one selected in the first step.¹¹

Step 3. Use 110 percent of the gap's critical sparkover voltage to determine the phase-to-ground peak voltage at gap sparkover ($V_{PPG\ Peak}$).

Step 4. Determine the maximum transient overvoltage, phase-to-ground, at the worksite from the following formula:

$$T = \frac{V_{PPG\ Peak}}{V_{L-G}\sqrt{2}}$$

Step 5. Use this value of T12 in the equation in Table R-3 to obtain the minimum approach distance. If the worksite is no more than 900 meters (3,000 feet) above sea level, the employer may use this value of T to determine the minimum approach distance from Table 14 through Table 21.

Note: All rounding must be to the next higher value (that is, always round up).

Sample protective gap calculations.

Problem: Employees are to perform work on a 500-kilovolt transmission line at sea level that is subject to transient over-voltages of 2.4 p.u. The maximum operating voltage of the line is 550 kilovolts. Determine the length of the protective gap that will provide the minimum practical safe approach distance. Also, determine what that minimum approach distance is

Step 1. Calculate the smallest practical maximum transient overvoltage (1.25 times the crest phase-to-ground voltage): 13

$$550kV \times \frac{\sqrt{2}}{\sqrt{3}} \times 1.25 = 561kV.$$

This value equals the withstand voltage of the protective gap.

Step 2. Using test data for a particular protective gap, select a gap that has a critical sparkover voltage greater than or equal to: $561kV \div 0.85 = 660kV$

For example, if a protective gap with a 1.22-m (4.0-foot) spacing tested to a critical sparkover voltage of 665 kilovolts (crest), select this gap spacing.

Step 3. The phase-to-ground peak voltage at gap sparkover (VPPG Peak) is 110 percent of the value from the previous step: $665\text{kV} \times 1.10 = 732\text{kV}$

This value corresponds to the withstand voltage of the electrical component of the minimum approach distance.

Step 4. Use this voltage to determine the worksite value of T:

$$T = \frac{732}{564} = 1.7 \text{ p.u.}$$

Step 5. Use this value of T in the equation in Table R-3 to obtain the minimum approach distance, or look up the minimum approach distance in Table 14 through Table 21: MAD = 2.29m (7.6 ft).

E. Location of Protective Gaps

1. Adjacent structures. The employer may install the protective gap on a structure adjacent to the worksite, as this practice does not significantly reduce the protection afforded by the gap.
2. Terminal stations. Gaps installed at terminal stations of lines or circuits provide a level of protection; however, that level of protection may not extend throughout the length of the line to the worksite. The use of substation terminal gaps raises the possibility that separate surges could enter the line at opposite ends, each with low enough magnitude to pass the terminal gaps without sparkover. When voltage surges occur simultaneously at each end of a line and travel toward each other, the total voltage on the line at the point where they meet is the arithmetic sum of the two surges. A gap installed within 0.8 km (0.5 mile) of the worksite will protect against such intersecting waves. Engineering studies of a particular line or system may indicate that employers can adequately protect employees by installing gaps at even more distant locations. In any event, unless using the default values for T from Table R-9, the employer must determine T at the worksite.
3. Worksite. If the employer installs protective gaps at the worksite, the gap setting establishes the worksite impulse insulation strength. Lightning strikes as far as 6 miles from the worksite can cause a voltage surge greater than the gap withstand voltage, and a gap sparkover can occur. In addition, the gap can sparkover from over-voltages on the line that exceed the withstand voltage of the gap. Consequently, the employer must protect employees from hazards resulting from any sparkover that could occur.

F. Disabling automatic reclosing.

There are two reasons to disable the automatic-reclosing feature of circuit-interrupting devices while employees are performing live-line work:

To prevent reenergization of a circuit faulted during the work, which could create a hazard or result in more serious injuries or damage than the injuries or damage produced by the original fault;

To prevent any transient overvoltage caused by the switching surge that would result if the circuit were reenergized.

However, due to system stability considerations, it may not always be feasible to disable the automatic-reclosing feature.

V. Minimum Approach-Distance Tables

A. Legacy tables.

Employers may use the minimum approach distances in Table 6 through Table 13 until March 31, 2015.

TABLE 6 MINIMUM APPROACH DISTANCES UNTIL DECEMBER 31, 2014				
Voltage range phase to phase (kV)	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
0.05 to 1.0	Avoid Contact	Avoid Contact	-	-
1.1 to 15.0	0.64	2.10	0.66	2.20
15.1 to 36.0	0.72	2.30	0.77	2.60
36.1 to 46.0	0.77	2.60	0.85	2.80
46.1 to 72.5	0.90	3.00	1.05	3.50
72.6 to 121	0.95	3.20	1.29	4.30
138 to 145	1.09	3.60	1.50	4.90
161 to 169	1.22	4.00	1.71	5.70
230 to 242	1.59	5.30	2.27	7.50
345 to 362	2.59	8.50	3.80	12.50
500 to 550	3.42	11.30	5.50	18.10
765 to 800	4.53	14.90	7.91	26.00

Note: The clear live-line tool distance must equal or exceed the values for the indicated voltage ranges.

TABLE 7 MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015 72.6 TO 121.0 KV WITH OVERVOLTAGE FACTOR				
T (p.u.)	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
2.0	0.74	2.42	1.09	3.58
2.1	0.76	2.50	1.09	3.58
2.2	0.79	2.58	1.12	3.67
2.3	0.81	2.67	1.14	3.75
2.4	0.84	2.75	1.17	3.83
2.5	0.84	2.75	1.19	3.92
2.6	0.86	2.83	1.22	4.00
2.7	0.89	2.92	1.24	4.08
2.8	0.91	3.00	1.24	4.08
2.9	0.94	3.08	1.27	4.17
3.0	0.97	3.17	1.30	4.25

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 8
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
121.1 TO 145.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
2.0	0.84	2.75	1.24	4.08
2.1	0.86	2.83	1.27	4.17
2.2	0.89	2.92	1.30	4.25
2.3	0.91	3.00	1.32	4.33
2.4	0.94	3.08	1.35	4.42
2.5	0.97	3.17	1.37	4.50
2.6	0.99	3.25	1.40	4.58
2.7	1.02	3.33	1.42	4.67
2.8	1.04	3.42	1.45	4.75
2.9	1.07	3.50	1.47	4.83
3.0	1.09	3.58	1.50	4.92

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 9
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
145.1 TO 169.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-phase exposure	
	m	ft	m	ft
2.0	0.91	3.00	1.42	4.67
2.1	0.97	3.17	1.45	4.75
2.2	0.99	3.25	1.47	4.83
2.3	1.02	3.33	1.50	4.92
2.4	1.04	3.42	1.52	5.00
2.5	1.07	3.50	1.57	5.17
2.6	1.12	3.67	1.60	5.25
2.7	1.14	3.75	1.63	5.33
2.8	1.17	3.83	1.65	5.42
2.9	1.19	3.92	1.68	5.50
3.0	1.22	4.00	1.73	5.67

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 10
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
169.1 TO 242.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
2.0	1.17	3.83	1.85	6.08
2.1	1.22	4.00	1.91	6.25
2.2	1.24	4.08	1.93	6.33
2.3	1.30	4.25	1.98	6.50
2.4	1.35	4.42	2.01	6.58
2.5	1.37	4.50	2.06	6.75
2.6	1.42	4.67	2.11	6.92
2.7	1.47	4.83	2.13	7.00
2.8	1.50	4.92	2.18	7.17
2.9	1.55	5.08	2.24	7.33
3.0	1.60	5.25	2.29	7.50

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 11
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
242.1 TO 362.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
2.0	1.60	5.25	2.62	8.58
2.1	1.65	5.42	2.69	8.83
2.2	1.75	5.75	2.79	9.17
2.3	1.85	6.08	2.90	9.50
2.4	1.93	6.33	3.02	9.92
2.5	2.03	6.67	3.15	10.33
2.6	2.16	7.08	3.28	10.75
2.7	2.26	7.42	3.40	11.17
2.8	2.36	7.75	3.53	11.58
2.9	2.49	8.17	3.68	12.08
3.0	2.59	8.50	3.81	12.50

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 12
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
362.1 TO 552.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	1.83	6.00	2.24	7.33
1.6	1.98	6.50	2.67	8.75
1.7	2.13	7.00	3.10	10.17
1.8	2.31	7.58	3.53	11.58
1.9	2.46	8.08	4.01	13.17
2.0	2.67	8.75	4.52	14.83
2.1	2.84	9.33	4.75	15.58
2.2	3.02	9.92	4.98	16.33
2.3	3.20	10.50	5.23	17.17
2.4	3.43	11.25	5.51	18.08

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

**TABLE 13
MINIMUM APPROACH DISTANCES UNTIL MARCH 31, 2015
552.1 TO 800.0 KV WITH OVERVOLTAGE FACTOR**

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	2.95	9.67	3.68	12.08
1.6	3.25	10.67	4.42	14.50
1.7	3.56	11.67	5.23	17.17
1.8	3.86	12.67	6.07	19.92
1.9	4.19	13.75	6.99	22.92
2.0	4.55	14.92	7.92	26.00

Note 1: The employer may apply the distance specified in this table only where the employer determines the maximum anticipated per-unit transient overvoltage by engineering analysis. (Table 6 applies otherwise.)

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

B. Alternative minimum approach distances.

Employers may use the minimum approach distances in Table 14 through Table 21 provided that the employer follows the notes to those tables.

TABLE 14 AC MINIMUM APPROACH DISTANCES-72.6 TO 121.0 KV				
T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5.	0.67	2.2	0.84	2.8
1.6	0.69	2.3	0.87	2.9
1.7	0.71	2.3	0.90	3.0
1.8	0.74	2.4	0.93	3.1
1.9	0.76	2.5	0.96	3.1
2.0	0.78	2.6	0.99	3.2
2.1	0.81	2.7	1.01	3.3
2.2	0.83	2.7	1.04	3.4
2.3	0.85	2.8	1.07	3.5
2.4	0.88	2.9	1.10	3.6
2.5	0.90	3.0	1.13	3.7
2.6	0.92	3.0	1.16	3.8
2.7	0.95	3.1	1.19	3.9
2.8	0.97	3.2	1.22	4.0
2.9	0.99	3.2	1.24	4.1
3.0	1.02	3.3	1.27	4.2
3.1	1.04	3.4	1.30	4.3
3.2	1.06	3.5	1.33	4.4
3.3	1.09	3.6	1.36	4.5
3.4	1.11	3.6	1.39	4.6
3.5	1.13	3.7	1.42	4.7

TABLE 15
AC MINIMUM APPROACH DISTANCES-121.1 TO 145.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	0.74	2.4	0.95	3.1
1.6	0.76	2.5	0.98	3.2
1.7	0.79	2.6	1.02	3.3
1.8	0.82	2.7	1.05	3.4
1.9	0.85	2.8	1.08	3.5
2.0	0.88	2.9	1.12	3.7
2.1	0.90	3.0	1.15	3.8
2.2	0.93	3.1	1.19	3.9
2.3	0.96	3.1	1.22	4.0
2.4	0.99	3.2	1.26	4.1
2.5	1.02	3.3	1.29	4.2
2.6	1.04	3.4	1.33	4.4
2.7	1.07	3.5	1.36	4.5
2.8	1.10	3.6	1.39	4.6
2.9	1.13	3.7	1.43	4.7
3.0	1.16	3.8	1.46	4.8
3.1	1.19	3.9	1.50	4.9
3.2	1.21	4.0	1.53	5.0
3.3	1.24	4.1	1.57	5.2
3.4	1.27	4.2	1.60	5.2
3.5	1.30	4.3	1.64	5.4

TABLE 16
AC MINIMUM APPROACH DISTANCES-145.1 TO 169.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	0.81	2.7	1.05	3.4
1.6	0.84	2.8	1.09	3.6
1.7	0.87	2.9	1.13	3.7
1.8	0.90	3.0	1.17	3.8
1.9	0.94	3.1	1.21	4.0
2.0	0.97	3.2	1.25	4.1
2.1	1.00	3.3	1.29	4.2
2.2	1.03	3.4	1.33	4.4
2.3	1.07	3.5	1.37	4.5
2.4	1.10	3.6	1.41	4.6
2.5	1.13	3.7	1.45	4.8
2.6	1.17	3.8	1.49	4.9
2.7	1.20	3.9	1.53	5.0
2.8	1.23	4.0	1.57	5.2
2.9	1.26	4.1	1.61	5.3
3.0	1.30	4.3	1.65	5.4
3.1	1.33	4.4	1.70	5.6
3.2	1.36	4.5	1.76	5.8
3.3	1.39	4.6	1.82	6.0
3.4	1.43	4.7	1.88	6.2
3.5	1.46	4.8	1.94	6.4

TABLE 17
AC MINIMUM APPROACH DISTANCES-169.1 TO 242.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	1.02	3.3	1.37	4.5
1.6	1.06	3.5	1.43	4.7
1.7	1.11	3.6	1.48	4.9
1.8	1.16	3.8	1.54	5.1
1.9	1.21	4.0	1.60	5.2
2.0	1.25	4.1	1.66	5.4
2.1	1.30	4.3	1.73	5.7
2.2	1.35	4.4	1.81	5.9
2.3	1.39	4.6	1.90	6.2
2.4	1.44	4.7	1.99	6.5
2.5	1.49	4.9	2.08	6.8
2.6	1.53	5.0	2.17	7.1
2.7	1.58	5.2	2.26	7.4
2.8	1.63	5.3	2.36	7.7
2.9	1.67	5.5	2.45	8.0
3.0	1.72	5.6	2.55	8.4
3.1	1.77	5.8	2.65	8.7
3.2	1.81	5.9	2.76	9.1
3.3	1.88	6.2	2.86	9.4
3.4	1.95	6.4	2.97	9.7
3.5	2.01	6.6	3.08	10.1

TABLE 18
AC MINIMUM APPROACH DISTANCES-242.1 TO 362.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	1.37	4.5	1.99	6.5
1.6	1.44	4.7	2.13	7.0
1.7	1.51	5.0	2.27	7.4
1.8	1.58	5.2	2.41	7.9
1.9	1.65	5.4	2.56	8.4
2.0	1.72	5.6	2.71	8.9
2.1	1.79	5.9	2.87	9.4
2.2	1.87	6.1	3.03	9.9
2.3	1.97	6.5	3.20	10.5
2.4	2.08	6.8	3.37	11.1
2.5	2.19	7.2	3.55	11.6
2.6	2.29	7.5	3.73	12.2
2.7	2.41	7.9	3.91	12.8
2.8	2.52	8.3	4.10	13.5
2.9	2.64	8.7	4.29	14.1
3.0	2.76	9.1	4.49	14.7
3.1	2.88	9.4	4.69	15.4
3.2	3.01	9.9	4.90	16.1
3.3	3.14	10.3	5.11	16.8
3.4	3.27	10.7	5.32	17.5
3.5	3.41	11.2	5.52	18.1

TABLE 19
AC MINIMUM APPROACH DISTANCES-362.1 TO 420.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	1.53	5.0	2.40	7.9
1.6	1.62	5.3	2.58	8.5
1.7	1.70	5.6	2.75	9.0
1.8	1.78	5.8	2.94	9.6
1.9	1.88	6.2	3.13	10.3
2.0	1.99	6.5	3.33	10.9
2.1	2.12	7.0	3.53	11.6
2.2	2.24	7.3	3.74	12.3
2.3	2.37	7.8	3.95	13.0
2.4	2.50	8.2	4.17	13.7
2.5	2.64	8.7	4.40	14.4
2.6	2.78	9.1	4.63	15.2
2.7	2.93	9.6	4.87	16.0
2.8	3.07	10.1	5.11	16.8
2.9	3.23	10.6	5.36	17.6
3.0	3.38	11.1	5.59	18.3
3.1	3.55	11.6	5.82	19.1
3.2	3.72	12.2	6.07	19.9
3.3	3.89	12.8	6.31	20.7
3.4	4.07	13.4	6.56	21.5
3.5	4.25	13.9	6.81	22.3

TABLE 20
AC MINIMUM APPROACH DISTANCES-420.1 TO 550.0 KV

T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	1.95	6.4	3.46	11.4
1.6	2.11	6.9	3.73	12.2
1.7	2.28	7.5	4.02	13.2
1.8	2.45	8.0	4.31	14.1
1.9	2.62	8.6	4.61	15.1
2.0	2.81	9.2	4.92	16.1
2.1	3.00	9.8	5.25	17.2
2.2	3.20	10.5	5.55	18.2
2.3	3.40	11.2	5.86	19.2
2.4	3.62	11.9	6.18	20.3
2.5	3.84	12.6	6.50	21.3
2.6	4.07	13.4	6.83	22.4
2.7	4.31	14.1	7.18	23.6
2.8	4.56	15.0	7.52	24.7
2.9	4.81	15.8	7.88	25.9
3.0	5.07	16.6	8.24	27.0

TABLE 21 AC MINIMUM APPROACH DISTANCES-550.1 TO 800.0 KV				
T (p.u.)	Phase-to-ground exposure		Phase-to-ground exposure	
	m	ft	m	ft
1.5	3.16	10.4	5.97	19.6
1.6	3.46	11.4	6.43	21.1
1.7	3.78	12.4	6.92	22.7
1.8	4.12	13.5	7.42	24.3
1.9	4.47	14.7	7.93	26.0
2.0	4.83	15.8	8.47	27.8
2.1	5.21	17.1	9.02	29.6
2.2	5.61	18.4	9.58	31.4
2.3	6.02	19.8	10.16	33.3
2.4	6.44	21.1	10.76	35.3
2.5	6.88	22.6	11.38	37.3

Notes to Table 14 through Table 21:

The employer must determine the maximum anticipated per-unit transient overvoltage, phase-to-ground, through an engineering analysis, as required by § 1910.269(l)(3)(ii), or assume a maximum anticipated per-unit transient overvoltage, phase-to-ground, in accordance with Table R-9.

For phase-to-phase exposures, the employer must demonstrate that no insulated tool spans the gap and that no large conductive object is in the gap.

The worksite must be at an elevation of 900 meters (3,000 feet) or less above sea level.

¹ Federal, State, and local regulatory bodies and electric utilities set reliability requirements that limit the number and duration of system outages.

² Sparkover is a disruptive electric discharge in which an electric arc forms and electric current passes through air.

³ The withstand voltage is the voltage at which sparkover is not likely to occur across a specified distance. It is the voltage taken at the 3s point below the sparkover voltage, assuming that the sparkover curve follows a normal distribution.

⁴ Test data demonstrates that the saturation factor is greater than 0 at peak voltages of about 630 kilovolts. Systems operating at 345 kilovolts (or maximum system voltages of 362 kilovolts) can have peak maximum transient over-voltages exceeding 630 kilovolts. Table R-3 sets equations for calculating a based on peak voltage.

⁵ For voltages of 50 to 300 volts, Table R-3 specifies a minimum approach distance of "avoid contact." The minimum approach distance for this voltage range contains neither an electrical component nor an ergonomic component.

⁶ For the purposes of estimating arc length, § 1910.269 generally assumes a more conservative dielectric strength of 10 kilovolts per 25.4 millimeters, consistent with assumptions made in consensus standards such as the National Electrical Safety Code (IEEE C2-2012). The more conservative value accounts for variables such as electrode shape, wave shape, and a certain amount of overvoltage.

⁷ The detailed design of a circuit interrupter, such as the design of the contacts, resistor insertion, and breaker timing control, are beyond the scope of this appendix. The design of the system generally accounts for these features. This appendix only discusses features that can limit the maximum switching transient overvoltage on a system.

⁸ Surge arrester application is beyond the scope of this appendix. However, if the employer installs the arrester near the work site, the application would be similar to the protective gaps discussed in paragraph IV.D of this appendix.

- ⁹ The employer should check the withstand voltage to ensure that it results in a probability of gap flashover that is acceptable from a system outage perspective. (In other words, a gap sparkover will produce a system outage. The employer should determine whether such an outage will impact overall system performance to an acceptable degree.) In general, the withstand voltage should be at least 1.25 times the maximum crest operating voltage.
- ¹⁰ The manufacturer of the gap provides, based on test data, the critical sparkover voltage for each gap spacing (for example, a critical sparkover voltage of 665 kilovolts for a gap spacing of 1.2 meters). The withstand voltage for the gap is equal to 85 percent of its critical sparkover voltage.
- ¹¹ Switch steps 1 and 2 if the length of the protective gap is known.
- ¹² IEEE Std 516-2009 states that most employers add 0.2 to the calculated value of T as an additional safety factor.
- ¹³ To eliminate sparkovers due to minor system disturbances, the employer should use a withstand voltage no lower than 1.25 p.u. Note that this is a practical, or operational, consideration only. It may be feasible for the employer to use lower values of withstand voltage.

[79 FR 20665-20677, July 10, 2014; 79 FR 56962, September 24, 2014]

APPENDIX C -- PROTECTION FROM STEP AND TOUCH POTENTIALS

I. Introduction

Current passing through an impedance impresses voltage across that impedance. Even conductors have some, albeit low, value of impedance. Therefore, if a "grounded" ¹ object, such as a crane or deenergized and grounded power line, results in a ground fault on a power line, voltage is impressed on that grounded object. The voltage impressed on the grounded object depends largely on the voltage on the line, on the impedance of the faulted conductor, and on the impedance to "true," or "absolute," ground represented by the object. If the impedance of the object causing the fault is relatively large, the voltage impressed on the object is essentially the phase-to-ground system voltage. However, even faults to grounded power lines or to well-grounded transmission towers or substation structures (which have relatively low values of impedance to ground) can result in **hazardous voltages**.² In all cases, the degree of the hazard depends on the magnitude of the current through the employee and the time of exposure. This appendix discusses methods of protecting workers against the possibility that grounded objects, such as cranes and other mechanical equipment, will contact energized power lines and that deenergized and grounded power lines will become accidentally energized.

II. Voltage-Gradient Distribution

A. *Voltage-gradient distribution curve.*

Absolute, or true, ground serves as a reference and always has a voltage of 0 volts above ground potential. Because there is an impedance between a grounding electrode and absolute ground, there will be a voltage difference between the grounding electrode and absolute ground under ground-fault conditions. Voltage dissipates from the grounding electrode (or from the grounding point) and creates a ground potential gradient. The voltage decreases rapidly with increasing distance from the grounding electrode. A voltage drop associated with this dissipation of voltage is a ground potential. Figure 1 is a typical voltage-gradient distribution curve (assuming a uniform soil texture).

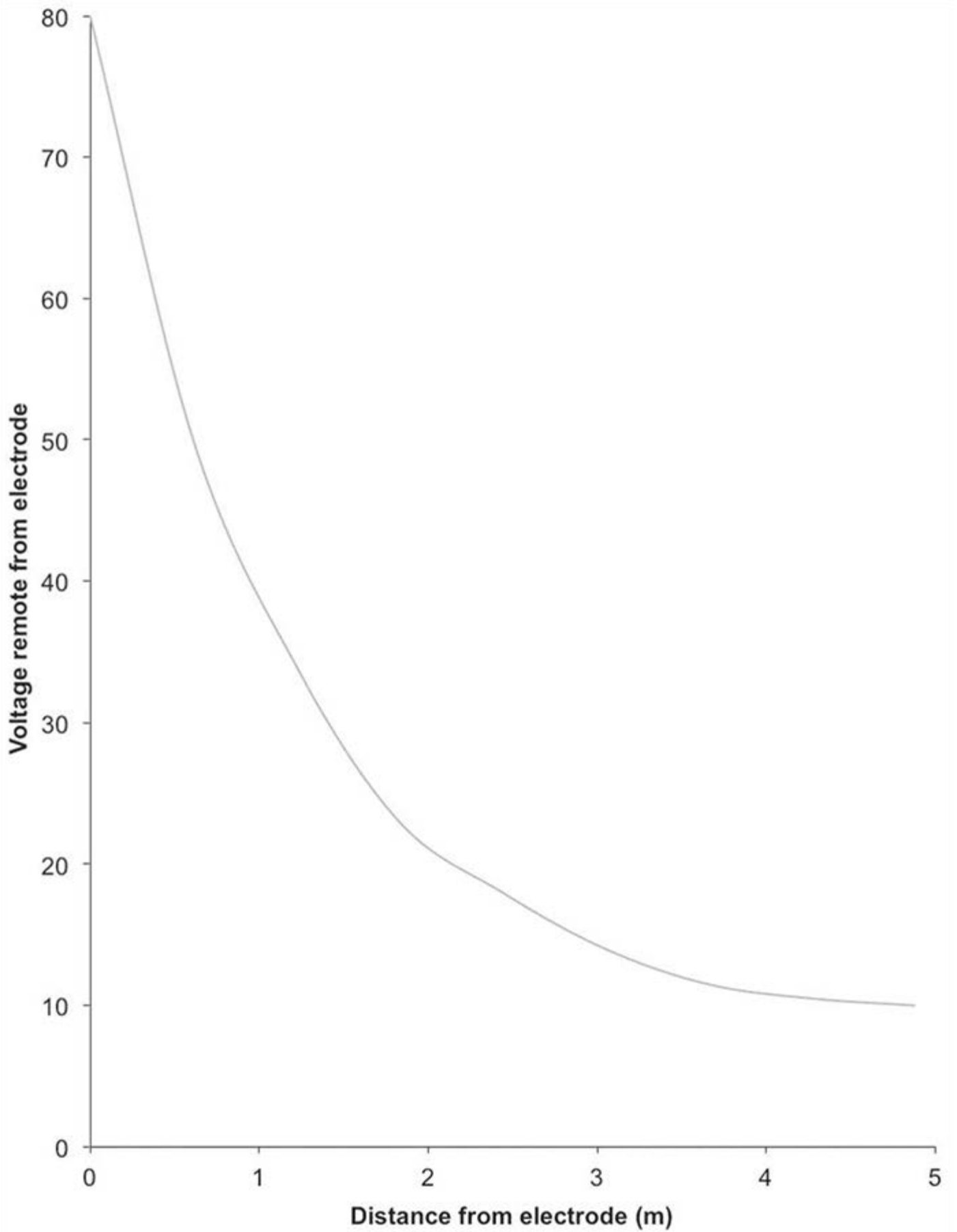


Figure 1 - Typical Voltage - Grandiet Distribution Curve

B. Step and touch potentials.

Figure 1 also shows that workers are at risk from step and touch potentials. Step potential is the voltage between the feet of a person standing near an energized grounded object (the electrode). In Figure 1, the step potential is equal to the difference in voltage between two points at different distances from the electrode (where the points represent the location of each foot in relation to the electrode). A person could be at risk of injury during a fault simply by standing near the object.

Touch potential is the voltage between the energized grounded object (again, the electrode) and the feet of a person in contact with the object. In Figure 1, the touch potential is equal to the difference in voltage between the electrode (which is at a distance of 0 meters) and a point some distance away from the electrode (where the point represents the location of the feet of the person in contact with the object). The touch potential could be nearly the full voltage across the grounded object if that object is grounded at a point remote from the place where the person is in contact with it. For example, a crane grounded to the system neutral and that contacts an energized line would expose any person in contact with the crane or its uninsulated load line to a touch potential nearly equal to the full fault voltage.

Figure 2 illustrates step and touch potentials.

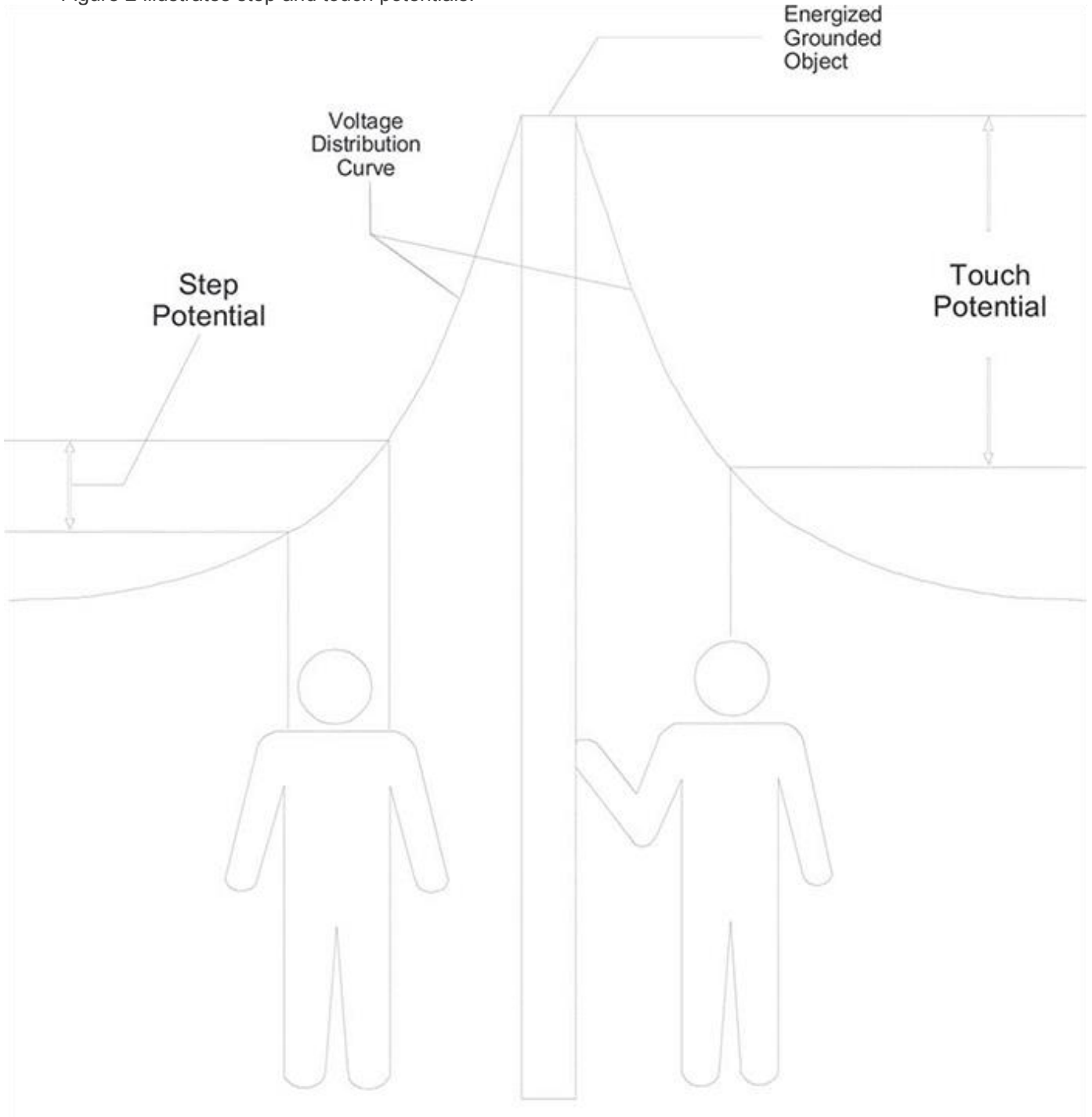


Figure 2 - Step and Touch Potentials

III. Protecting Workers From Hazardous Differences in Electrical Potential

A. **Definitions.** The following definitions apply to section III of this appendix:

Bond. The electrical interconnection of conductive parts designed to maintain a common electric potential.

Bonding cable (bonding jumper). A cable connected to two conductive parts to bond the parts together.

Cluster bar. A terminal temporarily attached to a structure that provides a means for the attachment and bonding of grounding and bonding cables to the structure.

Ground. A conducting connection between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounding cable (grounding jumper). A cable connected between a deenergized part and ground. Note that grounding cables carry fault current and bonding cables generally do not. A cable that bonds two conductive parts but carries substantial fault current (for example, a jumper connected between one phase and a grounded phase) is a grounding cable.

Ground mat (grounding grid). A temporarily or permanently installed metallic mat or grating that establishes an equipotential surface and provides connection points for attaching grounds.

B. **Analyzing the hazard.** The employer can use an engineering analysis of the power system under fault conditions to determine whether hazardous step and touch voltages will develop. The analysis should determine the voltage on all conductive objects in the work area and the amount of time the voltage will be present. Based on the this analysis, the employer can select appropriate measures and protective equipment, including the measures and protective equipment outlined in Section III of this appendix, to protect each employee from hazardous differences in electric potential. For example, from the analysis, the employer will know the voltage remaining on conductive objects after employees install bonding and grounding equipment and will be able to select insulating equipment with an appropriate rating, as described in paragraph III.C.2 of this appendix.

C. **Protecting workers on the ground.** The employer may use several methods, including equipotential zones, insulating equipment, and restricted work areas, to protect employees on the ground from hazardous differences in electrical potential.

1. An equipotential zone will protect workers within it from hazardous step and touch potentials. (See Figure 3.) Equipotential zones will not, however, protect employees located either wholly or partially outside the protected area. The employer can establish an equipotential zone for workers on the ground, with respect to a grounded object, through the use of a metal mat connected to the grounded object. The employer can use a grounding grid to equalize the voltage within the grid or bond conductive objects in the immediate work area to minimize the potential between the objects and between each object and ground. (Bonding an object outside the work area can increase the touch potential to that object, however.) Section III.D of this appendix discusses equipotential zones for employees working on deenergized and grounded power lines.
2. Insulating equipment, such as rubber gloves, can protect employees handling grounded equipment and conductors from hazardous touch potentials. The insulating equipment must be rated for the highest voltage that can be impressed on the grounded objects under fault conditions (rather than for the full system voltage).
3. Restricting employees from areas where hazardous step or touch potentials could arise can protect employees not directly involved in performing the operation. The employer must ensure that employees on the ground in the vicinity of transmission structures are at a distance where step voltages would be insufficient to cause injury. Employees must not handle grounded conductors or equipment likely to become energized to hazardous voltages unless the employees are within an equipotential zone or protected by insulating equipment.

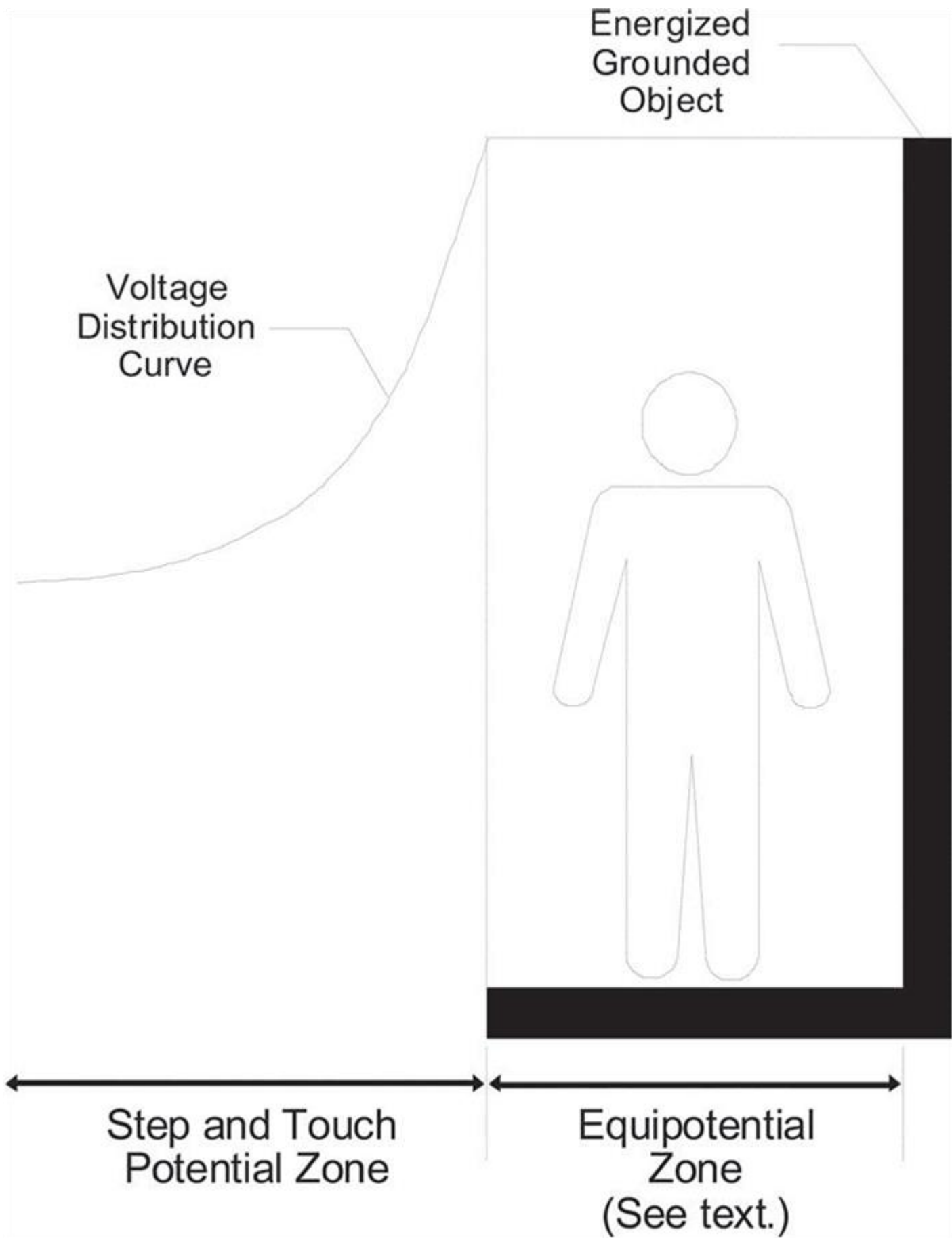


Figure 3 - Protection from Ground-Potential Gradients

D. Protecting employees working on deenergized and grounded power lines.

This Section III.D of Appendix C establishes guidelines to help employers comply with requirements in § 1910.269(n) for using protective grounding to protect employees working on deenergized power lines. Paragraph (n) of § 1910.269 applies to grounding of transmission and distribution lines and equipment for the purpose of protecting workers. Paragraph (n)(3) of § 1910.269 requires temporary protective grounds to be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent exposure of each employee to hazardous differences in electric potential.³ Sections III.D.1 and III.D.2 of this appendix provide guidelines that employers can use in making the demonstration required by § 1910.269(n)(3). Section III.D.1 of this appendix provides guidelines on how the employer can determine whether particular grounding practices expose employees to hazardous differences in electric potential. Section III.D.2 of this appendix describes grounding methods that the employer can use in lieu of an engineering analysis to make the demonstration required by § 1910.269(n)(3). The Occupational Safety and Health Administration will consider employers that comply with the criteria in this appendix as meeting § 1910.269(n)(3).

Finally, Section III.D.3 of this appendix discusses other safety considerations that will help the employer comply with other requirements in § 1910.269(n). Following these guidelines will protect workers from hazards that can occur when a deenergized and grounded line becomes energized.

1. *Determining safe body current limits.* This Section III.D.1 of Appendix C provides guidelines on how an employer can determine whether any differences in electric potential to which workers could be exposed are hazardous as part of the demonstration required by § 1910.269(n)(3).

Institute of Electrical and Electronic Engineers (IEEE) Standard 1048-2003, IEEE Guide for Protective Grounding of Power Lines, provides the following equation for determining the threshold of ventricular fibrillation when the duration of the electric shock is limited:

$$I = \frac{116}{\sqrt{t}},$$

where I is the current through the worker's body, and t is the duration of the current in seconds. This equation represents the ventricular fibrillation threshold for 95.5 percent of the adult population with a mass of 50 kilograms (110 pounds) or more. The equation is valid for current durations between 0.0083 to 3.0 seconds.

To use this equation to set safe voltage limits in an equipotential zone around the worker, the employer will need to assume a value for the resistance of the worker's body. IEEE Std 1048-2003 states that "total body resistance is usually taken as 1000 Ω for determining . . . body current limits." However, employers should be aware that the impedance of a worker's body can be substantially less than that value. For instance, IEEE Std 1048-2003 reports a minimum hand-to-hand resistance of 610 ohms and an internal body resistance of 500 ohms. The internal resistance of the body better represents the minimum resistance of a worker's body when the skin resistance drops near zero, which occurs, for example, when there are breaks in the worker's skin, for instance, from cuts or from blisters formed as a result of the current from an electric shock, or when the worker is wet at the points of contact.

Employers may use the IEEE Std 1048-2003 equation to determine safe body current limits only if the employer protects workers from hazards associated with involuntary muscle reactions from electric shock (for example, the hazard to a worker from falling as a result of an electric shock). Moreover, the equation applies only when the duration of the electric shock is limited. If the precautions the employer takes, including those required by applicable standards, do not adequately protect employees from hazards associated with involuntary reactions from electric shock, a hazard exists if the induced voltage is sufficient to pass a current of 1 milliamperes through a 500-ohm resistor. (The 500-ohm resistor represents the resistance of an employee. The 1-milliamperes current is the threshold of perception.) Finally, if the employer protects employees from injury due to involuntary reactions from electric shock, but the duration of the electric shock is unlimited (that is, when the fault current at the work location will be insufficient to trip the devices protecting the circuit), a hazard exists if the resultant current would be more than 6 milliamperes (the recognized let-go threshold for workers⁴).

2. *Acceptable methods of grounding for employers that do not perform an engineering determination.* The grounding methods presented in this section of this appendix ensure that differences in electric potential are as low as possible and, therefore, meet § 1910.269(n)(3) without an engineering determination of the potential differences. These methods follow two principles: (i) The grounding method must ensure that the

circuit opens in the fastest available clearing time, and (ii) the grounding method must ensure that the potential differences between conductive objects in the employee's work area are as low as possible.

Paragraph (n)(3) of § 1910.269 does not require grounding methods to meet the criteria embodied in these principles. Instead, the paragraph requires that protective grounds be "placed at such locations and arranged in such a manner that the employer can demonstrate will prevent exposure of each employee to hazardous differences in electric potential." However, when the employer's grounding practices do not follow these two principles, the employer will need to perform an engineering analysis to make the demonstration required by § 1910.269(n)(3).

i. *Ensuring that the circuit opens in the fastest available clearing time.* Generally, the higher the fault current, the shorter the clearing times for the same type of fault. Therefore, to ensure the fastest available clearing time, the grounding method must maximize the fault current with a low impedance connection to ground. The employer accomplishes this objective by grounding the circuit conductors to the best ground available at the worksite. Thus, the employer must ground to a grounded system neutral conductor, if one is present. A grounded system neutral has a direct connection to the system ground at the source, resulting in an extremely low impedance to ground. In a substation, the employer may instead ground to the substation grid, which also has an extremely low impedance to the system ground and, typically, is connected to a grounded system neutral when one is present. Remote system grounds, such as pole and tower grounds, have a higher impedance to the system ground than grounded system neutrals and substation grounding grids; however, the employer may use a remote ground when lower impedance grounds are not available. In the absence of a grounded system neutral, substation grid, and remote ground, the employer may use a temporary driven ground at the worksite.

In addition, if employees are working on a three-phase system, the grounding method must short circuit all three phases. Short circuiting all phases will ensure faster clearing and lower the current through the grounding cable connecting the deenergized line to ground, thereby lowering the voltage across that cable. The short circuit need not be at the worksite; however, the employer must treat any conductor that is not grounded at the worksite as energized because the ungrounded conductors will be energized at fault voltage during a fault.

ii. *Ensuring that the potential differences between conductive objects in the employee's work area are as low as possible.* To achieve as low a voltage as possible across any two conductive objects in the work area, the employer must bond all conductive objects in the work area. This section of this appendix discusses how to create a zone that minimizes differences in electric potential between conductive objects in the work area.

The employer must use bonding cables to bond conductive objects, except for metallic objects bonded through metal-to-metal contact. The employer must ensure that metal-to-metal contacts are tight and free of contamination, such as oxidation, that can increase the impedance across the connection. For example, a bolted connection between metal lattice tower members is acceptable if the connection is tight and free of corrosion and other contamination. Figure 4 shows how to create an equipotential zone for metal lattice towers.

Wood poles are conductive objects. The poles can absorb moisture and conduct electricity, particularly at distribution and transmission voltages. Consequently, the employer must either: (1) Provide a conductive platform, bonded to a grounding cable, on which the worker stands or (2) use cluster bars to bond wood poles to the grounding cable. The employer must ensure that employees install the cluster bar below, and close to, the worker's feet. The inner portion of the wood pole is more conductive than the outer shell, so it is important that the cluster bar be in conductive contact with a metal spike or nail that penetrates the wood to a depth greater than or equal to the depth the worker's climbing gaffs will penetrate the wood. For example, the employer could mount the cluster bar on a bare pole ground wire fastened to the pole with nails or staples that penetrate to the required depth. Alternatively, the employer may temporarily nail a conductive strap to the pole and connect the strap to the cluster bar. Figure 5 shows how to create an equipotential zone for wood poles.

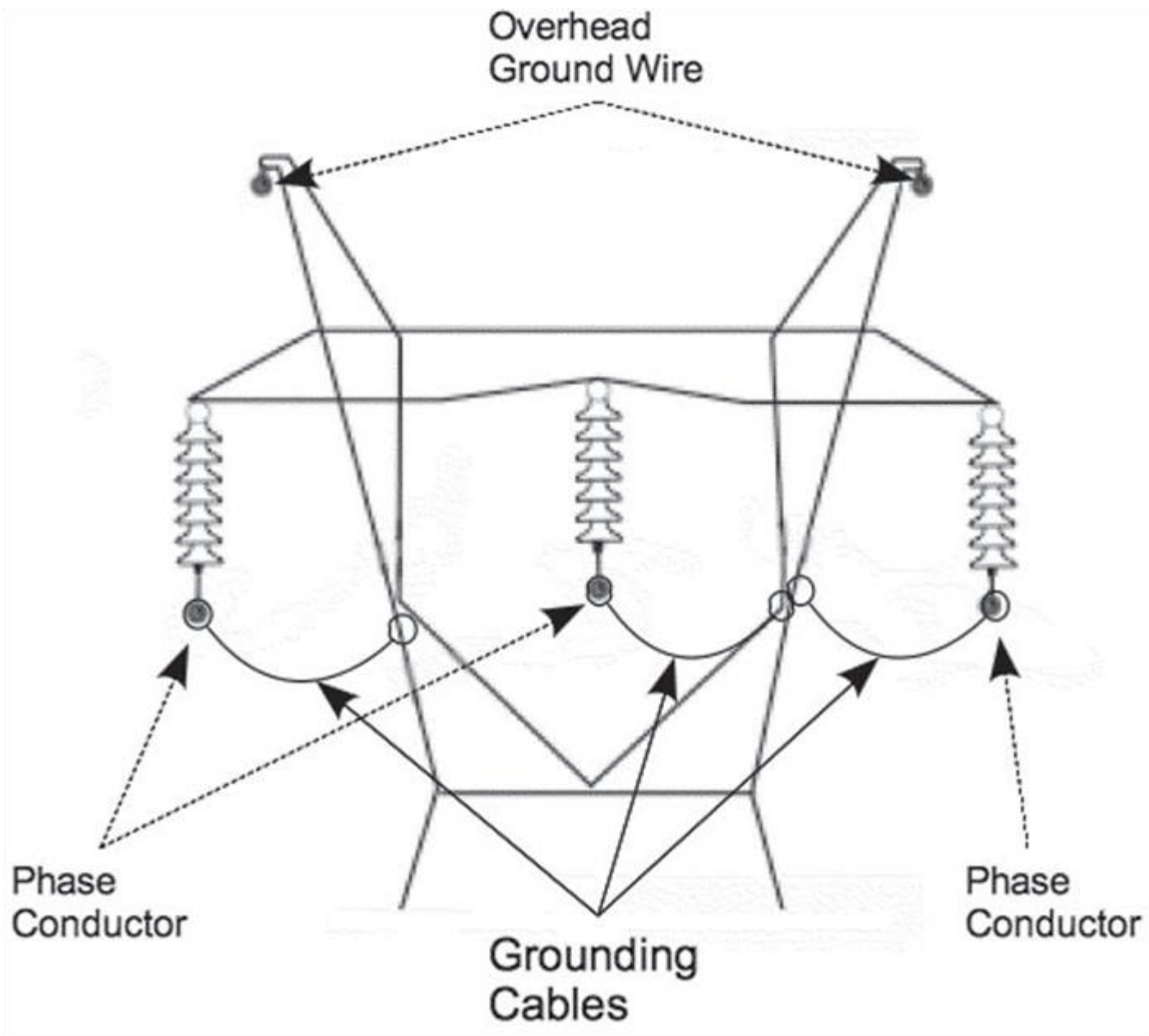


Figure 4 - Equipotential Zone for Metal Lattice Tower

Notes:

1. Employers must ground overhead ground wires that are within reach of the employee.
2. The grounding cable must be as short as practicable; therefore, the attachment points between the grounding cable and the tower may be different from that shown in the figure.

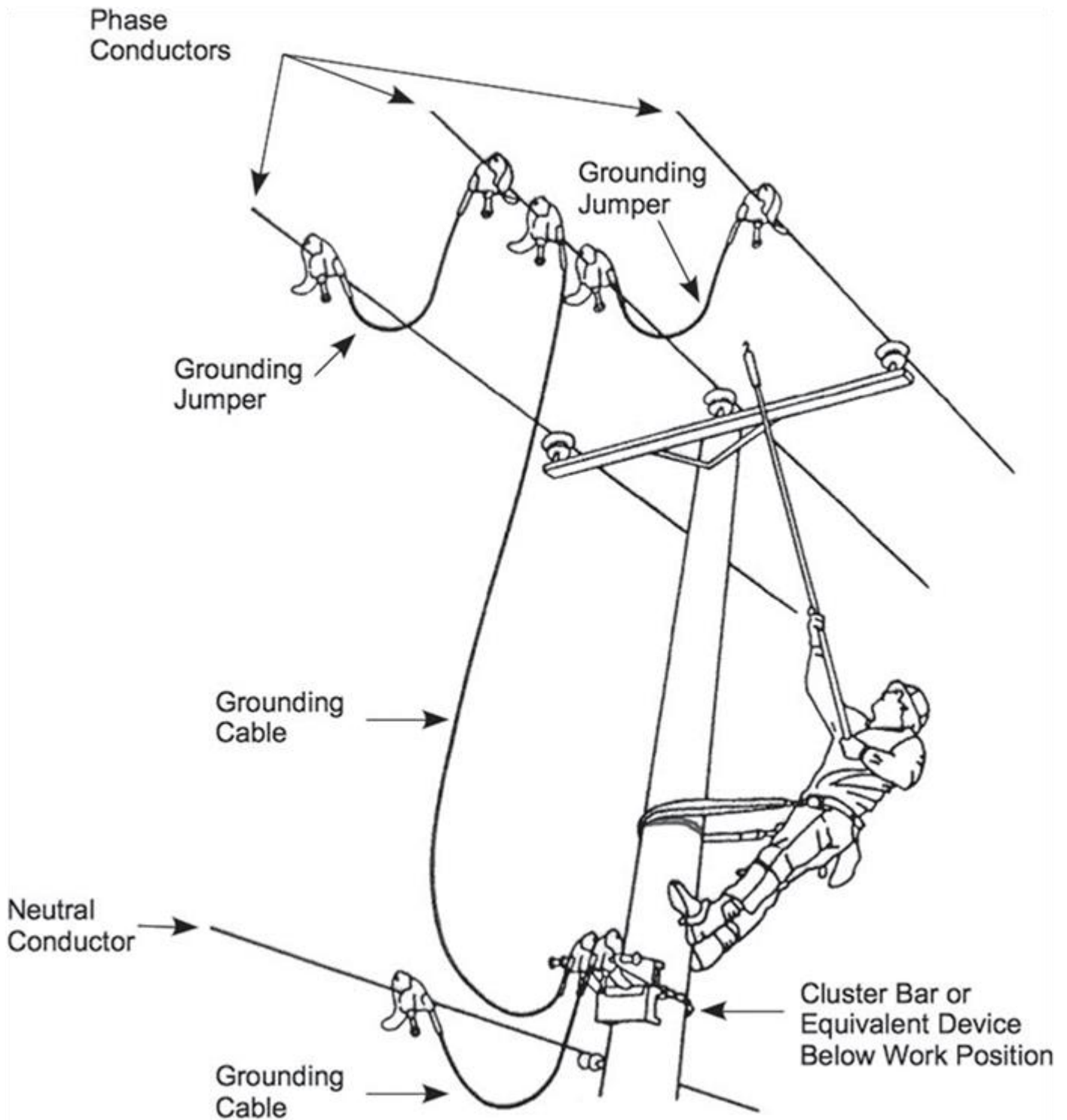


Figure 5 - Equipotential Grounding for Wood Poles

Figure reprinted with permission from Hubbell Power Systems, Inc. (Hubbell)
 OSHA revised the figure from Hubbell's original.

For underground systems, employers commonly install grounds at the points of disconnection of the underground cables. These grounding points are typically remote from the manhole or underground vault where employees will be working on the cable. Workers in contact with a cable grounded at a remote location can experience hazardous potential differences if the cable becomes energized or if a fault occurs on a different, but nearby, energized cable. The fault current causes potential gradients in the earth, and a potential difference will exist between the earth where the worker is standing and the earth where the cable is grounded. Consequently, to create an equipotential zone for the worker, the employer must provide a means of connecting the deenergized cable to ground at the worksite by having the worker stand on a

conductive mat bonded to the deenergized cable. If the cable is cut, the employer must install a bond across the opening in the cable or install one bond on each side of the opening to ensure that the separate cable ends are at the same potential. The employer must protect the worker from any hazardous differences in potential any time there is no bond between the mat and the cable (for example, before the worker installs the bonds).

3. *Other safety-related considerations.* To ensure that the grounding system is safe and effective, the employer should also consider the following factors:⁵

i. *Maintenance of grounding equipment.* It is essential that the employer properly maintain grounding equipment. Corrosion in the connections between grounding cables and clamps and on the clamp surface can increase the resistance of the cable, thereby increasing potential differences. In addition, the surface to which a clamp attaches, such as a conductor or tower member, must be clean and free of corrosion and oxidation to ensure a low-resistance connection. Cables must be free of damage that could reduce their current-carrying capacity so that they can carry the full fault current without failure. Each clamp must have a tight connection to the cable to ensure a low resistance and to ensure that the clamp does not separate from the cable during a fault.

ii. *Grounding cable length and movement.* The electromagnetic forces on grounding cables during a fault increase with increasing cable length. These forces can cause the cable to move violently during a fault and can be high enough to damage the cable or clamps and cause the cable to fail. In addition, flying cables can injure workers. Consequently, cable lengths should be as short as possible, and grounding cables that might carry high fault current should be in positions where the cables will not injure workers during a fault.

¹ This appendix generally uses the term "grounded" only with respect to grounding that the employer intentionally installs, for example, the grounding an employer installs on a deenergized conductor. However, in this case, the term "grounded" means connected to earth, regardless of whether or not that connection is intentional.

² Thus, grounding systems for transmission towers and substation structures should be designed to minimize the step and touch potentials involved.

³ The protective grounding required by § 1910.269(n) limits to safe values the potential differences between accessible objects in each employee's work environment. Ideally, a protective grounding system would create a true equipotential zone in which every point is at the same electric potential. In practice, current passing through the grounding and bonding elements creates potential differences. If these potential differences are hazardous, the employer may not treat the zone as an equipotential zone.

⁴ Electric current passing through the body has varying effects depending on the amount of the current. At the let-go threshold, the current overrides a person's control over his or her muscles. At that level, an employee grasping an object will not be able to let go of the object. The let-go threshold varies from person to person; however, the recognized value for workers is 6 milliamperes.

⁵ This appendix only discusses factors that relate to ensuring an equipotential zone for employees. The employer must consider other factors in selecting a grounding system that is capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault, as required by § 1910.269(n)(4)(i). IEEE Std 1048-2003 contains guidelines for selecting and installing grounding equipment that will meet § 1910.269(n)(4)(i).

APPENDIX D - METHODS OF INSPECTING AND TESTING WOOD POLES

I. Introduction

When employees are to perform work on a wood pole, it is important to determine the condition of the pole before employees climb it. The weight of the employee, the weight of equipment to be installed, and other working stresses (such as the removal or retensioning of conductors) can lead to the failure of a defective pole or a pole that is not designed to handle the additional stresses.¹ For these reasons, it is essential that, before an employee climbs a wood pole, the employer ascertain that the pole is capable of sustaining the stresses of the work. The determination that the pole is capable of sustaining these stresses includes an inspection of the condition of the pole.

If the employer finds the pole to be unsafe to climb or to work from, the employer must secure the pole so that it does not fail while an employee is on it. The employer can secure the pole by a line truck boom, by ropes or guys, or by lashing a new pole alongside it. If a new one is lashed alongside the defective pole, employees should work from the new one.

II. Inspecting Wood Poles

A qualified employee should inspect wood poles for the following conditions:²

- A. *General condition.* Buckling at the ground line or an unusual angle with respect to the ground may indicate that the pole has rotted or is broken.
- B. *Cracks.* Horizontal cracks perpendicular to the grain of the wood may weaken the pole. Vertical cracks, although not normally considered to be a sign of a defective pole, can pose a hazard to the climber, and the employee should keep his or her gaffs away from them while climbing.
- C. *Holes.* Hollow spots and woodpecker holes can reduce the strength of a wood pole.
- D. *Shell rot and decay.* Rotting and decay are cutout hazards and possible indications of the age and internal condition of the pole.
- E. *Knots.* One large knot or several smaller ones at the same height on the pole may be evidence of a weak point on the pole.
- F. *Depth of setting.* Evidence of the existence of a former ground line substantially above the existing ground level may be an indication that the pole is no longer buried to a sufficient depth.
- G. *Soil conditions.* Soft, wet, or loose soil around the base of the pole may indicate that the pole will not support any change in stress.
- H. *Burn marks.* Burning from transformer failures or conductor faults could damage the pole so that it cannot withstand changes in mechanical stress.

III. Testing Wood Poles

The following tests, which are from § 1910.268(n)(3), are acceptable methods of testing wood poles:

- A. *Hammer test.* Rap the pole sharply with a hammer weighing about 1.4 kg (3 pounds), starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 1.8 meters (6 feet). The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound or a less pronounced hammer rebound. Also, prod the pole as near the ground line as possible using a pole prod or a screwdriver with a blade at least 127 millimeters (5 inches) long. If substantial decay is present, the pole is unsafe.
- B. *Rocking test.* Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Exercise caution to avoid causing power lines to swing together. Apply the force to the pole either by pushing it with a pike pole or pulling the pole with a rope. If the pole cracks during the test, it is unsafe.

¹ A properly guyed pole in good condition should, at a minimum, be able to handle the weight of an employee climbing it.

² The presence of any of these conditions is an indication that the pole may not be safe to climb or to work from. The employee performing the inspection must be qualified to make a determination as to whether it is safe to perform the work without taking additional precautions.

APPENDIX E - PROTECTION FROM FLAMES AND ELECTRIC ARCS

I. Introduction

Paragraph (l)(8) of § 1910.269 addresses protecting employees from flames and electric arcs. This paragraph requires employers to: (1) Assess the workplace for flame and electric-arc hazards (paragraph (l)(8)(i)); (2) estimate the available heat energy from electric arcs to which employees would be exposed (paragraph (l)(8)(ii)); (3) ensure that employees wear clothing that will not melt, or ignite and continue to burn, when exposed to flames or the estimated heat energy (paragraph (l)(8)(iii)); and (4) ensure that employees wear flame-resistant clothing and protective clothing and other protective equipment that has an arc rating greater than or equal to the available heat energy under certain conditions (paragraphs (l)(8)(iv) and (l)(8)(v)). This appendix contains information to help employers estimate available heat energy as required by § 1910.269(l)(8)(ii), select protective clothing and other protective equipment with an arc rating suitable for the available heat energy as required by § 1910.269(l)(8)(v), and ensure that employees do not wear flammable clothing that could lead to burn injury as addressed by §§ 1910.269(l)(8)(iii) and (l)(8)(iv).

II. Assessing the Workplace for Flame and Electric-Arc Hazards

Paragraph (l)(8)(i) of § 1910.269 requires the employer to assess the workplace to identify employees exposed to hazards from flames or from electric arcs. This provision ensures that the employer evaluates employee exposure to flames and electric arcs so that employees who face such exposures receive the required protection. The employer must conduct an assessment for each employee who performs work on or near exposed, energized parts of electric circuits.

A. Assessment Guidelines

Sources electric arcs. Consider possible sources of electric arcs, including:

Energized circuit parts not guarded or insulated,

Switching devices that produce electric arcs in normal operation,

Sliding parts that could fault during operation (for example, rack-mounted circuit breakers), and

Energized electric equipment that could fail (for example, electric equipment with damaged insulation or with evidence of arcing or overheating).

Exposure to flames. Identify employees exposed to hazards from flames. Factors to consider include:

The proximity of employees to open flames, and

For flammable material in the work area, whether there is a reasonable likelihood that an electric arc or an open flame can ignite the material.

Probability that an electric arc will occur. Identify employees exposed to electric-arc hazards. The Occupational Safety and Health Administration will consider an employee exposed to electric-arc hazards if there is a reasonable likelihood that an electric arc will occur in the employee's work area, in other words, if the probability of such an event is higher than it is for the normal operation of enclosed equipment. Factors to consider include:

For energized circuit parts not guarded or insulated, whether conductive objects can come too close to or fall onto the energized parts,

For exposed, energized circuit parts, whether the employee is closer to the part than the minimum approach distance established by the employer (as permitted by § 1910.269(l)(3)(iii)).

Whether the operation of electric equipment with sliding parts that could fault during operation is part of the normal operation of the equipment or occurs during servicing or maintenance, and

For energized electric equipment, whether there is evidence of impending failure, such as evidence of arcing or overheating.

B. Examples

Table 1 provides task-based examples of exposure assessments.

TABLE 1 EXAMPLE ASSESSMENTS FOR VARIOUS TASKS		
Task		Is employee exposed to flame or electric arc hazard?
Normal operation of enclosed equipment, such as closing or opening a switch.	The employer properly installs and maintains enclosed equipment, and there is no evidence of impending failure.	No.
	There is evidence of arcing or overheating	Yes.
	Parts of the equipment are loose or sticking, or the equipment otherwise exhibits signs of lack of maintenance.	Yes.
Servicing electric equipment, such as racking in a circuit breaker or replacing a switch		Yes.
Inspection of electric equipment with exposed energized parts.	The employee is not holding conductive objects and remains outside the minimum approach distance established by the employer.	No.
	The employee is holding a conductive object, such as a flashlight, that could fall or otherwise contact energized parts (irrespective of whether the employee maintains the minimum approach distance).	Yes.
	The employee is closer than the minimum approach distance established by the employer (for example, when wearing rubber insulating gloves or rubber insulating gloves and sleeves).	Yes.
Using open flames, for example, in wiping cable splice sleeves		Yes.

III. Protection Against Burn Injury

A. Estimating Available Heat Energy

Calculation methods. Paragraph (l)(8)(ii) of § 1910.269 provides that, for each employee exposed to an electric-arc hazard, the employer must make a reasonable estimate of the heat energy to which the employee would be exposed if an arc occurs. Table 2 lists various methods of calculating values of available heat energy from an electric circuit. The Occupational Safety and Health Administration does not endorse any of these specific methods. Each method requires the input of various parameters, such as fault current, the expected length of the electric arc, the distance from the arc to the employee, and the clearing time for the fault (that is, the time the circuit protective devices take to open the circuit and clear the fault). The employer can precisely determine some of these parameters, such as the fault current and the clearing time, for a given system. The employer will need to estimate other parameters, such as the length of the arc and the distance between the arc and the employee, because such parameters vary widely.

TABLE 2
METHODS OF CALCULATING INCIDENT HEAT ENERGY FROM AN ELECTRIC ARC

1. Standard for Electrical Safety Requirements for Employee Workplaces, NFPA 70E-2012, Annex D, "Sample Calculation of Flash Protection Boundary."
2. Doughty, T.E., Neal, T.E., and Floyd II, H.L., "Predicting Incident Energy to Better Manage the Electric Arc Hazard on 600 V Power Distribution Systems," Record of Conference Papers IEEE IAS 45th Annual Petroleum and Chemical Industry Conference, September 28-30, 1998.
3. Guide for Performing Arc-Flash Hazard Calculations, IEEE Std 1584-2002, 1584a-2004 (Amendment 1 to IEEE Std 1584-2002), and 1584b-2011 (Amendment 2: Changes to Clause 4 of IEEE Std 1584-2002).*
4. ARCPRO, a commercially available software program developed by Kinectrics, Toronto, ON, CA.
* This appendix refers to IEEE Std 1584-2002 with both amendments as IEEE Std 1584b-2011.

The amount of heat energy calculated by any of the methods is approximately inversely proportional to the square of the distance between the employee and the arc. In other words, if the employee is very close to the arc, the heat energy is very high; but if the employee is just a few more centimeters away, the heat energy drops substantially. Thus, estimating the distance from the arc to the employee is key to protecting employees.

The employer must select a method of estimating incident heat energy that provides a reasonable estimate of incident heat energy for the exposure involved. Table 3 shows which methods provide reasonable estimates for various exposures.

TABLE 3 SELECTING A REASONABLE INCIDENT-ENERGY CALCULATION METHOD 1									
Incident-energy calculation method	600 V and Less 2			601 V to 15 kV 2			More than 15 kV		
	1Φ	3Φa	3Φb	1Φ	3Φa	3Φb	1Φ	3Φa	3Φb
NFPA 70E-2012 Annex D (Lee equation)	Y-C	Y	N	Y-C	Y-C	N	N3	N3	N3
Doughty, Neal, and Floyd	Y-C	Y	Y	N	N	N	N	N	N
IEEE Std 1584b-2011	Y	Y	Y	Y	Y	Y	N	N	N
ARCPRO	y	N	N	Y	N	N	Y	Y4	Y4
Key:									
1Φ: Single-phase arc in open air.									
3Φa: Three-phase arc in open air.									
3Φb: Three-phase arc in an enclosure (box).									
Y: Acceptable; produces a reasonable estimate of incident heat energy from this type of electric arc.									
N: Not acceptable; does not produce a reasonable estimate of incident heat energy from this type of electric arc.									
Y-C: Acceptable; produces a reasonable, but conservative, estimate of incident heat energy from this type of electric arc.									
Notes:									
¹ Although the Occupational Safety and Health Administration will consider these methods reasonable for enforcement purposes when employers use the methods in accordance with this table, employers should be aware that the listed methods do not necessarily result in estimates that will provide full protection from internal faults in transformers and similar equipment or from arcs in underground manholes or vaults.									
² At these voltages, the presumption is that the arc is three-phase unless the employer can demonstrate that only one phase is present or that the spacing of the phases is sufficient to prevent a multiphase arc from occurring.									
³ Although the Occupational Safety and Health Administration will consider this method acceptable for purposes of assessing whether incident energy exceeds 2.0 cal/cm ² , the results at voltages of more than 15 kilovolts are extremely conservative and unrealistic.									
⁴ The Occupational Safety and Health Administration will deem the results of this method reasonable when the employer adjusts them using the conversion factors for three-phase arcs in open air or in an enclosure, as indicated in the program's instructions.									

Selecting a reasonable distance from the employee to the arc. In estimating available heat energy, the employer must make some reasonable assumptions about how far the employee will be from the electric arc. Table 4 lists reasonable distances from the employee to the electric arc. The distances in Table 4 are consistent with national consensus standards, such as the Institute of Electrical and Electronic Engineers' National Electrical Safety Code, ANSI/IEEE C2-2012, and IEEE Guide for Performing Arc-Flash Hazard Calculations, IEEE Std 1584b-2011. The employer is free to use other reasonable distances, but must consider equipment enclosure size and the working distance to the employee in selecting a distance from the employee to the arc. The Occupational Safety and Health Administration will consider a distance reasonable when the employer bases it on equipment size and working distance.

TABLE 4 SELECTING A REASONABLE DISTANCE FROM THE EMPLOYEE TO THE ELECTRIC ARC		
Class of equipment	Single-phase arc mm (inches)	Three-phase arc mm (inches)
Cable	*NA	455 (18)
Low voltage MCCs and panelboards	NA	455 (18)
Low-voltage switchgear	NA	610 (24)
5-kV switchgear	NA	910 (36)
15-kV switchgear	NA	910 (36)
Single conductors in air (up to 46 kilovolts), work with rubber insulating gloves	380 (15)	NA
Single conductors in air, work with live-line tools and live-line barehand work	MAD - (2 × kV × 2.54)	NA
	(MAD - (2 × kV /10)) †	
* NA = not applicable.		
† The terms in this equation are:		
MAD = The applicable minimum approach distance, and		
kV = The system voltage in kilovolts.		

Selecting a reasonable arc gap. For a single-phase arc in air, the electric arc will almost always occur when an energized conductor approaches too close to ground. Thus, an employer can determine the arc gap, or arc length, for these exposures by the dielectric strength of air and the voltage on the line. The dielectric strength of air is approximately 10 kilovolts for every 25.4 millimeters (1 inch). For example, at 50 kilovolts, the arc gap would be $50 \div 10 \times 25.4$ (or 50×2.54), which equals 127 millimeters (5 inches).

For three-phase arcs in open air and in enclosures, the arc gap will generally be dependent on the spacing between parts energized at different electrical potentials. Documents such as IEEE Std 1584b-2011 provide information on these distances. Employers may select a reasonable arc gap from Table 5, or they may select any other reasonable arc gap based on sparkover distance or on the spacing between (1) live parts at different potentials or (2) live parts and grounded parts (for example, bus or conductor spacings in equipment). In any event, the employer must use an estimate that reasonably resembles the actual exposures faced by the employee.

TABLE 5 SELECTING A REASONABLE ARC GAP		
Class of equipment	Single-phase arc mm (inches)	Three-phase arc mm ¹ (inches)
Cable	NA ²	13 (0.5)
Low voltage MCCs and panelboards	NA	25 (1.0)
Low-voltage switchgear	NA	32 (1.25)
5-kV switchgear	NA	104 (4.0)
15-kV switchgear	NA	152 (6.0)
Single conductors in air, 15 kV and less	51 (2.0)	Phase conductor spacing
Single conductor in air, more than 15 kV	Voltage in kV × 2.54 (Voltage in kV × 0.1), but no less than 51 mm (2 inches)	Phase conductor spacing
¹ Source: IEEE Std 1584b-2011.		
² NA = not applicable.		

Making estimates over multiple system areas. The employer need not estimate the heat-energy exposure for every job task performed by each employee. Paragraph (l)(8)(ii) of § 1910.269 permits the employer to make broad estimates that cover multiple system areas provided that: (1) The employer uses reasonable assumptions about the energy-exposure distribution throughout the system, and (2) the estimates represent the maximum exposure for those areas. For example, the employer can use the maximum fault current and clearing time to cover several system areas at once.

Incident heat energy for single-phase-to-ground exposures. Table 6 and Table 7 provide incident heat energy levels for openair, phase-to-ground electric-arc exposures typical for overhead systems.² Table 6 presents estimates of available energy for employees using rubber insulating gloves to perform work on overhead systems operating at 4 to 46 kilovolts. The table assumes that the employee will be 380 millimeters (15 inches) from the electric arc, which is a reasonable estimate for rubber insulating glove work. Table 6 also assumes that the arc length equals the sparkover distance for the maximum transient overvoltage of each voltage range.³ To use the table, an employer would use the voltage, maximum fault current, and maximum clearing time for a system area and, using the appropriate voltage range and fault-current and clearingtime values corresponding to the next higher values listed in the table, select the appropriate heat energy (4, 5, 8, or 12 cal/cm²) from the table. For example, an employer might have a 12,470-volt power line supplying a system area. The power line can supply a maximum fault current of 8 kiloamperes with a maximum clearing time of 10 cycles. For rubber glove work, this system falls in the 4.0-to-15.0-kilovolt range; the next-higher fault current is 10 kA (the second row in that voltage range); and the clearing time is under 18 cycles (the first column to the right of the fault current column). Thus, the available heat energy for this part of the system will be 4 cal/cm² or less (from the column heading), and the employer could select protection with a 5-cal/cm² rating to meet § 1910.269(l)(8)(v). Alternatively, an employer could select a base incident-energy value and ensure that the clearing times for each voltage range and fault current listed in the table do not exceed the corresponding clearing time specified in the table. For example, an employer that provides employees with arc-flash protective equipment rated at 8 cal/cm² can use the table to determine if any system area exceeds 8 cal/cm² by checking the clearing time for the highest fault current for each voltage range and ensuring that the clearing times do not exceed the values specified in the 8-cal/cm² column in the table.

Table 7 presents similar estimates for employees using live-line tools to perform work on overhead systems operating at voltages of 4 to 800 kilovolts. The table assumes that the arc length will be equal to the sparkover distance⁴ and that the employee will be a distance from the arc equal to the minimum approach distance minus twice the sparkover distance.

The employer will need to use other methods for estimating available heat energy in situations not addressed by Table 6 or Table 7. The calculation methods listed in Table 2 and the guidance provided in Table 3 will help employers do this. For example, employers can use IEEE Std 1584b-2011 to estimate the available heat energy (and to select appropriate protective equipment) for many specific conditions, including lower-voltage, phase-to-phase arc, and enclosed arc exposures.

TABLE 6 INCIDENT HEAT ENERGY FOR VARIOUS FAULT CURRENTS, CLEARING TIMES, AND VOLTAGES OF 4.0 TO 46.0 KV: RUBBER INSULATING GLOVE EXPOSURES INVOLVING PHASE-TO-GROUND ARCS IN OPEN AIR ONLY * † ‡					
Voltage range (kV) **	Fault current (kA)	Maximum clearing time (cycles)			
		4 cal/cm ²	5 cal/cm ²	8 cal/cm ²	12 cal/cm ²
4.0 to 15.0	5	46	58	92	138
	10	18	22	36	54
	15	10	12	20	30
	20	6	8	13	19
15.1 to 25.0	5	28	34	55	83
	10	11	14	23	34
	15	7	8	13	20
	20	4	5	9	13
25.1 to 36.0	5	21	26	42	62
	10	9	11	18	26
	15	5	6	10	16
	20	4	4	7	11
36.1 to 46.0	5	16	20	32	48
	10	7	9	14	21
	15	4	5	8	13
	20	3	4	6	9
Notes:* This table is for open-air, phase-to-ground electric-arc exposures. It is not for phase-to-phase arcs or enclosed arcs (arc in a box).					
† The table assumes that the employee will be 380 mm (15 in.) from the electric arc. The table also assumes the arc length to be the sparkover distance for the maximum transient overvoltage of each voltage range (see Appendix B to § 1910.269), as follows: 4.0 to 15.0 kV 51 mm (2 in.) 15.1 to 25.0 kV 102 mm (4 in.) 25.1 to 36.0 kV 152 mm (6 in.) 36.1 to 46.0 kV 229 mm (9 in.)					
‡ The Occupational Safety and Health Administration calculated the values in this table using the ARCPRO method listed in Table 2.					
** The voltage range is the phase-to-phase system voltage.					

**TABLE 7
INCIDENT HEAT ENERGY FOR VARIOUS FAULT CURRENTS, CLEARING TIMES,
AND VOLTAGES: LIVE-LINE TOOL EXPOSURES INVOLVING PHASE-TO-GROUND
ARCS IN OPEN AIR ONLY * † ‡ #**

Voltage range (kV) **	Fault current (kA)	Maximum clearing time (cycles)			
		4 cal/cm2	5 cal/cm2	8 cal/cm2	12 cal/cm2
4.0 to 15.0	5	197	246	394	591
	10	73	92	147	220
	15	39	49	78	117
	20	24	31	49	73
15.1 to 25.0	5	197	246	394	591
	10	75	94	150	225
	15	41	51	82	122
	20	26	33	52	78
25.1 to 36.0	5	138	172	275	413
	10	53	66	106	159
	15	30	37	59	89
	20	19	24	38	58
36.1 to 46.0	5	129	161	257	386
	10	51	64	102	154
	15	29	36	58	87
	20	19	24	38	57
46.1 to 72.5	20	18	23	36	55
	30	10	13	20	30
	40	6	8	13	19
	50	4	6	9	13
72.6 to 121.0	20	10	12	20	30
	30	6	7	11	17
	40	4	5	7	11
	50	3	3	5	8
121.1 to 145.0	20	12	15	24	35
	30	7	9	15	22
	40	5	6	10	15
	50	4	5	8	11
145.1 to 169.0	20	12	15	24	36
	30	7	9	15	22
	40	5	7	10	16
	50	4	5	8	12
169.1 to 242.0	20	13	17	27	40
	30	8	10	17	25
	40	6	7	12	17
	50	4	5	9	13
242.1 to 362.0	20	25	32	51	76
	30	16	19	31	47
	40	11	14	22	33
	50	8	10	16	25

**TABLE 7
INCIDENT HEAT ENERGY FOR VARIOUS FAULT CURRENTS, CLEARING TIMES,
AND VOLTAGES: LIVE-LINE TOOL EXPOSURES INVOLVING PHASE-TO-GROUND
ARCS IN OPEN AIR ONLY * † ‡ #**

Voltage range (kV) **	Fault current (kA)	Maximum clearing time (cycles)			
		4 cal/cm ²	5 cal/cm ²	8 cal/cm ²	12 cal/cm ²
362.1 to 420.0	20	12	15	25	37
	30	8	10	15	23
	40	5	7	11	16
	50	4	5	8	12
420.1 to 550.0	20	23	29	47	70
	30	14	18	29	43
	40	10	13	20	30
	50	8	9	15	23
550.1 to 800.0	20	25	31	50	75
	30	15	19	31	46
	40	11	13	21	32
	50	8	10	16	24

Notes:

* This table is for open-air, phase-to-ground electric-arc exposures. It is not for phase-to-phase arcs or enclosed arcs (arc in a box).

† The table assumes the arc length to be the sparkover distance for the maximum phase-to-ground voltage of each voltage range (see Appendix B to this section). The table also assumes that the employee will be the minimum approach distance minus twice the arc length from the electric arc.

‡ The Occupational Safety and Health Administration calculated the values in this table using the ARCPRO method listed in Table 2.

For voltages of more than 72.6 kV, employers may use this table only when the minimum approach distance established under § 1910.269(l)(3)(i) is greater than or equal to the following values:

- 72.6 to 121.0 kV 1.02 m.
- 121.1 to 145.0 kV 1.16 m.
- 145.1 to 169.0 kV 1.30 m.
- 169.1 to 242.0 kV 1.72 m.
- 242.1 to 362.0 kV 2.76 m.
- 362.1 to 420.0 kV 2.50 m.
- 420.1 to 550.0 kV 3.62 m.
- 550.1 to 800.0 kV 4.83 m.

** The voltage range is the phase-to-phase system voltage.

B. Selecting Protective Clothing and Other Protective Equipment

Paragraph (l)(8)(v) of § 1910.269 requires employers, in certain situations, to select protective clothing and other protective equipment with an arc rating that is greater than or equal to the incident heat energy estimated under § 1910.269(l)(8)(ii). Based on laboratory testing required by ASTM F1506-10a, the expectation is that protective clothing with an arc rating equal to the estimated incident heat energy will be capable of preventing second-degree burn injury to an employee exposed to that incident heat energy from an electric arc. Note that actual electric-arc exposures may be more or less severe than the estimated value because of factors such as arc movement, arc length, arcing from reclosing of the system, secondary fires or explosions, and weather conditions. Additionally, for arc rating based on the fabric's arc thermal performance value 5 (ATPV), a worker exposed to incident energy at the arc rating has a 50-percent chance of just barely receiving a second-degree burn. Therefore, it is possible (although not likely) that an employee will sustain a second-degree (or worse) burn wearing clothing conforming to § 1910.269(l)(8)(v) under certain circumstances. However, reasonable employer estimates and maintaining appropriate minimum approach distances for employees should limit burns to relatively small burns that just barely extend beyond the epidermis (that is, just barely a second-degree burn). Consequently, protective clothing and other protective equipment meeting § 1910.269(l)(8)(v) will provide an appropriate degree of protection for an employee exposed to electric-arc hazards.

Paragraph (l)(8)(v) of § 1910.269 does not require arc-rated protection for exposures of 2 cal/cm² or less. Untreated cotton clothing will reduce a 2-cal/cm² exposure below the 1.2- to 1.5-cal/cm² level necessary to cause burn injury, and this material should not ignite at such low heat energy levels. Although § 1910.269(l)(8)(v) does not require clothing to have an arc rating when exposures are 2 cal/cm² or less, § 1910.269(l)(8)(iv) requires the outer layer of clothing to be flame resistant under certain conditions, even when the estimated incident heat energy is less than 2 cal/cm², as discussed later in this appendix.

Additionally, it is especially important to ensure that employees do not wear undergarments made from fabrics listed in the note to § 1910.269(l)(8)(iii) even when the outer layer is flame resistant or arc rated. These fabrics can melt or ignite easily when an electric arc occurs. Logos and name tags made from non-flame-resistant material can adversely affect the arc rating or the flame-resistant characteristics of arc-rated or flame-resistant clothing. Such logos and name tags may violate § 1910.269(l)(8)(iii), (l)(8)(iv), or (l)(8)(v).

Paragraph (l)(8)(v) of § 1910.269 requires that arc-rated protection cover the employee's entire body, with limited exceptions for the employee's hands, feet, face, and head. Paragraph (l)(8)(v)(A) of § 1910.269 provides that arc-rated protection is not necessary for the employee's hands under the following conditions:

For any estimated incident heat energy .	When the employee is wearing rubber insulating gloves with protectors.
If the estimated incident heat energy does not exceed 14 cal/cm ² .	When the employee is wearing heavy-duty leather work gloves with a weight of at least 407 gm/m ² (12 oz/yd ²).

Paragraph (l)(8)(v)(B) of § 1910.269 provides that arc-rated protection is not necessary for the employee's feet when the employee is wearing heavy-duty work shoes or boots. Finally, § 1910.269(l)(8)(v)(C), (l)(8)(v)(D), and (l)(8)(v)(E) require arc-rated head and face protection as follows:

Exposure	Minimum head and face protection		
	None *	Arc-rated faceshield with a minimum rating of 8 cal/cm2*	Arc-rated hood or faceshield with balaclava
Single-phase, open air	2-8 cal/cm2	9-12 cal/cm2	13 cal/cm2 or higher †.
Three-phase	2-4 cal/cm2	5-8 cal/cm2	9 cal/cm2 or higher ‡.
* These ranges assume that employees are wearing hardhats meeting the specifications in § 1910.135 or § 1926.100(b)(2), as applicable.			
† The arc rating must be a minimum of 4 cal/cm2 less than the estimated incident energy. Note that § 1910.269(l)(8)(v)(E) permits this type of head and face protection, with a minimum arc rating of 4 cal/cm2 less than the estimated incident energy, at any incident energy level.			
‡ Note that § 1910.269(l)(8)(v) permits this type of head and face protection at any incident energy level.			

IV. Protection Against Ignition

Paragraph (l)(8)(iii) of § 1910.269 prohibits clothing that could melt onto an employee's skin or that could ignite and continue to burn when exposed to flames or to the available heat energy estimated by the employer under § 1910.269(l)(8)(ii). Meltable fabrics, such as acetate, nylon, polyester, and polypropylene, even in blends, must be avoided. When these fibers melt, they can adhere to the skin, thereby transferring heat rapidly, exacerbating burns, and complicating treatment. These outcomes can result even if the meltable fabric is not directly next to the skin. The remainder of this section focuses on the prevention of ignition.

Paragraph (l)(8)(v) of § 1910.269 generally requires protective clothing and other protective equipment with an arc rating greater than or equal to the employer's estimate of available heat energy. As explained earlier in this appendix, untreated cotton is usually acceptable for exposures of 2 cal/cm2 or less.⁶ If the exposure is greater than that, the employee generally must wear flame-resistant clothing with a suitable arc rating in accordance with § 1910.269(l)(8)(iv) and (l)(8)(v). However, even if an employee is wearing a layer of flame-resistant clothing, there are circumstances under which flammable layers of clothing would be uncovered, and an electric arc could ignite them. For example, clothing ignition is possible if the employee is wearing flammable clothing under the flame-resistant clothing and the underlayer is uncovered because of an opening in the flame-resistant clothing. Thus, for purposes of § 1910.269(l)(8)(iii), it is important for the employer to consider the possibility of clothing ignition even when an employee is wearing flame-resistant clothing with a suitable arc rating.

Under § 1910.269(l)(8)(iii), employees may not wear flammable clothing in conjunction with flame-resistant clothing if the flammable clothing poses an ignition hazard.⁷ Although outer flame-resistant layers may not have openings that expose flammable inner layers, when an outer flame-resistant layer would be unable to resist breakopen,⁸ the next (inner) layer must be flame-resistant if it could ignite.

Non-flame-resistant clothing can ignite even when the heat energy from an electric arc is insufficient to ignite the clothing. For example, nearby flames can ignite an employee's clothing; and, even in the absence of flames, electric arcs pose ignition hazards beyond the hazard of ignition from incident energy under certain conditions. In addition to requiring flame-resistant clothing when the estimated incident energy exceeds 2.0 cal/cm2, § 1910.269(l)(8)(iv) requires flame-resistant clothing when: The employee is exposed to contact with energized circuit parts operating at more than 600 volts (§ 1910.269(l)(8)(iv)(A)), an electric arc could ignite flammable material in the work area that, in turn, could ignite the employee's clothing (§ 1910.269(l)(8)(iv)(B)), and molten metal or electric arcs from faulted conductors in the work area could ignite the employee's clothing (§ 1910.269(l)(8)(iv)(C)). For example, grounding conductors can become a source of heat energy if they cannot carry fault current without failure. The employer must consider these possible sources of electric arcs⁹ in determining whether the employee's clothing could ignite under § 1910.269(l)(8)(iv)(C).

-
- ¹ Flame-resistant clothing includes clothing that is inherently flame resistant and clothing chemically treated with a flame retardant. (See ASTM F1506-10a, Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards, and ASTM F1891-12 Standard Specification for Arc and Flame Resistant Rainwear.)
- ² The Occupational Safety and Health Administration used metric values to calculate the clearing times in Table 6 and Table 7. An employer may use English units to calculate clearing times instead even though the results will differ slightly.
- ³ The Occupational Safety and Health Administration based this assumption, which is more conservative than the arc length specified in Table 5, on Table 410-2 of the 2012 NESC.
- ⁴ The dielectric strength of air is about 10 kilovolts for every 25.4 millimeters (1 inch). Thus, the employer can estimate the arc length in millimeters to be the phase-to-ground voltage in kilovolts multiplied by 2.54 (or voltage (in kilovolts) × 2.54).
- ⁵ ASTM F1506-10a defines "arc thermal performance value" as "the incident energy on a material or a multilayer system of materials that results in a 50% probability that sufficient heat transfer through the tested specimen is predicted to cause the onset of a second-degree skin burn injury based on the Stoll [footnote] curve, cal/cm²." The footnote to this definition reads: "Derived from: Stoll, A. M., and Chianta, M. A., 'Method and Rating System for Evaluations of Thermal Protection,' Aerospace Medicine, Vol 40, 1969, pp. 1232-1238 and Stoll, A. M., and Chianta, M. A., 'Heat Transfer through Fabrics as Related to Thermal Injury,' Transactions-New York Academy of Sciences, Vol 33(7), Nov. 1971, pp. 649-670."
- ⁶ See § 1910.269(l)(8)(iv)(A), (l)(8)(iv)(B), and (l)(8)(iv)(C) for conditions under which employees must wear flame-resistant clothing as the outer layer of clothing even when the incident heat energy does not exceed 2 cal/cm².
- ⁷ Paragraph (l)(8)(iii) of § 1910.269 prohibits clothing that could ignite and continue to burn when exposed to the heat energy estimated under paragraph (l)(8)(ii) of that section.
- ⁸ Breakopen occurs when a hole, tear, or crack develops in the exposed fabric such that the fabric no longer effectively blocks incident heat energy.
- ⁹ Static wires and pole grounds are examples of grounding conductors that might not be capable of carrying fault current without failure. Grounds that can carry the maximum available fault current are not a concern, and employers need not consider such grounds a possible electric arc source.

APPENDIX F - WORK-POSITIONING EQUIPMENT INSPECTION GUIDELINES

I. Body Belts

Inspect body belts to ensure that:

- A. The hardware has no cracks, nicks, distortion, or corrosion;
- B. No loose or worn rivets are present;
- C. The waist strap has no loose grommets;
- D. The fastening straps are not 100-percent leather; and
- E. No worn materials that could affect the safety of the user are present.

II. Positioning Straps

Inspect positioning straps to ensure that:

- A. The warning center of the strap material is not exposed;
- B. No cuts, burns, extra holes, or fraying of strap material is present;
- C. Rivets are properly secured;
- D. Straps are not 100-percent leather; and
- E. Snaphooks do not have cracks, burns, or corrosion.

III. Climbers

Inspect pole and tree climbers to ensure that:

- A. Gaffs are at least as long as the manufacturer's recommended minimums (generally 32 and 51 millimeters (1.25 and 2.0 inches) for pole and tree climbers, respectively, measured on the underside of the gaff);

Note: Gauges are available to assist in determining whether gaffs are long enough and shaped to easily penetrate poles or trees.

- B. Gaffs and leg irons are not fractured or cracked;
- C. Stirrups and leg irons are free of excessive wear;
- D. Gaffs are not loose;
- E. Gaffs are free of deformation that could adversely affect use;
- F. Gaffs are properly sharpened; and
- G. There are no broken straps or buckles.

[79 FR 20691, July 10, 2014]

APPENDIX G - REFERENCE DOCUMENTS

The references contained in this appendix provide information that can be helpful in understanding and complying with the requirements contained in § 1910.269. The national consensus standards referenced in this appendix contain detailed specifications that employers may follow in complying with the more performance-based requirements of § 1910.269. Except as specifically noted in § 1910.269, however, the Occupational Safety and Health Administration will not necessarily deem compliance with the national consensus standards to be compliance with the provisions of § 1910.269.

ANSI/SIA A92.2-2009, *American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices.*

ANSI Z133-2012, *American National Standard Safety Requirements for Arboricultural Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush.*

ANSI/IEEE Std 935--1989, *IEEE Guide on Terminology for Tools and Equipment to Be Used in Live Line Working.*

ASME B20.1-2012, *Safety Standard for Conveyors and Related Equipment.*

ASTM D120-09, *Standard Specification for Rubber Insulating Gloves.*

ASTM D149-09 (2013), *Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.*

ASTM D178-01 (2010), *Standard Specification for Rubber Insulating Matting.*

ASTM D1048-12, *Standard Specification for Rubber Insulating Blankets.*

ASTM D1049-98 (2010), *Standard Specification for Rubber Insulating Covers.*

ASTM D1050-05 (2011), *Standard Specification for Rubber Insulating Line Hose.*

ASTM D1051-08, *Standard Specification for Rubber Insulating Sleeves.*

ASTM F478-09, *Standard Specification for In-Service Care of Insulating Line Hose and Covers.*

ASTM F479-06 (2011), *Standard Specification for In-Service Care of Insulating Blankets.*

ASTM F496-08, *Standard Specification for In-Service Care of Insulating Gloves and Sleeves.*

ASTM F711-02 (2007), *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.*

ASTM F712-06 (2011), *Standard Test Methods and Specifications for Electrically Insulating Plastic Guard Equipment for Protection of Workers.*

ASTM F819-10, *Standard Terminology Relating to Electrical Protective Equipment for Workers.*

ASTM F855-09, *Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment.*

ASTM F887-12^{e1}, *Standard Specifications for Personal Climbing Equipment.*

ASTM F914/F914M-10, *Standard Test Method for Acoustic Emission for Aerial Personnel Devices Without Supplemental Load Handling Attachments.*

ASTM F1116-03 (2008), *Standard Test Method for Determining Dielectric Strength of Dielectric Footwear.*

ASTM F1117-03 (2008), *Standard Specification for Dielectric Footwear.*

ASTM F1236-96 (2012), *Standard Guide for Visual Inspection of Electrical Protective Rubber Products.*

ASTM F1430/F1430M-10, *Standard Test Method for Acoustic Emission Testing of Insulated and Non-Insulated Aerial Personnel Devices with Supplemental Load Handling Attachments.*

ASTM F1505-10, *Standard Specification for Insulated and Insulating Hand Tools.*

ASTM F1506-10a, *Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards.*

ASTM F1564-13, *Standard Specification for Structure-Mounted Insulating Work Platforms for Electrical Workers.*

ASTM F1701-12, *Standard Specification for Unused Polypropylene Rope with Special Electrical Properties.*

ASTM F1742-03 (2011), *Standard Specification for PVC Insulating Sheeting.*

ASTM F1796-09, *Standard Specification for High Voltage Detectors-Part 1 Capacitive Type to be Used for Voltages Exceeding 600 Volts AC.*

ASTM F1797-09^{e1}, *Standard Test Method for Acoustic Emission Testing of Insulated and Non-Insulated Digger Derricks.*

ASTM F1825-03 (2007), *Standard Specification for Clampstick Type Live Line Tools.*

ASTM F1826-00 (2011), *Standard Specification for Live Line and Measuring Telescoping Tools.*

ASTM F1891-12, *Standard Specification for Arc and Flame Resistant Rainwear.*

ASTM F1958/F1958M-12, *Standard Test Method for Determining the Ignitability of Non-flame-Resistant Materials for Clothing by Electric Arc Exposure Method Using Mannequins.*

ASTM F1959/F1959M-12, *Standard Test Method for Determining the Arc Rating of Materials for Clothing.*

IEEE Stds 4-1995,4a-2001(Amendment to **IEEE Standard Techniques for High-Voltage Testing**), *IEEE Standard Techniques for High-Voltage Testing*.

IEEE Std 62-1995,*IEEE Guide for Diagnostic Field Testing of Electric Power Apparatus-Part 1: Oil Filled Power Transformers, Regulators, and Reactors*.

IEEE Std 80-2000,*Guide for Safety in AC Substation Grounding*.

IEEE Std 100-2000,*The Authoritative Dictionary of IEEE Standards Terms Seventh Edition*.

IEEE Std 516-2009,*IEEE Guide for Maintenance Methods on Energized Power Lines*.

IEEE Std 524-2003,*IEEE Guide to the Installation of Overhead Transmission Line Conductors* .

IEEE Std 957-2005,*IEEE Guide for Cleaning Insulators*.

IEEE Std 1048-2003,*IEEE Guide for Protective Grounding of Power Lines*.

IEEE Std 1067-2005,*IEEE Guide for In-Service Use, Care, Maintenance, and Testing of Conductive Clothing for Use on Voltages up to 765 kV AC and ±750 kV DC*.

IEEE Std 1307-2004,*IEEE Standard for Fall Protection for Utility Work*.

IEEE Stds 1584-2002,1584a-2004 Amendment 1 to IEEE Std 1584-2002), and 1584b-2011 (Amendment 2: Changes to Clause 4 of IEEE Std 1584-2002), *IEEE Guide for Performing Arc-Flash Hazard Calculations*.

IEEE C2-2012,*National Electrical Safety Code*.

NFPA 70E-2012,*Standard for Electrical Safety in the Workplace*.

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Five Minute Safety Talk No. 1

"Safe Lifting Techniques"

CONSULTATION EDUCATION & TRAINING DIVISION

Can you think of even one job or occupation where you never have to lift an object? I can't. Lifting of objects can range from very light objects such as a piece of paper, a pin or a pen to very heavy objects like loads of boxes. Lifting is very much a part of our every day jobs. And, because it is something we do so often, we tend to do it without thinking, or at least we do until we strain a muscle, or worse, hurt our backs.

Lifting incorrectly can result in a variety of injuries. Back strain is a very common one. It results from over-stretching certain muscles, but it can be avoided by practicing safe lifting techniques. A hernia is another injury associated with lifting. A hernia does not generally result from a single lifting effort. It is usually the result of continued extreme exertion, especially done contrary to the structure of body.

Don't underestimate the importance of being in good physical condition. Years of poor posture, overeating, lack of exercise, stress and improper lifting can catch up with you. Learn how your back works and what you can do to keep it strong. Ask for your physician's recommended stretching, warm-up, and reconditioning exercises; then practice them regularly.

Safe lifting plays an important role in keeping your back healthy. Although there doesn't seem to be just one right method to lift an object, there are lifting techniques that take strain off the low back area.

These techniques have several steps in common. They recommend you "size up the load". That is, look it over. Decide if you can handle it alone or if you need help. When in doubt, ask for help. Moving a box or other object that is too heavy for one person is not worth strained and sore back muscles.

You should also "size up the area." Look over the area where you are carrying the object to, and make sure it is clear of obstacles before beginning to carry the object.

For that period of time spent lifting, the load becomes a part of your body. You support and propel the object while it is attached to you. This attachment should be firm and sure. Get a good grip.

Attaching yourself to a load will change your balance. To keep this change of balance to a minimum, keep the load close to your body, to your normal center of gravity between the legs, between the shoulders.

Good foot position allows you to keep your balance and bring into play the full power of your leg muscles. Leg muscles are more powerful and more durable than back muscles. Let your leg muscles do the work. Again, footwork is important once you avoid twisting your upper body. Use your feet to change direction. Don't twist your body. Twisting compounds the stress of the lift and affects your balance.

When you have someone helping you lift an object, teamwork becomes important. If you're going to be carrying the load to another point, both of you should decide in advance how it is to be handled. Check the route and clearance. One person should be the leader and be in a position to observe and direct the other. Lifting and lowering should be done in unison. Don't let the load drop suddenly without warning your partner.

Everyone has a way of lifting that seems most natural. Examine yours to see if you are using lifting techniques that reduce strain on your lower back. As the employee making the lift, you're being counted on to make lifts that are safe and comfortable for you based on the items we've discussed:

- Stay in shape
- Size up the load; ask for help, if needed
- Get a good grip
- Keep the load close
- Keep your balance with footwork
- Let your leg muscles do the work
- Don't twist your body



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Five Minute Safety Talk No. 2

"Safe Housekeeping"

CONSULTATION EDUCATION & TRAINING DIVISION

Most of you probably have house cleaning responsibilities at home. For some of you, it's a regular weekly chore. Whatever the case may be, you'll agree that good housekeeping practices are important at home.

However, what we sometimes overlook is that good housekeeping is a key duty on the job, too. The orderly arrangement of work areas is vital to the safety of all workers, regardless of whether they are involved with machines and tools or with appliances and furniture.

It's a fact that approximately 6,000 persons are killed on the job annually in the United States, and an estimated 19,500 in home accidents.

Seventeen percent of the on-the-job deaths are caused by falls, many of which result from just plain poor housekeeping practices.

Falls often result from tripping over loose articles such as tools left in aisleways and work areas. Wet spots on the floor, or trash and other articles left in stairways also take their toll.

During periods of rain and snow, you know what happens when you and the kids track water into the house from outside. Tracked-in water is a serious problem at work, too. Wet spots cause slips and falls. They should be cleaned up immediately, regardless of who was responsible for their being there.

We have trash receptacles placed in several strategic areas, so there is no excuse for waste paper, pop bottles, or other materials being thrown on the floor.

You'd better get in close for a sure shot at the trash barrel.

A word of caution. If a bottle should be broken on the floor, don't attempt to pick up the glass with your bare hands. Wear gloves or sweep up the pieces. The same procedure should be used for cleaning up nails and other sharp objects.

Let's face it. It is just a lot easier to do your job when your work area is kept neat. Keep your tools and equipment off the floor and stored in the proper places. This not only reduces tripping hazards, but protects the equipment you use to earn a living with.

Did you ever go to your closet at home to get your golf clubs and have to pull them out from under some other articles? Things start falling all over. It's a mess. But before you blow your cool, stop and think. "How many times have I left stuff piled on top of the golf clubs when I was in a hurry looking for something else in the closet?"

The same principles apply when storing materials or equipment on the job. Take time to make the piles neat. It's unsafe to stack them too high and, if possible, it's best to keep them away from other equipment or articles that are used often.

We have to be a lot like a quarterback, keeping our eyes open for changes in the defense or certain other telltale moves of opposing players. On the job, we should keep a lookout for danger signals—loose flooring, articles out of place, or other unsafe conditions. These things should be corrected immediately, or notify me and I'll see that they're taken care of.

In closing, I'd like to emphasize that we're all dependent on each other for safety. It's up to each of us to hold up our end of the deal. When each of us keeps their own area in order, the whole plant is a safer place to work.

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MIOsha-CET-2 (Rev. 1/04)



Five Minute Safety Talk No. 3

"Hand Protection"

CONSULTATION EDUCATION & TRAINING DIVISION

Hand injuries account for 80 percent of all occupational injuries. This is because the hands are engaged in almost all activities on the job. Can you imagine any occupation that does not make use of the hand? Hands are so important because of their utility. They provide us with the dexterity needed to perform most daily activities. In fact, hands, as tools, are so versatile and can perform many intricate functions more than any single known tool developed by man.

No wonder hands are highly useful on our jobs. There are many dangerous conditions on the job to which the hand is always exposed. Sharp edges, pinch points, protruding objects, splinters, exposed blades on unguarded machinery and many more. These conditions may not always be too obvious to the working person.

Pinch points are basically traps for the hand especially. Doors may pinch your fingers if you get them caught in a jam. Paying attention and being aware of their existence helps us to avoid pinch points. We also need to take the proper precautions to avoid being pinched.

Our hands are also subject to cuts, bruises, burns and poking. Handling sharp objects, hot objects, rough materials and splinters without the necessary hand protection are sure signs of invitation for hand injury. A necessary precaution to take is to wear approved work gloves. Not all gloves protect you from all hand injuries. Check the appropriateness of the glove for the task before using them. Precautions must still be taken to reduce the level of danger before handling very dangerous material. Lockout machinery and power before reaching into them. Check and clear doorways and aisles and make sure you have proper head clearance before you move loads through.

Machines are guarded to avoid accidental exposure of its moving parts to the hands and parts of the body. Make sure machines are guarded at all times. Do not wear rings or wedding bands when working with machinery. Do not pick up broken glass or spilled machine parts with your bare hands. Remember your hands will obey any commands your brain sends them. Use your brain. Avoid dangers and protect your hands. You need them as long as you live.

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MIOSHA-CET-3 (Rev. 1/04)



Five Minute Safety Talk No.5

"Make A Mental Map"

CONSULTATION EDUCATION & TRAINING DIVISION

When you're on an extended automobile trip, it's a good idea to keep a road map handy, especially if you're in strange territory. Occasionally you may also run across a diagram on the bulletin board or in a newspaper that holds your attention. In either case, the map or the diagram assists you in finding your way around or in obtaining some other kind of information.

Rarely do you see anyone walking around at work with a map. That's because each person has a mental map of where they must go to perform their job. But a mental map shouldn't stop at simple directions. For safety's sake, the mental map you make should carry several other important items, such as location of the first aid station, fire extinguishers and other emergency equipment. But, above all, it should carry a well defined picture of your job and the equipment you use. Here are a couple of actual cases that occurred in another part of the state which highlight the importance of mental alertness on the job:

The branch office of a bank was robbed and a sizeable amount of money was taken. The manager, in an exhibition of foolhardiness, pursued the hold-up man out the door. In the chase that followed, the manager fell down and fractured his knee. Actually, he was lucky not to have been shot.

No doubt the manager had been instructed as to how to react in a hold-up situation, and maybe he had even instructed other employees on the same subject. But when the emergency arose, he reacted contrary to good judgment, and although he escaped unharmed in the hold-up, he was injured in the action that followed.

Apparently he didn't have a mental map, or he got it confused with something he had seen on television. After the hold-up man left, the branch manager should have gone to the nearest telephone or alarm system. Pursuit of the hold-up man added an unsafe act to an already unsafe situation.

In another incident, a supervisor was explaining the function of a die to a die-setter. While pointing, and placing a finger on the die, the press accidentally cycled, amputating the finger.

In this instance, a mental lapse resulted in an accident. Needless to say, the mishap to the

supervisor proved to be a very realistic explanation of the function of the die.

These incidents illustrate that alertness makes a mental map readable.

Here are some items that safety experts say should be included on your mental map, in addition to your own work area and equipment:

The closest first aid station and procedures for contacting the police and an ambulance. The closest fire extinguisher and fire alarm. It's obvious why these items head the list, although the other suggestions are not necessarily of less importance in their own right.

Other items are: where to turn in tools for repair, where tools, other than the ones you keep and use at your workplace, are kept.

The nearest water fountain, areas where you're most likely to encounter either hand or motorized trucks, areas where there may be danger from high working places or suspended loads.

The spot where you can usually find your supervisor, the nearest restroom, and the nearest exit.

You probably have got other things in mind that could be added to the list. For instance, if you worked with chemicals, you would certainly include the closest eye-wash fountain and emergency shower.

The important thing to know is where to go and how to get there the quickest and safest way.

People in pain or under stress may act unwisely. They may hurry around aggravating their problems and accomplishing nothing. This is where the good mental map comes in. It can help you to react to emergency situations in the safest way as well as to perform your regular job safely.

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Five Minute Safety Talk No.6

"Fire Safety"

CONSULTATION EDUCATION & TRAINING DIVISION

Most of you have heard a fire siren wailing in the night. It can send chills through you. If you're away from home at the time, the sound might bring on a feeling of concern for the safety of your family. Or you might even wonder if there's a fire at the place where you work. In many cases, when the siren sounds, it's too late.

I'd like to talk for a few moments about fire prevention. My remarks will deal with fire safety on the job, but many of the same principles should certainly be applied at home.

Actually, fire safety rules are so commonplace that we may become indifferent toward them. This lack of personal interest has been responsible for many fires and on-the-job accidents.

When your job goes up in smoke, you not only lose the source of your livelihood but also the part of you that had been going into your work. The days of your life, which through your job had helped transform a building into a productive business, are wiped out.

For a moment, let's review the leading causes of industrial fires. Number one on the list is electrical failure or misuse of electrical equipment. Next, listed in order, are friction, foreign substances, open flames, and then smoking and matches.

What can we as employees do to combat these hazards? First of all, we can comply with regulations: obey "No Smoking" signs, dispose of cigarettes and matches by placing them in the proper receptacles, and make sure they are extinguished. We should watch for frayed electrical cords and overloaded circuits and dispose of flammable wastes and scrap by placing them in metal containers.

Another important point to remember is to store combustibles in a safe area. You do-it-yourselfers might take note here to check on this at home, too. Combustible materials and fumes from paint, solvents, and other flammables are responsible for many fires both in home and industry. Fumes can reach out a considerable distance and become ignited by a furnace, stove, electrical equipment, or even a lit cigarette.

Industrial fires not only result in economic loss but in human suffering, as well. The following eye-witness account by a Michigan man gives a vivid description of what can happen when a spark ignites dust: "I went around the south side of the building. A young fellow who had just hired in about a month ago was lying on the ground in flames. I pulled off my work shirt and covered him up. I saw five other men walking and crawling to the west side of the building. Their clothes were all burning and they were all partially naked. The only person I really

recognized was Alex because he was bigger and stockier than the rest. They were all burned real bad."

That was not intended to be a scare story. But, it was a real example of what can occur if we are not aware of the hazards which can develop quickly under certain circumstances.

If you should ever need to dispose of flammable liquids, don't pour them down the drain. A proper method of disposal will be provided. If you should have to burn waste paper, make sure it doesn't contain explosive materials, such as aerosol cans or paint cans.

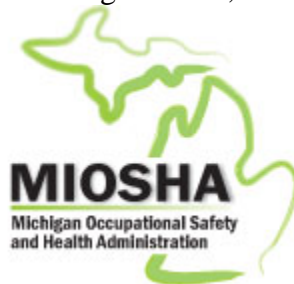
We should all be familiar with the location and operation of fire fighting equipment. (Here the speaker may wish to indicate where fire extinguishers are located and what types of fires they are to be used on. Alarm procedure might also be reviewed.)

Proper maintenance procedures are also important to fire safety. If you use electrical equipment or tools, inspect them regularly to make sure they are working correctly. Keep mechanical equipment properly lubricated to avoid excessive friction. Keep spark arrestors on exhausts.

Some of these things may not seem to concern you directly. However, it's everyone's responsibility to keep their eyes open for safety hazards and to either eliminate them, or report them to supervisors.

Remember, fire safety is your contribution to your job security.

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Five Minute Safety Talk No.7

"Slips and Falls"

CONSULTATION EDUCATION & TRAINING DIVISION

An unguarded wet floor is one of the many causes that accounted for approximately 10.1 million injuries last year at work. In Michigan, 17.4 percent of all Workers' Compensation cases were due to injuries sustained from falling or slipping on the job. It is important to spot unsafe conditions which may lead to slips and falls and prevent them.

There are various ways to suffer slips and falls while working. You can slip and lose your balance, you can trip over objects left improperly in your walkway, or you can simply fall from an elevated position above the ground.

To avoid slips and falls, be on the lookout for foreign substances on the floors. Watch for deposits of water, food, grease, oil, sawdust, soap, or debris. Even small quantities are enough to make you fall.

When entering a building from the outdoors or from debris areas, clean your footwear thoroughly. Snowy and rainy weather requires a door mat at each entrance to allow for complete wiping of shoes. Don't go too fast, walk safely and avoid changing directions too sharply.

Beware of tripping hazards. Any object left in the aisles or other areas designed for pedestrian traffic invites falls. Extension cords, tools, carts, and other items should be removed or properly barricaded. If equipment or supplies are left in walkways, report it. Let the proper personnel remove it. Keep passageways clean of debris by using trash barrels. If you project trash into a can but missed, PICK IT UP!

Walk where you're supposed to walk. Short cuts through machine areas invite accidents. Concentrate on where you are going—horseplay and inattention leaves you vulnerable to unsafe conditions.

Hold on to handrails when using stairs or ramps. They are there to protect you should a fall occur. If you're carrying a heavy load which hampers your ability to properly ascend or descend stairs, use the elevator, or find help!

The worst falls are from elevated positions like ladders and scaffolding. They may result in serious injuries and death.

Learn and practice ladder safety and the proper use of scaffolding.

When climbing, use a ladder of proper length that is in good condition. Keep it placed on a firm surface. Do not climb a ladder placed on machinery, crates, stock or boxes. Keep the ladder's base one foot away from the wall for every four feet of height. Don't over-reach. Always have control of your balance when working from a ladder. Never climb a ladder with your hands full, and always carry tools in proper carrying devices.

When using a scaffold, be sure it is properly assembled according to the manufacturer's specifications. Check carefully for defects. Standing and working planks should be level and clean. Use toe boards to prevent tools from falling and workers from slipping. Work only with people who practice scaffold safety.

Slips and falls occur every day. The extent of injuries and their recurrence can be minimized through proper safety knowledge and attitudes. Practice safety . . . don't learn it through "Accidental Experience."

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Five Minute Safety Talk No.8

"Personal Protective Equipment"

CONSULTATION EDUCATION & TRAINING DIVISION

Probably the last thing that comes to mind when you watch a pro football game is safety.

It starts in the locker room before the game when the players put on their uniforms. To play the game, they must wear protective equipment, including a shock-absorbing helmet with face guard, shoulder pads, knee pads, and cleated shoes. These things can get pretty bulky and uncomfortable, especially when its 95 degrees on the field and the only shade you can get is from someone's shadow.

Football is a rough game, and if a player wants to be with his family after the game instead of in a hospital, protective equipment must be worn. After all, a player is not much good to the team when sidelined with injuries.

A real pro knows these things. When protective equipment is worn, chances of getting through the game without a disabling injury are much greater; therefore, chances of continuing as a successful football player and family member are greater. Next to that, a little discomfort and inconvenience is a small price to pay.

Like a pro football player, you may work on a job that requires personal protective equipment; say ear muffs, hard hat, or safety shoes. This equipment can't prevent some accidents from happening. It can't prevent a drill from breaking, or stop a fellow worker from dropping a box on your foot, but it can prevent a serious injury. Take one example—in an automobile plant, an employee's feet were run over by a fork-lift truck. The worker was wearing safety shoes at the time, and the only injuries were a fractured left toe and bruises. I don't have to tell you how severe the injuries could have been had the employee been wearing regular shoes.

I know such things as safety glasses, hardhats, and safety shoes may be a nuisance to put on and may seem bulky and uncomfortable at first. In fact, it's tempting not to put them on at all, unless the safety supervisor is looking.

Complaints are as varied as the kinds of equipment. For Instance:

"It's too heavy."

"It gives me a headache. "

"They hurt my eyes."

"They're too hot" or "too cold," and so on.

Often these are real complaints. A poorly fitted piece of protective equipment can cause headache or pain, and if it does, see your supervisor immediately to have it adjusted or refitted.

Most of the time, it's just a matter of getting used to wearing particular equipment. This is a lot easier when you remember that like the football player, you stand a better chance of continuing successfully with your job and your home life if you are protected from possible serious injury by protective equipment.

Instead of laying in a hospital bed wondering how they are getting along without you at work, you'll be on the job, gaining valuable experience and receiving an uninterrupted paycheck. As you become accustomed to the feeling of protection you get from wearing safety equipment, you'll discover your confidence in your ability to handle the job will grow, and with it, your chances of a pay raise or promotion.

Personal protective equipment has its place in sports, construction, manufacturing, and many other fields. It is up to us to be real professionals and to recognize the role of protective equipment and take advantage of the benefits.

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Five Minute Safety Talk No. 9

"Manual Handling of Materials"

CONSULTATION EDUCATION & TRAINING DIVISION

The best way to handle boxes and cartons is to grasp the opposite top and bottom corners and draw a corner between your legs before lifting. Long pieces of pipe, bar stock or lumber should be carried over a padded shoulder with front end held high to avoid hitting other employees. Special caution should be used at corners.

There are several areas in material handling that require considerable skill—the rolling of heavy round objects and the handling of heavy barrels and drums. Special training and devices should be used before attempting to handle these tough items manually.

Needless to say, you've probably already encountered your share of slivers, loose hardware or anything else that could cause injuries. Again, good work gloves are helpful.

Regular inspection of tools and equipment is important. A dull or faulty tool can cause an injury to you and a cracked handle could mean an injury for you or your neighbor. So, be sure to report damaged equipment.

We can't mention too often the importance of using the right tool for the job. Don't attempt to use your fingers as a pry, a wrench for a hammer, or a screwdriver for a chisel; you'll just be inviting a painful injury.

Handling of materials does not necessarily mean we have to become engaged in hand-to-hand combat with them, but the results may be the same if we don't use all available protection and precautions.

You don't have to be involved in manual material handling very long to discover there's a hard way and an easy way to do things. And maybe you've also discovered that the easy way isn't always the safe way. Skinned knuckles or pinched fingers are instant reminders that something wasn't done correctly. So for a few moments let's review some of the precautions to protect ourselves while handling materials.

First, considerable hand protection can be gained by wearing work gloves. They can prevent many cuts and scratches and many types also give a better grip. Most work gloves are ventilated for the comfort of the wearer, so there's no good excuse for not wearing them when the occasion calls for them.

Conservation of space is important but sometimes we tend to pile things too close to a wall or column. Proper clearance at the top and on all sides of piles is necessary for safety. When material is piled, it should be in stacks that will stand steady. Sometimes this means that the materials must be criss-crossed or interleaved with corrugated board. Objects that roll should be chocked. When a pile falls, serious injury and damage can result. Piling too high, or in a manner that will interfere with lighting or circulation of air, should be avoided.

Don't be afraid of putting the cleaning crew out of a job by picking up things that you drop on the floor. Tripping and slipping hazards could put both you and the cleaners out of work for a long time. Keep tools and other articles in the right bin or drum and wipe up spills right away.

Injuries resulting from lifting are a continual problem both on and off the job. Most of us know we should crouch close to the load and then use leg muscles to lift. However, after the lift has been made, it's very important to turn correctly while carrying an object. Don't twist your body. Turn by shifting your feet or with short steps. Before lifting, make sure there are no obstructions or slippery spots on the route you intend to travel. If it's necessary for two or more workers to carry an object, they should both be about the same weight and one should be position to watch and coach the other en route.

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Five Minute Safety Talk No.10

"Hurry Up Can Hurt"

CONSULTATION EDUCATION & TRAINING DIVISION

Sports cars competing over race courses marked with racing stripes. People who race on the job are marked with cuts, bruises, and bandages.

There are places to race and places not to race. Speed belongs on the race course, not in the workplace.

Almost everyone has been guilty of speeding through a job. We forget, until it's too late, that "hurry up can hurt."

In just about every instance, hurrying on the job does not do much to increase productivity. Usually it is simply an easy way to get a job done—get a tough job out of the way—or try to get off the job as soon as possible.

When we hurry on the job, we accomplish little more than to increase our chances of an unsafe act happening. Let's look at some hurry up acts. Which ones have you caught yourself doing?

Didn't wear safety glasses because the job would only take a few minutes.

Used the wrong ladder because the proper one was too far away.

Didn't use proper lockout procedures because you could fix it yourself and wouldn't have to bother anyone else.

Took a short cut between machinery or stockpiles of materials.

Used a wrench instead of a hammer because your hammer was in your toolbox on the other side of the room.

Climbed a ladder with tools stuck in your pocket, or in your hand, because you didn't have a tool belt.

Cut the grounding prong off a three-way ground wire plug because you didn't have an adapter.

Removed a guard to repair your machine, or for a special run, but haven't got around to putting it back yet.

Reached "just-a-little-bit-further" on the ladder so you didn't have to get down and move it.

Didn't unplug a power tool before making adjustments because you would only have to plug it in again.

Used a dull saw blade for just one more cut.

Gave the fork lift truck just a little more "pedal" so you could get one more load in before lunch.

Didn't completely brace the scaffold because one of the braces was missing.

Laid a board down, full of nails, with the intention of bending the nails over "in a minute."

Climbed up the side of a bin instead of getting a ladder.

Didn't slow down this time at a blind corner because you never saw anyone there before.

The list is endless. Do they sound familiar? Too familiar? Sometimes when you hurry, nothing bad happens. Other times there may be "near misses," but eventually a serious injury will occur. It is only a matter of time. Is it really worth your eyesight, your limbs or even your life to save those few minutes?

When hurrying on the job, you don't end up speeding up the work, you just speed up your chances of an accident.

Hurry up can hurt.

"Practice safety—don't learn through Accidental Experience."

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Five Minute Safety Talk No.11

"Setting a Good Example"

CONSULTATION EDUCATION & TRAINING DIVISION

Setting a good example is not a "put-on." It's simply working safety into your daily routine at home and on the job. When we all work safely, everyone's job is safe and their future more secure.

New employees certainly benefit by seeing operations conducted the safe way. As you all know from experience, people new on the job take a while to adjust and to discover who they are in the overall set-up of the plant. New employees who have never held a job before or were employed by a firm that had a weak safety program probably will need considerable safety instruction. We'll attempt to give it to them, but naturally, they also observe and seek advice and information from fellow workers. These early impressions of you and of safety operations will be at least partially formed through these contacts and observations.

On the other hand, newcomers formerly employed by a firm that emphasized safety will probably think more of you personally if you measure up to the caliber of people they are accustomed to working with.

"Don't do as I do; do as I say" is a pretty tired expression, and it got tired because we all have repeated it many times— not just verbally but through our actions; and actions speak louder than words. When we leave our safety glasses resting on our foreheads rather than in place over our eyes, or when we kick an empty milk carton under a bench rather than pick it up, we're selling safety but it's a useless soft sell. Our actions are saying, "I believe in wearing eye protection but not in protecting my eyes; and I know trash can cause a tripping accident, but it isn't important enough to make me pick it up."

There's another angle to setting good examples. Too often people dress to impress others with their good taste rather than their knowledge of safety. Wearing rings, bracelets, and other ornaments is dangerous around machinery and in many other jobs where it's possible for jewelry to be caught by moving parts of machinery, thus cause injury to the wearer. Long sleeves, floppy pant legs, and long hair can be hazardous on some jobs, too.

So we should always dress for the job. Our image as a fashion expert may suffer, but it will give way to the more important and more beneficial image of safety.

Maybe some of us feel we are already setting good examples for safety, but maybe this self-image isn't too accurate. Think just for a moment— isn't it strange that we always think about having the nice things happen to us and when we think about an accident, it's usually happening to someone else?

Accidents are a reality. Make your personal safety just as real and you'll have a good chance of not becoming the other person to whom accidents are always happening.

We also might remember that our children some day will be entering the work force. And they, like the newcomer on the job, can benefit by our actions that exemplify safety consciousness.

Most of us try to demonstrate to our kids how to cross streets or how to light matches when they're of age. If, through the years, your kids learn from you how to use a ladder correctly, or that it's good practice to keep tools in their proper places or that there's a right way to lift things, you've given them an additional opportunity for the better life the future promises.

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"Use Machine Guards"

CONSULTATION EDUCATION & TRAINING DIVISION

We've all had the experience of doing what we thought was a favor for someone, only to have it rejected or unappreciated. I suppose if machine guards were human they would experience this type of frustration frequently. While the basic motive for guarding is to protect, not prohibit, guards are often looked upon by employees as obstacles. However, guards wherever they are—and whatever they are—are placed for protection.

Specifically, machine guards are used to protect against direct contact with moving parts. There are also guards designed to protect against flying chips, kickbacks and splashing of metal or harmful liquids.

Another area involves guards against human failures. You can understand why this demands a lot from any type of guard, in as much as the scope of human failure is much broader than the protection of a guarding device.

However, guards are engineered to give as much protection as possible, even to machine operators who deliberately take chances or who are distracted or emotionally upset on the job.

While guards may often appear to be a hindrance, overall they have proven to be otherwise. They've made large contributions to both security and production. Greater machine speeds have been made possible through proper guarding and certainly the conscientious employee works with greater confidence knowing that a machine offers maximum protection.

Two types of guards are used to protect machine operators and probably most of you have been involved with one or the other. These are fixed guards and interlocking and gate guards. Fixed guards are most commonly used and are preferred over others, the obvious reason being that the fixed guards protect you from dangerous parts of machines at all times. Fixed guards may only be adjusted by authorized persons.

Interlocking guards are used if a fixed guard is not practical. This type will not allow the machine to operate until dangerous parts are guarded. The interlocking guard is designed to disconnect the source of power from the machine. Safety devices such as pullbacks, sweeps and electronic devices are used where neither a fixed nor interlocking guard can be used satisfactorily.

Safety devices are operated by the machine itself. When this type of guard is used on a machine that is loaded and unloaded by hand, the operator must use hand tools.

As I pointed out earlier, no guard can do the job without the cooperation of the person operating the machine. When a new employee starts work, we attempt to explain the job thoroughly. This indoctrination includes calling attention to guarding devices. After that, if there are any questions concerning guards or any other part of the job, the answers should be sought from the supervisor. But again it should be noted that the employee's attitude toward safety is important.

It is important that everyone working with or around machinery understands the generally accepted safe procedures for this type of work. No guard shall be adjusted or removed unless permission is given by the supervisor, or the employee concerned is specifically trained and the adjustment is considered a normal part of the job.

In addition, no machine should be started without guards in place. If you see that guards are missing or defective, report it to your supervisor immediately. When guards or safety devices are removed for repair or adjustment, the power for the machine should be turned off and the main switch locked and tagged.

A final point concerns safe dress. Loose clothing, neckties, watches, rings or other jewelry should not be worn around mechanical equipment. In fact, as most of you already know, these items of apparel are considered dangerous on many jobs.

Everyone wants to work in safety. To do this, you must have a mature respect for machinery and for safeguards. They both will do this job for you if you let them.

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Five Minute Safety Talk No.13

"Compressed Air"

CONSULTATION EDUCATION & TRAINING DIVISION

Compressed air is dangerous and must be used in a safe manner. So before grabbing an air hose and going into action, there are a number of safety guidelines which should be followed.

First of all, make certain that you have an airline, not gas or water. Fittings and valves look different, but sometimes hose lines cross and you could be fooled. Take time to make sure, each time you use compressed air.

Next, check to be sure the air hose is in good condition. Air hose is designed to withstand pressure, but it becomes weakened at the places where it is bent, where it is attached to the shut off valve and to the nozzle and wherever it has been kinked. Such weak points may swell like a balloon and burst, throwing pieces of hose in every direction. This may also cause the hose to thrash about dangerously. These precautions should be followed:

Keep air hose off the floor where it is a trip hazard and subject to damage by trucks, doors, and dropped tools.

Prevent sharp objects—even hose fittings that have been burred—from rubbing against the hose.

Always coil the hose—without kinks—and hang it over a broad support, not over a hook, nail, or angle iron, when not in use.

Where you have choice of pressure, use the lowest pressure that will do the job. There are many good reasons for this and here are a few:

Air pressure in excess of 30 lbs. can drive chips, as well as scale from inside the piping, into your face and eyes with the force of shrapnel. Such air driven missiles still do damage when they bounce off a surface, spinning much like a high speed cutting head.

Air pressure against the skin may penetrate deeply to cause internal hemorrhage and intense pain.

Air that enters a body opening can burst internal organs and cause slow, agonizing death.

Air in excess of 30 lbs. can blow an eye from its socket, and/or rupture an eardrum.

Certainly no one would intentionally cause such injuries. Yet every so often someone does, either accidentally or in ignorance, thinking it's a joke.

The nozzle of an air hose is a deadly weapon. Don't point it at anyone, not even yourself. Use safer, better ways of cleaning dust from your clothes—by vacuum cleaning or brushing. Dust blown from anything merely rises a little and then settles again to become a nuisance. Some of the dust blown into the air ends up in our lungs, and that's not where we want it.

MIOSHA's General Provisions Standard states "air pressure at the discharge end of a portable air blow gun or portable air hose should be less than 30 lbs. per square inch gauge when dead-ended."

In a few cases, standard safe procedures are set up for trained employees using equipment with known safety factors and observing approved safe practices. These include the following instances:

Removing dust or particles from jigs, fixtures, deep holes in parts. Use low pressure, 30 lbs. or less, and the right nozzle. Wear cup-type goggles and set up shields to protect passers-by, and others in the area.

For transferring liquids from properly rated pressure vessels, check air pressure, attach hose connection tightly, remain at control valve to shut off in an emergency, and make sure bleed-off valve and pressure relief valve work. Never use compressed air to transfer flammable liquids.

Compressed air must be treated with respect. It's a valuable tool but it must be used intelligently and in a safe manner.

Note: A copy of the General Industry Safety Standard on Part 1, General Provisions may be obtained by calling the Standards Division at 517-284-7750 or online.

To request consultation education and training services, call: 517-284-7720.

"Conveyor Safety"

CONSULTATION EDUCATION & TRAINING DIVISION

Find a way to cut down on the amount of materials you handle manually, and you've got a good thing going. You lessen the chances of hurting your back and hands, which are two of the more common types of on-the-job injuries. In addition, your capacity for work will increase and so will production.

That's why conveyors are widely used. They move materials efficiently and safely. Conveyors are one of the earliest forms of automation. In fact, they've been around so long that we don't really look at them as a form of automation but as basic machinery for getting the job done.

Like other things we work with, conveyors are safe when used correctly. They're not a means of human transportation or a plaything. They come in many shapes and sizes, and each is designed to do a specific job, so it's not easy to sum up conveyor safety in a few sentences. But needless to say, you have to use the right conveyor for the job.

Certain safety precautions must be taken even though you don't work directly with conveyors. For instance, don't crawl over or under them. This is pretty elementary safety advice, but there are still many people who have tried it and get injured in the process.

Never ride a conveyor. We all find it's difficult enough going through life and avoiding injury without trying some foolhardy stunt.

So unless your job requires it, stay away from conveyors. Don't attempt to operate a conveyor unless you've been checked out on the procedures and are authorized to run it. Persons working on or about a conveyor should know the location and operation of stopping devices. If they don't, they should consult their supervisor.

Don't attempt to clean any belts or parts while the conveyor is running. If it's necessary to clean belts or drums while the equipment is in motion, proper barrier guards should be provided at pinch points.

Most companies that manufacture conveyors try to make them safe. If the equipment isn't safe, modifications have to be made. Pinch points and moving parts must be guarded. If a conveyor runs overhead, precautions must be taken to prevent injuries from materials which might fall from above. If a conveyor runs at head height or is the type that carries material hung from hooks, measures should be taken to prevent persons from being struck, and employees in the area should remain alert to possible danger.

Conveyors should be stopped and controls locked out when repairs are being made, and the equipment shouldn't be started again until it is certain that all is clear.

When you place materials on a conveyor or take them off, pinch points are created because of the movement of the machinery. So watch your hands and stay alert. When putting materials on a conveyor, place them so that they will ride safely.

The fact that conveyors run steadily and smoothly may lull you into a false sense of security when you're around them. Don't fall into this trap. Conveyors can be dangerous. Loose clothing and jewelry— particularly rings—are dangerous to wear on the job. Combine them with the presence of a conveyor and the hazard potential increases quickly.

Regardless of whether you're working with conveyors or any other type of machinery, you're expected to observe basic safety rules. In addition, your help is needed in reporting unsafe conditions or malfunctions to your supervisor. These steps will go a long way toward eliminating hazards and protecting your ability to earn a living.

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No.15

"Hard Hats"

CONSULTATION EDUCATION & TRAINING DIVISION

Shall = Mandatory Should = Advisory

There really isn't any excuse for not wearing a hard hat on jobs that require it. The miracles of chemistry and manufacturing have turned out head protection to fit every need and about every taste.

The colors are attractive and have proved to be positive factors in morale and in comfort. In some cases, the type of job a crew performs is identified by the color of its hard hats. This type of team identification—and protection—is also used by football teams, pilots in Air Force units and other groups. The color of a hard hat is also a factor in repelling the heat from the sun.

Hard hats shall be worn on all jobs where hazards exist from falling or flying objects, harmful contacts, exposure to electrical shock.

There are many ways head injuries can occur—objects falling on persons working with stacks of materials, falling tools, falling tree limbs, objects hanging from or dropping from overhead cranes. The list could be much longer and you can probably add to it yourselves.

Hard hats must be treated with care. If they are damaged or the suspension cushion doesn't fit well, they shall be replaced. They should be kept clean, and if a hard hat is assigned to someone after having been used by another employee, it shall be sanitized.

Never paint or alter a hard hat. The paint will soften the shell of the material or cause other damage.

Hard hats, or protective helmets as they are technically referred to, are of four types—classes A, B, C and D. Each of these classes must meet certain requirements for withstanding voltage and impact as outlined in standards set by the State of Michigan. No single hard hat necessarily fills the protection requirements of all types of jobs. So naturally it is important to follow safety rules and always wear the type of hard hat specified and issued for your particular job. Construction Safety Standards require that only A and B classes of Safety hard hats can be used.

Michigan General Industry Safety Standards state that the class C helmet or any metallic head device shall not be used except where it has been definitely determined that use of other types is impractical, such as deterioration from chemical reaction.

Chin straps and winter liners are used with some hard hats. If used near high voltage, only class B can be used. They must not contain metallic parts or conductive materials. Likewise, if liners or straps are used on jobs where there is danger of ignition from heat, flame or chemical reaction, they must be made of non-burning materials.

An injury report never makes pleasant reading. But it's particularly disturbing to read that the injured person had been instructed to wear a hard hat and didn't.

So a hard hat not only gives protection, but it's a symbol too. It shows that the person who is wearing it has brains and that they want to keep them.

NOTE: A copy of either the Construction Standard Part 6. Personal Protective Equipment or General Industry Standard Part 33. Personal Protective Equipment can be obtained by calling the Standards Division at 517-284-7750 or online.

Note: The ANSI Standard referenced in these Standards has been updated. The current version of the ANSI standard Z89.1 references a change in class lettering and numbering. Glass G (General) replaces Class A: Class E (Electrical), replaces Class B, and C (Conductive) remains Class C.

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No.16

"You're Responsible"

CONSULTATION EDUCATION & TRAINING DIVISION

Every person is the architect of their own fortune, good or bad, depends on the individuals acceptance of personal responsibility.

At a young age, we are taught to assume responsibilities. ("Look before you cross the street . . . playing with matches is dangerous . . . be home before dark . . .") Even today, as adults, we still learn and decide whether to accept certain obligations. Young or old, we make individual choices.

When responsibilities are shunned or rejected, someone must cope with the results. Police officers, judges, juvenile officers, and social workers respond to most of these rejections in our society. In safety, doctors, nurses, and funeral directors deal with the consequences of rejected responsibilities.

There are laws, both federal and state, designed to spell out responsibilities for safety in the workplace, (see your Rights & Responsibilities under MIOSHA - CET #0101) but actual performance of these obligations still belongs to you.

By accepting and practicing safety responsibility, you insure your future both at home and on-the-job. You do the same for your fellow worker as well, because socially and morally you are responsible for preventing accidents to others as well.

If you see an unsafe act, do something about it—point it out so others are aware and can avoid future mistakes.

Point out to other employees when safety isn't being practiced. (IT MAY SAVE YOUR LIFE SOMEDAY!) After all, it's their responsibility to prevent an accident to you as well.

Be willing to serve on a safety committee. Be more than just a member, be active and creative.

Use good work habits—don't be impulsive, and remember that hurry up can hurt!

Develop the attitude that "If I do something wrong, I'm going to get hurt!" Then do the job the right way.

If you are a supervisor—help new employees learn that safety is the rule, not the exception. Teach them proper safety responsibility before you turn them loose.

Practice leaving personal problems and emotional stress away from the job.

Remember that accidents don't happen—they are caused.

Correct little mistakes before they grow into permanent bad habits.

While attempts may be made to cloud or reject the responsibility for safety, when all is said and done, safety responsibility is up to you. You are the architects of your own fortune.

"Practice safety—don't learn it through Accidental Experience."

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No.18

"Power Press Safety"

CONSULTATION EDUCATION & TRAINING DIVISION

Shall = Mandatory Should = Advisory

Did you ever stop to think how many different ways there are to get hurt on the job? Probably not, because most of us don't like to think about these things.

However, it's a fact that there are a lot of ways to get hurt. Injury statistics in Michigan indicate that there are several different ways to be injured while working with presses.

Major types of injuries were amputations, lacerations, and crushing injuries. The top categories of injury causes were identified as "caught between" and "lack of guarding," both of which should ring a bell with you.

But maybe we shouldn't approach the subject of injuries from the negative side. Instead of considering the many different ways to get hurt, let's discuss the many ways not to get hurt. In other words, let's take a look at the safety precautions we all should be familiar with.

There are several basic safety rules that apply to every job. Your job as a power press operator is no exception.

To start with, never operate a press not equipped with adequate, point-of-operation safety guards or safety devices. Don't adjust or remove guards and safety devices or make repairs to your press without authorization from your supervisor. Call to the attention of your supervisor all unusual noises or loose parts on your press.

These rules are noteworthy not only because they emphasize safety, but also because they stress the importance of keeping your supervisor informed on all matters pertaining to your job.

Mental alertness is important on any job, particularly when considering safety. So it's necessary to give full attention to your job and not to be socializing while you work.

Presses shall be inspected by authorized personnel at regular intervals. Consult the Michigan Department of Licensing and Regulatory Affairs, MIOSHA Power Presses Standard for information on specific rules and regulations concerning Part 24 Inspection and Maintenance Requirements.

Personal protective equipment shall be provided and worn where there is reasonable probability of injury that can be prevented by using such equipment. Safety glasses shall be worn because the presence of flying metal particles/objects is always possible. Gloves are essential when the hands will contact sharp edges and rough surfaces.

Sometimes the glove can be more of a hazard than a safeguard, for example, when handling material near an in-running nip or revolving points. A job safety analysis will reveal where and when not to wear gloves in your facility. Shoes with steel toe guards built in, approved safety shoes (ANSI) are a must where danger to the feet from falling objects, hitting objects, or tripping over objects are possible. ALL personal protective equipment needs shall be thoroughly reviewed by your immediate supervisor prior to job placement.

Safe housekeeping is another of the safety basics important to all jobs. So keep tools and other materials off your press and keep the work area clean and clear of objects which might cause a fall. Also advise your supervisor if your work area or point of operation is poorly lighted.

A couple of other points to remember are to see to it that your press is lubricated and its parts are in good working condition. If you use a stool, check it regularly to make sure it's solid and won't tip unexpectedly.

In summing up, I remind you to stay alert on the job and don't attempt to adjust or repair a press without permission of your supervisor. Many serious injuries result from mechanical malfunctions, so it's important to have a competent person handle press maintenance.

This is quite a list of precautions. By themselves they may not mean much. But add them to the know-how of a conscientious power press operator, and they mean safety and security.

NOTE: A copy of the General Industry Safety Standard on Part 24, Mechanical Power Press may be obtained from the Standards Division by calling 517-284-7750 or online.

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No.19

"You're the Loser"

CONSULTATION EDUCATION & TRAINING DIVISION

Cost of living, inflation, taxes—these are things we all are very much concerned about. They're topics that creep into every conversation at home and at work because they deal with money.

But it's funny how many people express concern over living costs and then ignore a very important factor in keeping costs at a minimum. I'm talking about safety. If you think that safety doesn't have much to do with the cost of living, you'd better listen to this:

On-the-job accidents in an average year cost the U.S. economy about 120 billion dollars.

That's a substantial drain on the economy and we all pay for it in our roles as taxpayers, wage earners and consumers. But each of us as an individual is the big loser when we're injured. This is why safety should be important to cost conscious people. It's not the only reason for being safe but it may be the only reason some people understand.

Safety is part of doing a good job. You can't get hurt and still do a good job. When an injury occurs, there's something wrong, and the injured person is the first to find out about it. There's pain. The paycheck may stop. The bills pile up and the table begins to get bare.

You might ask, if all this is true, then how come people ignore safety rules? There are many good answers to that but we'd all have to be psychiatrists to understand them. However, there are a few things that are quite obvious.

Accident-prone people are likely to break rules that they consider unimportant or contrary to their philosophy of life. This may be based on an overinflated sense of self-importance.

People who disregard safety rules may also be reckless, both on and off the job. They're confident that accidents always happen to the other person. They have manufactured a false sense of security.

As previously noted, there are many good reasons for being safe but you can narrow it all down to just one— yourself. You either play it safe, or you trust your luck. There is no in-between. You either make safety a part of your job or you become a chance-taker. And a chance-taker's working career can be short.

Hazards exist in many forms. We attempt to keep them at a minimum around here, and we try to send you home in good condition at the end of each work day. But we can only do it with your cooperation. You are important to this job or you wouldn't be here. But you're also important to your family and your community.

So don't be a loser. Treat safety with the respect it deserves. When you lose at the game of chance-taking, you lose big.

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No. 20

"Wear Safety Shoes"

CONSULTATION EDUCATION & TRAINING DIVISION

Foot trouble can be as painful as back trouble, and it can be just as restrictive as to what type of work you can do, too.

People used to complain about their bunions and corns hurting, but these complaints are less common today due to improved medical treatment and the better shoes now available.

To conform with what is fashionable, many of us still wear shoes that aren't comfortable or aren't safe. They have heels or soles that can easily cause a bad fall.

As important as our feet are to us, there are still many people who insist that they don't want to wear safety shoes because they are too ugly, too heavy, too uncomfortable, too expensive, and so on.

In reality, none of these complaints are justified. The safety shoes available today match most other shoes for comfort, appearance and in most cases, price too. So, really there are no valid excuses for not wearing safety shoes when the situation calls for it.

Actually, it's a good idea to wear safety shoes whether they are specified for your job or not. It is now recognized that safety lenses in glasses are important both on and off the job, and the same theory is gaining in popularity concerning safety shoes.

There are many types of safety shoes, the most common being the safety toe shoe. Then there are shoes that have flexible steel insoles to prevent punctures by nails, and there are metal instep guards, safety boots, plastic shoe covers and many others. All these features combat the crippling and common job injuries of smashed toes and feet and nail wounds.

As mentioned before, safety shoes can be both effective and comfortable and comfort certainly is a prime consideration for any shoes.

Condition of shoes is also important. Soles that are worn thin can be easily punctured by sharp objects or a painful bruise can result if you step on a stone.

Rundown heels can cause you to lose your balance and fall or perhaps turn your ankle. Shoe laces should not be too long, as obviously they create a tripping hazard.

If there is still any doubt about the virtues of safety shoes, the following excerpt from a safety shoe advertisement may clear it up:

Nobody can touch our shoes for smart, sharp, up-to-the-minute styling, combined with proven protective features like our patented steel toe caps, plus solid comfort features like soft grain leather ripples, sweat resistant linings, cushion heel pads and more".

Here's another advertising pitch:

"Now here's another addition to this popular line of instep protection. It features an eight-inch side zipper for easy off and on, nonconductive nailless sole construction. Additional comfort features include lining that resists mildew and bacteria and has a full cushion insole".

And finally this advertisement:

"Our shoes are the ladies' choice for safe, sure protection in those heavy-duty jobs women now fill. They are ruggedly built for protection and long wear".

Perhaps these statements are a little flowery, but basically they reveal some very good reasons why safety shoes are a good, practical buy.

But safety shoes, like other protective equipment, must be worn to be effective. So why take a chance on ruining a good thing, namely your feet? Wear safety shoes!

To request consultation education and training services, call: 517-284-7720.

Five Minute Safety Talk No.21

"Powered Industrial Trucks vs Pedestrians"

CONSULTATION EDUCATION & TRAINING DIVISION

As an operator of a powered industrial truck, you must safeguard other employees at all times. This rule is no different than what is required of you as a safe driver when you are operating your own car. Pedestrians, whether they are walking down the aisle of a plant or walking down a city street, are no match against moving steel.

As a matter of fact, as pedestrians, your fellow employees are probably much more aware of the dangers involved in being hit by a car as it drives past them than they are aware of the dangers involved in being hit or crushed by a powered industrial truck as it goes by them at work. If you are driving your truck down a narrow aisle and there is a pedestrian in the aisle who steps to the side to let you by, are you absolutely positive that there is enough clearance for you to get by? Remember, you are responsible for safety.

Let's not forget what I said at the very beginning of this talk. As an operator of a powered industrial truck, you must safeguard other employees at all times. That responsibility is part of your job.

During a recent year 950 employees in the state were injured because they were struck by powered industrial vehicles.

So let's go over a few safety rules that can help you do your job a little better.

Don't let friends drive your truck so they can see what it feels like. You are letting them put themselves and other workers in danger if you do.

Another factor in the safety of pedestrians is speed. Travel at a safe speed, suitable to the surroundings and the type of load you are carrying. Don't ever become a race driver down aisles or elsewhere. Take your time and drive safely.

If the floors you are driving across are wet or slippery, drive at a slow speed. This is the same as on a highway in your own car. Conditions determine the speed you should go.

Slow down and sound your warning device at cross aisles and other locations where your vision is obstructed by fixed objects. Let others know you are coming. In level areas, travel with load engaging means elevated only enough to clear obstacles on the floor or roadway.

When you are moving loads which block your forward visibility, drive the truck with the load trailing. If you can't see where you're going, you're headed for an accident.

Watch for pedestrians—sound your horn to warn them that you are approaching. But don't sneak up and then scare them. They may suddenly move into your path.

Look behind you before backing up. Something may be there now that wasn't there a few minutes before.

Treat blind corners and doorways as "Stop Streets." Running these stop signs is just as much a hazard as doing it on a city street.

Don't drive your truck up to anyone who is standing in front of a bench or other fixed object. If your brakes fail, a serious accident could occur.

Don't allow anyone to stand or pass under the elevated portion of your truck, whether it is loaded or empty. If they don't listen, tell your supervisor.

And of course, stunt driving and horseplay are never permitted. This is a place to work—not a playground.

If we will all follow these safety rules we should be able to avoid accidents and protect fellow employees. The responsibility for safety belongs to everyone. By being a safe powered industrial truck driver you are doing your part to make this a safe place to work.

To request consultation education and training services, call: 517-284-7720.

MIOSHA-CET-21 (Rev. 1/04)

Five Minute Safety Talk No.22

"Hearing Safety"

CONSULTATION EDUCATION & TRAINING DIVISION

Noise is unwanted sound. It can have different effects on you.

Psychological effects mean that noise can startle you, annoy you, and disrupt your concentration.

Noise can interfere with your communications when you are talking to someone. As a consequence, it interferes with your job performance and your safety.

Physiological effects mean that you can lose your hearing. Noise can cause pain and even nausea when the exposure is severe.

Ear protectors, in effect, reduce noise levels at the inner ear. Ear protection is particularly important when noise exposures cannot be controlled adequately by environmental changes.

Ear protectors may be either ear plugs or ear muffs.

Many times workers resist wearing hearing protection more than any other type of personal equipment. One of the most common reasons that they give is that they don't think they really need it. But hearing loss is so gradual, even in intense exposures, that by the time you realize that you can't hear as well as you used to, the damage has been done and can't be reversed.

Another common reason workers give for not wearing hearing protectors is that they are uncomfortable. Evidence of this attitude can be found in such practices as springing muffs so they don't seal against the head, clipping off the inner end of plugs and leaving only the outer end tab to fool the supervisor, and indifferent molding and insertion of malleable-type plug materials.

Good protection depends on a good seal between the surface of the skin and the surface of the ear protector. A very small leak can destroy the effectiveness of the protection. Protectors have a tendency to work loose as a result of talking, chewing, etc., and they must be reseated from time to time during the workday.

Some initial discomfort is sometimes experienced in obtaining a good seal.

There will be no adverse reactions as a result of the use of ear protectors if they are kept reasonably clean. Ear plugs should be made of soft material such as neoprene, as hard fixed material can injure the canal. Skin irritations, injured ear drums, or other harmful reactions are exceedingly rare. A properly designed, well-fitted and clear ear protector will cause no more difficulty than a pair of safety goggles.

The use of ear protection will not make it more difficult to understand speech or to hear warning signals when worn in a noisy environment.

Most of the available ear protectors, when correctly fitted, provide about the same amount of protection. The best ear protector, therefore, is the one that you can wear properly.

Three factors may be used to determine the level of noise:

1. If it is necessary for you to speak in a very loud noise or shout directly into the ear of a person in order to be understood, it is likely that the exposure limit for noise is being exceeded.
2. If you have heard noises and ringing noises in your ears at the end of the work day, you are being exposed to too much noise.
3. If speech or music sounds muffled to you after leaving work, but sounds fairly clear in the morning when you return to work, there is no doubt about your being exposed to noise levels that can eventually cause a partial loss of hearing that can be permanent.

If any of these conditions exist, a safety professional, using a sound level meter, should measure the noise level at various work areas. They can then determine whether the exposure is great enough to require personal protection.

To request consultation education and training services, call: 517-284-7720.

MIOSHA-CET-22 (Rev. 1/04)

Five Minute Safety Talk No.23

"Safe Work Habits"

CONSULTATION EDUCATION & TRAINING DIVISION

A nineteenth century author wrote, "Habit is the deepest law of human nature."

Most of us would probably agree with that. Humans are quite often influenced by habit.

Habit and job safety are closely related. If you form safe work habits, it's a big plus for safety.

A national publication recently listed eight of the most common human elements involved in job safety. All are associated with habits, to some degree.

Recognition of hazards was one of the elements mentioned. By constantly being on the lookout for hazards, you enhance your own safety. In watching for hazards you must consider not just the obvious ones, but also hazards which might suddenly appear through some action of another employee or chain of unusual circumstances.

Indifference was another of the human elements listed. An individual might know the correct procedures for doing his or her particular job, and just ignore them. Or there might be persons who don't know safety procedures and just leave it at that, rather than finding out what they are.

Daring behavior is another obvious human element that can lead to a job accident. Working without guards and taking shortcuts are examples of daredevil tactics. Horseplay is in the same category.

Setting a poor example also can lead to trouble. The actions of all of us have an influence on the safety-mindedness of other workers, particularly newcomers. If a veteran employee is involved in an unsafe act of the job, a new worker might observe it and be swayed to adopt the same practice.

Another weak link in the chain of safety is someone who is impulsive or always in a hurry. Haste is a trait that often leads to accidents.

We are using our time foolishly if we don't take time to be safe. Temper falls into the same category, as it usually flares up on the job in the form of impatience.

Training, or lack of it, is also a safety factor. The supervisor is responsible for training an employee to do a job safely. However, as employees, we have to be responsible enough to ask questions if we don't understand instructions, or are in doubt about procedures. Also, it's very basic to safety that hazardous situations be called to the attention of the supervisor.

One of the eight human elements listed by the author was work habits. Of course, that is really the point of our talk.

We do our jobs from day to day, and in the process, good work habits are formed. But so are unsafe habits, unless we make an effort to break them. Some habits good or bad, are formed early in the job, while others develop naturally as time goes on.

A person might incorporate unsafe habits into the job and continue them for a long time before a mishap occurs. Other people might not be so fortunate. They could learn quickly how an unsafe act can catch up with them unexpectedly. Gambling with the law of averages is a bad bet.

First and foremost, the purpose of all safety efforts is to prevent accidents and injuries to human beings. As human beings, we all have the inclination to choose the easy method of doing something, or the fastest way to do it, without regard to safety.

By doing things the correct way, we gradually form safe work habits that carry through into our daily work, and this is one of the best safety devices available.

To request consultation education and training services, call: 517-284-7720.

MIOSHA-CET-23 (Rev. 1/04)

Five Minute Safety Talk No.24

"Job Safety Analysis"

CONSULTATION EDUCATION & TRAINING DIVISION

When something is analyzed, each of its parts is given a close examination. Such is the case when a Job Safety Analysis is made. Each step of the job is broken down to pinpoint safety hazards involved in doing it.

Most of us don't have time to completely analyze our jobs. This is usually an assignment that is given to a safety professional or someone with similar responsibilities. However, we should all be aware of potential hazards connected with our jobs, and this awareness should become second nature to us.

So let's take a look at some of the elements of a job safety analysis. I'm sure you'll recognize at least a few of the elements as things that you are already concerned with.

Motions, positions and actions often result in injuries, and their consideration is significant to safety. People who reach over moving equipment or objects are vulnerable to injuries. Reaching beyond the range of clear vision is also a dangerous practice.

Motions with conditions that involve off-balance positions, incorrect posture while lifting or handling objects, and positions which are hazardous in relation to machines or other workers, often result in serious injuries.

Looking into the job safety analysis further, we find that both physical and equipment hazards may be present. Problems around equipment and machinery develop at points of operation or around flywheels, gears, shafts, pulleys, keyways, belts, sprocket chains and so on.

In addition, other important concerns are the operation of brakes and exhausts. Activities such as feeding, oiling, adjusting, grounding and maintenance also have to be observed for possible hazards.

Other hazards include tools that are too long, too short, have faulty design, or are in poor repair. And certainly guards that do not give adequate protection are perils to your safety.

Faulty layout of work areas may cause hand and foot injuries in material handling operations. Poor work area arrangement can also be responsible for strains from lifting.

Safe housekeeping is important in all types of employment. It is also very predictable. Without it, a safety program won't be successful. Housekeeping problems often involve waste disposal, tool storage, misplaced objects and materials, and leakage and spillage. Windows, ledges and storage areas should not be overlooked in examining job hazards, particularly if storage involves flammables.

So you have to plan ahead and think your job through. That's being safety-minded.

In addition, a safety-minded person will do the following: Follow instructions; correct unsafe conditions, if authorized, or report them to the supervisor; avoid horseplay and distracting others; comply with safety rules and safe practices; practice good housekeeping; use the right tool for the job; lift properly; use proper protective equipment; operate, adjust or repair equipment only when authorized.

If an accident should occur and you are requested to supply information to help analyze it, or if your job is being analyzed for safety, keep in mind that your cooperation will contribute to your own security and the success of our overall safety program.

To request consultation education and training services, call: 517-284-7720.

MIOSHA-CET-24 (Rev. 1/04)

Five Minute Safety Talk No.25

"Obey The Un-Enforceable"

CONSULTATION EDUCATION & TRAINING DIVISION

It has been said: "The measure of a civilization is the extent of its obedience to the unenforceable."

If we apply this thought to accident prevention, we might well say: "The degree of success in preventing accidents reflects the degree in which individuals obey the unenforceable."

Today is a good time for each of us to analyze our own attitudes toward the so-called unenforceable as applied to safety. If our individual analysis reveals an unsatisfactory frame of mind toward accident prevention, it must be corrected before our faults affect the attitudes of our family and associates.

We all know that attitudes are seldom fixed. They change, often rapidly, depending on new knowledge and experience. Take your attitude toward a new worker. The first day you may think that person a pompous jerk. After several weeks, you discover that same person to be one of the most interesting persons you have ever met.

Attitudes toward safety can be just as varied—from the attitude that it is a crackpot obsession foisted on us from above to the attitude that safety makes sense and is well worth achieving.

If our attitude toward safety as a group or as individuals is bad, it is probably based on the wrong facts, or facts poorly presented—or not presented at all. We must be acutely aware of the fact that every time we talk about safety with a co-worker, safety attitudes are being influenced for good or bad.

Accordingly, we owe it to each other to have ample facts on safety, present them in a reasonable and believable manner. Above all, we should avoid mere exhortation which tends to put safety in the crackpot class.

Don't belittle safety. It's the person who has been hurt that knows this best. Take it seriously, and encourage the same point of view in others.

Take a good look around you. Are there soda bottles on an air conditioning duct? Is there broken glass that should be replaced? No one will develop a sound safety attitude unless given a safe environment in which to work.

Safety starts with people - you and me alike. We can make all the rules we like, but obedience to what is called the "Unenforceable" is our real problem.

To request consultation education and training services, call: 517-284-7720.