



Nail Gun Safety

Nail guns are used every day on many construction jobs, especially in residential construction. They boost productivity but also cause tens of thousands of painful injuries each year. This course is important for construction workers and contractors. It will discuss ways to protect yourself from nail gun injuries. We will also look at the types of training you will need to operate a nail gun on a worksite.

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OSHAcademy Course 611 Study Guide

Nail Gun Safety

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 611.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Course Introduction

Nail guns are used every day on many construction jobs—especially in residential construction. They boost productivity but also cause tens of thousands of painful injuries each year. Nail gun injuries are common—one study found that 2 out of 5 residential carpenter apprentices experienced a nail gun injury over a four-year period. When they do occur, these injuries are often not reported or given any medical treatment.

This course is important for construction workers and contractors. It will discuss ways to protect yourself from nail gun injuries. We will also look at the types of training you will need to operate a nail gun on a worksite.

Course Components

Once you complete this training, you will have knowledge of the following components:

- nail gun hazards
- likelihood of injuries
- nail gun triggers
- personal protective equipment
- establishing work procedures
- air pressure
- musculoskeletal disorders
- noise hazards

Module 1: Nail Gun Hazards

Nail guns are powerful, easy to operate, and boost productivity for nailing tasks. They are also responsible for an estimated 37,000 emergency room visits each year. Severe nail gun injuries have led to construction worker deaths. Nail gun injuries are common in residential construction. About two-thirds of these injuries occur in framing and sheathing work. Injuries also often occur in roofing and exterior siding and finishing.

Likelihood of Injuries

An OSHA study of apprentice carpenters in 2006 found:

- 1 out of 5 were injured twice.
- 1 out of 10 were injured three or more times.

More than half of reported nail gun injuries are to the hand and fingers. One quarter of these hand injuries involve structural damage to tendons, joints, nerves, and bones. After hands, the next most often injured are the leg, knee, thigh, foot, and toes. Injuries to the forearm or wrist, head and neck, and trunk are less common. Serious nail gun injuries to the spinal cord, head, neck, eye, internal organs, and bones have been reported. Injuries have resulted in paralysis, blindness, brain damage, bone fractures, and death.

Real World Accident

A 26-year-old Idaho construction worker died following a nail gun accident in April 2007. He was framing a house when he slipped and fell. His finger was on the contact trigger of the nail gun he was using. The nosepiece hit his head as he fell, driving a 3-inch nail into his skull. The nail injured his brain stem, causing his death. The safety controls on the nail gun were found to be intact. Death and serious injury can occur using nail guns—even when they are working properly.

Nail Gun Triggers

Nail gun safety starts with understanding the various trigger mechanisms. Let's take a look at what you need to know.

How Triggers Differ

All nailers rely on two basic controls: a finger trigger and a contact safety tip located on the nose of the gun. Trigger mechanisms can vary based on:

- 1) the order in which the controls are activated, and

2) whether the trigger can be held in the squeezed position to discharge multiple nails OR if it must be released and then squeezed again for each individual nail.

Combining the above variations gives four kinds of triggers. Some nail guns have a selective trigger switch which allows the user to choose among two or more trigger systems.

Each trigger type is described below along with a summary of how the controls are activated.

Full Sequential Trigger

The full sequential trigger is always the safest trigger mechanism for the job. It reduces the risk of unintentional nail discharge and double fires. It reduces the risk of unintentional nail discharge, double fires, and injuries from bumping into coworkers.

At a minimum, provide full sequential trigger nailers for placement work where the lumber needs to be held in place by hand. Examples include building walls and nailing blocking, fastening studs to plates and blocks to studs, and installing trusses. Unintended nail discharge is more likely to lead to a hand or arm injury for placement work compared to flat work, where the lumber does not need to be held in place by hand. Examples of flat work include roofing, sheathing, and subflooring.

You may want to consider restricting inexperienced employees to full sequential trigger nail guns starting out. Some contractors using more than one type of trigger on their jobs color-code the nail guns so that the type of trigger can be readily identified by workers and supervisors.

When using a full sequential trigger, there are things you need to remember both when using single nails and multiple nails.

Single Nail: Push the safety contact and then squeeze the trigger.

Multiple Nails: Release both the safety contact and trigger and repeat the process.

Contact Trigger

This type of trigger fires a nail when the safety contact and trigger are activated in any order. You can push the safety contact tip first and then squeeze the trigger, or you can squeeze the trigger first and then push the safety contact tip. If the trigger is kept squeezed, a nail will be driven each time the safety contact is pushed in. All nails can be bump fired. This type of triggers is also known as bump trigger, multi-shot trigger, successive trigger, dual-action, touch trip, contact trip, and bottom fire.

When using a contact trigger, there are things you need to remember both when using single nails and multiple nails.

Single nail: Push safety contact, then squeeze trigger, or squeeze trigger, then push safety contact.

Multiple nails: Squeeze and hold trigger, then push safety contact to fire one nail, move and push safety contact again to fire additional nails.

Single Sequential Trigger

Like the full sequential trigger, this trigger will only fire a nail when the controls are activated in a certain order. First, the safety contact tip must be pushed into the work piece. Then, the user squeezes the trigger to discharge a nail. To fire a second nail, only the trigger must be released. The safety contact tip can stay pressed into the work piece. Nails cannot be bump fired.

When using a single sequential trigger, there are things you need to remember both when using single nails and multiple nails.

Single nail: Push safety contact, then squeeze trigger.

Multiple nails: Release trigger, move tool, and squeeze trigger to fire additional nail.

Single Actuation Trigger

Like the contact trigger, this trigger will fire a single nail when the safety contact and trigger are activated in any order. A second nail can be fired by releasing the trigger, moving the tool and squeezing the trigger again without releasing the safety contact tip. Note that some manufacturers refer to these triggers as “single sequential triggers”, but they are different. The first nail can be bump fired with a single actuation trigger but not with a true single sequential trigger.

When using a single actuation trigger, there are things you need to remember both when using single nails and multiple nails.

Single nail: Push safety contact, squeeze trigger, or squeeze trigger, then push safety contact to fire.

Multiple nails: Release trigger, move tool, and squeeze trigger to fire additional nail.

Module #1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. More than half of all reported nail gun injuries occur to what part of the body?

- a. Hands and fingers
- b. Arms
- c. Feet
- d. Legs

2. Which type of trigger is always the safest trigger mechanism for the job?

- a. Contact trigger
- b. Single actuation trigger
- c. Full sequential trigger
- d. Single sequential trigger

3. This type of trigger fires a nail when the safety contact and trigger are activated in any order.

- a. Single sequential trigger
- b. Contact trigger
- c. Single actuation trigger
- d. Both b and c are correct

4. When using this trigger, a second nail can be fired by releasing the trigger, moving the tool and squeezing the trigger again without releasing the safety contact tip.

- a. Single actuation trigger
- b. Contact trigger
- c. Single sequential trigger
- d. Full sequential trigger

5. One out of ten carpenters report injuries with nail guns _____ times.

- a. 3 or more
- b. 5 or more
- c. 6 or more
- d. A dozen

Module 2: Nail Gun Training

Studies of residential carpenters found the overall risk of nail gun injury is twice as high when using contact trigger nail guns compared to using sequential trigger nail guns. About 1 in 10 nail gun injuries happen to co-workers.

This is from either airborne (projectile) nails or bumping into a co-worker while carrying a contact trigger nail gun with the trigger squeezed. A voluntary ANSI standard calls for all large pneumatic framing nailers manufactured after 2003 to be shipped with a sequential trigger. However, these may not always be full sequential triggers. Contractors may need to contact manufacturers or suppliers to purchase a full sequential trigger kit.

Real World Accident

A carpenter apprentice on his first day ever using a nail gun injured his right leg. He was working on a step ladder and was in the process of lowering the nail gun to his side when the gun struck his leg and fired a nail into it. He had no training prior to using the nail gun. New worker training is important and should include hands-on skills.

This module takes a closer look at ways to protect yourself against nail gun injuries, such as the one in the accident above.

Worker Training

Both new and experienced workers can benefit from safety training to learn about the causes of nail gun injuries and specific steps to reduce them. Be sure the training is provided in an understandable way. Here is a list of topics for training:

- Describe how nail guns work and how triggers differ.
- List the main causes of injuries - especially differences among types of triggers.
- Provide hands-on training with the actual nailers that will be used on the job. This gives each employee an opportunity to handle the nail and get feedback on the following issues:
 - how to load the nail gun
 - how to operate the air compressor
 - how to fire the nail gun

- how to hold lumber during placement work
- how to handle awkward position work
- Describe what to do if a nail gun malfunctions.
- Training should also cover items such as company nail gun work procedures, personal protective equipment, injury reporting, and first aid and medical treatment.

Establish Nail Gun Work Procedures

Contractors should develop their own nail gun work rules and procedures to address risk factors and make the work as safe as possible. Examples of topics for contractor work procedures include, but are not limited to, the following:

- Make sure tool manuals for the nailers are always available on the job site.
- Make sure manufacturers' tool labels and instructions are understood and followed.
- Check tools and power sources before operating to make sure they are working properly. Take broken or malfunctioning nail guns out of service immediately.
- Set up operations so that workers are not in the line of fire from nail guns being operated by co-workers.
- Check lumber surfaces before nailing. Look for knots, nails, straps, hangers, etc. that could cause recoil or ricochet.
- Use a hammer or positive placement nailer when nailing metal joinery or irregular lumber.
- For placement work, keep hands at least 12 inches away from the nailing point at all times. Consider using clamps to brace instead of your hands.
- Always shoot nail guns away from your body and away from co-workers.
- Always disconnect the compressed air when:
 - leaving a nailer unattended
 - traveling up and down a ladder or stairs

- passing the nail gun to a co-worker
- clearing jammed nails
- performing any other maintenance on the nail gun
- Recognize the dangers of awkward position work and provide extra time and precautions:
 - Use a hammer if you cannot reach the work while holding the nailer with your dominant hand.
 - Use a hammer or full sequential trigger nailer when working in a tight space. Recoil is more difficult to control, and double fires could occur with contact triggers.
 - Take extra care with toe-nailing. Nail guns can slip before or during firing because the gun cannot be held against the work piece. Use the trigger to fire ONLY after the safety contact piece is positioned.
- Recognize the dangers of nail gun work at height and provide extra time and precautions:
 - Set up jobs to minimize the need for nailing at height.
 - Consider using scaffolds instead of ladders.
 - If work must be done on ladders, use full sequential trigger nailers to prevent nail gun injuries which could happen from bumping a leg while climbing up or down a ladder.
 - Position ladders so you don't have to reach too far. Your belt buckle should stay between the side rails when reaching to the side.

Things You Should Not Do With a Nail Gun

When you are using nail guns, NEVER bypass or disable the safety features. This is strictly prohibited. Tampering includes removing the spring from the safety-contact tip and/or tying down, taping or securing the trigger so it does not need to be pressed. Tampering increases the chance the nail gun will fire unintentionally both for the current user and anyone else who may use it.

Workers should keep their fingers off the trigger when holding or carrying a nail gun. If this is not natural, workers should use a full sequential nail gun or even set down the nailer until they need to use it again.

Personal Protective Equipment

OSHA typically requires safety shoes, which help protect workers' toes from nail gun injuries, on residential construction sites. Employers should also provide, at no cost to employees, the following protective equipment for workers using nail guns:

- hard hats
- high impact eye protection, such as safety glasses or goggles marked ANSI Z87.1
- hearing protection (either earplugs or earmuffs)

Reporting of Injuries and Close Calls

Studies show many nail gun injuries go unreported. Employers should ensure their policies and practices only encourage their employees to report nail gun injuries. Reporting helps ensure employees get needed medical attention. It also helps contractors to identify unrecognized job site risks that could lead to more serious injuries, if not addressed.

First Aid and Medical Treatment

Employers and workers should get medical attention immediately after nail gun injuries. This includes for hand injuries which appear minimal. OSHA suggests 1 out of 4 nail gun hand injuries can involve some type of structural damage, such as a bone fracture. Materials such as nail strip glue or plastic or even clothing can get embedded in the injury and lead to infection. Barbs on the nail can cause secondary injury if the nail is removed incorrectly. These complications can be avoided by having workers seek immediate medical care.

Real World Accident

A construction worker accidentally drove a 16 penny framing nail into his thigh. It didn't bleed much, and he didn't seek medical care. He removed the nail himself. Three days later he felt a snap in his leg and severe pain. In the emergency room, doctors removed a sheared off nail and found his thigh bone had fractured.

Not all nail gun injuries are immediately visible. Failure to seek medical care can result in complications and more serious injuries.

Module #2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. Which of the following things should be discussed when training employees to use nail guns?

- a. How to load the nail gun
- b. What needs to be fixed
- c. What to do when a nail gun fires expectantly
- d. When the nail gun should be thrown away

2. When do you need to take broken or malfunctioning nail guns out of service?

- a. At the end of the work shift
- b. Immediately
- c. Before starting work
- d. When someone gets hurt

3. How can the barbs on a nail cause a secondary injury?

- a. If it stays in the skin too long
- b. If you remove it with tweezers
- c. If it is removed incorrectly
- d. If a friend removes the nail

4. Which of the following is a recommended form of personal protective equipment when using nail guns?

- a. Hard toe shoes
- b. Hard hats
- c. Face protection
- d. Gloves

5. When working at heights, consider using _____ instead of _____.

- a. ladders, scaffolds
- b. scaffolds, ladders
- c. bridges, scaffolds
- d. ladders, bridges

Module 3: Nail Gun Injuries and Other Hazards

There are several major risk factors that can lead to a nail gun injury. Understanding them will only help you to prevent injuries on the jobsite. This module will take a closer look at these important risk factors, as well as other hazards involving nail guns.



Unintended Nail Discharge from Double Fire

Unintended nail discharges from double fires usually occurs when using contact triggers.

The Consumer Product Safety Commission (CPSC) found contact trigger nailers are susceptible to double firing. This occurs a lot when workers are trying to accurately place the nailer against the work piece. Researchers found a second unintended firing can happen faster than the user is able to react and release the trigger.

Double fire can also be a particular problem for new workers who may push harder on the tool to compensate for recoil. It can also happen when the user is in an awkward position, such as tight work spaces, where the gun doesn't have the necessary space to recoil. The recoil of the gun can also cause a non-nail injury in tight spaces if the nail gun hits the user's head or face.

Unintended Nail Discharge from Knocking Safety Contact Trigger

Nail guns with contact and single actuation triggers will fire if the trigger is being squeezed and the safety contact tip gets knocked or pushed into an object or person by mistake. For example, a framer might knock his leg doing down a ladder or bump into a co-worker passing through a doorway. Contact trigger nailers can release multiple nails and single actuation trigger nailers can release a single nail to cause injury.

Holding or carrying contact trigger or single actuation trigger nail guns with the trigger squeezed increases the risk of unintended nail discharge. Construction workers tend to keep a finger on the trigger because it is more natural to hold and carry an 8-pound nail gun using a full, four-finger grip. Tool manufacturers, however, do warn against it.

Nail Penetration through Lumber Work Piece

This can happen with ALL trigger types. Nails can pass through a work piece and either hit the worker's hand or fly off as a projectile nail. A blow-out nail is just one example. Blow-outs can occur when a nail is placed near a knot in the wood. Knots involve a change in wood grain, which creates both weak spots and hard spots that can make the nail change direction and exit the work piece. Nail penetration is especially a concern for placement work where a piece of lumber needs to be held in place by hand. If the nail misses or breaks through the lumber it can injure the non-dominant hand holding it.

Real World Accident

Two framers were working together to lay down and nail a subfloor. One framer was waiting and holding the nail gun with his finger on the contact trigger. The other framer was walking backwards toward him and dragging a sheet of plywood. The framer handling the plywood backed into the tip of the nail gun and was shot in the back. The nail nicked his kidney, but fortunately he recovered. As a result of this incident, the contractor switched to using only sequential triggers on framing nail guns. Co-workers can get injured if they bump into your contact trigger nail gun. You can prevent this by using a full sequential trigger.

Nail Ricochet after Striking a Hard Surface or Metal Feature

When a nail hits a hard surface, it has to change direction and it can bounce off the surface, becoming a projectile. Wood knots and metal framing hardware are common causes of ricochets. Problems have also been noted with ricochets when nailing into dense, laminated beams. Ricochet nails can strike the worker or a co-worker to cause an injury. This can happen with ALL trigger types.

Missing Work Piece

Injuries may occur when the tip of the nail gun does not make full contact with the work piece and the discharged nail becomes airborne. This can occur when nailing near the edge of a work piece, such as a plate. Positioning the safety contact is more difficult in these situations and sometimes the fired nail completely misses the lumber. Injuries have also occurred when a nail shot through plywood or oriented strand board sheeting missed a stud and became airborne. This can happen with ALL trigger types.

Awkward Position Nailing

Nailing in awkward positions where the tool and its recoil are more difficult to control may increase the risk of injury. These include toe-nailing, nailing above shoulder height, nailing in tight quarters, holding the nail gun with the non-dominant hand, nailing while on a ladder, or nailing when the user's body is in the line of fire (nailing towards yourself). Toe-nailing is awkward because the gun cannot be held flush against the work piece. Nailing from a ladder makes it difficult to position the nail gun accurately. Nailing beyond a comfortable reach distance from a ladder, elevated work platform, or leading edge also places the user at risk for a fall. This happens with ALL trigger types. However, accidental discharges are a concern in awkward position work with contact and single actuation triggers.

Bypassing Safety Mechanisms

Bypassing or disabling certain features of either the trigger or safety contact tip is an important risk of injury. For example, removing the spring from the safety contact tip makes an unintended discharge even more likely. Modifying tools can lead to safety problems for anyone who uses the nail gun. Nail gun manufacturers strongly recommend against bypassing safety features, and voluntary standards prohibit modifications or tampering. OSHA's Construction Standard at 29 CFR 1926.300(a) requires all hand and power tools and similar equipment, whether furnished by the employer or the employee shall be maintained in a safe condition. This happens with ALL trigger types.

Other Hazards

There are other important hazards to remember when operating a nail gun. Let's take a look.

Air Pressure

Pneumatic tools and compressor use are regulated under OSHA's Construction Standard at 29 CFR 1926.302(b). The provisions in this standard that are relevant for nail guns are provided below.

1. Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected.
2. All pneumatically driven nailers, staplers, and other similar equipment provided with automatic fastener feed, which operate at more than 100 p.s.i. pressure at the tool, shall have a safety device on the muzzle to prevent the tool from ejecting fasteners, unless the muzzle is in contact with the work surface.
3. The manufacturer's safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded.

4. The use of hoses for hoisting or lowering tools shall not be permitted.

Noise

Pneumatic nail guns produce short (less than a tenth of a second in duration) but loud “impulse” noise peaks: one from driving the nail and one from exhausting the air. Most nail gun manufacturers recommend users wear hearing protection when using a nailer.

Nail gun noise can vary depending on the gun, the work piece, air pressure, and the work setting. The type of trigger system does not appear to affect the noise level. Peak noise emission levels for several nailers range from 109 to 136 dBA. These loud short bursts can contribute to hearing loss. Employers should provide hearing protection in the form of earplugs or muffs and make sure they are worn correctly. Employers should also ask about noise levels when buying nail guns—studies have identified ways to reduce nail gun noise and some manufacturers may incorporate noise reduction features.

Musculoskeletal Disorders

Framing nail guns can weigh up to 8 pounds and many framing jobs require workers to hold and use these guns for long periods of time in awkward hand/arm postures. Holding an 8-pound weight for long periods of time can lead to musculoskeletal symptoms such as soreness or tenderness in the fingers, wrist, or forearm tendons or muscles. These symptoms can progress to pain, or in the most severe cases, inability to work. No studies have shown that one trigger type is any more or less likely to cause musculoskeletal problems from long periods of nail gun use.

No studies have shown that one trigger type is any more or less likely to cause musculoskeletal problems from long periods of nail gun use. Get medical help if using a nail gun is causing musculoskeletal pain.

Module #3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. Unintended nail discharges from double fires usually occur when using ____.

- a. contact triggers
- b. single actuation triggers
- c. full sequential triggers
- d. single sequential triggers

2. ____ can occur when a nail is placed near a knot in the wood.

- a. Ricochet
- b. Injuries
- c. Misfires
- d. Blow-outs

3. Ricochet nails can happen with ____ trigger types.

- a. all
- b. many
- c. several
- d. some

4. Peak noise emission levels for several nailers range from ____.

- a. 50 to 100 dBA
- b. 109 to 136 dBA
- c. 75 to 150 dBA
- d. 25 to 50 dBA

5. What could make an unintended discharge more likely?

- a. Removing the spring from the safety contact tip
- b. Lack of training
- c. Faulty nail gun
- d. Workers trying to be funny on the job site

Endnotes

1. Occupational Safety and Health Administration. (2011). Nail Gun Safety-A Guide for Construction Contractors. Retrieved from:
https://www.osha.gov/Publications/NailgunFinal_508_02_optimized.pdf