
Fire Investigator Safety Series
Series 3: Personal Protective Equipment (PPE), Selection and Use
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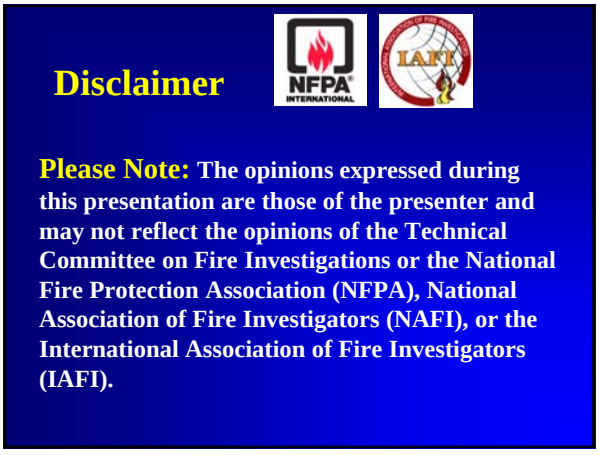
Welcome!
IAFI
Cowboy after O.S.H.A.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Fire Investigator Safety Series

The **"Fire Investigator Safety Series"** will be comprised of four programs that will provide the participants an opportunity to explore the common health and safety hazards found on the fire and explosion investigation scene and during subsequent evidence inspections and other post scene analysis.

Fire Investigator Safety Series

Through this exploration process the participant will be able to put control mechanisms in place to eliminate hazards or limit potential exposure to those working on the fire or explosion scene or during post scene activities.

Series 4: Safety and Health Programs and Program Management

This session will provide an overview of the Occupational Safety and Health Administration (OSHA, US) Standards that may be applicable while conducting a scene investigation and subsequent post scene analysis. The program will also address the difference between the OSHA Standards and the written program that will be developed for a specific scene. In addition, there will be a discussion of Safety and Health Program Management.

- ***Date and Time to be Determined***

Series 3: Personal Protective Equipment (PPE), Selection and Use

This session will review the broad categories of PPE, the need to utilize the hierarchy of the control mechanisms, the completion of a PPE Assessment in order to identify the most suitable PPE and a summary of the training and other requirements to ensure that the equipment is utilized properly.

Series 3: Personal Protective Equipment (PPE), Selection and Use

Terminal Outcome

Provide the participants an overview of the requirements for Personal Protective Equipment (PPE) and an opportunity to review the process of completing a PPE Assessment in order to identify the proper PPE required during a Fire or Explosion Scene Investigation.

Enabling Objectives

Upon completion of this program the participant will be able to:

1. Describe the General Requirements for all PPE.
2. Describe the recommended process for a PPE Assessment.
3. Describe the requirements for Foot Protection.
4. Describe the requirements for Hand Protection.

Enabling Objectives

Upon completion of this program the participant will be able to:

5. Describe the requirements for Eye and Face Protection.
6. Describe the requirements for Head Protection.
7. Describe the requirements for Respiratory Protection.
8. Describe the basic types and components for Fall Protection.

Course Outline

A. General Requirements for all PPE, 1910.132
B. Requirements for Foot Protection, 1910.136
C. Requirements for Hand Protection, 1910.138
D. Requirements for Eye and Face Protection, 1910.133
E. Occupational Noise Exposure, 1910.95
F. Requirements for Head Protection, 1910.135

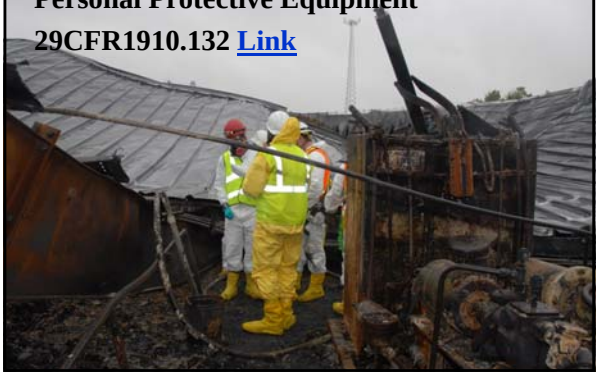
Course Outline

G. Requirements for Respiratory Protection, 1910.134
H. Fall Protection, Subpart I Appendix B
Compliance guidelines for hazard assessment and personal protective equipment selection (non-mandatory) and SubPart M (Construction)
I. Summary and Closing

A. General Requirements for PPE

Personal Protective Equipment

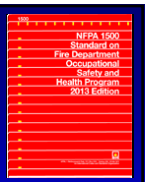
29CFR1910.132 Link



1. Legal Requirements for the selection and use of PPE

- Private Sector (US) Occupational Safety and Health Administration (OSHA)
- Public Sector – OSHA State Plan States
  State OSHA
- Public Sector Employee Plan State – Federal OSHA or a State Agency
- Public Sector Employee – Federal OSHA State
  Exempt from the requirements

Fire Service



NFPA Standards:

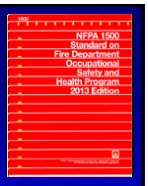
NFPA 1500 (2013) Standard on Fire Department Safety and Health Program

- Do not carry the weight of the law unless they are adopted by the Authority Having Jurisdiction.
- Civil Court: “Standard of Care”

1. Legal Requirements for the Selection and Use of PPE

1910.132 (a) Application. Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

NFPA 1500



NFPA 1500 (2013) 7.1.1* The fire department shall provide each member with protective ensembles, ensemble elements, and protective equipment designed to provide protection from hazards to which the member is likely to be exposed and that is suitable for the tasks the member is expected to perform.

a. Related PPE Standards

Appendix A

Responsibilities

Employer

- Assess workplace for hazards
- Provide PPE
- Determine when to use
- Provide PPE training for employees

Employee

- Use PPE in accordance with training received and other instructions
- Inspect daily and maintain in a clean and reliable condition

2. Controlling Hazards

- Employers must protect employees from hazards such as falling objects, harmful substances, and noise exposures that can cause injury
- Employers must:
  - Use all feasible engineering and work practice controls to eliminate and reduce hazards
  - Use personal protective equipment (PPE) if the controls don't eliminate the hazards.
- PPE is the last level of control!

Engineering Controls

If . . .

The work environment can be physically changed to prevent employee exposure to the potential hazard,

Then . . .

The hazard can be eliminated with an engineering control

Engineering Controls

Examples . . .

- Initial design specifications
- Substitute less harmful material
- Change process
- Enclose process
- Isolate process

Work Practice Controls

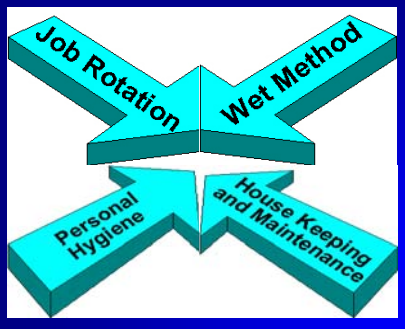
If . . .

Employees can change the way they do their jobs and the exposure to the potential hazard is removed,

Then . . .

The hazard can be eliminated with a work practice control

Work Practice Controls - Examples



Personal Protective Equipment, (PPE)

- Only when the previous are not feasible.
- Always the Last Resort!

3. Employee-owned equipment

Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

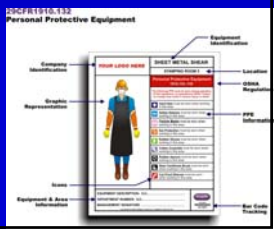
4. Design

All personal protective equipment shall be of safe design and construction for the work to be performed.

5. Recommended Process for the Completion of a PPE Assessment

Subpart I Appendix B

Compliance guidelines for hazard assessment and personal protective equipment selection (non-mandatory) Link



Step 1: Survey Work Area

Conduct a walk-through survey of the areas in question.

Step 1: Survey Work Area

Purpose of the survey is to identify sources of hazards to workers and co-workers!

And to put corrective measures in place, not to punish.

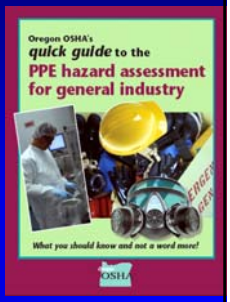
Step 1: Survey Work Area

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.

Tools that May Assist

- Safety Data Sheets
- Review Equipment
  Owners Manual
  Safety Warnings
- Job Hazard Analysis
- Job Safety Analysis



See Appendix B

Step 2: Identify the Sources

A. Sources of Physical Hazards

- Slip, Trip, and Fall
- Sharp Surfaces
- Broken Glass
- Environmental Hazards
  - Temperature Extremes
  - Fatigue
  - Strenuous Physical Activity

B. Sources of Structural Hazards

C. Sources of Electrical Hazards

D. Sources of Chemical Hazards

Sources of Chemical Hazards; Dust

E. Sources of Biological Hazards

F. Sources of Mechanical Hazards

Step 3: Organize Data

- 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.

Step 3: Organize Data

- Oregon OSHA PPE Assessment Form Link

MSWord File available with the course resources

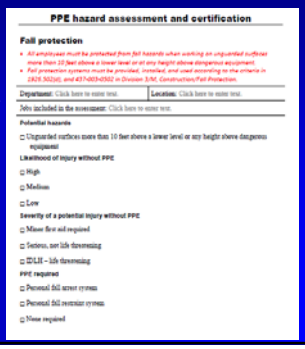
PPE hazard assessment and certification

Step 4: Analyze the Data

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

Step 4: Analyze the Data

- Oregon OSHA PPE Assessment Form Link



PPE hazard assessment and certification

Fall protection

- All employees must be protected from fall hazards when working on unguarded surfaces more than 10 feet above a lower level or at any height above dangerous equipment.
- Fall protection systems must be provided, installed, and used according to the criteria in (1926.502(d), and 437-003-0502 in Division 3/M, Construction/Fall Protection.

Department: Click here to enter text. Location: Click here to enter text.

Jobs included in the assessment: Click here to enter text.

Potential hazards

☐ Unguarded surfaces more than 10 feet above a lower level or any height above dangerous equipment

Likelihood of injury without PPE

☐ High

☐ Medium

☐ Low

Severity of a potential injury without PPE

☐ Minor first aid required

☐ Serious, not life threatening

☐ IDLH - life threatening

PPE required

☐ Personal fall arrest system

☐ Personal fall restraint system

☐ None required

6. PPE Selection Guidelines

a. Become familiar with the potential hazards, the type of protective equipment that is available, and how it will protect you.

b. Compare the hazards associated with the environment;

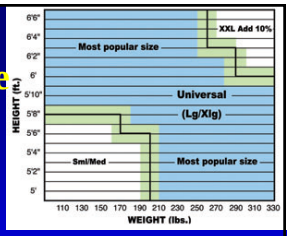
6. PPE Selection Guidelines

c. Select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards.

d. Fit the user with the protective device and give instructions on care and use of the PPE.

Fitting the Device

- If it does not fit properly, the PPE will not be worn.
- If it does not fit properly, the PPE will mot properly protect you.
- If it does not fit properly, the PPE may cause a hazard.



Miller Full Body Harness Sizing Chart

7. Training, 1910.132(f)

(i) When PPE is necessary;

(ii) What PPE is necessary;

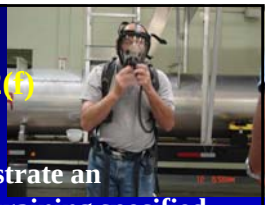
(iii) How to properly don, doff, adjust, and wear PPE;

(iv) The limitations of the PPE; and

(v) The proper care, maintenance, useful life and disposal of the PPE.

Minimum Content!

Training, 1910.132(f)



- The user shall demonstrate an understanding of the training specified,
- The user shall demonstrate the ability to use PPE properly.
- Training is required prior to being allowed to perform work requiring the use of PPE.

Re-Training

- Changes in the Workplace
- Equipment Changes
- User does not use properly

8. Reassessment of the 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.

9. Select the most Appropriate PPE

Body Part	Protection
Eye	safety glasses, goggles
Face	face shields
Head	hard hats
Feet	safety shoes
Hands and arms	gloves
Bodies	vests
Hearing	earplugs, earmuffs

10. Selection Guidelines

- Guidance is provided in Sections 8-11 of Appendix B

11. Cleaning and Maintenance

- PPE is required to be properly cleaned and maintained.
- 1910.132 (a) and (b)
- Follow Manufactures Recommendations

3M

Technical Data Bulletin

#150, September, 2001 — Reusable Respirators

11. Cleaning and Maintenance

Cleaning and Disinfecting

- According to Manufacturers Recommendations
- According to Recognized Procedures
- After Each Use

11. Cleaning and Maintenance

Properly Inspected

- Daily, Prior to Use
- Believed that it may have been damaged during use
- Scheduled

Damaged

- Removed from Service
- Tagged
- Proper Person Notified

11. Cleaning and Maintenance

Repaired by a trained and authorized Person

- Manufacturer
- Authorized by the Manufacturer
- Other Trained Person

After Repair

- Tested
- Returned to Service

B. Requirements for Foot Protection, 1910.136

When Must Foot Protection be Provided?

When any of these are present:

- Heavy objects such as barrels or tools that might roll onto or fall on employees' feet
- Sharp objects such as nails or spikes that might pierce ordinary shoes
- Molten metal that might splash on feet
- Hot or wet surfaces
- Slippery surfaces

Safety Shoes

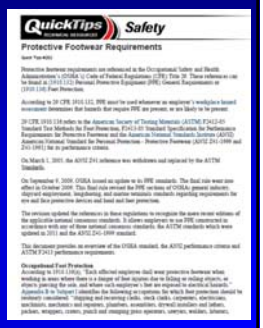
Steel and Composite Toes

- Impact-resistant toes and heat-resistant soles protect against hot surfaces common in roofing and paving
- Some have metal insoles to protect against puncture wounds
- May be electrically conductive for use in explosive atmospheres, or nonconductive to protect from workplace electrical hazards

Requirements for Foot Protection

Grainger Protective Footwear Requirements

Appendix C



http://www.grainger.com/content/quicktips?redirect=Quick++Tips

C. Requirements for Hand Protection, 1910.138

Hand Protection, 1910.138

Hand Protection

- Condor Hand Protection Fact Sheet – Appendix D

"The Whys and How's of Hand Protection for Healthier Working Hands"

- Appendix E

Discussion of hand protection requirements

"The Whys and How's of Hand Protection for Healthier Working Hands"

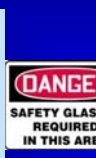
Hand Protection

Double Glove

Inner – Nitrile or Latex

Outer – Cut and Abrasion Protection

D. Requirements for Eye and Face Protection, 1910.133



Eye and Face Protection, 1910.133

Ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from:

- Flying particles,
- Molten metal,
- Liquid chemicals, acids or caustic liquids,
- Chemical gases or vapors,
- Potentially injurious light radiation

Eye and Face Protection

- Appendix F

Eye Protection
Criteria for Selection

- Protects against specific hazard(s)
- Comfortable to wear
- Does not restrict vision or movement
- Durable and easy to clean and disinfect
- Does not interfere with the function of other required PPE

Eye Protection for Employees Who Wear Eyeglasses

Ordinary glasses do *not* provide the required protection

Proper choices include:

- Prescription glasses with side shields and protective lenses
- Goggles that fit comfortably over corrective glasses without disturbing the glasses
- Goggles that incorporate corrective lenses mounted behind protective lenses

Eye Protection

- Lens Selection
- Appendix G


QuickTips Safety

Eyewear Lens Type Selection

Quick Tips #378

Choosing protective eyewear is not as simple as simply finding a pair of safety glasses that meet the American National Standards Institute (ANSI) standard, ANSI Z89.1 Occupational and Educational Eye and Face Protection. There are many more features available for eyewear that can help ensure you have the best eyewear for the job you need to do. These features include lens coatings, lens tints/colors, welding filter shades and sizing.

Lens Coatings

Lens coatings are made to enhance the versatility (and even the life span) of a pair of safety glasses. These coatings are often available separately or in combination with other coatings for more functionality. One available coating is an anti-scratch coating. This coating is designed to protect the lens when subjected to repeated impacts such as grinding applications. It can also extend the life of glasses when they are stored in conditions that would precipitate scratches. Some of these coatings are added on top of the standard lens while others are permanently bonded to the lens for even longer life.

Anti-fog coated lenses are another option to get the best performance out of safety glasses. This type of lens coating is designed to help reduce fogging in conditions such as cold-to-warm temperature transitions, humid environments or half-mask respirator applications. While anti-fog coating is not 100% fog free, fogging can be limited by using a fog-free lens, getting a pair of eyewear that sits further away from the face and supplementing the lens coating by adding an anti-fog cleaner or spray.

Anti-Static coatings are another option that is available. This type of coating reduces the dust and particulate levels that stick to a pair of eyewear. This coating would work well in environments where particulate levels are a concern or where dusts and particulates sticking to the lens would create a safety concern due to reduced visibility.

Mirror coatings in a variety of colors can be added to both clear and tinted lenses and are used to reduce glare. Mirror coatings on clear lenses are appropriate for indoor glare reduction and for workers going from light to dark conditions. Mirrored coatings on tinted lenses are most appropriate for outdoor work in bright conditions where glare is a concern.

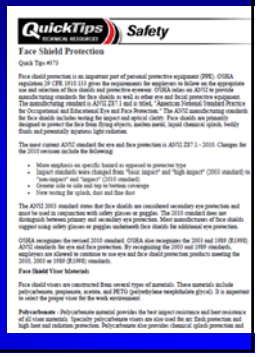
Face Shields

- Full face protection
- Protects face from dusts and splashes or sprays of hazardous liquids
- May or may not protect from impact hazards
- Wear safety glasses or goggles underneath

Eye and Face Protection

Face Shield Protection

Appendix H


QuickTips Safety
Face Shield Protection

E. Occupational Noise Exposure, 1910.95

76

Hearing Conservation

Course Resources

Table G 16 - Permissible Noise Exposures[1]	
Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
1/2	110
1/4 or less	115

1. When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 C_n/T_n$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level.
Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

When Must Hearing Protection be Provided?

After implementing engineering and work practice controls

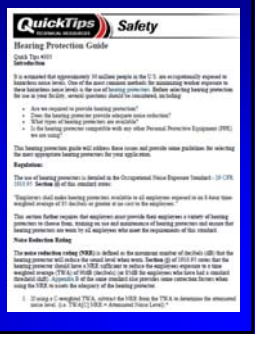
When an employee's noise exposure exceeds an 8-hour time-weighted average (TWA) sound level of 90 dBA

Action Level 85dBA

Hearing Protection Guide

There were several additional documents on the Grainger Quick Tips page that provide Hearing Protection Information

Appendix I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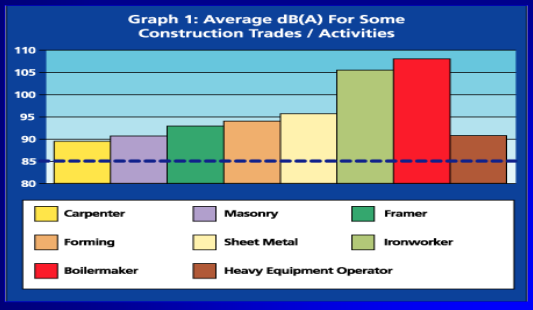
Hearing Protection Guide

Hearing Protection

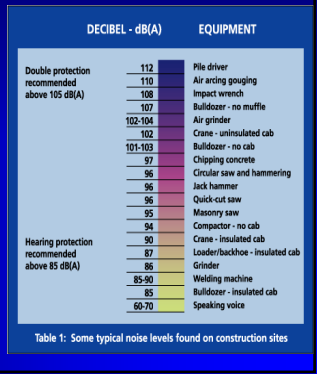


http://www.entnet.org/healthinfo/hearing/noise_hearing.cfm

Hearing Protection

When it's not feasible to reduce the noise or its duration – use ear protective devices

Ear protective devices must be fitted



	DECIBEL - dB(A)	EQUIPMENT
Double protection recommended above 105 dB(A)	112	Pile driver
	110	Air arcing gouging
	108	Impact wrench
	107	Bulldozer - no muffle
	102-104	Air grinder
	102	Crane - uninsulated cab
	101-103	Bulldozer - no cab
	97	Chipping concrete
	96	Circular saw and hammering
	96	Jack hammer
	96	Quick-cut saw
	95	Masonry saw
	94	Compactor - no cab
Hearing protection recommended above 85 dB(A)	90	Crane - insulated cab
	87	Loader/backhoe - insulated cab
	86	Grinder
	85-90	Welding machine
	85	Bulldozer - insulated cab
	60-70	Speaking voice

Table 1: Some typical noise levels found on construction sites

Noise Level Exposure Limits

Damage Occurs:

Noise Level, dB	Time (hours, minutes)
80	25:00
85	8:00
90	2:30
95	0:47
100	0:15
105	0:04
110	0:01

Source: NIOSH

Examples of Hearing Protectors

Earmuffs

Earplugs

Canal Caps

E. Requirements for Head Protection, 1910.135

Causes of Head Injuries

- Falling objects such as tools
- Bumping head against objects, such as pipes or beams
- Contact with exposed electrical wiring or components

Requirements for Head Protection, 1910.135

Appendix J


QuickTips Safety

DANGER
HARD HAT AREA

Selecting the Right Hard Hat

Sec. 1910.135 Head protection. * * * * * (b) Criteria for head protection.

(1)Head protection must comply with any of the following consensus standards:

(i) Z89.1-2003, ``American National Standard for Industrial Head Protection,'' which is incorporated by reference in Sec. 1910.6;

(ii) ANSI Z89.1-1997, ``American National Standard for Industrial Head Protection,'' which is incorporated by reference in Sec. 1910.6; or

(iii) ANSI Z89.1-1986, ``American National Standard for Personnel Protection--Protective Headwear for Industrial Workers--Requirements,'' which is incorporated by reference in Sec. 1910.6.

(2) Head protection devices that the employer demonstrates are at least as effective……

Selecting the Right Hard Hat

- ANSI Z-89.1 1997 Changed the classifications.

Type I Hard Hats - intended to reduce the force of impact resulting from a blow to the top of the head.

Type II Hard Hats - designed to provide protection against both side impact and blows to the top of the head. Locations in your workplace requiring Type II protection will be determined by your Safety Management.

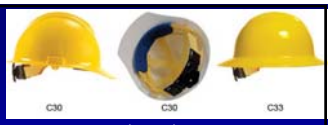
Selecting the Right Hard Hat

ANSI Z87.1-1997 also changed the designations for the 3 electrical protection classes that apply to both Type I and Type II hard hats. Testing requirements remain the same.

Classifications under old and new standards

Z89.1 1986	Z89.1 1997	Application	Test Voltage
A	G	General	2,200 Volts
B	E	Electrical	20,000 Volts
C	C	Conductive	Not Tested

Hard Hat Issues!



- Shelf Life - About 5 years (UV)
- MSA Suspension 1 Year
- No Solvents
- No Paints
- No Stickers

Check MFG's Recommendations

- ANSI Z89.1-1969, Falling/Flying
- ANSI Z89.2-1971, Electrical

Hard Hat Bill Direction

- **Letter of Interpretation 4-2002**
- **In the July 22, 1992, letter to Mr. Artie Scruggs, OSHA stated:**

ANSI only tests and certifies hard hats to be worn with the bill forward [;] hard hats worn with the bill to the rear would not be considered reliable protection and would not meet the requirements of 29 CFR 1926.100(a) and (b) unless the hard hat manufacturer certifies that this practice meets the ANSI Z89.1-1969 requirements.

This continues to be OSHA's interpretation of this standard. Additionally, note that a manufacturer may certify that it would be acceptable to wear the hard hat with the bill to the rear when the hard hat liner is turned/reversed.

F. Requirements for Respiratory Protection, 1910.134

NFPA 1852, Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

4.1 General.

4.1.1 Emergency services organizations shall have a written respiratory protection program that addresses the respiratory protection for the members of that organization.

Respiratory Protection Program, 1910.134(c)(1)

Where respirators are required you need:

- Written program
- Worksite-specific procedures

Required elements include:

(i) Procedures for selecting respirators for use in the workplace;

(ii) Medical evaluations of employees required to use respirators;

(iii) Fit testing procedures for tight-fitting respirators;

(iv) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

Required elements include:

(v) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

(vi) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

(vii) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

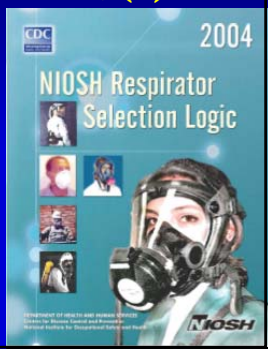
Required elements include:

(viii) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

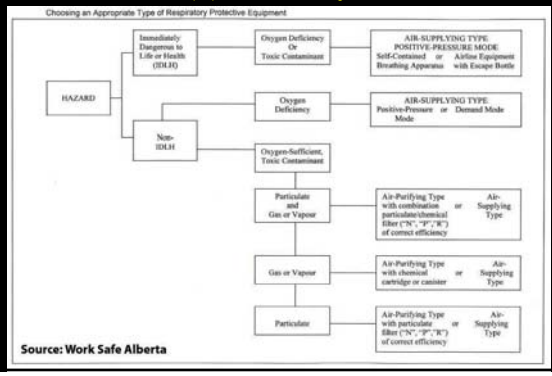
(ix) Procedures for regularly evaluating the effectiveness of the program.

Selection of Respirators, (d)

- Course Materials
- Current Edition
- Read the Document Prior to Use



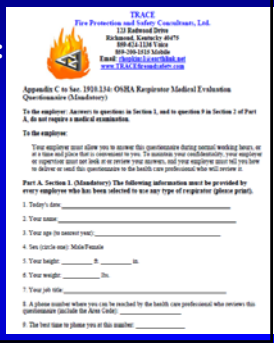
Respirator Selection,
1910.134 (d) Summary



Medical Evaluations (e)

1910.134 Appendix C: OSHA Respirator Medical Evaluation Questionnaire (mandatory)

Link



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Email: rhopkins1@earthlink.net
www.TRACEfireandsafety.com

Appendix C to Sec. 1910.134- OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee:

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date: _____
2. Your name: _____
3. Your age (to nearest year): _____
4. Sex (circle one): Male/Female
5. Your height: _____ ft _____ in.
6. Your weight: _____ lbs.
7. Your job title: _____
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____
9. The best time to phone you at this number: _____

Medical Screening

Online Respirator Medical Evaluations

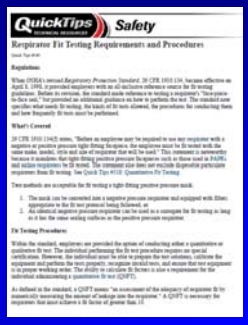
3M facilitates a convenient method for employers to obtain medical evaluation of respirator wearers as required by the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Fit Testing (f)

(2) The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and **at least annually thereafter**.

Fit Testing (f)

- Appendix K


QuickTips Safety

Respirator Fit Testing Requirements and Procedures

Protection Factors

Maximum Exposure Concentration	=	Protection Factor {APF}	X	Permissible Exposure Limit {PEL}

Respirator Type	Assigned Protection Factor
• Dust Mask	5
• Quarter Face APR	5
• Half Face APR	10
• Full Face APR	50
• PAPR	50
• SCBA/Pressure Demand	10,000

Maintenance and Care of Respirators (h)

1910.134 Appendix B-2 Respirator cleaning procedures (mandatory)

The employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2.

Cleaning and Disinfecting

- Single User
- Multiple User
- Fit Testing

Cleaning and Disinfecting

A. Remove filters, cartridges, or canisters.

B. Wash components in warm (43 °C [110 °F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer.

C. Rinse components thoroughly in clean, warm (43 °C [110 °F] maximum), preferably running water. Drain.

Cleaning and Disinfecting

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 °C (110 °F); or,
2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 °C (110 °F); or,

Cleaning and Disinfecting

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

Cleaning and Disinfecting

E. Rinse components thoroughly in clean, warm (43 °C [110 °F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

N 95 Respirator Use

G. Requirements for Fall Protection Equipment

- Guarding floor and wall openings and holes, 1910.23
- Fall Protection Equipment and Systems, Subpart M Fall Protection, Construction Industry Standards
- Subpart D Walking Working Surfaces, General Industry Standards is under revision.

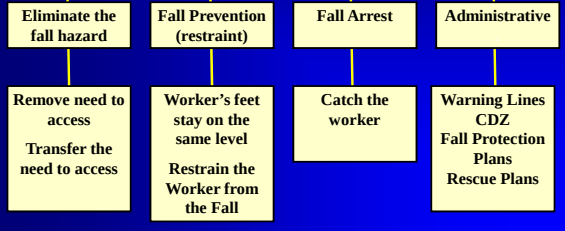
Fall Protection Requirements

- Appendix L


QuickTips Safety

Fall Protection Equipment

Fall Protection



Trigger Heights for Fall Protection*

- 4 Feet, General Industry
- 6 Feet, Construction Industry
- 10 Feet, Scaffolding

Note: Check State Plan State Requirements or other regulatory requirements

Fall Protection Options

General

- Guardrail systems
- Safety net systems
- Personal fall arrest systems
- Warning line systems

Guardrail Systems

- Top rail, mid-rail, and toe board
- Withstand a minimum force

Safety Net Systems

- Installed a maximum of 30' below working level
- 400 pound drop test or *certified* by employer or CP
- Extends sufficiently from outer edge
- Inspected weekly
- Objects removed within shift
- Border rope strength of 5000 pounds

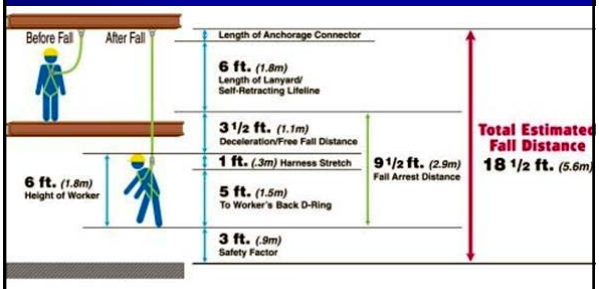
Personal Fall Arrest System

- Anchorage
- Connectors
- Lanyard
- Full Body Harness

Calculation of Total Fall Distance

- Freefall = 6 feet maximum
- Deceleration Distance = 3.5 feet maximum
- Lifeline elongation = 2 feet maximum
- Total fall before stopping = 11.5 feet
- Portion of body landing below attachment point approximately 5 feet
- Total clearance below required to avoid contacting lower level may be as great as 16.5 feet or more!

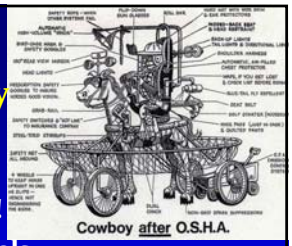
Calculation of Total Fall Distance



Warning Line Systems

- Erected around all sides of roof
- Erected at least six feet from edge if no mechanical equipment is used.
- 10 feet if mechanical equipment is used.

H. PPE Summary



PPE is the Last Resort!

- Engineering Controls
- Administrative Controls
- PPE

PPE Selection

Based on a Survey of the Work Site

- Based on the Hazards Identified
- Based on the Level of Hazards Identified
- Select the PPE that is most effective
- Insure that the PPE is Used

PPE Fit

- If it does not fit properly, the PPE will not be worn.
- If it does not fit properly, the PPE will not properly protect you.
- If it does not fit properly, the PPE may cause a hazard.

PPE Care and Maintenance

- Properly Inspected, Prior to Use
- Cleaned and Inspected, After Use
- Maintained by a Properly Trained and Equipped Technician
- Remove, Tag, and Notify the Proper Person if Damaged

PPE Training

- Properly Trained Prior to Use
- Training Materials
  - OSHA Requirements
  - Manufacturers Requirements
  - Site Specific Requirements
  - Manufacturer Resources

PPE Use

- Used Appropriately
- Used within Limitations

Series 3: Personal Protective Equipment (PPE), Selection and Use

Questions and Discussion

Ron Hopkins, CFEI, CFPS
TRACE Fire Protection and Safety
Richmond, Kentucky


Series 3: Personal Protective Equipment (PPE), Selection and Use
Thank You for Your Participation!
Ron Hopkins, CFEI, CFPS
TRACE Fire Protection and Safety
Richmond, Kentucky
IAFI


Fire Investigator Safety Series
Series 3: Personal Protective Equipment (PPE), Selection and Use
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Appendix A

Safety Standards, Regulations, and Related Documents

NFPA References

NFPA 1500-2013Standard on Fire Department Occupational Safety and Health Program
Chapter 7 Protective Clothing and Protective
Equipment

7.1 General.

7.1.1* The fire department shall provide each member with protective ensembles, ensemble elements, and protective equipment designed to provide protection from hazards to which the member is likely to be exposed and that is suitable for the tasks the member is expected to perform.

NFPA 1404: Standard for Fire Service Respiratory Protection Training, 2013 Edition
NFPA 1521, Standard for Fire Department Safety Officer Professional Qualifications
NFPA 1581, Standard on Fire Department Infection Control Program
NFPA 1975, Standard on Station/Work Uniforms for Emergency Services
NFPA1851, Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting
NFPA 1852, Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)
NFPA 1951, Standard on Protective Ensembles for Technical Rescue Incidents
NFPA 1952, Standard on Surface Water Operations Protective Clothing and Equipment
NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting
NFPA 1977, Standard on Protective Clothing and Equipment for Wildland Fire Fighting
NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services
NFPA1982, Standard on Personal Alert Safety Systems (PASS)
NFPA 1983, Standard on Life Safety Rope and Equipment for Emergency Services
NFPA 1984, Standard on Respirators for Wildland Fire-Fighting Operations
NFPA 1989, Standard on Breathing Air Quality for Emergency Services Respiratory Protection
NFPA 1991, Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies
NFPA 1992, Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies
NFPA 1994, Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents
NFPA 1999, Standard on Protective Clothing for Emergency Medical Operations

US Federal Government References

NIOSH

42 CFR 84, Approval of respiratory protective devices

NIOSH Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Open Circuit Self-Contained Breathing Apparatus (SCBA).

OSHA

Subpart I Personal Protective Equipment (General Industry)

29 CFR 1910.132 General Requirements

29 CFR 1910.133 Eye and face protection

29 CFR 1910.134, Respiratory protection

29 CFR 1910.135 Head protection

29 CFR 1910.136 Foot protection

29 CFR 1910.137 Electrical protective equipment

29 CFR 1910.138 Hand protection

Subpart E - Personal Protective and Life Saving Equipment (Construction Industry)

29 CFR 1926.95 Criteria for personal protective equipment

29 CFR 1926.96 Occupational foot protection

29 CFR 1926.100 Head protection

29 CFR 1926.101 Hearing protection

29 CFR 1926.102 Eye and face protection

29 CFR 1926.103 Respiratory protection

ANSI References

ANSI/AIHA/ASSE Z10-2012 Occupational Health and Safety Management Systems

ANSI/ISEA Z87.1-2010 American National Standard for Occupational and Educational Personal Eye and Face Protection Devices

ANSI Z88.2, Practices for Respiratory Protection

ANSI/ISEA Z89.1-2014 American National Standard for Industrial Head Protection

ANSI/ISEA 105-2011 Hand Protection Selection Criteria

ANSI/ISEA 107-2010 American National Standard for High Visibility Safety Apparel and Headwear Devices

ANSI/ISEA 207-2011 American National Standard for High-Visibility Public Safety Vests

ASTM References

ASTM F1731-96(2013) Standard Practice for Body Measurements and Sizing of Fire and Rescue Services Uniforms and Other Thermal Hazard Protective Clothing

ASTM F2061-12 Standard Practice for Chemical Protective Clothing: Wearing, Care, and Maintenance Instructions

Appendix B

Oregon OSHA's

quick guide to the PPE hazard assessment for general industry

What you should know and not a word more!

Oregon OSHA

About this guide

This quick guide to the Personal Protective Equipment (PPE) hazard assessment for general industry is an *Oregon OSHA Standards and Technical Resources* publication. Oregon OSHA quick guides are for employers and employees who want to know about a specific topic and get back to business — quickly.

Read this guide if you want to know how to determine what PPE your employees need to protect themselves from hazards. You'll learn:

- What a PPE hazard assessment is
- Why you should do a PPE hazard assessment
- When your employees should use PPE
- How to do a PPE hazard assessment

This guide also gives you a link to a convenient hazard assessment form on our website that you can download and use to do your own hazard assessment. (See page 12.)

Layout, design, and editing

- Patricia Young: Oregon OSHA, layout and design
- Mark Peterson: DCBS Communications, editing and proofing

We want you to understand what you read!

Every Oregon OSHA quick guide comes with a plain-language guarantee! Let us know if you're not satisfied. Contact Ellis Brasch: 503-947-7399, **ellis.k.brasch@state.or.us.**

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Contents

What is a PPE hazard assessment?

A PPE hazard assessment is an evaluation of your workplace that helps you determine what hazards your employees are exposed to *and* the personal protective equipment they need to protect themselves from those hazards.

An effective assessment should include:

- The jobs (or tasks) that your employees do
- The hazards your employees are exposed to and where the hazards are located
- The likelihood that those hazards could injure your employees
- The severity of a potential injury
- The types of PPE necessary to protect your employees from those hazards

For more information, see *How to do a PPE hazard assessment*, Page 10.

Why should you do a PPE hazard assessment?

There are three good reasons:

Reason 1: **A hazard assessment will help you find hazards at your workplace**

Reason 2: **A hazard assessment will help you determine what personal protective equipment your employees need for protection**

Reason 3: **Our *Personal Protective Equipment rule [437-002-0134] for general industry* requires that you do one**

Why a PPE hazard assessment is a good thing to do

– a real-world example

Not long ago, a worker died from complications resulting from severe burns on his face and hands when he tried to remove the bottom of a 55-gallon drum, which contained traces of motor oil, with a plasma cutter. The drum exploded.

He shouldn't have been using a plasma cutter on an oil drum until it had been cleaned and decommissioned; however, he might have survived with less severe burns if he had been using a face shield and appropriate protective gloves. He was wearing gloves, but they were made with fabric that melted on his hands from the heat of the explosion.

His employer had not done a PPE hazard assessment.

What our Personal Protective Equipment rule says about hazard assessments

Our *Personal Protective Equipment* rule says that you must "*assess your workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment.*" If you find hazards at your workplace that you can't eliminate or control without PPE, you must:

- Select the PPE that protects your employees from the hazards
- Communicate your selection decisions to each employee
- Ensure that the PPE fits each employee
- Require your employees to use their PPE when they're exposed to the hazards

When should your employees use PPE?

What's the best way to protect your employees from hazards?

It's not PPE.

The best way to protect your employees is to eliminate the hazards. But what if you can't eliminate the hazards? Then you should control them so they won't harm your employees. There are many ways to control hazards. The most effective ways are controls such as interlocks on machine guards and other "fail-safe" mechanisms that protect workers by reducing the risk of human error.

When is PPE necessary?

PPE is necessary when your employees are exposed to a hazard and you can't eliminate it or prevent their exposure any other way. Although PPE is another way to control a hazard, it's only a barrier between the hazard and the worker. When PPE doesn't fit a worker properly or the worker doesn't use it correctly, the PPE doesn't do its job and the worker risks exposure.

Before you purchase PPE, know what hazards it protects against and be sure it fits the person using it. If you're unsure, ask someone who is familiar with the type of PPE you need — especially when you're selecting respirators or chemical-protective clothing.

Always train employees how to wear, use, and maintain their PPE before they use it for the first time. Training must also include the types of PPE that are necessary and their limitations.

What types of PPE may be necessary?

Your hazard assessment should determine if your employees need any of the following types of PPE:

- Torso and abdominal protection
- Eye and face protection
- Head protection
- Foot protection
- Leg protection
- Hand protection
- Hearing protection
- Respiratory protection
- Fall protection

Table 1 ***(on the following two pages)*** shows these basic types of PPE and gives examples of hazards they control.

Table 1: Types of PPE		
PPE	**Typical hazards controlled**	**Covered by our personal protective equipment rule?**
Torso protection	• Harmful or hazardous temperatures and humidity • Hot splashes from molten metal and other hot liquids • Impacts from tools, machinery, and materials • Hazardous chemicals • Ionizing radiation • Moving vehicles	Yes; see *437-002-0134(6),Work Clothing; 437-002-0134(7), High Visibility Garments;* see also *437-002-0144(2), Additional Oregon Rules for General Environmental Controls*
Eye and face protection	• Dust, dirt, metal, or wood chips from chipping, grinding, sawing, hammering, and from power tools • Chemical splashes from corrosive substances, hot liquids, and solvents • Objects such as tree limbs, chains, tools, and ropes that swing into the eyes or face • Radiant energy from welding and harmful rays from lasers or other radiant light	Yes; see *437-002-0134(8), Eye and Face Protection*
Head protection	• Overhead objects that could fall • Exposed pipes or beams • Energized electrical equipment	Yes; see *437-002-0134(9), Head Protection*
Foot protection	• Heavy objects such as barrels or tools that might roll onto or fall on a worker's feet • Sharp objects such as nails or spikes that could pierce the soles or uppers of ordinary shoes • Molten metal • Hot, wet, or slippery surfaces • Energized electrical equipment	Yes; see *437-002-0134(10),Foot Protection*

Table 1: Types of PPE		
PPE	**Typical hazards controlled**	**Covered by our personal protective equipment rule?**
Leg protection	• Hot substances • Dangerous chemicals • Cuts from chain saws	Yes; see *437-002-0134(11), Leg Protection*
Hand protection	• Harmful or hazardous temperatures • Chemicals that can be absorbed into the skin or cause burns • Energized electrical equipment • Mechanical equipment that can cause bruises, abrasions, cuts, punctures, fractures, or amputations	Yes; see *437-002-0134(12),Hand Protection and 437-002-0134(13), Skin Protection*
Hearing protection	• Excessive noise	Yes – Ear plugs or ear muffs are required when workers are exposed to noise that equals or exceeds 85 dBA, averaged over eight hours. *See also 1910.95, Occupational Noise Exposure.*
Respiratory protection	• Harmful substances and below normal concentrations of oxygen in the air. What makes a substance harmful depends on its toxicity, chemical state, physical form, concentration, and the period of time one is exposed. Examples include particulates, gases and vapors, and biological organisms.	Yes – Appropriate respirators are required when workers are exposed above *permissible exposure limits* (PEL) for specific air contaminates, listed in *437-002-0382, Oregon Rules for Air Contaminants; see also Respiratory Protection, 1910.134*.
Fall protection	• Falls from unguarded surfaces more than 10 feet above a lower level or any height above dangerous equipment.	Yes – PPE includes personal fall arrest systems and personal fall restraint systems, which are covered in *437-002-0125, Oregon Rules for Fall Protection; 1926.502(d), Personal Fall Arrest Systems; and 437-003-0502, Personal Fall Restraint Systems*.

How to do a PPE hazard assessment

Do a baseline survey to identify workplace hazards

A baseline survey is a thorough evaluation of your entire workplace — including work processes, tasks, and equipment — that identifies safety and health hazards. A complete survey will tell you *what* the hazards are, *where* they are, and *how severe* a potential injury could be. The second column in **Table 1** includes hazards to consider in your baseline survey.

Suggestion: Use material safety data sheets (MSDS) to identify chemical hazards. An MSDS has detailed information about a hazardous chemical's health effects, its physical and chemical characteristics, and safe handling practices.

Suggestion: Review equipment owner and operator manuals to determine the manufacturer's safety warnings and recommended PPE.

Suggestion: Do a job-hazard analysis. A job-hazard analysis (JHA) is a method of identifying, assessing, and controlling hazards associated with specific jobs. A JHA breaks a job down into tasks. You evaluate each task to determine if there is a safer way to do it. A job-hazard analysis works well for jobs with difficult-to-control hazards and jobs with histories of accidents or near misses. JHAs for complex jobs can take a considerable amount of time and expertise to develop. You may want to have a safety professional help you.

Suggestion: Have an experienced safety professional survey your workplace with you.

Evaluate your employees' exposures to each hazard identified in the baseline survey

Consider the employee's task, the likelihood than the employee would be injured without PPE, and the severity of a potential injury. In the *real world example*, the worker was using a plasma cutter without a face shield and synthetic gloves to cut open a 55-gallon metal drum that had not first been properly cleaned or decommissioned. An effective PPE hazard assessment would produce the following information for the task of using a plasma cutter:

Task: Using a plasma cutter.

Hazards: The plasma-cutting arc produces hot metal and sparks, especially during the initial piercing of the metal. It also heats the work piece and the cutting torch. *Never cut closed or pressurized containers such as tanks or drums, which could explode. Do not cut containers that may have held combustibles or toxic or reactive materials unless they have been cleaned, tested, and declared safe by a qualified person.*

Likelihood of injury without PPE: High

Severity of a potential injury: Life-threatening burns

PPE necessary for the task:

Body: dry, clean clothing made from tightly woven material such as leather, wool, or heavy denim

Eyes and face: safety glasses with side shield or face shield

Feet: high-top leather shoes or boots

Hands: flame-resistant gloves

After you do a hazard assessment, document that you've done it!

We call the document a *written certification*; it must include the following information:

- A heading that says the document is a "certification" of the hazard assessment
- The name of the workplace evaluated
- The name of the person certifying the hazard assessment was completed
- The date of the hazard assessment

Your written certification can be as simple as this one.

PPE hazard assessment certification

Workplace evaluated: _____

Person certifying the evaluation: _____

Hazard assessment date: _____

There's a convenient hazard assessment form on our website that you can download and use to do your own hazard assessment.

Follow this link to download our *PPE hazard assessment and certification form*.

Reassess workplace hazards periodically

Do regular workplace inspections. Regular inspections tell you whether you've eliminated or controlled existing hazards, and help you identify new hazards. Quarterly inspections by employees trained in hazard recognition are a good way to get the job done.

Look for new hazards whenever you change equipment, materials, or work processes. Determine what hazards could result from the changes and how to control them. If your business works at multiple sites, you may need to do a hazard assessment at each site.

Notes:

*Oregon*OSHA **Services**

Oregon OSHA offers a wide variety of safety and health services to employers and employees:

Appeals

503-947-7426; 800-922-2689; admin.web@state.or.us

- Provides the opportunity for employers to hold informal meetings with Oregon OSHA on concerns about workplace safety and health.
- Discusses Oregon OSHA's requirements and clarifies workplace safety or health violations.
- Discusses abatement dates and negotiates settlement agreements to resolve disputed citations.

Conferences

503-378-3272; 888-292-5247, Option 1; oregon.conferences@state.or.us

- Co-hosts conferences throughout Oregon that enable employees and employers to learn and share ideas with local and nationally recognized safety and health professionals.

Consultative Services

503-378-3272; 800-922-2689; consult.web@state.or.us

- Offers no-cost, on-site safety and health assistance to help Oregon employers recognize and correct workplace safety and health problems.
- Provides consultations in the areas of safety, industrial hygiene, ergonomics, occupational safety and health programs, assistance to new businesses, the Safety and Health Achievement Recognition Program (SHARP), and the Voluntary Protection Program (VPP).

Enforcement

503-378-3272; 800-922-2689; enforce.web@state.or.us

- Offers pre-job conferences for mobile employers in industries such as logging and construction.
- Inspects places of employment for occupational safety and health hazards and investigates workplace complaints and accidents.
- Provides abatement assistance to employers who have received citations and provides compliance and technical assistance by phone.

Public Education

503-947-7443; 888-292-5247, Option 2;
ed.web@state.or.us

- Provides workshops and materials covering management of basic safety and health programs, safety committees, accident investigation, technical topics, and job safety analysis.

Standards and Technical Resources

503-378-3272; 800-922-2689; tech.web@state.or.us

- Develops, interprets, and gives technical advice on Oregon OSHA's safety and health rules.
- Publishes safe-practices guides, pamphlets, and other materials for employers and employees.
- Manages the Oregon OSHA Resource Center, which offers safety videos, books, periodicals, and research assistance for employers and employees.

Need more information?
Call your nearest Oregon OSHA office.

Salem Central Office

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Salem, OR 97301-3882
Phone: 503-378-3272
Toll-free: 800-922-2689
Fax: 503-947-7461
en Español: 800-843-8086
Website: www.orosha.org

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Red Oaks Square
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541-388-6066
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Eugene, OR 97401-2101
541-686-7562
Consultation: 541-686-7913

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541-776-6030
Consultation: 541-776-6016

Pendleton

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Consultation: 541-276-2353

Portland

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Consultation: 503-229-6193

Salem

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Salem, OR 97303
503-378-3274
Consultation: 503-373-7819

DEPARTMENT OF CONSUMER & BUSINESS SERVICES
Oregon OSHA

440-2738 (1/12)

OR-OSHA

Appendix C

QuickTips TECHNICAL RESOURCES Safety

Protective Footwear Requirements

Quick Tips #252

Protective footwear requirements are referenced in the Occupational Safety and Health Administration's (OSHA's) Code of Federal Regulations (CFR) Title 29. These references can be found in (1910.132) Personal Protective Equipment (PPE) General Requirements or (1910.136) Foot Protection.

According to 29 CFR 1910.132, PPE must be used whenever an employer's workplace hazard assessment determines that hazards that require PPE are present, or are likely to be present.

29 CFR 1910.136 refers to the American Society of Testing Materials (ASTM) F2412-05 Standard Test Methods for Foot Protection, F2413-05 Standard Specification for Performance Requirements for Protective Footwear and the American National Standards Institute (ANSI) American National Standard for Personal Protection - Protective Footwear (ANSI Z41-1999 and Z41-1991) for its performance criteria.

On March 1, 2005, the ANSI Z41 reference was withdrawn and replaced by the ASTM Standards.

On September 9, 2009, OSHA issued an update to its PPE standards. The final rule went into effect in October 2009. This final rule revised the PPE sections of OSHAs general industry, shipyard employment, longshoring, and marine terminals standards regarding requirements for eye and face protective devices and head and foot protection.

The revision updated the references in these regulations to recognize the more recent editions of the applicable national consensus standards. It allows employers to use PPE constructed in accordance with any of three national consensus standards; the ASTM standards which were updated in 2011 and the ANSI Z41-1999 standard.

This document provides an overview of the OSHA standard, the ANSI performance criteria and ASTM F2413 performance requirements.

Occupational Foot Protection

According to 1910.136(a), "Each affected employee shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards." Appendix B to Subpart I identifies the following occupations for which foot protection should be routinely considered: "shipping and receiving clerks, stock clerks, carpenters, electricians, machinists, mechanics and repairers, plumbers, assemblers, drywall installers and lathers, packers, wrappers, craters, punch and stamping press operators, sawyers, welders, laborers,

freight handlers, gardeners and grounds keepers, timber cutting and logging workers, stock handlers and warehouse laborers."

Requirements of ANSI Z41
The ANSI Z41 standard defines performance measurements and test methods for protective footwear. Effective with the last revision of this standard, the ANSI Z41-1999 requires suppliers and manufactures of Protective Footwear to have independent laboratory test results available to confirm compliance with the standard. And all protective footwear that is certified as meeting ANSI Z41 must first meet the requirements of Section 1 General Requirements for All Types of Footwear--Impact and Compression Resistance. Then the requirements of additional sections such as electrical hazard protection, conductive protection and protection against punctures and penetration can be met.

Protective footwear can meet all the requirements of the ANSI standard or specific elements of it, as long as it first meets the requirements for toe protection in Section 1. A work boot that meets the impact and compression requirements of the ANSI standard may not provide protection for metatarsal, electrical or penetration hazards. All footwear manufactured to ANSI specifications will be marked with the specific portion of the standard with which it complies.

The ANSI standard incorporates a coding system that manufacturers use to identify the portions of the standard with which the footwear complies. The identification code must be legible (printed, stamped, stitched, etc.) on one shoe of each pair of protective footwear.

The following is an example of an ANSI Z41 marking that may be found on protective footwear:
ANSI Z41 PT 99
F I/75 C/75
Mt/75 EH
PR

Line #1: ANSI Z41 PT 99:
This line identifies the ANSI standard. The letters PT indicate the protective toe section of the standard. This is followed by the last two digits of the year of the standard with which the footwear meets compliance (1999).

Line #2: F I/75 C/75:
This line identifies the applicable gender [M (Male) or F (Female)] for which the footwear is intended. It also identifies the existence of impact resistance (I), the impact resistance rating (75, 50 or 30 foot-pounds), compression resistance (C) and the compression resistance rating (75, 50 or 30 which correlates to 2500 pounds, 1750 pounds, and 1000 pounds of compression respectively).

Lines 3 & 4: Mt Cd EH PR & SD:
Lines 3 and 4 are used to reference additional sections in the standard. They are use to designate metatarsal (Mt) resistance and rating, conductive (Cd) properties, electrical hazard (EH), puncture resistance (PR) and static dissipative (SD) properties, if applicable. Line 4 is only used when more than three sections of ANSI Z41 apply.

The purpose of metatarsal footwear is to prevent or reduce the severity of injury to the metatarsal and toe areas. The existence of metatarsal resistance (Mt) and the rating (75, 50 or 30 foot-pounds) is identified.

Conductive (Cd) footwear is intended to protect the wearer in an environment where the accumulation of static electricity on the body is a hazard. It is designed to dissipate state electricity from the body to the ground. The electrical resistance must range between zero and 500,000 ohms.

Electrical hazard (EH) footwear is manufactured with non-conductive electrical shock resistant soles and heals. It is intended to provide a secondary source of protection against accidental contact with live electrical circuits, electrically energized conductors, parts or apparatus. It must be capable of withstanding the application of 14,000 volts at 60 hertz for one minute with no current flow or leakage current in excess of 3.0 milliamperes, under dry conditions.

The purpose of sole puncture resistant (PR) protective footwear is to reduce the possibility of injury caused by sharp objects that may penetrate the soles of the footwear. The puncture resistant device must be an integral part of the footwear and must be constructed into the shoe during the manufacturing process. The footwear must withstand a minimum force of 270 pounds. Devices constructed of metal must pass the corrosion resistance testing and show no sign of corrosion after being exposed to a five percent salt solution for 24-hours. The puncture resistant footwear must show no signs of cracking after being subjected to 1.5 million flexes.

Static dissipative (SD) footwear is designed to reduce the accumulation of excess static electricity by conducting body charge to ground while maintaining a sufficiently high level of resistance. There are two static dissipative classifications Type I and Type II. Both types have a lower limit of resistance of 106 ohms. Type I footwear's electrical resistance must not exceed 108 ohms, which is generally considered acceptable for semiconductor applications. Type II footwear's electrical resistance must not exceed 109 ohms and has applications in work environments less demanding than Type I.

ASTM F2413-05 Requirements

ASTM F2413-05 Standard Specification for Performance Requirements for Foot Protection covers minimum requirements for the design, performance, testing and classification of protective footwear. Footwear certified as meeting ASTM F2413-05 must first meet the requirements of Section 5.1 Impact Resistant Footwear and Section 5.2 Compression Resistant Footwear. Then the requirements of additional sections such as metatarsal protection, conductive protection, electric shock protection, static dissipative protection and protection against punctures can be met.

All footwear manufactured to the ASTM specification must be marked with the specific portion of the standard with which it complies. One shoe of each pair must be clearly and legibly marked (stitched in, stamped on, pressure sensitive label, etc.) on either the surface of the tongue, gusset, shaft or quarter lining.

The following is an example of an ASTM F2413-05 marking that may be found on protective footwear:
ASTM F2413-05
M I/75/C/75/Mt75
PR
CS

Line #1: ASTM F2413-05:
This line identifies the ASTM standard it indicates that the protective footwear meets the performance requirements of ASTM F2413 issued in 2005.

Line #2: M I/75 C/75 Mt75:
This line identifies the gender [M (Male) or F (Female)] of the user. It also identifies the existence of impact resistance (I), the impact resistance rating (75 or 50 foot-pounds), compression resistance (C) and the compression resistance rating (75 or 50 which correlates to 2500 pounds and 1750 pounds of compression respectively). The metatarsal designation (Mt) and rating (75 or 50 foot-pounds) is also identified.

Lines 3 & 4: PR CS
Lines 3 and 4 are used to identify footwear made to offer protection from other specific types of hazards referenced in the standard. They are used to designate conductive (Cd) properties, electrical insulation properties (EH), footwear designed to reduce the accumulation of excess static electricity (SD), puncture resistance (PR), chain saw cut resistance (CS) and dielectric insulation (DI), if applicable. Line 4 is only used when more than three sections of the ASTM standard apply.

Conductive (Cd) footwear is intended to provide protection for the wearer against hazards that may result from static electricity buildup and to reduce the possibility of ignition of explosives or volatile chemicals. The footwear must facilitate electrical conductivity and the transfer of static electricity build up from the body to the ground. The electrical resistance must range between zero and 500,000 ohms.

Electrical shock resistant (EH) footwear is manufactured with non-conductive electrical shock resistant soles and heals. The outsole is intended to provide a secondary source of electric shock resistance protection to the wearer against the hazards from an incidental contact with live electrical circuits, electrically energized conductors, parts or apparatus. It must be capable of withstanding the application of 14,000 volts at 60 hertz for one minute with no current flow or leakage current in excess of 3.0 milliamperes, under dry conditions.

Static dissipative (SD) footwear is designed to provide protection against hazards that may exist due to excessively low footwear resistance, as well as maintain a sufficiently high level of resistance to reduce the possibility of electric shock. The footwear must have a lower limit of electrical resistance of 106 ohms and an upper limit of 108 ohms.

Puncture resistant (PR) footwear is designed so that a puncture resistant plate is positioned between the insole and outsole. It is an integral and permanent part of the footwear. Devices

constructed of metal must pass the ASTM B117 Practice for Operating Salt Spray (Fog Apparatus) corrosion resistance testing. The device must show no sign of corrosion after being exposed to a five percent salt solution for 24-hours. The puncture resistant footwear must show no signs of cracking after being subjected to 1.5 million flexes and have a minimum puncture resistance of 270 pounds.

Chain saw cut resistant (CS) footwear is designed to provide protection to the wearer's feet when operating a chain saw. It is intended to protect the foot area between the toe and lower leg. This footwear must meet the ASTM F1818 Specification for Foot Protection for Chainsaw Users standard.

Dielectric insulation (DI) footwear is designed to provide additional insulation if accidental contact is made with energized electrical conductors, apparatus or circuits. It must meet the minimum insulation performance requirements of ASTM F1117 (Specification for Dielectric Footwear) and be tested in accordance with ASTM F1116 (Test Method for Determining Dielectric Strength of Dielectric Footwear).

ASTM F2413-11 Requirements
The primary purpose of this standard is the certification of protective footwear.Â Certification must be performed by independent third party laboratories.

ASTM F2413-11 Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear contains performance requirements for footwear to protect workers' feet from the following hazards by providing:

1. Impact resistance (I) for the toe area of footwear (75 foot-pounds);
2. Compression resistance (C) for the toe area of the footwear (75/ 2,500 pounds);
3. Metatarsal impact protection (Mt) that reduces the chance of injury to the metatarsal bones at the top of the foot (75 foot-pounds);
4. Conductive properties (Cd) which reduce hazards that may result from static electricity buildup; and reduce the possibility of ignition of explosives and volatile chemicals (electrical resistance zero â€“ 500,000 ohms);
5. Electric hazard protection (EH) to protect the wearer when accidental contact is made by stepping on live electrical wire (capable of withstanding the application of 18,000 volts at 60 hertz for one minute with no current flow or leakage current in excess of one milliampere, under dry conditions);
6. Static dissipative properties (SD) to reduce hazards due to excessively low footwear electrical resistance that may exist where SD footwear is required (must have a lower limit of electrical resistance of 106 ohms and an upper limit of 108 ohms when tested at 50-volts); and
7. Puncture resistance (PR) (when viewed at a 90° angle, the test pin tip must not visually penetrate beyond the face of the material nearest the foot after an applied force of 270 pounds, no signs of de-lamination or cracking after 1.5 million flexes and no sign of corrosion, de-lamination or deterioration after being exposed to a five percent salt solution for 24-hours.)

Footwear certified as meeting ASTM F2413-11 must first meet the requirements of Section 5.1 Impact Resistant Footwear (75 foot-pounds) and Section 5.2 Compression Resistant Footwear (75 / 2,500 pounds). Then the requirements of additional sections such as metatarsal protection, conductive protection, electric shock protection, static dissipative protection and protection against punctures can be met.

Each protective toe cap must be marked with the manufacturer's name, trademark or logo. The cap number or identification, toe cap size, and R (right)/ L (left) must be permanently stamped or marked in a conspicuous location.

Each metatarsal and puncture resistant device must be marked with the manufacturer's name, trademark or logo and device number or identification in a conspicuous location.

All footwear manufactured to this ASTM specification must be marked with the specific portion of the standard with which it complies. One shoe of each pair must be clearly and legibly marked (stitched in, stamped, pressure sensitive label, or a combination of these methods) on the inside or outside surface of the tongue, gusset, shaft or quarter lining. The marking must be enclosed in a rectangular border and a four line format is suggested. Line four is to be used when more than three sections of the standard applies to the footwear.

Any changes to the original components of safety toe footwear such as replacing or adding after market footbeds/inserts could cause failure to any or all parts of this standard and the ASTM marking would be invalid.

Add-On Devices

An important point to remember is that neither the ANSI nor ASTM standards allows for the use of add-on type devices - strap-on foot, toe or metatarsal guards - as a substitute for protective footwear. According to the ANSI and ASTM standards, any protective toe caps or metatarsal guards must be designed, constructed and manufactured into the protective footwear during the manufacturing process and tested as an integral part of the footwear.

While ANSI and ASTM both exclude add-on devices, it doesn't necessarily mean they're not acceptable to OSHA. This paradox exists because OSHA states in 1910.136(b)(2) "Protective footwear that the employer demonstrates is at least as effective as protective footwear that is constructed in accordance with one of the above consensus standards will be deemed to be in compliance with the requirements of this section." This means that if an employer can provide documentation, such as testing data proving their add-on devices provide protection equivalent to either the ANSI or ASTM performance standards, then the add-on devices are acceptable to OSHA. Most manufacturers of add-on devices have submitted their products to independent laboratories for testing. This data and its results can be obtained upon request.

Questions and Answers

Q. What performance standards are incorporated by reference in OSHA's Foot Protection Standard?
A. 29 CFR 1910.136 refers to the American Society of Testing Materials (ASTM) F2412-05 Standard Test Methods for Foot Protection and F2413-05 Standard Specification for Performance Requirements for Protective Footwear and the American National Standards Institute (ANSI) American National Standard for Personal Protection - Protective Footwear (ANSI Z41-1999 and Z41-1991) for its performance criteria.

On September 9, 2009, OSHA issued an update to its personal protective equipment (PPE) standards. The final rule went into effect in October that year and revised the PPE sections of OSHAs general industry, shipyard employment, longshoring, and marine terminals standards regarding requirements for eye- and face-protective devices, head protection and foot protection.

The revision updated the references in these regulations to recognize the more recent editions of the applicable national consensus standards. It allows employers to use PPE constructed in accordance with any of three national consensus standards the two most recent and the incorporated reference in the current standards.

Q. When is footwear with impact and compression protection suggested for use?
A. Per Appendix B to Subpart I safety shoes or boots with impact protection are suggested 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 are suggested for work activities involving skid trucks, around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet.

Sources

OSHA 29 CFR 1910.132
Personal Protective Equipment General Requirements

OSHA 29 CFR 1910.136
Personal Protective Equipment Occupational Foot Protection

ASTM B117
Practice for Operating Salt Spray (Fog) Apparatus

ASTM F1116
Test Method for Determining Dielectric Strength of Dielectric Footwear

ASTM F117
Specification for Dielectric Footwear

ASTM F1818
Specification for Foot Protection for Chainsaw Users

ASTM F2412-05
Standard Test Methods for Foot Protection

ASTM F2413-05
Standard Specification for Performance Requirements for Foot Protection

ASTM F2412-11
Standard Test Methods for Foot Protection

ASTM F2413-11
Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear

Rev. Date: 7/2012

Find even more information you can use to help make informed decisions about the regulatory issues you face in your workplace every day. View all Quick Tips Technical Resources at www.grainger.com/quicktips.

Think Safety. Think Grainger.®
Grainger has the products, services and resources to help keep employees safe and healthy while operating safer facilities. You'll also find a network of safety resources that help you stay in compliance and protect employees from hazardous situations. Count on Grainger for lockout tagout, fall protection equipment, confined space products, safety signs, personal protective equipment (PPE), emergency response and so much more!

Appendix D

FACT SHEET

Hand Protection

Condor personal protective equipment offers you a wide range of quality gear made to meet or exceed relevant ANSI and OSHA safety standards.

Glove Information

COMPLIANCE

OSHA 1910.138(a) General Requirements

Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.

1910.138(b) Selection

Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified. For additional information on OSHA Standards please visit: *www.osha.gov*.

TYPES OF GLOVES

2XRU7

Impact

Protect against hand, finger, and arm fatigue by reducing vibration impact and shock hazards from tools and equipment.
Uses: Automotive assembly, construction, manufacturing, warehousing.

2YEH9

Chemical Resistant

Protect against a variety of chemicals with excellent abrasion, puncture, and tear resistance.
Uses: Aerospace, agriculture, automotive, chemical and food processing, general maintenance, mining, petrochemicals, refining.

2RA22

Cut and Puncture Resistant

Available in a wide variety of materials that offer different levels of cut, abrasion, and puncture resistance against all types of sharp objects, including glass, metal, and needles.
Uses: Automotive assembly, construction, food industry, glass handling, metal fabrication, parts handling, wood handling.

6JF92

Disposable

For one-time use applications; thin gauge thickness provides superior flexibility, sensitivity, and dexterity.
Uses: Food service, general maintenance, laboratories, medical, pharmaceutical.

6AF50

General Purpose

Reduce hand injuries and fatigue while providing excellent grip, flexibility, comfort, and abrasion resistance.
Uses: Automotive and light assembly, food handling, maintenance, metal/steel industries, warehousing.

5T926

Leather Palm and Driver's

Choose from a variety of cowhide, pigskin, goatskin, and deerskin gloves for comfort, durability, dexterity, and abrasion resistance.
Uses: Construction, contractors, gardening, general assembly and maintenance, welding.

3BA57

Mechanic's

Protect workers' hands from impact, nicks, and abrasion without sacrificing dexterity or grip for handling tools and parts.
Uses: Assembly, maintenance, construction, contractors, mechanics, warehousing.

2UUA8

Palm Coated

Offer dexterity, grip, and comfort while protecting against snags, punctures, and abrasions. Appropriate for use in wet areas where grip and dexterity are critical. Substitute for leather work gloves.
Uses: Automotive and light assembly, construction, maintenance, shipping/receiving.

1ZPP3

Temperature-Resistant

Protect from extreme hot and cold temperatures. Certain applications depend on weight of product handled and length of time handled.
Uses: Aluminum casting, automotive, cold storage, injection molding, steel manufacturing, stamping.

Call or visit your local branch or go to **grainger.com/condor** for complete product line information

Glove Information

OSHA REGULATIONS FOR HAND PROTECTION

1910.138(a) General Requirements

Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.

1910.138(b) Selection

Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

GLOVE SIZING CHART

Wrap a tape measure around your palm to determine the circumference of your hand in inches. Refer to the sizing chart to determine your appropriate glove size.

Palm Size (In.):	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12
Size:	XS	S	M	L	XL	2XL
Other Sizes:	Ladies			Men's		
		Universal				
					Jumbo	

ANSI Cut, Puncture and Abrasion Resistance Guide

CHOOSE THE APPROPRIATE LEVELS OF CUT, PUNCTURE, AND ABRASION RESISTANCE FOR HAND AND ARM PROTECTION

The ANSI Cut, Puncture, and Abrasion Resistance tables below, provided by ANSI, help identify the level of resistance needed in each area, enabling compliance with OSHA regulations 1910.138 (a) and 1910.138 (b), mitigating risk of injury, and increasing worker productivity. The ANSI/ISEA 105-2005 standard provides a consistent, numeric-scale method for manufacturers to rate their products in each of the designated areas. The "level of resistance" numbering has been incorporated into the catalog to help purchasers and users make informed decisions when choosing gloves and sleeves for each category of protection.

- **The ANSI/ISEA 105-2005 standard provides performance classification levels for many different materials based on standardized test methods.**

ANSI/ISEA: American National Standards Institute and International Safety Equipment Association. For additional information on ANSI Standards please visit: *www.ansi.org.*

LEVEL	WEIGHT (GRAMS) NEEDED TO CUT THROUGH MATERIAL WITH 25MM OF BLADE TRAVEL
Cut Resistance	
0	< 200
1	≥ 200
2	≥ 500
3	≥ 1000
4	≥ 1500
5	≥ 3500

Note: When tested in accordance with ASTM F1790-97.

LEVEL	PUNCTURE (NEWTONS)
Puncture Resistance	
0	< 10
1	≥ 10
2	≥ 20
3	≥ 60
4	≥ 100
5	≥ 150

Note: When tested in accordance with Clause 6.4 on EN 388:2003.

LEVEL (TESTED AT 500G LOAD)	ABRASION CYCLES TO FAIL
Abrasion Resistance	
0	< 100
1	≥ 100
2	≥ 500
3	≥ 1000
LEVEL (TESTED AT 1000G LOAD)	ABRASION CYCLES TO FAIL
4	≥ 3000
5	≥ 10000
6	≥ 20000

Note: When tested in accordance with ASTM D3389-05.

Leather Glove Information

CUFF STYLES


4AZ97

Knit Wrist
Seamless, stretchable rib knit is sewn onto glove to provide a comfortable, secure fit. Fits under clothing sleeves to keep cold air out.


2AH54

Safety
Protects wrist and allows easy movement and removal of glove in emergency situations.


5AR16

Gauntlet
Extended cuff provides greater protection of wrist and forearm.


1D999

Slip-On
Constructed without a cuff, these gloves slip on and off easily. Material extends over the wrist. Primarily used in a driver's, mechanic's, or general purpose gloves.

THUMB STYLES


3NCK4

Keystone
Specially designed 1-piece, inset thumb is double-sewn and has double thickness at this critical wear point. This construction provides extra comfort and allows extra wear.


4YV44

Wing
Mirrors the natural shape of the hand and offers comfortable gripping and free thumb movement. Provide extended wear. The thumb pattern is easily identified: when the glove is laid flat, the thumb should extend to the side.


5AJ33

Straight
Cut as 1 piece with the palm, the thumb extends straight from the wrist. This style uses less material than the similar Wing thumb, reducing the cost of the glove.

CUT STYLES


3AJ10

Gunn
Seamless on back for greater comfort; the palm side of the middle 2 fingers is a separate glove pattern and is sewn into the palm at the base of the middle 2 fingers. In leather styles, the seam is reinforced with a welt increasing gloves' durability and wear life.


3AD76

Clute
Seamless palm made from a continuous piece of leather means greater ease of movement, comfortable gripping, and a roomy fit. Back of glove has parallel seams. Finger side seams are toward palm side of glove. Primarily used in fabric gloves and lightweight leathers.

MATERIALS


4TJX3

Cowhide
Excellent abrasion resistance, breathability, and thermal protection.


5AC74

Pigskin
High abrasion resistance and heat protection. Material is flexible and won't stiffen when wet. Suitable for jobs that are exposed to moisture.


6JJ99

Goatskin
Most abrasion resistance. Soft and pliable. Twice as durable as cowhide and pigskin materials. Suitable for jobs where optimal dexterity is important.


4TJW8

Deerskin
Features the highest tensile strength. Soft, flexible and long wearing. Suitable for jobs where optimal dexterity is important.

Call or visit your local branch or go to **grainger.com/condor** for complete product line information

Mechanic's Glove Information

Gloves are available in a variety of styles to meet the demands of a broad range of applications. Choose gloves with single-layer palms for general tasks, padded palms for impact resistance, or patch palms for additional wear and abrasion resistance. PVC-coated palms offer increased grip. Insulated styles are available for hot or cold applications.

2RA40

High-Visibility Mechanic's Gloves
Bright colored mechanic's gloves promote awareness and compliance.

2XRR8

Abrasion-Resistant Mechanic's Gloves
Clarino® synthetic leather palms and PVC patches improve grip.

2PY90

Leather Mechanic's Gloves
Mechanic's gloves made out of leather.

2PY90

Abrasion-Resistant Extrication Gloves
Feature synthetic leather, sewn with Kevlar®, Armortex® patches on top and bottom, and gel-padded palm patches. Elastic wrist.

2XRV1

Box-Handling Gloves
Mechanic's gloves designed for box-handling applications.

5NGL7

Cold Conditions Gloves
Mechanic's gloves designed for colder climates.

2XRU5

Impact Mechanic's Gloves
Provide protection against impact and vibration. All brands feature synthetic leather padded palms, except Condor and Mechanix Wear® styles have Clarino® synthetic leather palms for excellent durability. All styles have hook-and-loop closure.

Palm-Coated Glove and Liner Information

Choose from a variety of coating material and liner options.

COATING MATERIALS:

2UUG7

Polyurethane
Flexible, synthetic material helps protect hands from harmful residues and chemicals while providing grip and abrasion-resistance. Allows tactile sensitivity.

3ZL55

PVC
Synthetic thermoplastic polymer provides abrasion resistance, tactility, and dexterity combined with wet and dry grip. Ideal for applications where wear rates are moderate to high.

4NMR8

Nitrile
A synthetic rubber that resists snags, punctures, abrasions, and cuts. Nitrile is suitable for people with latex allergies and provides resistance to petroleum, acids, and aromatic and chlorinated solvents.

4NMR3

Nitrile Foam
Absorbs oils better than standard nitrile coating and provides grip in oily or greasy applications. Bi-polymer. Combination of nitrile and polyurethane that provides durability, abrasion resistance, softness, and dexterity.

4NMN6

Natural Rubber/Latex
A natural material with elasticity that provides resistance to cuts, punctures, and slashes with a safe, secure grip.

LINERS:

Nylon
Lightweight lining provides high tensile strength and dexterity.

Knit
Standard weight lining allows hands to breathe for cool and comfortable extended-wear protection.

Bamboo
Lighter, softer, and more absorbent than cotton or other synthetic materials. Breathable material wicks moisture away from the skin. 100% natural bamboo knit shells are inherently strong, antibacterial, biodegradable, and provides UV protection.

Condor®

Exclusively from Grainger.

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Appendix E

Prepared by Best Glove, Inc. exclusively for IHN

"The Whys and How's of Hand Protection for Healthier Working Hands"

By Donald F. Groce, Technical Product Specialist, Best Glove, Inc.

It's no accident that the workplace has traditionally referred to workers as "hands."

The human hand, with its 27 bones (including the eight wrist bones), complex network of nerves, muscles and tendons, and an outer skin layer that's only three red blood cells thick, remains critical to the success of industries across the board from high tech laboratories to food processing, manufacturing and distributing enterprises. Protecting it on the job is essential to efficient production and the avoidance of costly injuries and lost work time.

According to the Bureau of Labor Statistics, injuries to the hand, wrist and finger (23 percent of total workplace injuries) are second only to back injuries (24.7 percent). The Bureau estimates there are approximately 110,000 lost-time hand injuries annually.

Hand protection is so important that it is required by the Occupational Safety and Health Administration (OSHA). Most recently, OSHA published a final rule mandating that employers provide, at no cost to employees, almost all personal protective equipment - or, "PPE" - when the PPE is used to comply with OSHA standards. OSHA's Hand Protection Standard, 29 CFR 1910.138, requires that "employers shall select and require employees to use appropriate hand protection [and that] employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified."

The tricky part lies in that last sentence calling for "appropriate hand protection." Knowing what the best choice is for the task to be performed requires knowledge of the hand protection available today. A far cry from the early days when gloves were either cotton or leather, today's hand protection arena includes choices to meet all the requirements of the workplace: chemical resistance, cut resistance, protection from contaminants, thermal protection (hot and cold), improved grip, oil absorption, stealth, high visibility and water proofing. With hundreds of glove styles available, it is essential to understand what to look for.

Fit and Dexterity

No matter what the glove type, it must fit and provide the dexterity necessary for the job.

To determine proper fit, measure the circumference of the hand around the palm or at the base of the metacarpals. The number of inches will help determine the correct size:

≤ 7 inches = Extra Small
7.5 inches = Small
8 inches = Medium
9 inches = Large
10 inches = Extra Large
> 10.5 inches = Extra Extra Large

In general, disposable thin-gauge gloves made from elastomeric polymers such as Natural Rubber Latex (NRL), Nitrile or Neoprene or even plastic PVC offer the greatest dexterity and tactile sensitivity. A disposable glove that is 4 to 8 mils thick provides touch sensitivity for the finest motor manipulation of small parts, laboratory work, patient contact or food preparation. As gloves get thicker, dexterity is traded off in order to gain durability or protection.

Chemical-Resistance

Some disposable Nitrile gloves offer excellent protection from oils and greases and limited splash protection from some chemicals. NRL gloves are not resistant to organic chemicals and especially not to petroleum based chemicals. Nitrile, on the other hand, offers limited protection from many organic chemicals, especially petroleum-based aliphatic hydrocarbons and fuels.

In the laboratory, Nitrile gloves offer very good protection from exposure to dry chemicals and most other laboratory chemicals. They offer even more protection when they are layered. Disposable Nitrile gloves would be inappropriate for use in heavy contact total immersion in a heavy industrial environment. There is no disposable glove that works well with Acetone, one of the most widely used solvents in chemical laboratories.

Here are a few general guidelines for choosing chemical-resistant gloves for specific applications.

Janitorial and Sanitation Chemical Hazard: When choosing gloves for the aqueous chemicals used in janitorial/sanitation operations, a number of gloves work very well, including those coated with NRL, Nitrile, Neoprene and PVC.

Automotive Chemical Hazard: For the chemicals used in the automotive industry such as oils, greases and fuels, Nitrile is the best overall choice. In fact, one of the main other uses for Nitrile is for automotive hoses and parts because Nitrile is not broken down by these types of chemicals. Conversely, NRL gloves are particularly prone to severe degradation in and around oils, grease and fuels. Neoprene offers very good protection, and PVC gloves are used in numerous refining operations because of their extremely longwearing properties and low cost.

Solvents, Acids and Bases Chemical Hazard: The selection process is much more difficult for protection from solvents, acids and bases. Chemical databases provided by glove manufacturers provide the best advice. Sometimes you can make a generalization based on the chemical class such as:

- Butyl or laminate gloves work best for Ketones
- Nitrile works best for aliphatic hydrocarbons or fuels
- Viton or laminate gloves work best for halogenated hydrocarbons or aromatic hydrocarbons
- Neoprene works best for most acids and caustics

However, there are exceptions to these rules and databases such as www.chemrest.com from Best Glove provide the best information for the safest selection. In general, chemical-resistant gloves that do not have a textile substrate offer greater dexterity and touch sensitivity than textile-lined, polymer-coated chemical resistant gloves.

Cut-resistance

The rating system from ANSI standard 105-2005 American National Standard for Hand Protection Selection Criteria is based on ASTM testing for cut resistance. Cut-resistant gloves are ranked from level 0 to level 5, worst to best, based on the weight needed to cut through the materials: Level 0 = < 200 grams to Level 5 = ≥ 3500 grams. It is easy to understand: the higher the level, the more force applied to a sharp object the glove can withstand. There is, however, no glove that offers protection from a circulating or serrated blade. Engineering controls must be relied upon for protection from such motorized blades.

Oil-Absorption

Holding onto oil-coated objects can be a daunting task. The newer sponge, or foam-coated gloves, provide the ability to hold onto oily objects without slippage. These coatings were developed with a greater coefficient of friction to ensure better gripping ability. Oil penetrates the gloves making them better able to grasp the object whereas other coatings repel oil making them slippery.

Protection Against Viral and Bacterial Agents

Disposable gloves provide excellent protection from viral and bacterial agents that may be present in body fluids:

- Medical grade exam gloves are the best choice for blood-borne pathogenic microorganisms.
- Medical grade disposable gloves have a tighter Acceptable Quality Level (AQL) for freedom from pinholes than their industrial grade counterparts.
- Some disposable latex, Nitrile and Neoprene gloves have extensive test data proving their viral barrier efficacy such as certification to NFPA 1999 Standard for Emergency Medical Services. Such certification means that the gloves have passed ASTM viral penetration testing under the auspices of an independent, third-party certification organization.

Durability

Because of their durability and low cost, cotton and leather gloves are often used in environments where multiple tasks are performed and where abrasive materials or heavy objects are handled. Polymer-coated work gloves invariably involve a textile substrate (cotton, nylon, Kevlar® or Dyneema®) and coatings made from NRL, PVC, Nitrile, Neoprene or Polyurethane. The resulting coated gloves have been shown to outwear cotton and leather by 10 to 20 times.

The longest-wearing gloves also have the thickest coatings and, therefore, the least dexterity. To get both excellent dexterity and very long wear, consider gloves with lighter weight coatings or even palm-coated or flat dipped gloves. Newer models offer a three-quarter dip that provides knuckle protection with maximum flexibility.

Hand Protection is Good Business

Choosing the right hand protection for each job is critical. For employees, knowing they are protected and have a safe working environment can be a major catalyst for improved work performance, job satisfaction and positive morale to the benefit of the entire work place environment. For the employer, ensuring the best environment to keep hands healthy pays off in improved worker morale and on the bottom line.

About the Author: Donald F. Groce, Best Glove, Inc. is a technical product specialist and a research chemist. Before joining Best, he worked for the U.S. Centers for Disease Control and Prevention on chemical toxicology studies that included the Agent Orange Study. He is a noted speaker and expert on a variety of occupational and workplace hazards, including latex allergies and chemical exposure-related illnesses. He is a part of the local Citizen's Meth Task Force and serves on the NFPA 1999 Technical Committee and the American Industrial Hygiene Protective Clothing Committee.

Appendix F

Personal Protective Equipment (PPE) Requirements: Eye & Face Protection

Quick Tips #125

Introduction

According to Prevent Blindness America, eye injuries in the workplace are very common. Thousands of eye accidents happen each day and one in 10 injuries requires one or more missed workdays.

It is estimated that using the correct eye protection could lessen the severity or even prevent 90% of eye injuries.

Personal Protective Equipment (PPE) Requirements

General personal protective equipment (PPE) requirements are addressed in Title 29 Code of Federal Regulations (CFR) 1910.132 – Occupational Safety and Health Standards.

"Protective equipment including personal protective equipment for eyes, face, head and extremities, protective clothing, respiratory devices, and protective shields and barriers shall be provided, used and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact." (29 CFR 1910.132(a))

Eye and face protection requirements are outlined in 29 CFR 1910.133:

- Employers must ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.
- Employers must ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on sideshields) meeting the pertinent requirements of this section are acceptable.
- Employers must ensure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards wears eye protection that incorporates the prescription in its design, or wears eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

- Employers must ensure that each affected employee uses equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. (CFR) 1910.132, as determined by the Occupational Safety and Health Administration (OSHA), lists general PPE requirements.

Criteria for Protective Eye & Face Devices

On Sept. 9, 2009 OSHA issued a Final Rule concerning 29 CFR (Part 1910 and others) that revised the personal protective equipment (PPE) requirements for eye and face protective devices, head protection and foot protection. The Final Rule incorporated the latest versions of national consensus and industry standards. Additionally, OSHA also announced its use of "direct final rule" to ensure that when standards change, the law is automatically updated.

Therefore, employers must comply with this Final Rule by using and providing for employees eyewear that are constructed in accordance with any of the last three American National Standards Institute (ANSI) national consensus standards or their proven equivalent:

- ANSI Z87.1-1989 (R-1998), American National Standard Practice for Occupational and Educational Eye and Face Protection
- ANSI Z87.1-2003, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices
- ANSI Z87.1-2010, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices

NOTE: Even though "direct final rule" applies, the process to actually incorporate ANSI Z87.1-2010 into the federal law may take some time.

History of ANSI Z87.1

The first "standard" for head and eye protection dates back to 1922 with the first edition of the Z2 standard by the War and Navy Department and the National Bureau of Standards.

In 1968, the eye and face protection standard was published with the Z87 designation, Z87.1-1968. Since then Z87.1 has been revised four times – 1979, 1989, 2003 and 2010.

The purpose of this standard has remained the same – to provide minimum requirements for eye and face protective devices including selection, use and maintenance of the devices.

ANSI Z87.1 Key Changes

The 2003 editions and its predecessors are organized by the type of device. Each type of device has a "chapter" in the standard that describes the device, the required testing and optical properties and also establishes product marking PPE requirements.

The 2010 standard focuses on the hazards and is organized by the nature of the hazard – impact, optical radiation, droplet and splash, dust and fine dust and mist. This focus encourages users to

evaluate the specific hazards that they are exposed to and to select appropriate protection based on that evaluation. Because of this change, required product markings have changed. Users will have to match the hazard that they need protection from with the marking on the device.

The 2003 versions and predecessors had no defined minimum coverage requirement. The 2010 version has a minimum frontal requirement and for impact rated devices, a lateral coverage requirement:

- The frame front encircling one lens and lens must cover in plane view an area of not less than 40-millimeters (1.57-inches) in width and 33-millimeters (1.30 inches) in height (elliptical) in front of each eye.
- Frames designed for small head sizes must cover in plane view an area of not less than 34-millimeters (1.34-inches) in width and 28-milliliters (1.10-inches) in height.
- Impact rated protectors must provide continuous lateral coverage from the vertical plane of the lenses tangential to a point not less than 10-millimeters (0.394-inch) posterior to the corneal plane and not less than 10-millimeters (0.394-inch) in height [or 8-millimeters (0.315-inch) for small head sizes] above and not less than 10-millimeters (0.394-inch) in height [or 8-millimeters (0.315-inch) for small head sizes] below the horizontal plane.

The 2003 versions and its predecessors had no defined performance criteria for splash/droplet, dust or fine dust. The 2010 revision has specific performance and marking requirements for devices claiming to provide protection from splash/droplet, dust or fine dust hazards.

The 2010 revision eliminates the previous flammability test and replaces it with an ignition test which uses a hot steel rod to determine if the protector will ignite.

The 2003 versions and its predecessors use the "Alderson" head form for product testing. The 2010 revision adopts the European small and medium head form size for testing.

The 2010 version section on selection, use and maintenance has been revised to show recommended protectors for various types of work activities that can expose workers to impact, heat, chemical, dust or optical radiation hazards.

This newer version also addresses aftermarket components. All original equipment manufacturers and non-original equipment manufacturers aftermarket components not sold with the original device must be tested and assembled with the original complete device in the as-worn condition. For aftermarket side shields, the side shields must be tested on representative frames for which the product is specified to fit. Documentation listing all devices that the component or accessory has been tested and is approved for must be made available by the manufacturer. The entity claiming compliance of the component is responsible for testing the assembled device.

ANSI Z87.1 Markings

ANSI Z87.1-1989: Each lens must be distinctly marked with the manufacturer’s monogram. In addition, if applicable the lens must be marked with the appropriate shade and special purpose

designation. All major spectacle components (front with bridge area, lens or lenses, temples and sideshields) except the lens or lenses, and all major goggle components must have a trademark identifying the manufacturer and must be marked "Z87" to indicate compliance with the standard.

ANSI Z87.1-2003: Two levels of protection are described – basic and high impact. Removable lenses must be marked with the manufacturer's monogram and basic impact lenses require no additional mark, but high impact lenses require a "+". Non-removable lenses must be marked with the manufacturer’s monogram and basic impact lenses must be marked "Z87" and high impact lenses must be marked "Z87+". If applicable the lenses must be marked with the appropriate shade and special purpose designation. Spectacles front, at least one temple and removable sideshields and goggles frame and lens housing or carrier must be marked with the manufacturer's monogram and "Z87 or Z87+". Non-removable lens products require only one marking – for spectacles the marking may be placed on the frame or temples and for goggles the marking may be applied to any component including the lens.

ANSI Z87.1-2010: Products are either non-impact or impact protectors. In addition to the manufacturer's monogram, Z87 marking and impact marking, manufacturers must add lens type (welding, UV filter, visible light filter, IR filter, variable tint and special purpose) and use (protection against splash droplet, dust and fine dust) markings when claims of impact rating, specific lens type and/or use are made.

Type of Mark	Description	Marking
Impact	Impact Rated Plano	Z87+
	Impact Rated Prescription	Z87-2+
Non Impact	Plano	Z87
	Prescription	Z87-2

Lens Type	Clear	None
	Welding	W and Shade Number (Shades range from 1.3 to 14 – the higher the number the darker the lens)
	UV Filter	U and Scale Number (Scale ranges from 2 to 6 – the higher the number the highest protection from far and near UV)
	Visible Light Filter	L and Scale Number (Scale ranges from 1.3 to 10 – lower numbers providing greater light transmittance)
	IR Filter	R and Scale Number (Scale ranges from 1.3 to 10)
	Variable Tint	V
	Special Purpose	S
Use	Splash/Droplet	D3
	Dust	D4
	Fine Dust	D5

Definitions

Complete device – A product with all its components in their configuration of intended use, subjected to testing for determination of compliance with the standard.

Component – A functional part of a complete device.

Filter lens – A lens that attenuates specific wavelengths of ultraviolet, visible and/or infrared radiation

Frame – A structure, which holds the lens or lenses on the wearer.

Front – That part of a spectacle or goggle frame that is intended to contain the lens or lenses.

Goggle – A protector intended to fit the face surrounding the eyes in order to shield the eyes from certain hazards, depending upon the hazard type.

Lens – The transparent part of a protector through which the wearer sees.

Lens housing or carrier – That part of a goggle that mechanically houses a lens.

Non-Removable lens – A lens and holder that are homogeneous and continuous or a lens that cannot be removed from the frame/front without damage to the device.

Plano lens – A lens that does not incorporate a corrective prescription.

Protector – A complete device meeting, at a minimum the General Requirements of ANSI Z87.1.

Removable lenses – Prescription or plano lenses fabricated to fit a single spectacle frame.

Replaceable lenses – Interchangeable lens/fronts designed for spectacle or goggle devices that are directly mounted to the frame or shell of the device.

Sideshield – A permanent or detachable part of a spectacle that provides side impact resistance and that may be an original or aftermarket component.

Spectacle – A protector intended to shield the wearer's eyes from certain hazards, depending on the type of hazard.

Temple – That part of a spectacle frame commonly attached to the front and generally extending behind the ear of the wearer.

Ultraviolet radiation (UV) – Electromagnetic energy with wavelengths from 200 to 380 nanometers.

Commonly Asked Questions

Q. When will products conforming with ANSI Z87.1-2010 be available?

A. There will be a time lag before protective eyewear and the packaging with the new markings will be available. At present, there is NO "deadline" to mark, sell, or use products with these new Personal Protective Equipment (PPE) requirements. Manufacturers are planning to manufacture, test and mark their protective devices in compliance with ANSI Z87.1-2010 and compliant products will be phased in as current inventory is depleted.

Q. What should the lenses of my protective eyewear be made of?

A. Most lenses are made from polycarbonate. This lightweight plastic absorbs 99% of UV light, can be purchased in welding shades and is highly impact-resistant.

Q. I need safety glasses for work, but I already wear prescription eyewear. What are my options?

A. Workers who wear prescription lenses must wear a pair of safety glasses that incorporate the prescription in its design, or wear safety glasses that can be worn over prescription lenses without disturbing the proper position of either.

OTG safety glasses can be worn over prescription lenses. Safety reading glasses (with diopters incorporated into the lens design) are also available.

Eyewear frames and prescription insert holders are available through Grainger for your convenience.

Sources

Quick Tips #192: Hazard Assessment Form

29 CFR 1910.132, General Requirements

29 CFR 1910.133, Eye and Face Protection

American National Standard Institute (ANSI)
11 W. 42nd St.
New York, NY 10036
(212) 642-4900

ANSI Z87.1-1989, American National Standard for Occupational and Educational Eye and Face Protection

ANSI Z87.1-2003, American National Standard for Occupational and Educational Eye and Face Protection Devices

(Rev. 5/2014)

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Appendix G

Eyewear Lens Type Selection

Quick Tips #376

Choosing protective eyewear is not as simple as simply finding a pair of safety glasses that meet the American National Standards Institute (ANSI) standard, ANSI Z89.1 Occupational and Educational Eye and Face Protection. There are many more features available for eyewear that can help ensure you have the best eyewear for the job you need to do. These features include lens coatings, lens tints/colors, welding filter shades and sizing.

Lens Coatings

Lens coatings are made to enhance the versatility (and even the life span) of a pair of safety glasses. These coatings are often available separately or in combination with other coatings for more functionality. One available coating is an anti-scratch coating. This coating is designed to protect the lens when subjected to repeated impacts such as grinding applications. It can also extend the life of glasses when they are stored in conditions that would precipitate scratches. Some of these coatings are added on top of the standard lens while others are permanently bonded to the lens for even longer life.

Anti-fog coated lenses are another option to get the best performance out of safety glasses. This type of lens coating is designed to help reduce fogging in conditions such as cold-to-warm temperature transitions, humid environments or half-mask respirator applications. While anti-fog coating is not 100% fog free, fogging can be limited by using a fog-free lens, getting a pair of eyewear that sits further away from the face and supplementing the lens coating by adding an anti-fog cleaner or spray.

Anti-Static coatings are another option that is available. This type of coating reduces the dust and particulate levels that stick to a pair of eyewear. This coating would work well in environments where particulate levels are a concern or where dusts and particulates sticking to the lens would create a safety concern due to reduced visibility.

Mirror coatings in a variety of colors can be added to both clear and tinted lenses and are used to reduce glare. Mirror coatings on clear lenses are appropriate for indoor glare reduction and for workers going from light to dark conditions. Mirrored coatings on tinted lenses are most appropriate for outdoor work in bright conditions where glare is a concern.

Lens Tints/Color Options

Eyewear lenses are available in many colors and tints. Selecting the correct colored lens for the application is important to get the best visual acuity.

Clear lenses are appropriate for general indoor applications or outdoor applications with low light conditions. Clear lenses made of polycarbonate will remove approximately 99.9% of dangerous UV light. Most brands provide protection from UV wavelengths to at least 380nm while others, such as Uvex, protect up to 400nm. For specific UV light applications, always look into the properties of the specific eyewear to ensure you are protected from the wavelength you are exposed to.

Gray lenses are typically referred to as a sunglass style tint. They are used in environments where bright light conditions and glare could cause eye fatigue. A gray lens provides good color recognition but should not be used in low light conditions as it can block too much light.

Brown/Espresso lenses are similar to gray lenses and can be used like a sunglass lens where bright light conditions or glare can cause eye fatigue. This lens should not be used in low light conditions.

Indoor/Outdoor lenses are used for employees who go from light to dark conditions or need to reduce glare in indoors conditions due to harsh lighting. An indoor/outdoor lens is a clear lens with a mirrored surface to reduce glare. This lens is not a photochromic (auto darkening) lens.

Amber lenses are appropriate for low light conditions. This lens color blocks blue light and gives optimum contrast. This lens should not be used at night as too much light is blocked.

Light blue lenses reduce glare and the yellow tint often given off by industrial/sodium vapor lighting. Yellow light can cause eye strain and fatigue.

Vermillion lenses enhance contrast while color perception is unaffected. They are often used in inspection applications where color acuity is needed.

Photochromic lenses transition from light to dark with changing light conditions.

Dark Green lenses offer general purpose protection from glare and UV. This tint should not be confused with a welding filter shade and will not provide adequate protection during soldering, torch blazing, cutting, gas welding or electric arc welding.

Welding Filter Shades

These filter shade lenses are designed specifically to be worn during soldering, torch blazing, cutting, gas welding and electric arc welding operations. They should never be worn as a general purpose sunglass or for driving due to reduced light transmittance and the color distortion associated with filter shades.

OSHA's (Occupational Health and Safety Administration) standard on eye and face protection, 29 CFR 1910.133(a)(5) references the filter lenses that are appropriate based on the operation being performed. See Grainger's Quick Tips #109 for more information on selecting the appropriate welding shade.

Lens Sizing

Most eyewear is made in a standard size to fit most faces. But in situations where a one-size-fits-all approach doesn't work, in many cases other sizes are available to make wearing safety glasses comfortable.

OTG or over-the-glass eyewear is made to facilitate wearing safety glasses over prescription glasses. These glasses have a wider frame and lens to allow for most prescription eyewear to be worn underneath.

Large safety glasses are made for people with wider facial features, while size small glasses are available for women and individuals with smaller or narrower faces.

Commonly Asked Questions

Q I need protection from UV light, what eyewear will provide protection?
A All clear polycarbonate eyewear provides 99.9% protection from UV up to approximately 380nm. For specific UV product applications and wavelengths, check to see if the eyewear selected will cover your needs.
Q I used a fog-free product on my lenses and they still fog up when I leave my freezer. What's going on?
AFog-free cleaners and wipes are made to minimize fogging but in some extreme conditions fogging will still happen due to the physics of the moisture molecules from the wearer being attracted to the nearest surface. Nothing is ever 100% fog-free in all conditions.
Q I've used welding shades in the past and they are green to dark green. Can I use a dark green colored safety glass in place of a shaded lens?
A No, welding filter shades are designed to protect from optical/radiant energy which includes specific requirements for UV ranges and infrared protection. A green tinted lens will not provide any of those protections for welding.

Sources

OSHA Eye and Face protection standard

ANSI Z87.1-2010 Standard for Occupational and Educational Person Eye and Face Protection Devices

Uvex Lens Technology Brochure

Elvex FAQ Eyewear Protection

Quick Tips #109

Elvex UV Nanometer and Shade Chart

UVEX Lens Tint Reference Guide

(Rev. 9/2013)

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Lens Coatings

Lens coatings are made to enhance the versatility (and even the life span) of a pair of safety glasses. These coatings are often available separately or in combination with other coatings for more functionality. One available coating is an anti-scratch coating. This coating is designed to protect the lens when subjected to repeated impacts such as grinding applications. It can also extend the life of glasses when they are stored in conditions that would precipitate scratches. Some of these coatings are added on top of the standard lens while others are permanently bonded to the lens for even longer life.

Anti-fog coated lenses are another option to get the best performance out of safety glasses. This type of lens coating is designed to help reduce fogging in conditions such as cold-to-warm temperature transitions, humid environments or half-mask respirator applications. While anti-fog coating is not 100% fog free, fogging can be limited by using a fog-free lens, getting a pair of eyewear that sits further away from the face and supplementing the lens coating by adding an anti-fog cleaner or spray.

Anti-Static coatings are another option that is available. This type of coating reduces the dust and particulate levels that stick to a pair of eyewear. This coating would work well in environments where particulate levels are a concern or where dusts and particulates sticking to the lens would create a safety concern due to reduced visibility.

Mirror coatings in a variety of colors can be added to both clear and tinted lenses and are used to reduce glare. Mirror coatings on clear lenses are appropriate for indoor glare reduction and for workers going from light to dark conditions. Mirrored coatings on tinted lenses are most appropriate for outdoor work in bright conditions where glare is a concern.

Lens Tints/Color Options

Eyewear lenses are available in many colors and tints. Selecting the correct colored lens for the application is important to get the best visual acuity.

Clear lenses are appropriate for general indoor applications or outdoor applications with low light conditions. Clear lenses made of polycarbonate will remove approximately 99.9% of dangerous UV light. Most brands provide protection from UV wavelengths to at least 380nm while others, such as Uvex, protect up to 400nm. For specific UV light applications, always look into the properties of the specific eyewear to ensure you are protected from the wavelength you are exposed to.

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Appendix H

QuickTips TECHNICAL RESOURCES Safety

Face Shield Protection

Quick Tips #373

Face shield protection is an important part of personal protective equipment (PPE). OSHA regulation 29 CFR 1910.133 gives the requirements for employers to follow on the appropriate use and selection of face shields and protective eyewear. OSHA relies on ANSI to provide manufacturing standards for face shields as well as other eye and facial protective equipment. The manufacturing standard is ANSI Z87.1 and is titled, "American National Standard Practice for Occupational and Educational Eye and Face Protection." The ANSI manufacturing standards for face shields includes testing for impact and optical clarity. Face shields are primarily designed to protect the face from flying objects, molten metal, liquid chemical splash, bodily fluids and potentially injurious light radiation.

The most current ANSI standard for eye and face protection is ANSI Z87.1 - 2010. Changes for the 2010 revision include the following:

- More emphasis on specific hazard as opposed to protector type
- Impact standards were changed from "basic impact" and "high impact" (2003 standard) to "non-impact" and "impact" (2010 standard)
- Greater side to side and top to bottom coverage
- New testing for splash, dust and fine dust

The ANSI 2003 standard states that face shields are considered secondary eye protection and must be used in conjunction with safety glasses or goggles. The 2010 standard does not distinguish between primary and secondary eye protection. Most manufacturers of face shields suggest using safety glasses or goggles underneath face shields for additional eye protection.

OSHA recognizes the revised 2010 standard. OSHA also recognizes the 2003 and 1989 (R1998) ANSI standards for eye and face protection. By recognizing the 2003 and 1989 standards, employers are allowed to continue to use eye and face shield protection products meeting the 2010, 2003 or 1989 (R1998) standards.

Face Shield Visor Materials

Face shield visors are constructed from several types of materials. These materials include polycarbonate, propionate, acetate, and PETG (polyethylene terephthalate glycol). It is important to select the proper visor for the work environment.

Polycarbonate - Polycarbonate material provides the best impact resistance and heat resistance of all visor materials. Specialty polycarbonate visors are also used for arc flash protection and high heat and radiation protection. Polycarbonate also provides chemical splash protection and

holds up well in extremely cold temperatures. Polycarbonate is generally more expensive than other visor materials.

Acetate - Acetate provides the best clarity of all the visor materials and tends to be more scratch resistant. It also offers chemical splash and may be rated impact protection.

Propionate – Propionate material provides better impact protection than acetate while also offering chemical splash protection. Propionate material tends to be a lower price point than both acetate and polycarbonate.

PETG - PETG offers chemical splash protection and may provide impact protection. PETG tends to be the most economical option for face shield choices.

ANSI does not provide a standard that applies to chemical splash protection or chemical resistance. The manufacturer of the face shield is the best source for information on chemical resistance testing.

Some face shield visors come in steel or nylon mesh material. Mesh visors provide good airflow for worker comfort and are typically used in the logging and landscaping industry to protect the face from flying debris when cutting wood or shrubbery.

Specialty Face Shield Protection

Specialty face shields for arc flash, heat, radiation, and welding protection are available as well. Specialty shields such as these may need to meet specific requirements and it is generally best to contact a safety supply provider such as Grainger technical support to determine what protective shield will be most appropriate for your application or need.

Arc Flash - These face shields are used for protection against an arc flash. The requirements for arc flash protection are provided by National Fire Protection Association (NFPA) in the NFPA's 70E standard. Face shields are included in this standard and must provide protection based on Arc Thermal Performance Value (ATPV) which is measured in calories per square centimeter (cal/cm2). The calorie rating will need to be determined first in order to be able to select the shield that will provide the best protection. In determining the level of protection needed for your job or task, some methods available to you are; referring to the NFPA 70E-2012 Article 130 tables 130.4 (C)(a) or (b), 130.7 (C)(15)(a) and 130.7 (C) (16) or Annex D. Another option is to use an industry accepted software program or use a consulting firm to complete the risk assessment.

Heat and Radiation - There are face shields that will provide protection against heat and radiation. These face shields prevent burns by filtering out intense ultraviolet and infrared radiation. They are made from polycarbonate with special coatings. An example of this would be adding a thin layer of gold film to increase reflectivity.

Welding - Shaded welding face shields provide protection from UV and Infra-red radiation generated when working with molten metal. The shades usually range from Shade 2 – 14 with

Shade 14 being the darkest shade. Refer to Quick Tips #109: Welding Safety for more information and proper selection of welding face shields.

When selecting a face shield or any other PPE, OSHA suggests conducting a worksite hazard assessment. OSHA provides guidelines in 29 CFR 1910 Subpart I Appendix B on how to evaluate worksite hazards and select the proper PPE. After selecting the proper PPE, employers should provide training to workers on the correct use and maintenance of their PPE. Proper hazard assessment, PPE selection and training can significantly reduce worker injuries and ensure a safe work environment.

Frequently Asked Questions

Q. What is the best face shield visor for a specified chemical?

A. OSHA suggests that PPE such as face shield protection should be used as a last resort and an engineering solution is preferable when working with injurious chemicals. Engineering solution examples include using a chemical splash guard or a fume hood. A chemical splash guard or a fume hood will stop injurious chemicals from ever reaching the face. If an engineering solution is not practical, a face shield visors will offer limited chemical splash protection. The manufacturer of the face shield is the best source for chemical resistance data. If, for example, a face shield is needed for hydrochloric acid splash protection, contact the manufacturer of the face shield to inquire about its resistance to this chemical.

Q. Can I use an inexpensive face shield for impact protection?

A. The revised ANSI Z87.1 – 2010 categorizes face shields as either impact or non-impact. All ANSI Z87.1 rated face shields with a "+" symbol stamped on the face shield (meaning impact rated) provide impact protection regardless of price. Manufacturer testing of visor materials indicate that polycarbonate offers the best impact protection and PETG the least amount of protection from impact force. This said, visors made from both polycarbonate and PETG may meet the ANSI testing standards for impact, even though polycarbonate is generally most expensive visor material. OSHA states that the employer must provide PPE to workers that give sufficient protection from the hazard. Polycarbonate would be a better choice if the hazard requires a higher impact protection than PETG.

Sources

- ANSI Z87.1 – 2003 AND 2010
- 29 CFR 1910.133
- Elvex FAQ Face Protection
- Quick Tips #109: Welding Safety
- http://www.plasticsintl.com/datasheets/PETG.pdf
- http://www.osha.gov/SLTC/etools/safetyhealth/comp3.html
- http://www.osha.gov
- http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10120

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Appendix H

QuickTips TECHNICAL RESOURCES Safety

Face Shield Protection

Quick Tips #373

Face shield protection is an important part of personal protective equipment (PPE). OSHA regulation 29 CFR 1910.133 gives the requirements for employers to follow on the appropriate use and selection of face shields and protective eyewear. OSHA relies on ANSI to provide manufacturing standards for face shields as well as other eye and facial protective equipment. The manufacturing standard is ANSI Z87.1 and is titled, "American National Standard Practice for Occupational and Educational Eye and Face Protection." The ANSI manufacturing standards for face shields includes testing for impact and optical clarity. Face shields are primarily designed to protect the face from flying objects, molten metal, liquid chemical splash, bodily fluids and potentially injurious light radiation.

The most current ANSI standard for eye and face protection is ANSI Z87.1 - 2010. Changes for the 2010 revision include the following:

- More emphasis on specific hazard as opposed to protector type
- Impact standards were changed from "basic impact" and "high impact" (2003 standard) to "non-impact" and "impact" (2010 standard)
- Greater side to side and top to bottom coverage
- New testing for splash, dust and fine dust

The ANSI 2003 standard states that face shields are considered secondary eye protection and must be used in conjunction with safety glasses or goggles. The 2010 standard does not distinguish between primary and secondary eye protection. Most manufacturers of face shields suggest using safety glasses or goggles underneath face shields for additional eye protection.

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Sources

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- http://www.plasticsintl.com/datasheets/PETG.pdf
- http://www.osha.gov/SLTC/etools/safetyhealth/comp3.html
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Appendix I

Hearing Protection Guide

Quick Tips #305

Introduction

It is estimated that approximately 30 million people in the U.S. are occupationally exposed to hazardous noise levels. One of the most common methods for minimizing worker exposure to these hazardous noise levels is the use of hearing protectors. Before selecting hearing protection for use in your facility, several questions should be considered, including:

- Are we required to provide hearing protection?
- Does the hearing protector provide adequate noise reduction?
- What types of hearing protectors are available?
- Is the hearing protector compatible with any other Personal Protective Equipment (PPE) we are using?

This hearing protection guide will address these issues and provide some guidelines for selecting the most appropriate hearing protectors for your application.

Regulations

The use of hearing protectors is detailed in the Occupational Noise Exposure Standard - 29 CFR 1910.95 **Section (i)** of this standard states:

"Employers shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees."

This section further requires that employers must provide their employees a variety of hearing protectors to choose from, training on use and maintenance of hearing protectors and ensure that hearing protectors are worn by all employees who meet the requirements of this standard.

Noise Reduction Rating

The **noise reduction rating (NRR)** is defined as the maximum number of decibels (dB) that the hearing protector will reduce the sound level when worn. **Section (j)** of 1910.95 states that the hearing protector should have a NRR sufficient to reduce the employees exposure to a time weighted average (TWA) of 90dB (decibels) (or 85dB for employees who have had a standard threshold shift). Appendix B of the same standard also provides some correction factors when using the NRR to assets the adequacy of the hearing protector.

1. If using a C-weighted TWA, subtract the NRR from the TWA to determine the attenuated noise level. (i.e. TWA[C] NRR = Attenuated Noise Level).*

2. 2) If using an A-weighted TWA, first subtract 7dB from the NRR, then subtract the remainder from the TWA to determine the attenuated noise level. (i.e. A weighted TWA[A] (NRR - 7db) = Attenuated Noise Level).*

OSHA also recommends reducing the NRR by an additional safety factor of 50%; however, this is only a suggestion, and citations cannot be issued for not using this 50% reduction factor.

**For a full definition of the A and C weighting scales.*

Types of Hearing Protection

A wide variety of hearing protection is available, each with their own unique set of advantages and disadvantages. The most common types are:

Disposable earplugs: These are the most common type of hearing protection. They are usually made of a PVC (polyvinyl chloride) or PU (polyurethane) foam. Disposable earplugs are compressed or rolled down prior to insertion, and then they slowly re-expand to fill the ear canal. These earplugs are usually available with or without a pre-attached cord and are usually one size fits all. (Some sized plugs may also be available.) This type of earplug is intended for single use. Disposable earplugs are not intended to be cleaned or reused.

Figure 1

Reusable earplugs: Made of flexible material, such as silicone, and tapered to fit the ear canal. These are intended to be reused and can be cleaned using soap and water. Available either corded or uncorded. While these are more durable than disposable earplugs, they typically have a lower NRR. Both reusable and disposable earplugs are small enough to be used with any other head/face/eye protective equipment, such as hard hats, face shields or safety glasses.

Figure 2

Hearing bands: Consist of a pair of earplugs connected to a flexible band, which can be worn in a number of positions (over the head, under the chin or behind the neck). The NRR of these bands is similar to most earplugs. The band allows this item to be stored around the neck while not in use. Depending on which position the band is worn in, these can be used with most any hardhat, face shield or glasses.

Figure 3

Earmuffs: Rigid cups with soft cushions seal around the ears to block noise. Typically an earmuff with a higher NRR tends to be bulkier (larger cups with more sound-reducing insulation) than an earmuff with a lower NRR. Earmuffs are usually constructed of plastic materials (these are called **dielectric** and are ideal for work around electrical hazards) or a combination of metal and plastic for added durability. The three common designs of earmuffs are **over the head** (see Figure 4a), **cap mounted** (Figure 4b) and **behind the neck** (Figure 4c). Cap-mounted earmuffs are designed to mount directly to most hard hats with side-accessory slots. Behind-the-neck style can also be used while wearing a hard hat or face shield.

Figure 4a

Figure 4b

Figure 4c

Electronic earmuffs: These provide the same hearing protection as standard earmuffs but also offer other features, such as AM/FM radio reception, two-way radio reception or amplification of low sound levels.

Figure 5

Commonly Asked Questions

Q. Can earmuffs and earplugs be used together to provide more noise reduction?

A. Yes. OSHA allows for earplugs to be worn underneath earmuffs. The NRR this will produce is calculated by adding 5dB to the NRR of whichever protector (the earplug or the earmuff) has the higher NRR. Keep in mind that this is after the necessary reduction factor of 7dB (if using the A weighted scale) has been calculated. For example, if you were using an earplug with a NRR of 32dB with an earmuff with 27dB NRR, your noise reduction calculations would be:

- 32dB[A] (earplug) 7db (OSHA Safety Factor) = 25dB
- 25dB + 5dB (for using earmuff and earplug together) = 30dB
- Total corrected NRR = **30dB**

Sources

Hazard Assessment Form
29 CFR 1910.95, Occupational Noise Exposure

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Appendix J

QuickTips TECHNICAL RESOURCES Safety

Hard Hat Requirements

Quick Tips #241

The Occupational Safety and Health Administration (OSHA) guidelines for head protection are referenced in 29 Code of Federal Regulations (CFR) 1910.135 and 1926.100.

Occupational Hard Hats

29 CFR 1910.135(a)(1) states, "Each affected employee shall wear protective helmets when working in areas where there is a potential for injury to the head from falling objects." The standard also covers conditions where electrical hazards are present. 1910.135(a)(2) states, "Protective helmets designed to reduce electrical shock hazard shall be worn by each such affected employee when near exposed electrical conductors which could contact the head." "Affected Employees" are defined by OSHA as "those employees who are exposed to the hazard(s) identified as violation(s) in a citation." This definition has been added to clarify that the term, as used in this regulation, applies specifically to those employees who are put at risk by the safety or health hazard cited by the OSHA Compliance Officer.

Although the OSHA standards themselves do not identify specific occupations or applications where a hard hat is required, appendix B to subpart I part 9 lists some examples. It states "Some examples of occupations for which head protection should be routinely considered are: carpenters, electricians, lineman, mechanics and repairers, plumbers and pipe fitters, assemblers, packers, wrappers, sawyers, welders, laborers, freight handlers, timber cutting and logging, stock handlers, and warehouse laborers." The appendix also provides examples of general applications where hard hats should be worn.

Performance Criteria

The performance criteria for head protection is provided in the American National Standards Institute (ANSI) Z89.1 American National Standard for Industrial Head Protection. This Standard is incorporated in 29CFR 1910.135 and by reference in 29CFR 1910.6.

Which Consensus Standards are applicable to Hard Hat Regulations?

On September 9, 2009, OSHA issued an update to its personal protective equipment (PPE) standards. The final rule went into effect in October that year and revised the PPE sections of OSHA's general industry, shipyard employment, longshoring, and marine terminals standards regarding requirements for eye- and face-protective devices, head protection and foot protection.

The revision updated the references in these regulations to recognize the more recent editions of the applicable national consensus standards (ANSI/ISEA 789.1). It allows employers to use PPE constructed in accordance with any of three national consensus standards, the two most recent and the incorporated reference in the current standards (OSHA 1910.135).

ANSI Z89.1-1997

ANSI Z89.1-1997 separates protective hard hats into different types and classes.

“Type” is used to designate whether a hard hat provides protection strictly from blows to the top of the head (Type I) or protection from blows to both the top and sides of the head (Type II).

Under Z89.1-1997, the following three classes are recognized:

- **Class G (general) helmets**: Class G helmets are proof tested at 2,200 volts
- **Class E (electrical) helmets**: Class E helmets are proof tested at 20,000 volts
- **Class C (conductive) helmets**: This class provides no electrical insulation.

According to the ANSI/ISEA standard, hard hats must also contain user information such as instructions pertaining to sizing, care and service life guidelines.

Every hard hat conforming to the requirements of ANSI Z89.1-1997 must be appropriately marked to verify its compliance. The following information must be marked inside the hard hat:

- The manufacturer's name or identifying mark
- Date of Manufacture
- The legend, "ANSI Z89.1"
- The Type and Class Designation
- The approximate headsize range

ANSI Z89.1-2003

ANSI published a revision to the Z89.1-1997 standard in 2003. The most significant changes from the 1997 version were made to harmonize with other national standards that test and evaluate equipment performance. In addition, many physical hard hat requirements that do not provide added user value, or that limited design or performance, were removed.

ANSI Z89.1-2009

ANSI published a revision in January of 2009. The significant changes from the 2003 version include three non-mandatory tests.

The three optional hard hat test criteria are:
Reverse donning: Hard hats marked with a "reverse donning arrow"  can be worn frontward or backward in accordance with the manufacturer's wearing instructions. They pass all hard hat testing requirements, whether worn frontward or backward.

Lower temperature: Hard hats marked with an "LT" indicate that the hard hat meets all testing requirements of the standard when preconditioned at a temperature of -30°C (-22°F).

High visibility: Hard hats marked with an "HV" indicate that the hard hat meets all testing requirements of the standard for high visibility colors. This includes tests for chromaticity and luminescence.

Service Life

One common misconception is that hard hats have a predetermined service life - that is not the case. Both the 1986 and 1997 ANSI standards address service life under maintenance and care of the hard hat. The standards state that all hard hat components should be inspected daily for signs of dents, cracks, penetration and any damage due to impact, rough treatment or wear. Although it is not considered a "shelf life", MSA brand hard hats do have "Useful Service Life Guidelines". These guidelines suggest replacing the suspension every 12 months and the hard hat after 5 years of use. Any hard hat that fails the visual inspection should be removed from service until the problem is corrected.

In addition to everyday wear and tear, ultraviolet (UV) radiation can pose a problem for hard hats constructed of plastic materials. Damage caused by UV radiation is easy to spot: the hat will lose its glossy finish and eventually take on a chalky appearance. Further degradation could cause the shell to actually start flaking away. Once the effects of UV radiation are detected, the hard hat shell should be immediately replaced.

Commonly Asked Questions

Q. Can I paint or put decals on my hard hat?

A. OSHA would consider painting or placing adhesive stickers acceptable if the manufacturer authorizes the alteration or the employer can demonstrate the reliability of the helmet is not affected by the paint or the adhesive on the stickers, and if the paint or placement of stickers would not reduce the ability to identify defects (i.e., use of see-through stickers) or other conditions that would indicate a reduced reliability.

Q. Can I wear my hard hat backward?

A. Most likely. Check the hard hat for the "reverse donning arrow" 2marking. The current 2009 edition addresses the issues of reverse wearing of hard hats. The standard now provides a non-mandatory test protocol that will allow manufacturers of hard hats to test the helmet and be marked with the "reverse donning arrow" 2. This means the hard hat can be worn frontward or backward in accordance with the manufacturer's wearing instructions.

Q. Can a cap, scarf, liner or other items for purposes of cold weather protection be worn safely with a hard hat?

A. OSHA recommends that employers permit only liners that are specifically designed to be compatible with the protective properties of the hard hat. They also recommend that the employer contact the hard hat manufacturer to determine if any type of liner or garment is compatible with the use of the hard hat. Further information can be found in OSHA’s Standard Interpretations Letter dated April 17, 2006.

Q. How can I tell what size hard hat to wear?

A. Here is a simple chart that converts the circumference of your head into hard hat sizing.

Sizing Chart		
HAT SIZE	**CIRCUMFERENCE**	
	Centimeters	**Inches**
6-1/2	52	20-1/2
6-5/8	53	20-7/8
6-3/4	54	21-1/4
6-7/8	55	21-5/8
7	56	22
7-1/8	57	22-3/8
7-1/4	58	22-3/4
7-3/8	59	23-1/8
7-1/2	60	23-1/2
7-5/8	61	23-7/8
7-3/4	62	24-1/4
7-7/8	63	24-5/8
8	64	25
8-1/2	68	26-1/2
Note: This table is intended for sizing guidance of round head bands only and should not be construed as prohibiting larger or smaller headbands.		

Sources

Quick Tips #192: Hazard Assessment Form

OSHA 29 CFR 1910.135,
Occupational Head Protection Standard

1910 Subpart I App B,
Non-mandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection.

ANSI Z89.1-2009,
American National Standard for Personal Protection—Protective Headwear for Industrial Workers

ANSI Z89.1-2003,
American National Standard for Personal Protection—Protective Headwear for Industrial Workers

ANSI Z89.1-1997,
American National Standard for Personal Protection Protective Headwear for Industrial Workers

OSHA's Standard Interpretations Letter dated April 17, 2006.

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Appendix K

QuickTips TECHNICAL RESOURCES Safety

Respirator Fit Testing Requirements and Procedures

Quick Tips #140

Regulations

When OSHA's revised *Respiratory Protection Standard*, 29 CFR 1910.134, became effective on April 8, 1998, it provided employers with an all-inclusive reference source for fit testing guidelines. Before its revision, the standard made reference to testing a respirator's "face-piece-to-face seal," but provided no additional guidance on how to perform the test. The standard now specifies what needs fit testing, the kinds of fit tests allowed, the procedures for conducting them and how frequently fit tests must be performed.

What's Covered

29 CFR 1910.134(f) states, "Before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style and size of respirator that will be used." This statement is noteworthy because it mandates that tight-fitting positive pressure facepieces such as those used in PAPRs and airline respirators be fit tested. The statement also does not exclude disposable particulate respirators from fit testing. See Quick Tips #318: Quantitative Fit Testing.

Two methods are acceptable for fit testing a tight-fitting positive pressure mask:

1. The mask can be converted into a negative pressure respirator and equipped with filters appropriate to the fit test protocol being followed, or
2. An identical negative pressure respirator can be used as a surrogate for fit testing as long as it has the same sealing surfaces as the positive pressure respirator.

Fit Testing Procedures

Within the standard, employers are provided the option of conducting either a quantitative or qualitative fit test. The individual performing the fit test procedure requires no special certification. However, the individual must be able to prepare the test solutions, calibrate the equipment and perform the tests properly, recognize invalid tests, and ensure that test equipment is in proper working order. The ability to calculate fit factors is also a requirement for the individual administering a quantitative fit test (QNFT).

As defined in the standard, a QNFT means "an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator." A QNFT is necessary for respirators that must achieve a fit factor of greater than 10.

A QNFT uses an instrument to take a sample from within the wearer's breathing zone while the respirator is being worn. In addition to the instrument, a challenge agent and a probed respirator (or probed adapter for a standard respirator) are necessary to perform a QNFT. A QNFT is more precise than a qualitative fit test; it's also less commonly performed because of the complexity of the procedure and the prohibitive cost of the analyzation instrument. The protocol for a QNFT is detailed in Appendix A, subpart C to 29 CFR 1910.134.

The standard defines a qualitative fit test (QLFT) as "a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent." A QLFT, according to 29 CFR 1910.134(f)(6), "may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less."

The downside to a QLFT is that it relies upon the subjective response of the individual being tested, so that reproducibility and accuracy may vary. The upside is that a QLFT is simpler to perform than a QNFT; the necessary testing equipment is also more accessible and economical.

Within appendix A of the standard, the following four acceptable QLFT protocols are defined: Isoamyl Acetate (more commonly known as banana oil), Saccharin Solution Aerosol, Bitrex™ Solution Aerosol, and Irritant Smoke (Stannic Chloride).

The test method performed will dictate the type of air-purifying element that's used on the facepiece. The isoamyl acetate QLFT requires respirators equipped with organic vapor cartridges. Both the saccharin and bitrex™ QLFT require respirators equipped with particulate filters (either 95, 99 or 100 series filters are acceptable). To perform the irritant smoke test, the respirator needs to be equipped with either a P100 series particulate filter or HEPA filter.

It's important to note that when performing the irritant smoke test, no form of enclosure or hood for the test subject is to be used. The other QLFTs all require the use of an enclosure. Complete instructions for all QLFTs are detailed within appendix A to 29 CFR 1910.134.

Three Approved Methods for QNFT

1. Generated Aerosol Booth System QNFT uses an aerosol mixture (commonly corn oil) administered in a test chamber or booth. The subject stands inside the booth or chamber and performs a series of exercises as the instrument samples how much challenge agent leaks into the respirator. This system is not widely used due to the high maintenance required to clean the equipment and the relatively large size of the system.
2. Ambient Aerosol QNFT instruments measure aerosol concentrations inside and outside the test respirator and compute the fit factor. The challenge agents used in this test includes ambient microscopic dust in the air and other aerosols. Ambient aerosol fit testers use a technology referred to as condensation nuclei counting (CNC) or condensation particle counting (CPC). These testers use laser technology to count particles. The respirator used in the test is equipped with P100 (HEPA) filters that prevent the ambient particles from passing into the respirator. Accessories are also available to conduct a QNFT on lower class filters, such as the 95 class filters, commonly

found in disposable filtering facepiece respirators. One of the more common ambient aerosol fit testers is the TSI Portacount.

3. Controlled Negative Pressure (CNP) QNFT involves the instrument pulling affixed vacuum on the respirator and the instrument measuring the airflow, or leak rate, needed to maintain the vacuum. There are two drawbacks to this type of testing: 1) the subject must hold their breath and remain motionless during the measurement, and 2) CNP testing cannot be performed with filtering facepiece respirators.

Advantages of QNFT vs. QLFT

There are several advantages to QNFT:

- QNFT is an objective test and eliminates the subjectivity of a persons sense of smell, taste and sensitivity to challenge agents.
- QNFT is suitable for determining higher levels of fit that may be required for full-face, gas masks, or other respirators.
- QNFT provides faster, more precise and hard copy documentation of the instrument results.
- QNFT eliminates the chances of deception often found in QLFT.

Frequency

29 CFR 1910.134(f)(2) states, "The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter." In addition, fit testing must be repeated "whenever the employee reports, or the employer, PLHCP (physician or other licensed healthcare professional), supervisor, or program administrator makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight."

Also, an employee who's passed a fit test but later finds the fit of the respirator unacceptable must be given a reasonable opportunity to select a new facepiece and be retested.

Record Keeping

The employer is responsible for recording the results of fit testing. As stated under 29 CFR 1910.134(m)(2), the following information must be recorded: The name of the employee; the type of test performed (QLFT or QNFT); specific respirator tested; date of the test; and the results of the test. This information must be retained until the next fit test is administered.

Fit Checking

Fit testing should not be confused with a respirator fit check. A fit check, or "user seal check" as it's referred to in appendix B to 29 CFR 1910.134, should be performed each time a tight-fitting respirator is donned to ensure there's an adequate seal. The appendix provides guidelines for

performing positive- and negative-pressure fit checks but states, "User seal checks are not substitutes for QLFTs or QNFTs."

Source

29 CFR 1910.134, Respiratory Protection Standard

(Rev. 5/2014)

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Appendix L

QuickTips TECHNICAL RESOURCES Safety

Fall Protection Equipment

Quick Tips #130

Introduction

Before you can begin a fall protection program, you must identify the potential fall hazards in your workplace. Any time a worker is at a height of six feet or more (4 feet in general industry), the worker is at risk and needs to be protected. The two ways of accomplishing this are: engineering controls and fall protection equipment. Engineering controls can be as simple as moving the work to ground level and eliminating the work height. Or they can mean the addition of platforms, railings and toe boards to provide permanent, secure access to high maintenance areas and devices. The number of engineering controls is extensive, so contact your plant engineering or maintenance department for further assistance. When engineering controls are not feasible or practical, such as construction or maintenance projects, a personal fall protection system is employed to prevent injuries from falls.

Fall Protection Systems

Fall protection systems can consist of devices that arrest a free fall or devices that restrain a worker in position to prevent a fall from occurring. A fall arrest system (see Figures A, B and C) is employed when a worker is at risk of falling from an elevated position. A positioning system (see Figure D) restrains the elevated worker, preventing him from getting into a hazardous position where a fall could occur, and also allows hands-free work. Both systems have three components: harnesses or belts, connection devices and tie-off points.

Harnesses and Belts

Full-body harnesses wrap around the waist, shoulders and legs (see Figures A, B and C). A D-ring located in the center of the back provides a connecting point for lanyards or other fall arrest connection devices. In the event of a fall, a full-body harness distributes the force of the impact throughout the trunk of the body—not just in the abdominal area. This allows the pelvis and shoulders to help absorb the shock, reducing the impact to the abdominal area.

Maximum force arrest on a full-body harness, which is used for the most severe free fall hazards, is 1800 pounds. Full-body harnesses come with optional side, front and shoulder D-rings. The side and front D-rings are connection points used for work positioning, and the shoulder D-rings are for retrieval from confined spaces.

Three factors determine the arresting force from a fall: lanyard material type, free fall distance and the weight of the worker. The use of a shock-absorbing lanyard or a higher tie-off point will reduce the impact force.

Belts are used in positioning system applications. These belts have two side D-rings, and are used only for restraining a worker in position. This type of belt is not used for any vertical free fall protection (see Figure D).

IMPORTANT NOTE: ANY EQUIPMENT EXPOSED TO A FALL MUST BE TAKEN OUT OF SERVICE AND NOT USED AGAIN FOR FALL PROTECTION.

Connection Devices

Connection devices attach the belt or harness to the final tie-off point. This can be one device, such as a lanyard, or a combination of devices, such as worklines, rope grabs, tie-off straps, carabiners, lanyards and lifelines.

Lanyards are used both to restrain workers in position, and to arrest falls. When using a lanyard as a restraining device, the length is kept as short as possible (see Figure D), as a restraining lanyard should not allow a worker to fall more than two feet. Restraining lanyards are available in a variety of materials, including steel cables, rebar chain assemblies and nylon rope. Fall protection lanyards (see Figures A and C) can be made of steel, nylon rope, nylon webbing or dacron webbing.

Fall protection lanyards may also have a shock-absorbing feature built in, thus reducing the potential fall arrest force. Remember that maximum arrest force is 900 pounds for belts, or 1800 pounds for full-body harnesses. With a belt, the use of a shock-absorbing lanyard is recommended because it limits the arresting force from a six-foot drop to 830 pounds. If a shock-absorbing lanyard is not used, the tie-off point must be high enough to limit the arrest force to less than the 900-pound limit. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system in the construction industry but they can continue to be used as part of a positioning device system. The height of this tie-off point will vary, depending on the lanyard material and the weight of the person involved. A lanyard used for a fall is limited to allow a maximum six-foot free fall. For this reason, most lanyards are a maximum of six feet long. However, if a higher tie-off point is used, the lanyard can be longer if the free fall distance does not exceed 6 feet.

Lifelines add versatility to the fall arrest system. When used in conjunction with rope grabs (see Figure C), a lifeline allows the worker to move along the length of the line rather than having to disconnect and find a new tie-off point. The rope grab is engineered to arrest a fall instantly. A rope grab and lifeline system is a passive form of protection, allowing the user to move as long as tension is slack on the lifeline. If a fall occurs, the tension on the rope grab triggers the internal mechanism to arrest the fall. Retractable lifelines (see Figure B) automatically retract any slack line between the worker and the tie-off point. While this type of line doesn't require a rope grab, it must be kept directly above the worker to eliminate any potential swing hazard if the worker falls.

A cross-arm strap (see Figure A) is used at a tie-off point with a large diameter, such as an I-beam, to which a lanyard or lifeline cannot directly attach. Using a cross-arm strap ensures the lanyard or lifeline doesn't become abraded from wrapping around the I-beam. A carabiner (see

Figure D) works in the same situations. It is used for tie-off points with a diameter of one to five inches, and then the lanyard is attached to the carabiner.

Tie-Off Points

A tie-off point (see Figures A, B, C and D) is where the lanyard or lifeline is attached to a structural support. This support must have a 5000-pound capacity for each worker tying off. Workers must always tie off at or above the D-ring point of the belt or harness. This ensures that the free fall is minimized, and that the lanyard doesn't interfere with personal movement. Workers must also tie off in a manner that ensures no lower level will be struck during a fall. To do this, add the height of the worker, the lanyard length, and an elongation factor of 3.5 feet. Using this formula, a six-foot tall worker requires a tie-off point at least 15.5 feet above the next lower level.

Other Devices

For confined space applications, a tripod and winch system is used as both the tie-off point and connection device. It is used in conjunction with a full-body harness to lower and raise workers into tanks or manholes. Make sure that the tripod system you choose is designed for your application. Never use a material-handling device for personnel use unless it is specifically designed to do so.

Ladder systems are lifelines attached directly to a fixed ladder. The systems consist of a cable or channel, with a grabbing device attached for a connection point.

Fall Rescue

Any fall rescue program should be as safe as possible and take as little time as possible to bring a fallen worker to safety. When a fall occurs, any number of factors can create challenges to the effective rescue of the victim. Weather conditions, physical obstacles and the condition of the victim can consume time and create hindrances for rescue personnel.

Any rescue plan should be regularly reviewed to ensure that the procedures are manageable and realistic in their time estimates. Employers act in their own best interests by implementing the safest and quickest rescue plan and by practicing procedures to maximize preparation for a real emergency.

OSHA recommends these general guidelines:

- Rescue suspended workers as quickly as possible
- Be aware of the potentially life-threatening risks of orthostatic intolerance and suspension trauma
- Be aware of signs and symptoms of orthostatic intolerance
- Be aware that suspended workers who are unconscious or have head injuries are particularly at risk for orthostatic intolerance
- Be aware of the factors that can increase the risk of suspension trauma
- Be aware that some authorities advise against moving the rescued workers to a horizontal position too quickly

For more information on the OSHA bulletin on orthostatic intolerance and rescue, please go to: www.osha.gov/dts/shib/shib032404.html.

Inspection and Maintenance

OSHA regulations require that all fall arrest equipment be inspected prior to its use. This includes looking for frays or broken strands in lanyards, belts and lifelines, and oxidation or distortion of any metal connection devices. To properly maintain the devices, periodic cleaning is necessary. Clean all surfaces with a mild detergent soap, and always let the equipment air dry away from excess heat. Follow the manufacturer's instructions for cleaning and maintenance.

IMPORTANT NOTE: ANY EQUIPMENT EXPOSED TO A FALL MUST BE TAKEN OUT OF SERVICE AND NOT USED

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Quick Tips #192: Hazard Assessment Form

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ANSI A10.14-1991, Standard for Construction and Demolition Operations—Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use.

ANSI Z359.1-1992, Standard for Personal Arrest Systems, Subsystems and Components.

Figure A

1. Tie-off Point
2. Lifeline
3. Rope Grab
4. Shock-Absorbing Lanyard
5. Cross-Arm Strap
6. Retractable Lifeline
7. Full-Body Harness
8. Restraining Belt
9. Restraining Lanyard
10. Carabiner

Figure B

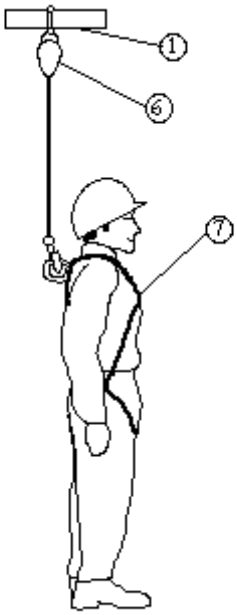


Figure C

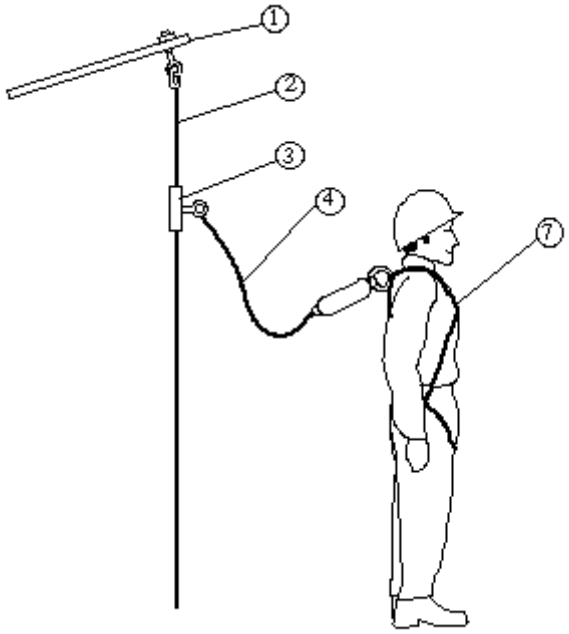
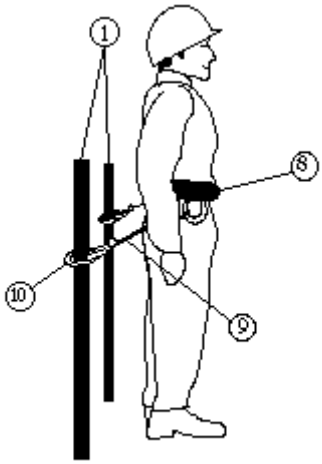


Figure D



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