CFSEI
COLD-FORMED STEEL ENGINEERS INSTITUTE

TECHNICAL NOTE

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On Cold-Formed Steel Construction

1201 15th Street, NW, Suite 320 Washington, DC 20005 (202) 785-2022

PNEUMATICALLY DRIVEN PINS FOR WOOD BASED PANEL ATTACHMENT

This Technical Note updates and replaces LGSEA Technical Note 561b.

Summary: Wood based panels for shear wall and horizontal diaphragms have traditionally been attached to cold-formed steel framing using tapping screws. To increase the speed of installation and to reduce the amount of labor used making these attachments, several companies supply pneumatic nailing systems. These products allow wood based panels to be fastened to steel in a manner similar to which panels are nailed to wood framing. This Technical Note provides information on specifications, selection and field inspection of pneumatic drive pins.

INTRODUCTION

The use of air driven fasteners, called pins, for fastening into relatively thick steel, 97 mil to 3/8", has been common in commercial construction for over 20 years. The predecessor of the International Code Council (ICC), the International Conference of Building Officials (ICBO), first approved the use of such pins in horizontal diaphragms and shear walls constructed with minimum 97 mil steel supports in 1986. Pins currently being used for cold-formed steel framing are smaller in diameter than pins used for thicker steel and are installed using hand held pneumatic tools, similar to the air nailers that are used in traditional wood framed construction.

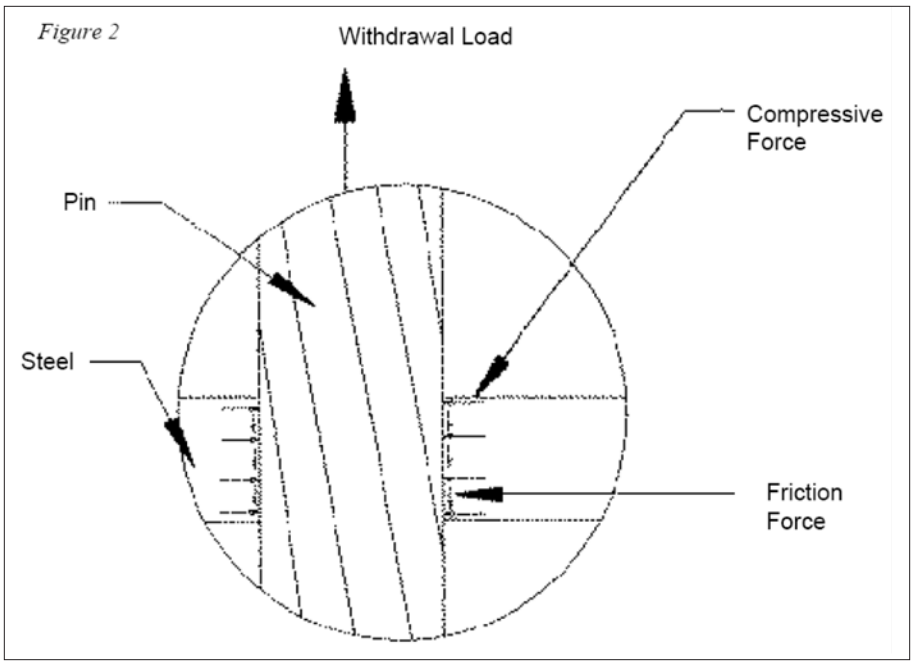
A typical pin fastener for cold formed steel is shown in Figure 1. Like a pin shot into concrete by a powder actuated tool, pneumatic drive pins are made of high carbon steel and are heat treated by a special process which makes them very hard, yet ductile. This enables pins to easily penetrate steel studs, but will not produce a brittle failure when subjected to a shear or tensile load. They have a ballistic shaped point and a deformed surface pattern, called a knurl, which varies by manufacturer.

As the pin is driven, the point pierces, not tears, the stud, forcing the steel outward and down. The compressive strength of the steel causes the stud to grip the pin. So long as the pin's point completely penetrates the steel, all compressive forces are perpendicular to the pin, holding it in the steel as shown in Figure 2. Also, the knurled shank of the pin increases the surface area of the pin in contact with the stud, creating additional holding strength due to friction. An increase in stud thickness or tensile strength will increase the pin's pullout resistance.

Figure 1

Like nails, pins are supplied in collated coils of up to 300 fasteners. The collation media, the material used to connect adjacent pins, may be extruded plastic, pre-formed sheet plastic or wire welded to each fastener. The type of collation must be matched to a specific model of pneumatic tool to insure proper indexing and subsequent driving of pins. The tools are made to hold a coil of pins which allows rapid installation of pins with the pull of a trigger without frequent handling of individual fasteners.

Typically, each manufacturer of pins supplies a system of proprietary tools and collated fasteners made to work in their tools. Some manufacturers also market pins which are designed to fit into generic or other manufacturer's tools. Most tools used for cold formed steel fastening work with air pressures from 90 to 120 pounds per square inch (psi). depending upon the thickness of steel substrate. Also, most tools have a workpiece contact which prevents the tool from being actuated unless both the trigger has been depressed and the tool is depressed against a work surface. Overdrive control devices, tool weight and size vary by manufacturer. Consult individual manufacturers for details.



FASTENER SELECTION

Pneumatically driven pins are used to attach plywood and oriented strand board to cold formed steel from 27 mil to 68 mil thickness. Typically, the same pin can be used in the full range of steel thickness by adjusting tool operating pressure in the field. Common applications include the attachment of wood based panels for roof sheathing and subflooring where the combination of panel framing and fastener may act as a horizontal diaphragm. Panels can also be fastened to wall studs and act as a shear wall. Some basic parameters affect proper fastener selection in each of these applications and must be considered when selecting and specifying pins. Different applications may use different pins and there may be variations between manufacturers. Consult manufacturer recommendations and product evaluation reports for detailed requirements.

PIN LENGTH

Pin length is measured from under the head to the tip of the point, as shown in Figure 3. Pins are produced in lengths ranging from 1-3/8" to 2-1/2". Proper pin length is determined by selecting a pin that is long enough to penetrate the steel framing a minimum of 1/4".

SHANK DIAMETER

Unlike screws which are called out by the outside diameter of the threads, pins are specified by the diameter of the wire used to make the pin. This diameter is the diameter of the unknurled portion of the pin. Common pin diameters are 0.100", 0.105", and 0.120", depending upon manufacturer.

HEAD DIAMETER

Head diameters typically range from ¼" to 5/16". This variation is seen not only between manufacturers, but also among product offerings from individual companies.

FINISH

Common finishes include mechanical zinc plating, electrozinc plating with a chromate rinse and organic coatings. These finishes provide corrosion protection ranging from 24 hours to 1000 hours salt spray resistance. Exposure to weather, damp environments, and climatic conditions must be considered when specifying pin finish.

INSTALLATION AND INSPECTION

Installation of pneumatic drive pins into steel framing is similar to air nailing methods used in wood framing. This can facilitate the transition for a carpenter crew to the use of steel framing. However, there are some subtle differences that must be observed.

PIN DRIVING DEPTH

The ideally driven fastener is driven so that the pin's head is flush with the surface of the panel. An overdriven pin breaks the top ply of wood, weakening the panel at the fastening point. It is recognized that not every pin will be perfectly set. A reasonable installation tolerance is a maximum 1 out of 10 pins permitted to be overdriven up to 1/16" in plywood ½" or less in thickness, and by up to 1/8" in plywood thicker than ½ inch.

An underdriven fastener causes a loose connection which is not as strong and can squeak. To properly drive the fastener, first adjust air compressor line pressure to the proper setting for the steel to be fastened, based upon the tool manufacturer's recommendation. Since the length and diameter of the air hose used will effect working pressure at the tool, the required compressor setting may differ slightly from manufacturer's suggestion. Final adjustment should be made using the mechanical overdrive control on the tool, if so equipped. The pins must be properly set in one shot. *Do not attempt to set underdriven pins by shooting them again or by using a hammer to drive the pin.* A second hit will loosen the pin. An underdriven pin must be removed and another fastener installed.

WARPED WOOD PANELS

The pins and tools that drive them do not have the ability to straighten warped wood. The wood must be in contact with the steel prior to installing the pin. Warped panels must be brought tight to the steel using the weight of the worker (as in the case of floors or roofs) or by a screw placed in the corner, used to draw the wood tight to the steel. Once the panel is in contact with the steel supports, pin fasteners can be installed.

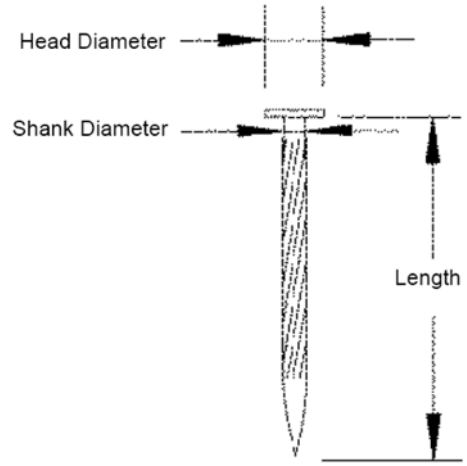
PANEL EDGE DISTANCES

To maintain panel strength along its edges, 3/8" is generally recognized as the minimum distance required between a pin and panel edge.

SUBFLOORING

To reduce floor squeaks, an adhesive is recommended in addition to pins when fastening subfloors to steel framing. The adhesive should be specified to be formulated for wood to steel attachment. After applying the adhesive, the wood panels must be set and fastened into position before the adhesive sets. If the adhesive is allowed to set, forming a "skin" prior to placing the panels, the adhesive will act as a flexible gasket rather than bonding to the wood. If this happens, foot traffic will compress the adhesive even with pins installed correctly, causing floor squeaks.

Figure 3



Pneumatically driven pins are proprietary products that have unique characteristics and performance capabilities that vary by manufacturer. Pin manufacturers publish design values for their own products, typically in a format similar to nailing schedules. Consult individual pin manufacturers for design values for their specific products.

References

1. 2009 International Building Code (IBC), International Code Council (ICC).
2. 1997 Uniform Building Code (UBC), International Council of Building Officials (ICBO).

Primary Author of this Technical Note:
David P. Nolan, P.E.; ET&F Fastening Systems, Inc.