

OSC 12
Ohio Safety Congress & Expo

WELL AT HOME. SAFE AT WORK.

256 NIOSH: Latest Research in Ergonomics

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Ohio Bureau of Workers' Compensation

Nail Gun Safety

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Overview

1. Background
2. Understanding types of triggers
3. Injury overview – What we know about nail gun injuries
4. Risk Factors: How do nail gun injuries happen?
5. Preventing nail gun injuries
6. Other issues – noise, productivity, ergonomics

Background

NIOSH/OSHA Nail Gun Guidance Document

- Joint NIOSH/OSHA publication
- Released 9/21/2011
- 
- Target Audience: Construction Contractors





Background

Nail guns = Nailers

Finishing and Flooring nailers → smaller nails
Framing and Roofing nailers → larger nails (more dangerous)



"Nu-Matic" Nailer (1959)
early pneumatic nail gun



Today

Understanding types of triggers



Trigger



Contact safety tip

Nail gun safety starts with understanding triggers

Trigger system = Actuation system

Two controls: Trigger + Contact Safety tip

Mechanisms vary based on:

- ✓ The order in which controls are activated
- ✓ Whether the trigger can be held squeezed to discharge multiple nails

Safest trigger is one that minimizes risk of unintended discharge

Contact Actuation Trigger

aka: bump trigger, multi-shot trigger, successive trigger, dual action, touch trip, contact trip, and bottom fire

- Fires a nail when controls are activated in **ANY** order
- Push safety contact tip first then squeeze trigger OR squeeze trigger then push the safety contact tip.
- If trigger held squeezed, a nail will be driven each time the safety contact is "bumped" against the workpiece

→ BUMP FIRING

→ Higher risk of unintentional discharge



Full Sequential Actuation Trigger

aka: single shot trigger, restrictive trigger, trigger fire mode

- Fires a nail when controls are activated in a certain order
 - First – press safety contact against work piece
 - Second – squeeze trigger
- **MUST** Release both safety contact and trigger and repeat steps to fire a 2nd nail

→ Cannot "BUMP FIRE"

→ Lower risk of unintentional discharge

Other Trigger Systems

Single Sequential

- Like full sequential, except, to fire 2nd nail, only the trigger must be released (safety contact can stay pressed against work piece)

→ Cannot BUMP FIRE as defined

Single Actuation

- Like single sequential trigger, except, the first nail will fire when controls are activated in any order.
- Some manufacturers call these "single sequential" triggers ---but the first nail can be bump fired.

→ Can use BUMP FIRE action for first nail

Single Sequential vs. Single Actuation Why is it important to distinguish?

Definitions in ANSI SNT-101-2002 are confusing!!!

- NIOSH found "Single Sequential" nailers (labeled as such) that can be fired by squeezing the trigger first - thus functioning like a **single shot contact trigger**
- We use the term Single Actuation to describe these.
- "Sequential" concept should be reserved for actuation systems where the contact tip must first be pressed.
- A loose Single Sequential definition blurs this distinction if it allows the first nail to be bump fired

Injury overview: What we know about nail gun injuries

- 66% of injuries to hands/fingers, 24% to lower extremities – not life threatening
- Small percentage of injuries to head and internal organs
- Fatal injuries have occurred
- In residential carpentry the risk of nail gun injury is twice as high when using contact trigger nail guns compared to using sequential trigger nail guns (*Lipscomb et al., 2010*)
- Full Sequential Actuation Trigger subjects user to fewer risk factors

Risk Factors: How do Nail Gun Injuries Happen?

Common events leading to injury

- Unintended nail discharge from "double fire"
- Unintended nail discharge from knocking the safety contact tip with the trigger squeezed
- Nail penetration through lumber work piece
- Nail ricochet after striking hard surface or metal feature
- Others

Unintended nail discharge from double fire

Occurs with CONTACT triggers

Double fire occurs when a second nail unintentionally fires because the nailer re-contacted the work piece after recoil.

CPSC found this can happen faster than user is able to react and release the trigger.



Unintended nail discharge from knocking the safety contact tip with the trigger squeezed

Occurs with CONTACT & SINGLE ACTUATION triggers

Contact and single actuation nailers will fire if trigger is depressed and the safety tip gets knocked or pushed into a person or object by mistake.

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.



Nail penetration through lumber work piece

Occurs with ALL Trigger types

Nail penetration is especially a concern for PLACEMENT work where lumber is held in place by hand.

Nails can pass through a work piece and hit the worker's hand or fly off as a projectile (airborne) nail.



Nail ricochet after striking hard surface or metal feature

Occurs with ALL Trigger types

When a nail hits a hard surface it has to change direction and it can bounce off the surface and become a projectile.

Wood knots and metal framing hardware and dense laminated beams can cause ricochets

Ricochets can strike the worker or a co-worker



Other Risk Factors

- Missing the work piece - The discharged nail can become airborne if the nail gun safety tip does not make full contact with the work piece.
- Awkward position nailing - Nailing in awkward positions may increase the risk of injury because the tool and its recoil are more difficult to control
- Bypassing safety mechanisms - Important risk of injury. Example: removing the spring from the safety contact tip makes unintended discharge more likely

Preventing nail gun injuries

Safety professionals are familiar with the hierarchy of controls

- Eliminate or Substitute
- Engineering Controls
- Training and Procedures
- Personal Protective Equipment

Most Preferred
 ↓
Least Preferred

Step 1) Use the 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 –including injuries caused by bumping the safety contact tip into co-workers.

Consider restricting inexperienced employees to full sequential trigger nail guns starting out.

At a minimum, provide full sequential trigger nailers for placement work.

Comparisons.....

Placement work



Hold work piece by hand

- ✓ Building walls
- ✓ Nailing blocking
- ✓ Studs to plates
- ✓ Blocks to studs
- ✓ Installing trusses

↑ Injury risk

Flat work



Work piece NOT held

- ✓ Roofing
- ✓ Sheathing
- ✓ Subflooring

↓ Injury risk

Step 2) Provide training

- Both new and experienced workers can benefit from training:

- How triggers differ
- Major causes of injuries
- Instructions and manuals
- Malfunctions and jams
- Work procedures, PPE, injury reporting, first aid
- Hands on training

Users need info on “residual risks” involved with using nail guns

Very unlikely that previous training has included risk factors or trigger issues

Provide training in manner employees can understand

Step 3) Establish safe nail gun work procedures

- Contractors should develop their own nail gun work rules and procedures tailored to their work and sites.
- For examples of “do’s” and “don’ts” see the NIOSH/OSHA guidance document



Other Steps to Preventing Injury

- Step 4 – Provide PPE
 - Hard hats
 - High Impact eye protection
 - Hearing protection
- Step 5 – Encourage reporting and discussion of injuries and close calls
- Step 6 – Provide first aid and medical treatment immediately

Other Issues:

Productivity – contact vs. sequential trigger

- Industry show faster *nailing rate* with contact actuation trigger in flatwork
- Study with 10 experienced framers stick-building two small shed structures (Lipscomb et al., 2008)
 - Avg. nailing time using contact trigger was 10% faster, accounted for less than 1% of total building time
 - Trigger type →found to be less important to productivity than who was using tool
- Unpublished field observations with time study suggest user skill more influential on productivity than trigger

Other Issues: Musculoskeletal Disorders (MSDs)

- Framing nail guns can weigh up to 8 pounds
- Framing jobs require workers to hold 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
- 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 likely to cause musculoskeletal problems

Other Issues

- Noise
- Compressed Air

(see Guidance Document for more information)

Getting copies of *Nail Gun Safety*

Download from OSHA at
http://www.osha.gov/Publications/NailgunFinal_508_02_optimized.pdf
or from NIOSH at <http://www.cdc.gov/niosh/docs/2011-202/>

Order Hard copies from OSHA (up to 10)
at 1-800-321-OSHA or www.osha.gov

Or from NIOSH (can accommodate multiple orders)
at 1-800-CDC-INFO or <http://www.cdc.gov/niosh/pubs/default.html>.

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