Investigation Guideline

Product: Nailers/Nail Guns
Appendix #: 132
Date amended: October 2004

I. Introduction

A. Background Information

Portable pneumatic fastener driving tools, commonly known as nail guns or nailers, have been identified as a product with an increasing trend in injury incidents. Estimated injuries associated with nailers have steadily increased from 8,970 emergency room-treated injuries in 1996 to 16,240 emergency room-treated injuries in 2002. There was a slight decrease in injuries in 2003. Staff will continue to monitor the injuries to see if this trend continues.

A common hazard pattern is accidental firing of a nail into a body part (usually hand or finger) or into another person. Many nail guns are activated by a trigger and a contact piece on the muzzle of the nail gun (see Figure 1). It is common practice to hold the trigger down and simply push the contact piece into the work material to fire a nail. This practice is susceptible to unintentional firing of a nail by accidentally contacting the nailer to a body part or nearby person, or unexpected recoil (backward jerk of a gun when it is fired) of the nail gun that causes contact. Sensitive triggers in conjunction with nailer recoil can also lead to inadvertent firing of an additional nail. This second nail can ricochet off the first nail and cause injury, or miss the work piece entirely to strike a body part or nearby person.

Figure 1: Nail Gun, finish nailer type

In May 2003, the latest revision of the voluntary standard for pneumatic nailers became effective. The revised standard requires that most nailers be manufactured with some type of sequential trigger.

CPSC staff is evaluating the adequacy of the current voluntary standard for nailers to determine if the latest revision of the voluntary standard is adequately addressing accidental contact hazards.

B. Product Descriptions

Pneumatic nailers should not be confused with powder-actuated nailers, which use combustion of a powder to drive fasteners into the material. These products use cartridges, much like a gun, and are known as stud guns. In general, powder-actuated nailers are designed to fire fasteners into concrete and structural steel. Powder-actuated nail guns are very easy to tell apart from pneumatic nail guns. They do not have a nozzle to hook up to an air compressor hose and look more like a gun.

Pneumatic nailers use compressed air to drive a piston that 'hammers' a nail out the tool nozzle into the work material. The depth of nail penetration can be adjusted either by the compressed air pressure (higher pressures result in deeper nail penetration) or by adjusting the distance between the nail's exit from the tool and the surface of the work material (the closer the exiting nail is to the material, the deeper it will penetrate).

The basic components of a pneumatic nailer are: a compressed air inlet, a trigger, a workpiece contact, and a nail source. There are several trigger systems defined in the current voluntary standard:

1) Contact Actuation -- Requires depression of the trigger and the workpiece contact, in any sequence, to fire a nail. Additional nails can be fired by holding the trigger down and depressing the workpiece contact. This trigger was the most prevalent type used in nailers before the latest revision of the standard. It was popular due to the ease of operating the nailer by holding the trigger down and firing by simply pushing the contact against the work piece (also known as "bump firing").

2) Single Sequential Actuation -- Requires depression of the trigger and workpiece contact, in a specific sequence, to fire a nail. The trigger and workpiece contact are considered operating controls, and at least two operating controls are required to fire a nail. Additional nails can be fired only if the workpiece contact remains depressed and another operating control, usually the trigger, is release and re-activated.

3) Full Sequential Actuation -- Requires at least two operating controls activated in a specific sequence to fire a nail. Additional nails can be fired only when all operating controls are release and re-activated in the same sequence.

4) Selective Actuation -- Allows discrete selection of single sequential, full sequential, or contact actuation. At least one type of sequential actuation must be an option.

5) Automatic Reversion Actuation -- Requires at least two operating controls activated in any sequence to fire a nail. Regardless of the initial sequence, the tool automatically reverts to a single sequential, full sequential, neutral or off position.

There are two types of nail-loading mechanisms (as shown in Figures 2 and 3): coil feed and nail strip feed. Coils of nails are formed by welding nails to a wire which is then wound up into a coil. The coil is loaded into a cylindrical holder, and one end is fed to the "barrel" of the nailer. The compact size of coil nailers allows access to tight areas. Strips of nails are formed by gluing nails together with paper or by joining nails together with a plastic material. If the nails in the strips have a full round head, the collation material is usually plastic. If the nails in the strips have only half of the nail head, the nails can be lined up right against each other and are called clipped nails. The nail strip is loaded into a magazine, which feeds into the "barrel" of the nailer. Nailers that use strips of nails are referred to as stick nailers. They are lighter and more balanced as the weight of the nails is distributed, but the length of the magazine limits their use in tight working spaces.

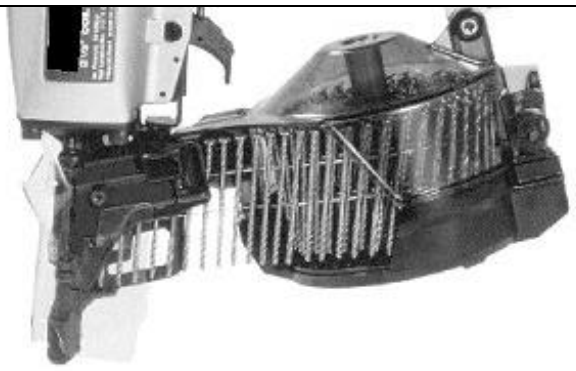

Figure 2. Coil of nails

Figure 3. Strip of full round head nails.

There are a variety of pneumatic nailers, but the most common categories are roofing nailers, framing nailers, and finish nailers. Roofing nailers, as the name implies, are designed to nail roofing material. They are typically coil nailers that use shorter nails with wide heads to maximize surface area. Due to the hazardous applications involved in roofing, it's not expected that many consumers would purchase this type of nailer.

Framing nailers are designed to drive 2 to 3.5 inch nails. These nailers are typically used to build any type of framing (drywall, home construction, etc.) and most come equipped with a touch trip trigger. Framing nailers are readily available as both coil and stick nailers. Because these nailers are particularly useful in refinishing basements, deck building, and framing of additions, it's expected that many consumers would purchase this product.

Finish nailers are designed to drive small nails or brads in applications such as trim work or picture frame fabrication. These nailers are lighter, and require slightly less air pressure to operate. The smaller volume and pressure of air required to operate the finish nailer results in lower nail velocity, less noise, and less recoil during operation. Most finish nailers use the sequential trigger, while some small gauge nailers (in the range of 19 gauge) have no contact piece at all and only require depression of the trigger to fire a nail.

C. Specific Items of Interest

Incidents involving nailers require information on nailer type, trigger mechanism, brand, model, serial number, as well as detailed information on the use of the nailer at the time of the accident. Of particular interest is the type of trigger system on the nailer and whether or not the actuation system meets the current voluntary standard.

Also of interest is if the nailer recoiled or if recoil contributed to the accident. Recoil occurs when the nail is fired into the workpiece and the nail gun jerks back, towards the user. Depending on the nailer and the amount of pressure in the tank, the user might let the nailer recoil on purpose. An air compressor pumps air into the tank to reach the maximum PSI, often 120 PSI. As the air tool is being used, the pressure in the tank falls to a predetermined level, say 70 PSI, before the air compressor kicks on again and pumps more air into the tank. If the tank is full, at the maximum PSI, the nail may sink too deep into the wood. If the tank is at the lower end of this range, the nail head may stick out of the wood. If the nail gun has a depth-of-drive feature, it may account for this variation in pressure. Otherwise, the user may attempt to account for the difference in pressure. If the tank just filled up, then the pressure is high and the user may allow the nail gun to recoil a little. That will keep the nail from sinking into the workpiece too far. Although, this is a technique only an experienced user will know.

D. Headquarters Contacts

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II. Instructions for Collecting Specific Information

If the injury was work related, i.e. a hired contractor on a jobsite, only obtain basic information about how the injury occurred and the triggering mechanism of the nail gun. There is no need to conduct an on-site investigation; a telephone investigation should be sufficient.

A. Synopsis

It is important to describe clearly the sequence of events. Describe what happened immediately before, during, and after the incident. Include location of the victim, and a detailed description of how the nailer was being used. Describe whether the victim is the operator, helper, or bystander. Where the incident occurred (home, school, at work, etc.). What the injury was and how severe was the injury. Include the following important information:

- Explain in a step by step manner the tasks required to set up and use the nailer (i.e. attach compressed air hose, verify air pressure in the compressor, set trigger switches, etc.).
- Describe in detail the exact task being performed by the victim such as type of structure being built
- Did the nailer fire a nail more than once? Was this expected?
- Provide details of the victim's hands, feet, and body in relation to the material being nailed. Was the victim reaching with the nailer? Was the victim nailing overhead? Did the victim have a firm grasp of the nailer?
- Use **ATTACHED DATA RECORD SHEET** to obtain specific information associated with nailer related incidents.

B. Description of Incident Environment

Describe all relevant information on environmental factors such as lighting, its location and intensity, slippery floor/debris on the floor, standing on a ladder, or uneven footing. **Visually** examine the product of signs for abuse, modified safety devices, or other problems on the nailer.

Inspect the nailer, owner manual, or other available material for ANSI labeling or other listings of certification. Report presence or absence of the ANSI labeling or listings of certification. Photograph these indications and transcribe information on them. If none of these indications are found, include a statement indicating this in the investigation report.

C. Description of Interaction between Injured Person(s) and Product

- Determine the incident sequence and the exact position the victim was in when injured.
- Describe the position of the victim's left and right hands with respect to the nailer and material, just before the incident, and right at the time of the incident.
- Specify if the victim was reaching.
- Specify whether the victim was holding the nailer firmly or loosely.
- Describe whether the victim is right-handed or left-handed or he/she uses both hands interchangeably.

- Indicate whether the victim was wearing safety goggles, gloves, or other special clothing at the time of the incident.
- In the victim's opinion what caused the accident?

D. Description of Product (Involved in the injury)

Provide the following detailed information on the nail gun:

- Type of nailer, manufacturer, model number, and serial number or any other identification number.
- Nail gun air pressure (PSI) and tool air volume (SCFM or CFM) required.
- Type of trigger system on the nailer. Does it meet the current voluntary standard actuation requirements? (current standards require some type of sequential trigger, types 2-5 described on pages 2 and 3)
- Air compressor used with the nail gun:
  - Manufacturer, model number
  - Capacity- expressed in gallons
  - Air pressure- number of pounds per square inch (PSI)
  - Air volume- standard cubic feet per minute (SCFM or CFM). The measure of how much air a compressor can deliver or the amount of air required by a tool. Air delivery should be higher than the nail gun's air requirement.
  - Horsepower (HP)
  - Length of air hose used between air compressor and nail gun.
- Manner in which the nailer was acquired: new, used, rented, or borrowed.
- Age of the nailer (if acquired used, state number of years owned and total age, if known).
- Condition of the nailer, maintenance level, or previous repairs or modifications (**pay special attention to repairs made shortly before the incident)**
- The depth setting on the contact piece (if applicable).

III. Photographs/ Diagrams of Incident Scene

- Photograph the nailer front, side, and top views and how the nailer was positioned at the time of the incident.
- Provide close-up photos of labels, controls, contact piece, and off-on switches.
- Have victim pose for photo that depicts his/her position (**WITHOUT AIR PRESSURE TO THE NAILER)**, as well as the position of the material being nailed, at the time of the incident.

IV. Obtaining samples and documents related to the investigation

- Photocopy the owners' manual and attached it to the report.
- Collect any official records associated with this incident that may be available.
- Only collect the nail gun as a sample if it *malfunctioned* in some way. If there was no product malfunction photographs and detailed information should be sufficient.

(DATA RECORD SHEET – Attached)

DATA RECORD SHEET
Investigation Guideline

PRODUCT: Nailer/Nail Gun

TASK NUMBER _____ INCIDENT DATE _____

1. Describe the nailer involved in the incident. Does the nailer use "compressed air" or a "powder cartridge" to drive or shoot the nail?

2. Was it a coil or stick nailer?

_____ Coil
_____ Stick
_____ Other, Specify:_____
_____ Don't Know

3. Was it a framing or finish nailer?

_____ Framing
_____ Finish
_____ Other, Specify:_____
_____ Don't Know

2. What type of trigger mechanism is on the nailer?

_____ Contact Actuation --> can you hold the trigger and "bump" the workpiece contact as many times as you need to fire a nail?
_____ Single Sequential --> after you depressed the trigger and the contact to fire a nail, can you fire additional nails as long as the workpiece contact remains depressed? (i.e. slide the nailer along and fire the trigger)
_____ Full Sequential --> do you have to release the trigger and contact, and re-activate each in sequential order to fire another nail?
_____ Selective Actuation --> can you select between a sequential and contact actuation? (usually a switch)
_____ Automatic Reversion-> does the nailer have a micro-chip that automatically reverts to a "safe mode" once you finish firing nails in "bump" or sequential mode? (you use the nailer in "bump" or sequential mode depending on the sequence you use to depress the trigger and contact)
_____ Other, Specify: _____
_____ None
_____ Don't Know

3. About how old is the nailer?

4. What is the brand name (manufacturer), model name and number of the nailer?

_____ Manufacturer/brand name

_____ Model name/number

5. What is the air pressure and air volume required to operate the nailer?

_____ PSI

_____ SCFM / CFM

6. Air compressor information:

_____ Manufacturer/brand name

_____ Model name/number

_____Capacity- expressed in gallons

_____ Air pressure- expressed in PSI

_____ Air volume- expressed in SCFM or CFM

_____ Horsepower (HP)

_____ Length of air hose used to attach nail gun to compressor

7. Had the nailer been changed, modified, or repaired in anyway since you got it? How was the nailer changed or modified? Who did it?

8. Does the nailer have a trigger lock switch or something similar?

9. How long had the operator been working with the nailer that day before the accident occurred?

10. What type of material was being nailed?

11. What type of structure was being built?

12. Was the operator nailing at an angle?

13. Was the operator nailing near the edge of the material?

14. Did the nailer fire more than one nail?

15. Was the victim the operator, helper, or bystander?

16. Where was the operator's index finger at the time of the incident? Did the operator release the trigger after operation?

17. Did the nailer recoil? Did the recoil contribute to the accident?

18. Did the nailer malfunction or act strangely in any way prior to the accident?

19. Is the operator right-handed or left-handed or ambidextrous?

20. Was the operator wearing eye glasses, safety goggles, gloves or any other special clothing at the time of the accident?

21. How much experience did the operator have with this nail gun? With nail guns in general?

22. In the victim’s opinion, what caused the accident?