TENN PAF Tools

Powder-Actuated Fastening Systems

Older versions of powder-actuated tools, which are known in the industry as "high velocity" tool systems, function much like guns. In these tools, the powder charge directly powers the drive pin, which is shot out of the tool's barrel at speeds of around 600 meters per second. Special care has to be taken to ensure that the base material is strong or thick enough to stop the pin from exiting the back side of the wall.

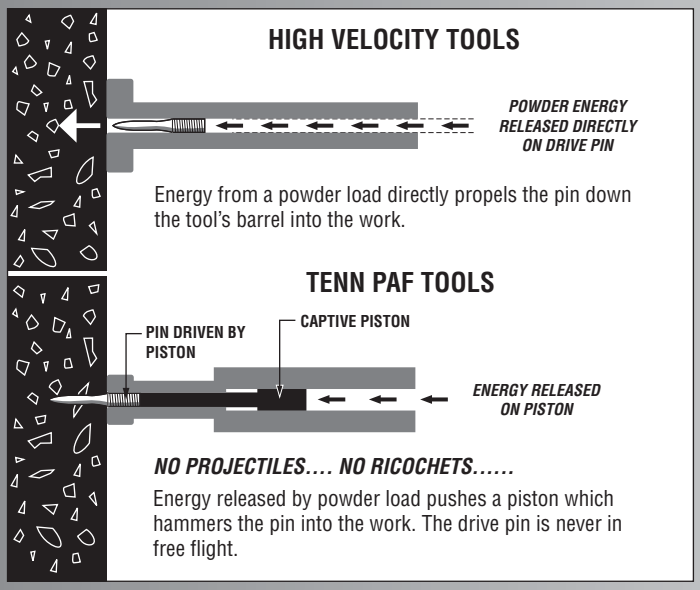
The tendency of the pins to ricochet after hitting steel or hard aggregate in the concrete was an ever present danger to users and bystanders.

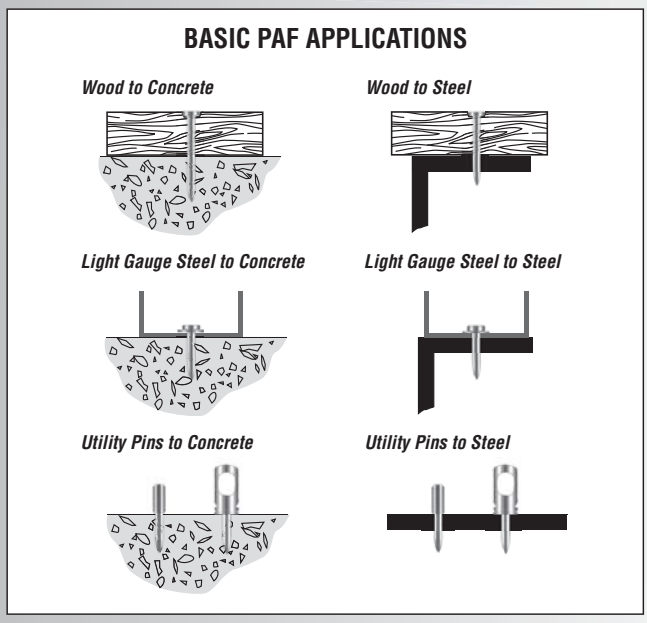
TENN PAF Tools work differently.....

Tenn PAF Tools are classified as "low-velocity" powder-actuated tools because the drive pins are driven at much lower speeds (around 100 meters per second).

In Tenn PAF Tools, safety is inherent in the system: the energy released by a powder load activates a "captive" piston which in turn rams the drive pin into the work. As with a hand hammer and nail, piston and drive pin always travel together: when the piston stops, the pin stops.

There is no risk of ricochets because the piston is captive within the tool, so the drive pin does not at any time become a projectile.





Tenn FASTENING SYSTEMS

TENN PD700

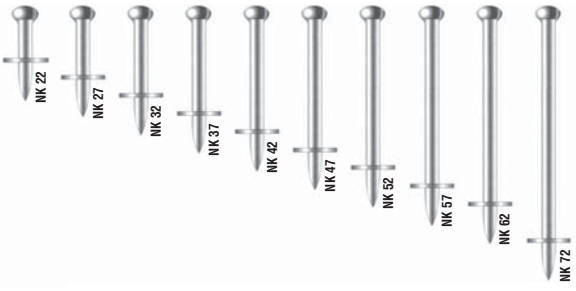
Powder-Actuated Fastening Tool

Engineered for tough use, TENN PD700 has all the features needed in a powder-actuated tool by the professional user.

Silenced operation and low recoil increase operator comfort, leading to higher productivity.

LENGTH	:	350 mm
WEIGHT	:	3.17 kg
POWDER LOADS	:	6.8 x 11 mm in a 10-shot strip
BODY	:	Precision cast aluminium
NOISE SUPPRESSOR	:	Yes
POWER REGULATOR	:	Yes

NK DRIVE PINS



TB EYELET PINS

6.8 x 11 mm STRIP LOADS

Tenn FASTENING SYSTEMS

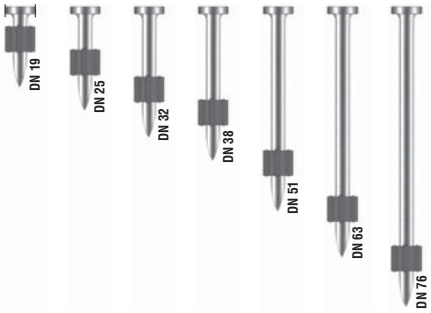
TENN PD350-R

Powder-Actuated Fastening Tool

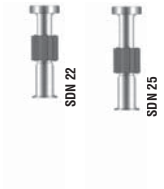
The proven reliability, versatility and speed of TENN PD350-R make it the "one-tool" solution for a wide variety of specialist trades.

LENGTH	: 345 mm
WEIGHT	: 2.38 kg
POWDER LOADS	: 6.8 x 11 mm in a 10-shot strip
BODY	: Precision cast aluminium
NOISE SUPPRESSOR	: Yes
POWER REGULATOR	: Yes

DN DRIVE PINS



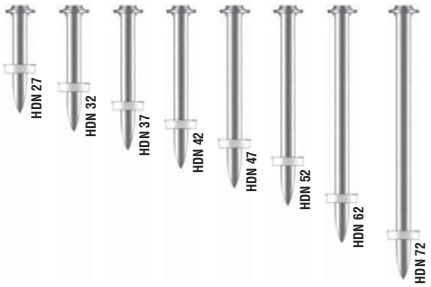
SDN DRIVE PINS



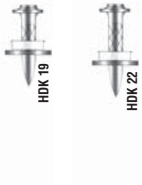
DN-C PIN-CLIP ASSEMBLIES

DN-T THREADED PINS

HDN DRIVE PINS



HDK DRIVE PINS



6.8 x 11 mm STRIP LOADS

Tenn FASTENING SYSTEMS

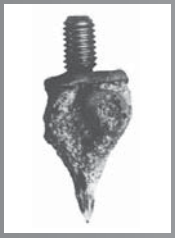
POWDER-ACTUATED FASTENING

Powder-actuated fastening, or PAF, is an efficient and reliable method of attaching metal or wood fixtures to concrete and steel substrates. It is also extremely fast because there is no need to prepare holes in both the fixture and substrate.

A specially designed fastening tool is used together with gunpowder loads and special nails called "drive pins". The pins are made from high carbon steel and undergo a special through-hardening process known as austempering, to achieve the required ductility and hardness.

How it works…in concrete

The drive pin crushes and displaces the concrete while penetrating it. Forced entry roughens the pin's surface. The high penetration speeds and deformed surface generate friction and heat (reaching up to 900 °C) resulting in a sintered bond between drive pin and crushed concrete.



The bond achieved is such that failure under pull-out tension loading is usually rupture in the concrete in the immediate vicinity of the pin and not in the bond between the pin and concrete (see inset).

TENN PAF FASTENERS

Drive pins need to be 2 to 3 times harder than the materials into which they are likely to driven. The hardness or compressive strength of structural concrete is generally between 15 and 60 MPa, while that of structural steel may be between 400 and 600 MPa. The hardness of drive pins therefore have to be in the 54 to 57 HRC range (or between 1800 and 2000 UTS).

The following table shows the relationship between Ultimate Tensile Strength (UTS) and Rockwell Hardness "C" Scale.

Ultimate Tensile Strength MPa	965	1834	1889	1944	2070
Rockwell hardness HRC	30	55	55	56	57

Tenn PAF drive pins are manufactured from steel wire conforming to AISI 1062 or 1065 and are austempered to a Rockwell "C" hardness between 52 and 56. The pins are given a zinc corrosion resistance coating applied by the mechanical plating process.

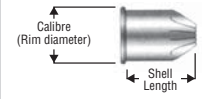
In general, carbon steel fasteners with a hardness of HRC 32 (property class 10.9) or higher, which have been electroplated will have absorbed hydrogen and may fail prematurely due to hydrogen embrittlement cracking. Measures can be taken to control this failure mechanism, such as baking immediately after plating, however according to the present state of the art, the risk of cracking cannot be totally excluded.

For this reason, Tenn drive pins are not electroplated but instead are mechanically plated. Mechanical plating is a room temperature coating technology that utilises kinetic energy to cold weld a zinc coating to fasteners. Since no electric current is used, the risk of hydrogen induced failure is avoided.

TENN POWDER LOADS

Tenn powder loads are 6.8 mm (.27") calibre cartridges of 11 mm length collated in a 10-load plastic strip magazine.

The power levels conform to ANSI A10.3-1985 which defines strength levels based on velocity measured in a standard test procedure with standardised test apparatus.



Tenn 6.8 x 11 mm Powder Loads

Colour Code	Power Level	Powder Weight in grains	Approx. Velocity m/s
Yellow	4	2.60	175
Red	5	3.15	190
Purple	6	3.40	205

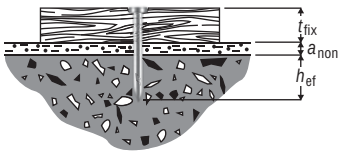
Shipping description: "Cartridges, Power Device UN0323, 1.4S, PG II"

TECHNICAL INFORMATION

The following factors influence the drivability and load bearing capacity of a drive pin in concrete.

- Depth of penetration
- Compressive strength of the concrete
- Concrete aggregate
- Fastener spacing and edge distance

Depth of penetration. The ideal penetration range for a drive pin is between 5 and 8 times the shank diameter or between 20 and 30 mm. The harder the concrete, the lesser the penetration, and the shorter the drive pin required.

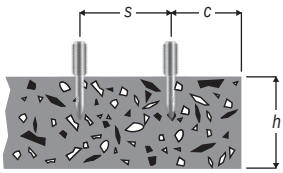


Fixture thickness, t_{fix}
\+ Depth of screeding or void, a_{non}
\+ Penetration depth, h_{ef} (between 20 to 30 mm)
= **Drive pin length**

Compressive strength of concrete. Structural concretes with compressive strengths between 10 and 50 N/mm^2 are the most acceptable base materials for powder-actuated fastening. In principle, the harder the concrete, the greater the holding power will be. However, very high compressive strength e.g. 60 N/mm^2, decreases the possibility of successful penetrations.

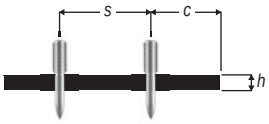
Fastener spacing and edge distance

Fastening into concrete



c = Min. edge distance = 100 mm
s = Min. spacing = 75 mm
h = Min. concrete thickness = 3 * h_{ef}

Fastening into steel



c = Min. edge distance = 12 mm
s = Min. spacing = 25 mm
h = Min. steel thickness = 4.8 mm

Concrete aggregate. While softer aggregates may be easily penetrated by a drive pin, harder aggregates and those that are struck by the pin at an unfavourable angle may cause the pin to be bent. The pin then has a reduced or negligible capacity.

SAFE WORKING LOADS FOR TENN DRIVE PINS INSTALLED IN CONCRETE

Effective Embed. Depth h_{ef}, mm	Safe Working Loads, kN				
	Concrete Compressive Strength, f_{cc}				
	15 N/mm^2		20 N/mm^2	25 N/mm^2	
	Tension ϕN	Shear ϕV	Tension ϕN	Tension ϕN	Shear ϕV
20	0.20	0.40	0.36	0.55	0.40
25	0.25	0.53	0.44	0.67	0.91
32	0.62	1.18	1.13	1.65	1.18

Note:

1. *The safe working loads are for the anchorage of the drive pin only and do not consider the pull-over or pull-through strengths of wood, plywood or thin metal fixtures. These attachments must be investigated seperately in accordance with accepted design criteria.*
2. *Concrete thickness should be minimum 3 times h_{ef}.*
3. *For combined tension shear loading, the straight line method is used for the calculation of interaction of tension and shear:*

$$(N/\phi N) + (V/\phi V) \leq 1$$

where:
N = Actual tensile load
ϕN = Safe working tensile load
V = Actual shear load
ϕV = Safe working shear load

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