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# Heavy Civil Construction Safety

## Part 2. Personal Protective Equipment

by

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### Introduction

Welcome to this PDH course on Construction Safety. This is the Second Part of this series. If interested, please consider taking the previous courses for a better understanding of the series format. Hopefully, you will find the courses interesting and informative. It is the intent of the course to provide the reader with a sound knowledge base of the fundamentals of safety so they can be considered one of the Industry's Competent Safety Personnel. Supervisory engineering responsibilities require this type of training so leaders can help the staff they oversee to avoid accidents.



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The series of courses will attempt to make this material easy to read and understand. It does not go into any depth on technical subjects but will provide enough material for the reader to be aware of the basics in a wide variety of subject areas. Some topics may not directly affect a present job, but it is important to become well rounded in all safety areas and to understand why certain things are done for better safety.

Course Topics of this series may include:

General OSHA and MSHA Responsibilities, Personal Protection, Hand and Power Tools, Ladders and Scaffolds, Excavation and Trenches, Equipment operations, Crane Safety, Rigging Safety, Traffic Control, Fire Protection, & Equipment Transporting

The goal of this second course is to review personal protective equipment needs. The material will include general discussions of the various equipment available and the Occupational Safety and Health Administration (OSHA) standards which govern their use. This course of construction safety should provide easier reading than other areas of construction safety and serves as a good starting point in introducing specific OSHA Standards which relate to our work.

### **General**

The Construction Industry has often been labeled as one of the most hazardous industries to work in. Unfortunately, the general impression is that construction companies don't care about safety and those who make that statement support this belief with accident statistics which are higher than most other industries. What is not understood is that it takes a significantly higher effort to have a good safety record in construction than it does in most other professions. Construction work changes every day. It involves work outside, the work forces change constantly, it coordinates work between employees from subcontractors who are working completely independent of each other, the work is heavier and must often make do with tasks and equipment not completely suited to the resources present, and so on. In other industries, they typically work in controlled environments, with level floors, low turnover of employees, handling the same equipment and tools they used the day before, and doing the same thing, in the same place, over and over again. Their biggest challenge to them is boredom. One thing our business is NOT is boring.



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Despite the perception of danger and carelessness by others outside of the business, there is a symbol of safety which is highly recognized throughout the world as representing construction safety. That symbol is the Hard hat! It is the number one most basic and fundamental safety item for our business. That is why this first course is starting off with personal protective equipment and the first item of personal protection to be discussed will be the Hard hat.

On that note, let's start off this discussion with hard hats, a symbol of pride for many, and a pain in the neck for some.



(Typical safety cabinet equipped with replacement personal protective gear)



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## **Head Protection**

**OSHA 29 CFR 1910.135** – Occupational Safety and Health Standards – Head Protection

**OSHA 29 CFR 1926.100** – Personal Protective and Life Saving Equipment – Head Protection

Construction requires the use of hard hats. They must be worn at all times while working. The only exceptions are for office personnel when in the office, drivers when they are in their vehicles, and operators when they are inside an enclosed equipment cab. Mechanics may sometimes wear bump caps when working specifically in repair and maintenance areas.

Rather than end the discussion at that point, let's look at head protection a little closer. OSHA states, "Employees working in areas where there is a POSSIBLE danger of head injury from impact, or from falling or flying objects, or from electrical shock or burns, shall be protected by protective helmets." Does this apply to our work? Without a question it does. There are no types of areas or types of construction work where there aren't examples of past head injuries. Some of those accidents may seem bizarre and isolated, but they occur. We often think that a great deal of our work is without exposure, and then we hear of a new and unique way of hurting ourselves. The head is the most important part of a person's body to protect. One can live without arms or legs and can even recover from injuries involving the heart or lungs, but you only get one chance at life where your head is involved.

What hard hats are acceptable?

The recognized authority in specifying the conditions a hard hat must meet is the American National Standards Institute (ANSI). For protection against all of the hazards OSHA identifies, a hard hat must meet ANSI Standard Z89.1 1997, 2003, or 2009, Class E requirements. This certification must be labeled on the Hard hat.



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(The aluminum hardhat on the wall belongs with the other antique pieces on display)

The following list briefly details the different Class designations for hard hats:

**Class G Hard Hats:** protection for impact & penetration from falling or flying objects, and low-voltage electrical rated for 2,200 volts.

**Class E Hard Hats:** protection for impact & penetration from falling or flying objects, and low-voltage electrical rated for 20,000 volts.

**Class C Hard Hats:** protection for impact & penetration from falling or flying objects, but provides no electrical insulation.



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Bump caps, which can be allowed on a limited basis, do not meet ANSI Standards and are meant strictly for protection from bumping into things. They do not provide protection adequately against falling or flying objects, or electric hazards.

Other than what we have just discussed, what is important to remember about hard hats in our jobs as supervisors?

1. All employees in the crew must wear them.
2. If a hard hat is damaged in anyway, get a new one. Damages include cracks, holes, dent, gouges, etc... There are instances where employees have drilled holes in their hard hat for ventilation. This destroys the protection.
3. Do not allow employees to paint their hard hats, paint hides defects and affects the electrical protection.
4. The suspension inside the hard hat must not be altered or removed.

There are no valid complaints for not wearing a hard hat.

Most complaints are concerned about them falling off. A properly adjusted hard hat will not fall off unless it is knocked off. The hat should be tight enough to prevent it from falling off but not so tight that it causes headaches. This may take some trial and error, but most manufacturers make the suspension so variable, that it's hard to find someone who can't find the right fit. Another common complaint involves heat. Hard hats are hot to wear. The problem is usually the point where the suspension meets your head. If a person was to weigh the benefits of wearing hard hats, against the problem of heat, the protection is the winner in that debate. And for the record, hard hats are not any worse than a baseball cap and in fact, maybe a little better since they reflect heat and they do have some circulation underneath them.

A hard hat must be able to stop the equivalent of a 1-pound plumb bob falling 10 feet or an 8 -pound ball repeatedly falling 5 feet. They must be able to resist chemicals, heat, and 20,000 V of electricity. What else can protect a person from these hazards and a substantial head injury? If you know anyone's head that can do all that, they qualify for an exemption from OSHA's policy.



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## Eye Protection



**OSHA 1926.102** states, “employee shall be provided with a protection equipment when machines or operations present potential eye injury from physical, chemical, or radiation agents.”

When required, eye protection shall meet ANSI Z 87.1 – 1978.

Contractors should provide eye protection at no cost to employees where conditions warrant their use. Primary eye protection equipment consists of lightweight plastic safety glasses and goggles. Every attempt should be made to accommodate personal preferences if that means employees will wear them when the protection is needed. Because the leeway given in the statement “warrant their use” is often abused, many





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contractors are now making eye protection a mandatory requirement for personal protective equipment.

Eye injuries are one of the most frequent sources of injury. At every construction jobsite, there probably isn't a day that goes by where someone doesn't get something in their eyes. Usually, they just wipe it out or rub their eyes, and don't even mention it. On occasion, they need to go to the office to flush it out and then go back to work. But for large contractors, about twice a week during the regular construction season, workers end up in the hospital or doctor's office having something removed from their eye. Go and beyond that, they'll have at least one worker per year who has a serious injury which involves a great deal of lost time, pain, and sometimes permanent eye problems. With education and preventive measures, it is rare for any injuries to cause total blindness, but the potential exists every time workers chip, or grind, or pour.



Eye protection is an item requiring some degree of thought. Hard hat head protection has had the guess work removed because they must be worn at all times. Even OSHA leaves the selection of eye protection up to the supervisor (although they will comment when the need is being ignored).



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Roughly we should use the following guidelines:

Chipping - safety glasses  
Grinding - safety glasses  
Sawing - safety glasses  
Liquid chemicals - goggles

Pouring concrete - safety glasses  
Jackhammer work - safety glasses  
Torch cutting or burning - welding goggles  
Arc welding - welding helmet

These are minimum requirements. Most projects require mandatory safety glasses full-time, just like hard hats. This may be a requirement of a contract like with the Army Corps of Engineers, or it may just be because the project manager believes in them, and he's fed up with having to remind people all of the time to use them when they are needed. If the conditions are Dusty, you should always plan on upgrading to goggles. When we're cutting and welding there's one other requirement we should keep in mind, eye protection for this work must include shaded lenses. The minimum should be:

Cutting - shade number 4  
Gas Welding - shade number 5  
Arc Welding - shade number 12

This is for basic operations. For specialty welding operation, such as large diameter electrodes and carbon arc welding, one would need to get advice from the supplier or a knowledgeable welder.

Before we move onto the next subject there is another thing to keep in mind. Workers who wear regular prescription lenses are not adequately protected unless their glasses are safety glasses with high impact lenses. Even they should consider using side shields for most operations. Side shields are inexpensive and can be slipped on and off regular glasses easily. You would be surprised what safety glasses and goggles can stop if they are worn. It only takes one second to get hurt, so don't allow someone to perform work without the protection they need "only because it will only take a second" and "we have to make one cut". They may regret that for the rest of their lives.

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**Hearing Protection**



OSHA requires preventive measures for workers exposed to excessive noise. They define the exposure limits in terms of time of exposure to certain level of noise in decibels.

Noise is a problem if it exceeds certain limits. For instance, in construction work, workers can safely be exposed to levels of sound up to 90 dBA for eight hours without a problem. To explain this, you need to understand what dBA means. The term dBA stands for decibels measured on the A scale. A decibel is a unit of measurement, basically it's how loud something is. Some typical decibel levels are shown later in this section as to compare the various levels. When we indicate that the noise is measured



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on the A scale, we are setting the scale to correspond with the way the human ear most closely responds.

There are three scales for measurement A, B, and C. A is chosen for its closeness to how we hear. The other scales measure different frequencies which are useful to people who are trying to provide noise reduction controls.

Noise exposure is a direct function of the time spent in an exposure area. As previously stated, workers can spend eight hours at a level of 90 dBA without harming their hearing. Workers can still work at higher dBA levels without causing harm if they reduce their time exposure. At 100 dBA, workers can safely work for two hours. OSHA uses a chart to determine if the noise exposure is dangerous to worker's hearing (the chart is provided later in this section).

What to keep in mind if directly in charge of workers?

1. If an operation you are conducting is noisy, require the workers to wear hearing protection either plugs and muffs.
2. If possible, workers should be kept clear from noisy operations when they're not directly involved. The noise levels drop six dBA each time the distance is doubled (for instance, if a job is 94 dBA when standing 10 feet from the noise source, the level is only 88 dBA at a distance of 20 feet).
3. If using plugs or inserts in the ear, they must be clean and replaced frequently.
4. Each type of hearing protection comes with a noise reduction ratio (NRR). For instance, an NRR of 22 dBA means the hearing protection, if properly worn, will protect up to 22 dBA. A worker in an area can be exposed to 102 dBA and therefore reduce the level of hearing to 80 dBA by wearing this production. Recently, one of the governments research branches reported that the manufactures of hearing protection equipment were overstating the protection levels of their products. They believe that the overstatement is around 7 dB and suggest a subtraction of seven dBA from the NRR before subtracting it from the noise level. The manufacturers dispute this, but to be on the safe side, use this method as an example: A set up for the plugs that had an NRR of 22 dBA and the exposure was 102 dBA, subtract seven from 22 to get 15, then subtract that from the noise level 102 to get an exposure of 87.



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5. Hearing protection is fine for temporary operations but if the task is going to last a long time, attempts should be made to control the noise at the source by containment or dampeners. For long exposures workers should have their hearing tested periodically to be sure the noise is not having an adverse effect.
6. Do not allow employees to use makeshift hearing protection such as cotton. It doesn't work and can cause ear infections.

Certain work is noisy and requires controls whenever performed. For instance, require hearing protection whenever chipping, jackhammering, working around a crusher, working around a milling machine, or working around a rock job.

As a closing statement, people cannot tell when they're losing their hearing until it's too late. People lose hearing ability due to the aging process and do not need to have it compounded with work related hearing loss. The amount of hearing lost in any one day is so small that it cannot be perceived, but overtime that small loss accumulates until the ear can no longer hear the quiet or high-pitched sounds. Hearing does not recover once loss occurs. Don't let griping and groaning convince you that it's all right to let a crew go without hearing protection, because maybe not now, but sooner or later they'll be sorry they didn't have the protection



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**For Comparison, some generally accepted noise levels**



Normal Conversation 65 dBA



Electric Motor 88 dBA



Power Saw 110 dBA



Pain Begins 125 dBA

Jet Plane 145 dBA

Highest Sound that can occur 194 dBA



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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
1 1/2 .....	102
1.....	105
1/2 .....	110
1/4 or less.....	115

Footnote(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:  $C(1)/T(1) + C(2)/T(2) + \dots + C(n)/T(n)$  exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn 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.

Table taken from OSHA 1910.95 - Occupational noise exposure



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### Respiratory Protection



Personal Respiratory Protection is a difficult subject, and it will not be covered in great depth because of how involved it is. Important things to remember as a supervisor will be covered only. Any safety measures should be addressed specific to the exposure and should be coordinated with all personnel what procedures will be needed. If there is any exposure to chemicals or gases, or excessive dust, some type of respiratory protection will be required. This may involve cartridge respirators, or air supplied respirators, or simply dust masks. They're very different and serve specific purposes.





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Just because someone has something over their mouth and nose doesn't mean they are protected.

We learn about the need for respiratory protection from material safety data sheets (MSDS) and reviews of the specific exposed operations. Every attempt should be made to uncover operations where protection is necessary. Certainly, very dusty areas, or other areas where there are strong chemical odors should be looked at. For exposure questions, consult with experienced workers because conditions may change from job to job and the staff may not be aware of an exposure. For instance, outside work rarely needs to provide respiratory protection for welding and cutting, and yet, if welding occurs on lead paint coated steel, or with zinc-based filler materials, substantial respiratory protection is needed.

Some things for you to remember include:

1. Ask your supervisor if you have any questions about the need and type of respiratory protection for your work.
2. If equipment is necessary, make sure it is worn.
3. Fit tests are required for workers who must wear respiratory protection for any length of time. Arrangements will be made for respirator users to be fit tested. All should read the instruction provided on the equipment and relay that information to any workers. A proper fit is necessary, each type of respirator will come with instructions.
4. If respirators are necessary, they must be cleaned regularly and stored where they won't get dirty. They must be checked routinely for defects or cracks, which can occur when the rubber face piece dries out.
5. This is a tough one, workers who wear respirators cannot have beards. A proper fit test cannot be performed with beards.
6. Do not use someone else's respirator without disinfecting it.
7. Workers with asthma or heart conditions should not wear respirators without a doctor's approval. Some cases may require lung capacity tests before starting work with respirators. It may also be advisable not to allow employees to wear respirators with a severe cold or flu.



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Recent changes in OSHA respiratory requirements have been made concerning silica fume dust. These will be addressed in a future specific course section of the series.

**Other personal protection equipment**

Other everyday personal protective equipment which may be necessary include gloves, safety vests or other high visibility clothing, and for clothing safety shoes, long pants, shirts with sleeves that cover the shoulders, and any weather-related protective covering. Common personal protective equipment includes face shields, fall protection harnesses, life-preservers, safety belts, chaps, or toe-guards. Employee education is needed to advise which items are required for each exposure. For each exposure provide training of proper use and explain policies on personal protection equipment. Posted signs for the types of equipment needed depending on the exposure are a helpful reminder.

Possible tasks and the needed personal protection (always hardhat):

- jackhammer work needs: safety glasses, hearing protection, gloves, good work boots.
- sandblasting needs: supplied air hoods, gloves, hearing protection, dust mask, goggles
- form stripping needs: safety glasses, gloves, good work boots
- concrete pouring needs: safety glasses, gloves, rubber boots and full clothing
- milling work needs: hearing protection, gloves, safety glasses, good work boots

Many of these items are similar and should be considered mandatory equipment.

**Lastly and Most Importantly!**

Personal Protective Equipment is the “Last Line” of defense to safeguard employees from hazards. The “First Line” is to engineer a solution that eliminates the hazard and provides a safe workplace with no exposure. Do not rely on the effectiveness of an employee’s personal protective equipment if an alternate means of construction can be utilized.



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### CONCLUSION



As previously stated, this is the second course in a proposed series on Construction Safety. The series of courses offer only a brief introduction to each topic and do not offer or imply any type of certification or level of expertise upon completion. For a better understanding, the reader should consider getting their OSHA 10-hour and OSHA 30-hour Construction Safety and Health Card by successfully completing OSHA recognized Classes.

Lastly, safety must be a constant focus of every operation. Because of the variability of Heavy Civil Construction Projects, they are often chosen to be constructed in some of the most adverse and inaccessible areas imaginable. Working with extreme weights, at excessive heights, in adverse conditions, and around large equipment requires safety diligence from every stakeholder. Personal protective devices must be worn at all times. Please be **safe**.