HILTI DIRECT FASTENING TRAINING

March 2017
Plano, Tx

DEFINITION & TERMINOLOGY

Direct fastening means driving hardened nails or threaded studs without pre-drilling into the base material to fix sheet metal, wood or soft materials.

DIRECT FASTENING

The need to fasten quickly and reliably diverse materials on concrete and steel triggered the development of direct fastening through **P**owder **A**ctuated **T**echnology (**PAT**) and recently Gas Technology (**GX**).

In the Hilti world the term
DX is used for **PAT** systems and
GX is used for **GAS** systems.

HILTI PAT TRAINING FOLLOWS OSHA RECOMMENDATIONS AND ALSO COMPLIES WITH ANSI 10.3 2013 GUIDELINES

- Identify DX & GX fastening applications on steel and concrete.
- Identify the basic operating principles of DX/GX tools & fasteners
- Describe, identify, and select a fastener based on the application.
- Select the correct fastener, DX/GX tool, cartridge and accessories
- Operate and maintain DX & GX tools.

- Certify powder & gas actuated tool users in the safe use of these tools
  - ANSI & OSHA guidelines state that it is the employer's responsibility to see that all tool operators are trained for the particular tool being used.

- Train qualified individuals to be authorized instructors for Hilti powder & gas actuated systems who, in turn, can train another to be a qualified operator.
  - Per ANSI guidelines, a record of authorized instructors trained by Hilti representatives is maintained at Hilti headquarters.
  - All authorized instructors shall have in their possession a valid authorized instructor's card issued and signed by an authorized representative of the manufacturer

DIRECT FASTENING IS AN ALTERNATIVE TO TRADITIONAL METHODS

Sheet metal on steel with DX

Welding

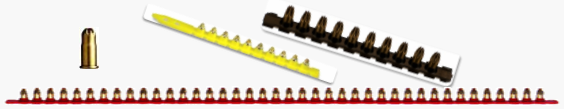
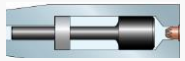
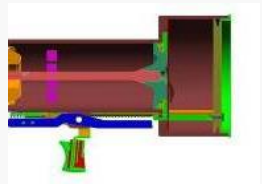
Wood on concrete with DX

Hand nailing

Metal track on concrete with GX

Drilling + anchoring

DX / GX

System:	 **Powder actuated / DX**	 **Gas / GX**
Power source:	 **Cartridge strips (1, 10 or 40 settings)**	 **Gas can (750+ settings)**
Combustion chamber:	 **Small**	 **Large**
Advantages:	**=> Works on hard base materials**	**=> Tool produces no residues, requires no cleaning**

COORDINATED SYSTEM = HIGH PERFORMANCE AND SAFETY

Tool
+
Cartridge
+
Fastener
+
Base Material

=

Fastening Quality

MAKING A DX FASTENING IS EASY

Step 1
Insert nails

Step 2
Insert cartridge

Step 3
Press tool against work surface

Step 4
Pull the trigger

GX TOOLS WORK THE SAME AS DX TOOLS

Step 1
Insert nails

Step 2
Insert gas can

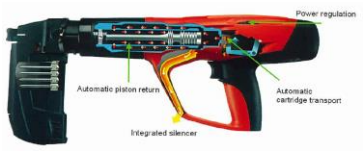
Step 3
press tool against work surface

Step 4
Pull the trigger

SAFETY FEATURES FOR BOTH DX & GX

Hilti DX piston principle

DX is based on the low velocity / piston principle, which means 90% of the energy is retained in the piston.



Trigger safety

This mechanism ensures that pulling the trigger alone cannot cause the cartridge to fire.

Contact pressure safety

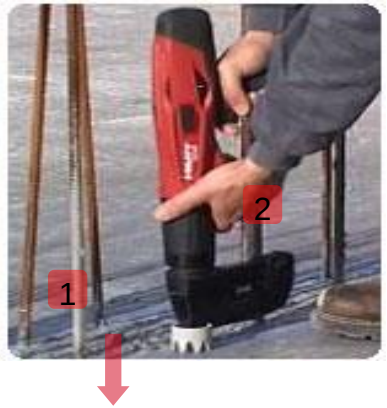
The tool can be fired only when pushed fully against the surface.

Drop fire safety

The drop fire safety mechanism prevents the tool from firing if dropped

Unintentional firing safety

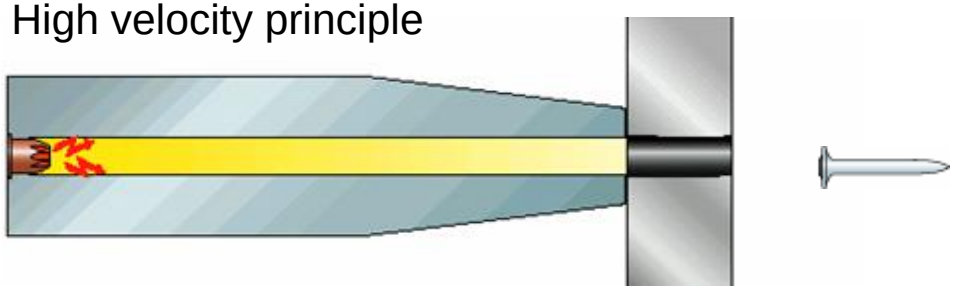
The tool can only be fired if it is first compressed against the work surface and then the trigger is pulled.



ALL HILTI POWDER ACTUATED TOOLS ARE CLASSIFIED AS LOW VELOCITY MEETING ANSI & OSHA REGULATIONS

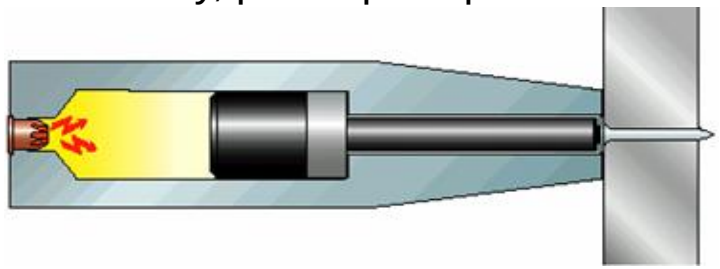
There are 2 types of powder actuated systems in the market:

High velocity principle



Fastener velocity can exceed 1000 ft/sec
=> High danger of through shots

Low velocity, piston principle

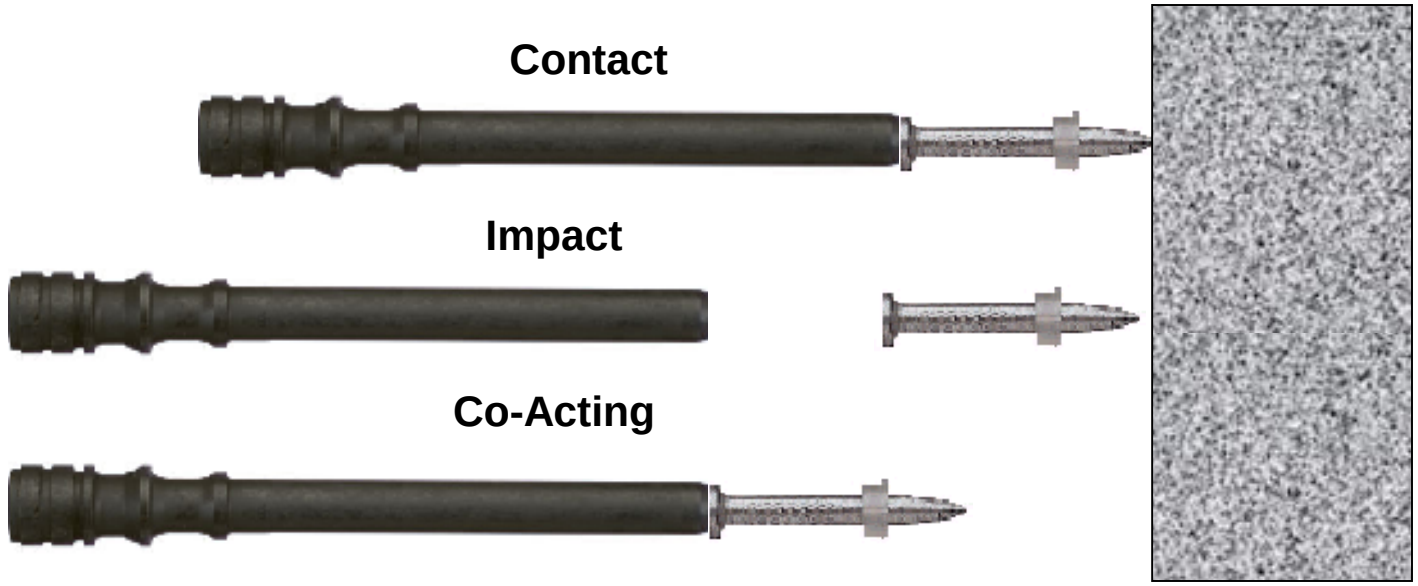


Same energy – higher mass at lower speed!

In ANSI and OSHA, the term “low velocity” tool is appropriate when, using the lightest fastener and the heaviest load for the tool, a free-flighted fastener does not exceed 328 feet/sec measured 6-1/2 feet from the muzzle of the tool.

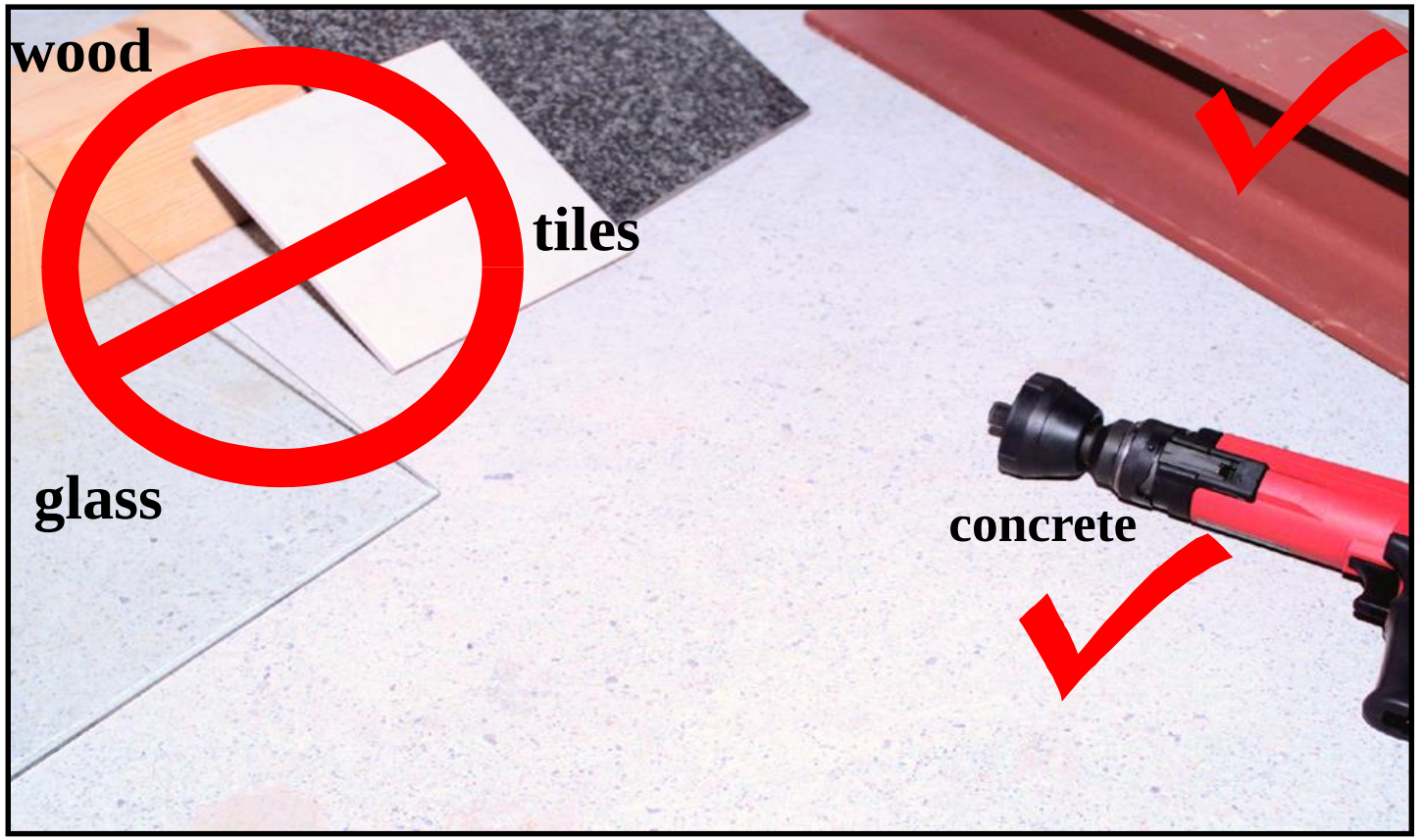
Hilti has ICC-ES, COLA, UL, FM, SDI approvals where necessary to meet local codes for load requirements

PISTON PRINCIPLES



	Power	Recoil	Stress on Fastener	Speed
Contact	Least	Most	Most	Slowest
Impact	In between	In between	In between	Very Fast
Co-Acting	Most	Least	Least	In between

MAKE SURE THE BASE MATERIAL IS SUITABLE FOR POWDER ACTUATED FASTENING. MATERIALS THAT ARE TOO HARD (E.G. WELDED STEEL, CAST IRON), TOO SOFT (E.G. WOOD, DRYWALL), OR TOO BRITTLE (E.G. TILE, GLASS), CAN CAUSE THE FASTER TO SHATTER OR FREE-FLIGHT.



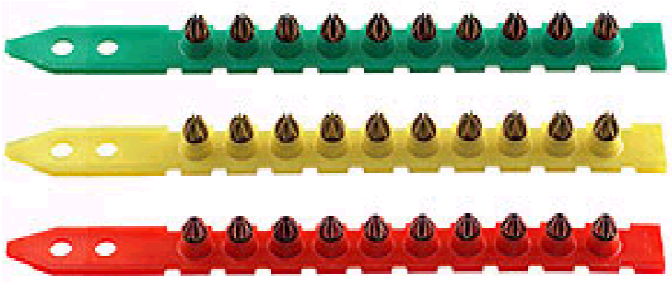
CARTRIDGES

.22 Caliber

DX E72

.25 Caliber

DX 35



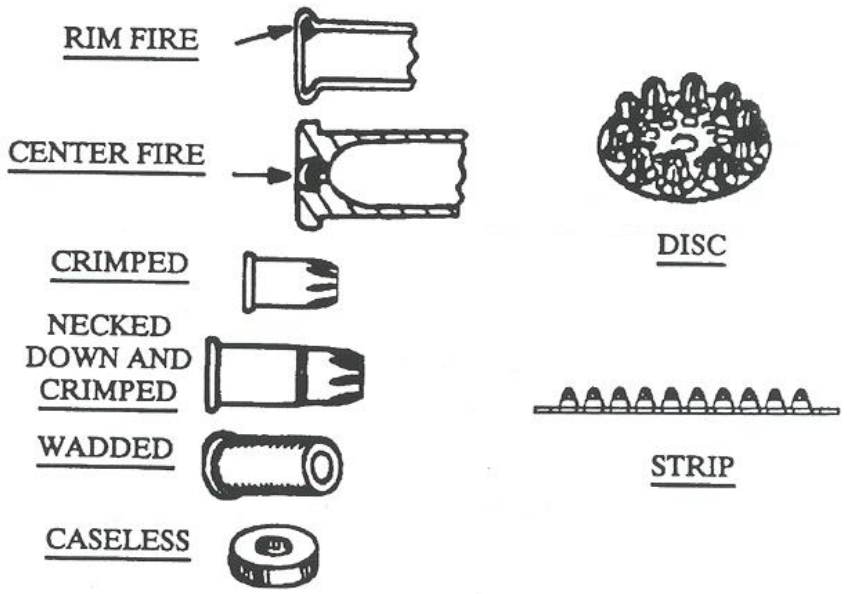
.27 Caliber

DX 2

DX 460

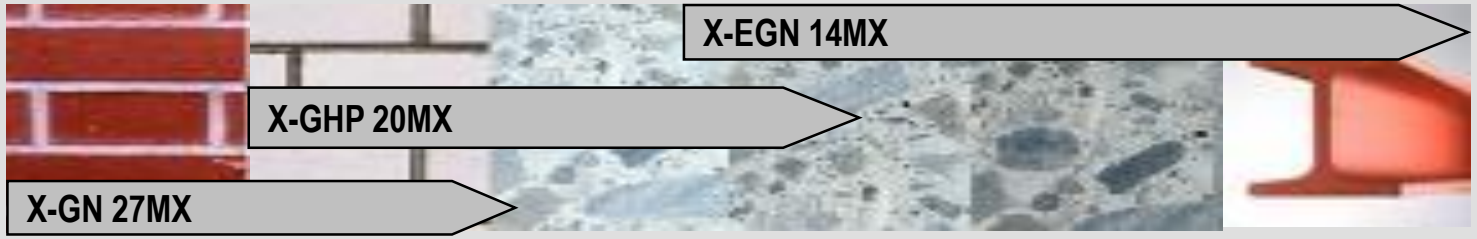
DX 351

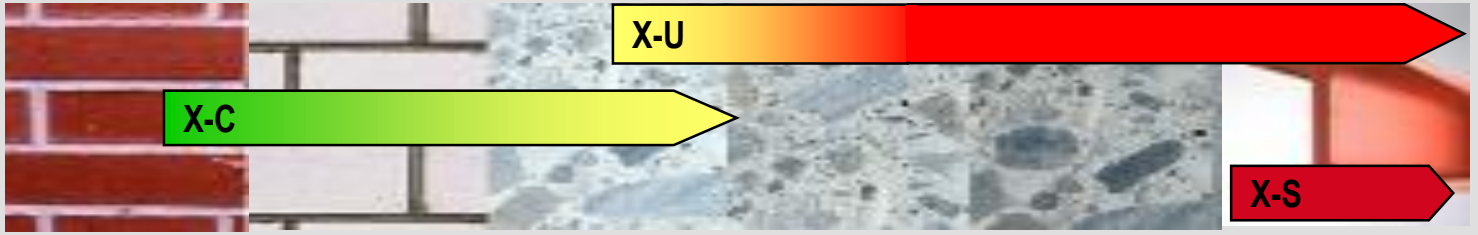
CARTRIDGES FOR POWDER ACTUATED TOOLS



Color Code	Power Level	Description
White	2	Extra Light
Green	3	Light
Yellow	4	Medium
Red	5	Heavy
Black	6	Extra Heavy

GX VS. DX POWER RECOMMENDATIONS





Brickwork joints | Sand lime stone | Green/Soft Concrete Composite Deck | Pre-cast Hard Concrete | Old Concrete | Steel

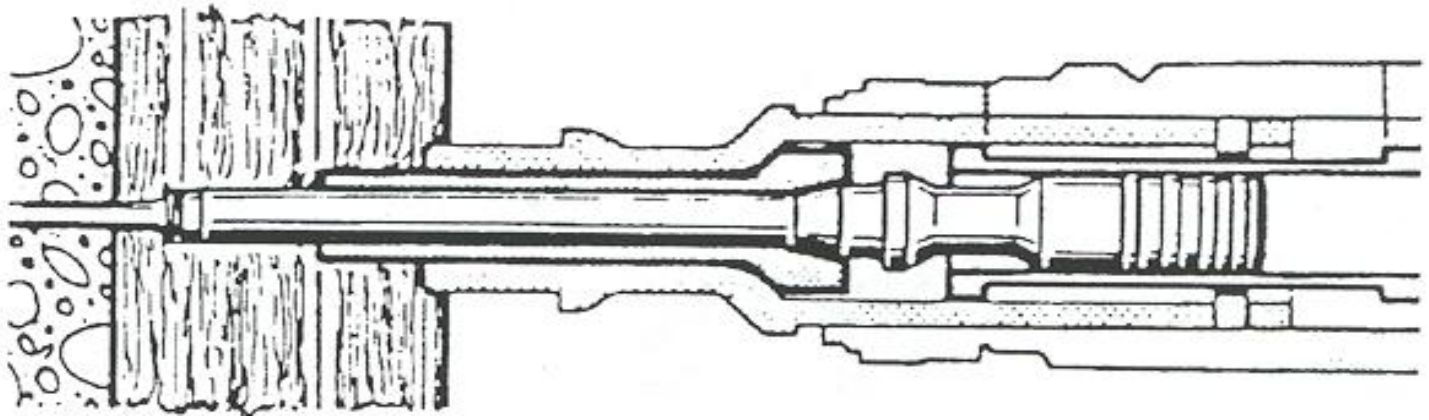
*For DX – Arrow's color = cartridge color. Selection depends on the nail diameter and length

⇒ Non load value dependent applications – GX

⇒ Ceiling wire / Load value dependent applications / pole tool needed – DX

⇒ Jobsite testing is always recommended

TOO MUCH POWER CAN CAUSE REPAIRS



Overdrive - too heavy a power load drives fastener and tool parts too deeply into base material

Stop Ring or Shear clip - absorbs excess energy (deforms)

Perform a pre-punch test to determine suitability of base material

COORDINATED SYSTEM = HIGH PERFORMANCE AND SAFETY

Tool
+
Cartridge
+
Fastener
+
Base Material

=

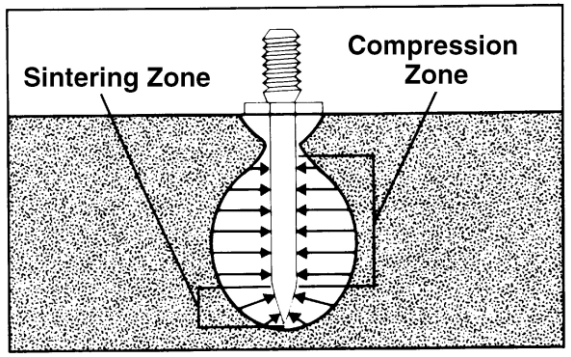
Fastening Quality

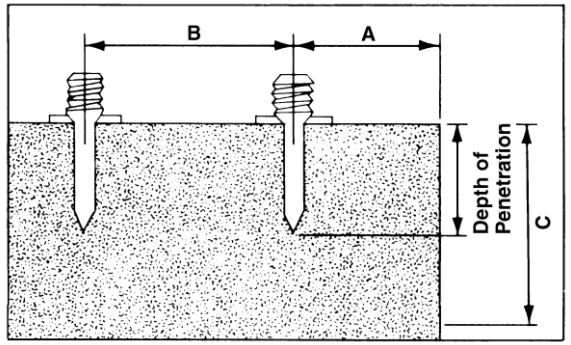
COORDINATED SYSTEM = HIGH PERFORMANCE AND SAFETY

If other cartridges not recommended or suitable for the tool are used, there is a possibility of:

- Misfires
- Split casings
- Casing fragments flying off
- Poor extraction from the tool

FASTENER SELECTION



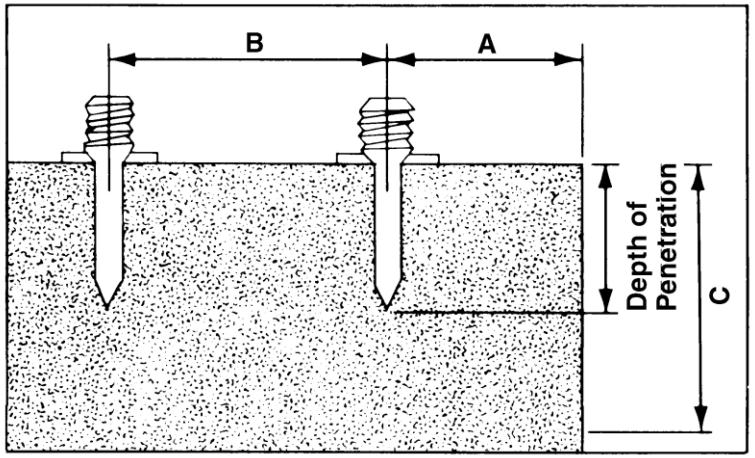


A fastener driven into concrete is influenced by the following factors:

- ➔ Depth of penetration
- ➔ Compressive strength of the concrete
- ➔ Edge distance & fastener spacing (A & B)
- ➔ Fastener shank diameter
- ➔ Concrete aggregate

Material	**Typical Penetration Depth**
Concrete block and mortar joints	1” – 1 ¼”
Average concrete (2,000 - 4,000 psi)	¾” – 1 ½”
Precast or pre-stressed concrete (5,000 psi +)	7/8” – 1 ¼”

FASTENER SELECTION - CONCRETE



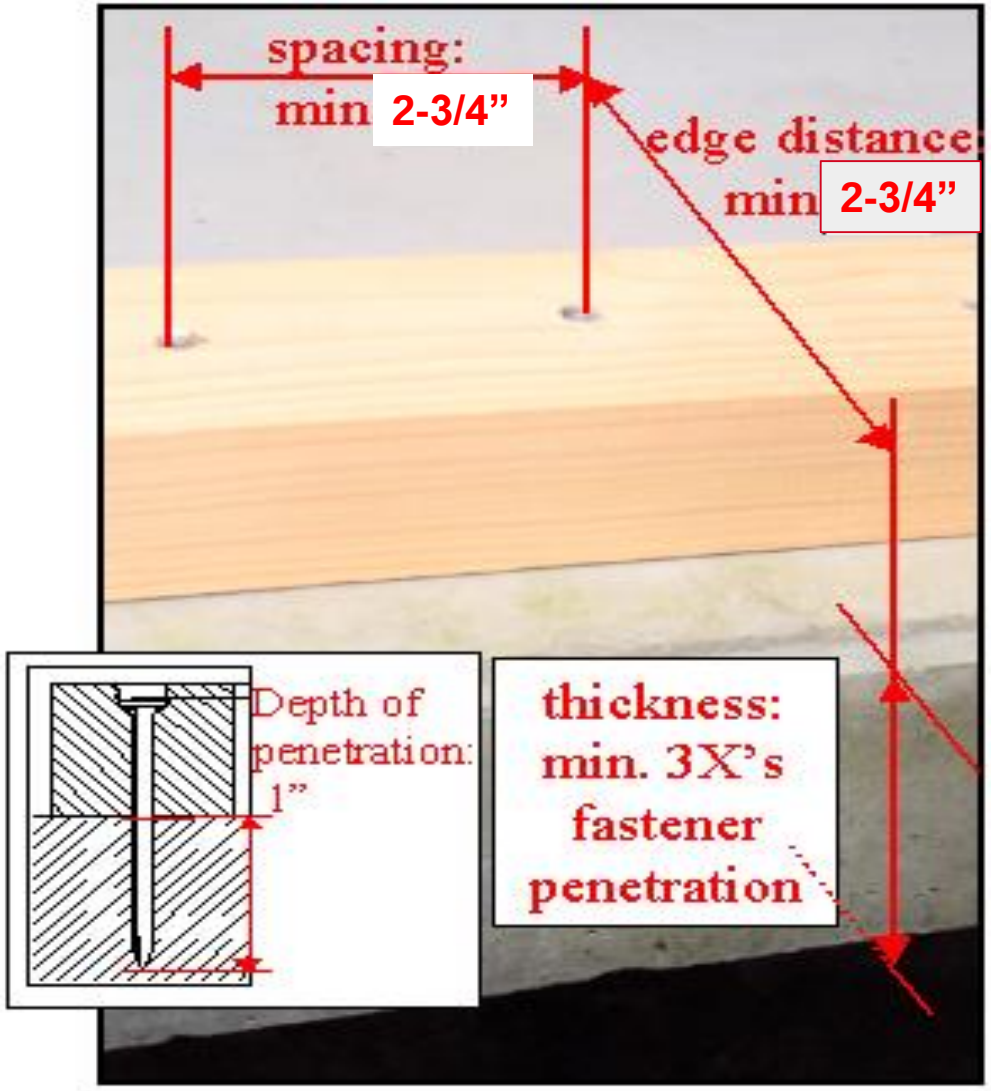
General Guidelines for Fastener Spacing, Edge Distance and Base Material Thickness for Concrete

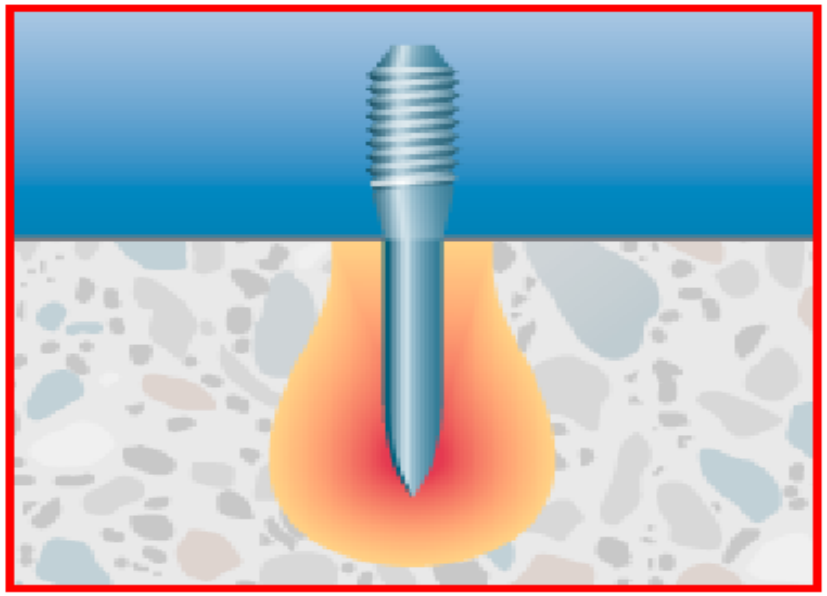
A. Minimum edge distance = 2-3/4”

B. Minimum fastener spacing without reduction in performance = 2-3/4”

C. Minimum concrete thickness = 3X fastener penetration

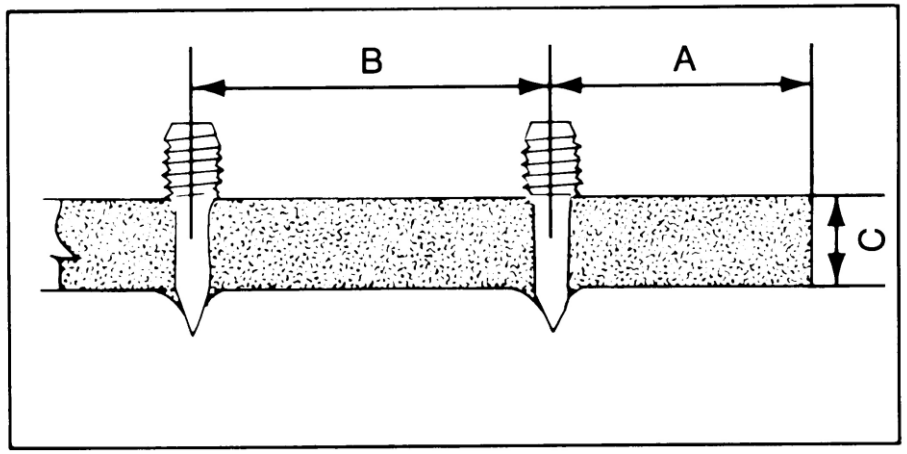
FASTENER SELECTION - CONCRETE





When a powder-actuated fastener is driven into concrete, the concrete around the fastener shank is displaced. This displaced concrete compresses against the shank creating a friction hold. In addition, heat generated during the driving process causes a sintering of the concrete to the fastener

FASTENER SELECTION - STEEL



A fastener driven into steel is influenced by the following factors:

- Base steel thickness
- Tensile strength of base steel
- Fastener spacing and edge distance
- Fastener shank diameter

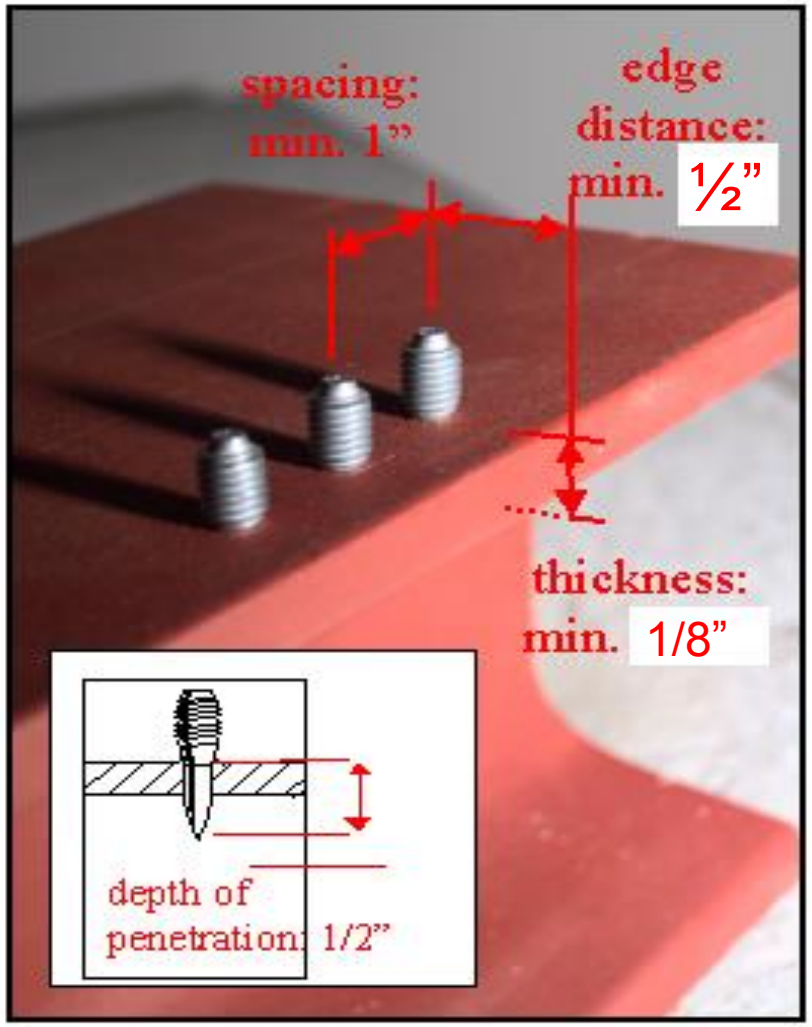
General Guidelines for Fastener Spacing, Edge Distance and Base Material Thickness for Steel

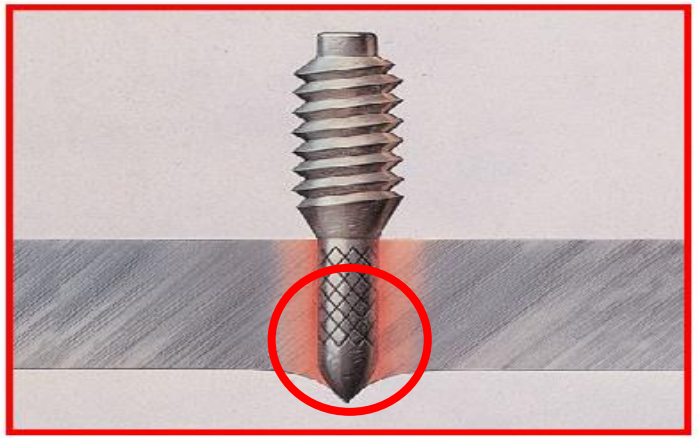
A. Minimum edge distance = ¼”

B. Minimum fastener spacing without reduction in performance = 1”

C. Minimum steel thickness = 1/8”

FASTENER SELECTION - STEEL





When a powder-actuated fastener is driven into steel, the steel around the fastener shank is displaced. This displaced steel flows back around the shank and into the knurling creating a keying or in the case of smooth shank fasteners a friction hold. In addition, the heat generated during the driving process, at temperatures of approximately 1650 degrees, causes partial fusion of the fastener to the steel.

FASTENER SELECTION

Attach a 2X4 to concrete

2X4 thickness	1 ½”
Depth of penetration	+ 1”
Minimum Nail length	2 ½” long

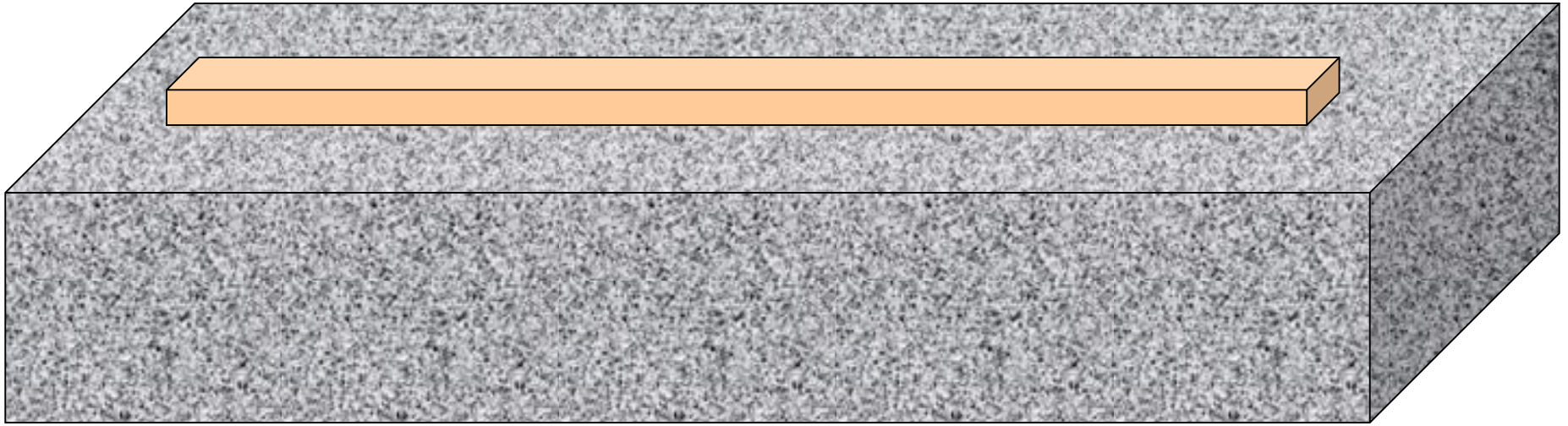
Attach a 2X4 to 3/16” thick steel

2X4 thickness	1 ½”
Depth of penetration	+ ¼”
Minimum Nail length	1 ¾” long

Attach 5\8” plywood backer board to concrete block

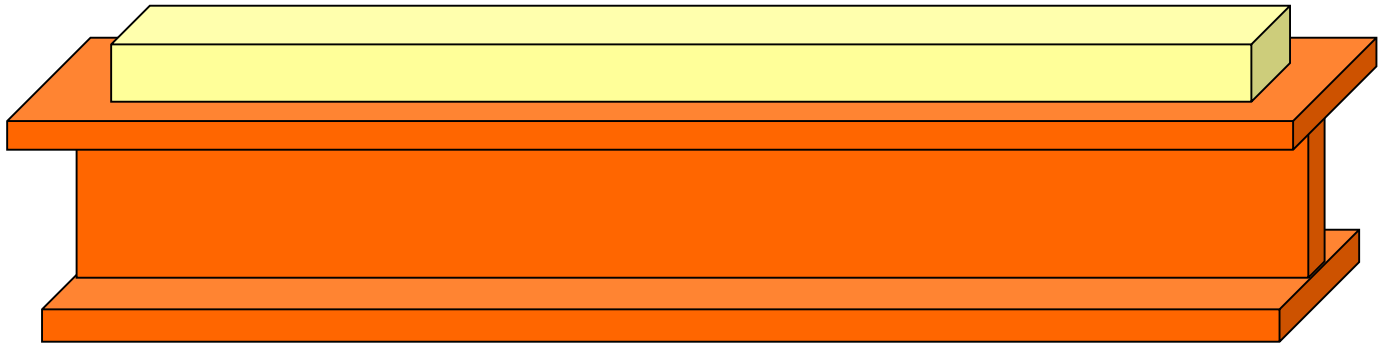
Backerboard thickness	5/8”
Depth of penetration	+ 1 ¼”
Minimum Nail length	1 7/8” long

WHAT LENGTH PIN WOULD YOU SELECT TO ATTACH A 2 X 4 TO CONCRETE?



Thickness of 2 x 4	**1-1/2”**
Required Penetration in concrete	**1”**
Pin length required for fastening	**2-1/2”**

WHAT LENGTH PIN WOULD YOU SELECT TO ATTACH A 2 X 4 TO 3/8” STEEL?



Thickness of 2 x 4	**1-1/2”**
Thickness of steel	**3/8”**
Pin length required for fastening	**1-7/8” - 2”**