

3. Health and safety

The safety of powder-actuated fastening systems can be examined in terms of three general safety characteristics:

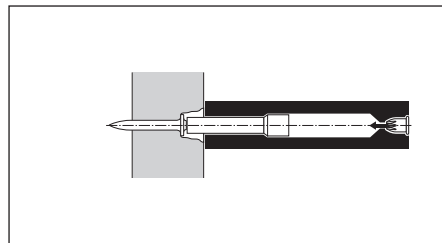
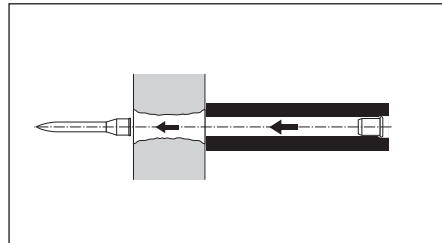
- **Operator safety** refers to safeguarding the operator and bystanders.
- **Fastening safety** is a measure of the adequacy of the in-place fastenings.
- **Functional safety** refers to the operability of the tool, especially the operator safety devices, under construction site conditions.

3.1 Operator safety

Hilti powder-actuated systems incorporate five main design features for maximum operator safety – the DX piston principle, drop-firing safety mechanism, contact pressure safety mechanism, trigger safety mechanism and the unintentional firing safety mechanism.

Hilti DX/GX piston principle

One of the main concerns about the use of explosive powder-filled cartridges to drive fasteners is what happens if the base material is missed by the fastener. The piston principle ensures that the energy from the propellant in the cartridge is transferred to a piston, the accelerated mass of which then drives the fastener. Because the piston is captive within the tool, roughly 95% of the driving energy is absorbed by the tool in the event of the fastener missing the base material. Thus, the velocity of a fastener that misses the base material is far lower than the velocities associated with fasteners from high-velocity tools (tools that do not operate with the piston principle).



Drop-firing safety

The drop firing safety mechanism prevents the tool from firing if dropped unintentionally. This mechanism is so designed that the tool, cocked or uncocked, will not fire when dropped at any angle onto a hard surface.



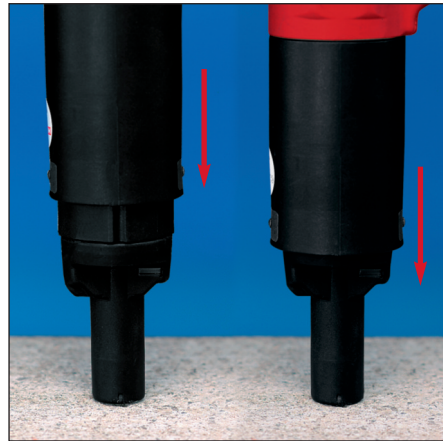
Trigger safety

This mechanism ensures that pulling the trigger alone cannot cause the cartridge to fire. The trigger in a Hilti DX- or GX-tool is uncoupled from the firing pin mechanism until the tool is fully compressed against the work surface.



Contact pressure safety

A Hilti tool is made ready for firing by compressing it against the work surface. This requires a force of at least 50 N [11.2 pounds]. Tools with large baseplates that can be easily gripped with the hand, for example the DX 76 and the DX 460 SM, GX 120, have an additional surface contact pin that must also be pushed back to allow firing. This is designed to prevent the tool firing when its nosepiece is not in contact with the work surface.



Unintentional firing safety

Hilti DX tools cannot be fired by pulling the trigger and then compressing the tool against the work surface (also known as “bump firing”). These tools can be fired only when they are (1) compressed against the work surface and (2) the trigger is then pulled.



Cartridge (power load or booster)

The propellant powder in the cartridge can only burn if the primer burns first. Burning of the primer is initiated by an impact applied with the correct velocity at the correct location of the cartridge. The propellant and primer are protected from external influences by the metal casing of the cartridge.

Magazine strip

Collated cartridges in strips of 10 (or 40) offer greater safety because the plastic strip helps protect the cartridge cases from impacts and ensures separation between the cartridges.

Packaging

The packaging must contain provisions with respect to tool compatibility.

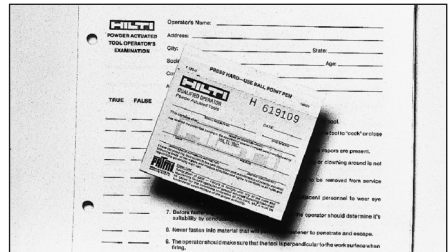
Promotion of operator safety

Safety of the operator and bystanders is promoted by use of the appropriate safety equipment and by following the instructions in the operator's manual. By supplying the powder-actuated tool in a lifetime kit box with space for eye protectors, operator's manual, etc., retention and use of the safety equipment is much improved.

Tool compatibility information and installation guidelines printed on the cartridge and fastener packaging supplement the operator's manual.



Hilti organizes operator training courses in which general safety measures for powder-actuated tools are covered as well as measures specific to each model of tool used. In some countries, certificates or operator IDs are issued upon completion of training courses to encourage attention to safety by operators and to allow safety officials to enforce training requirement regulations.



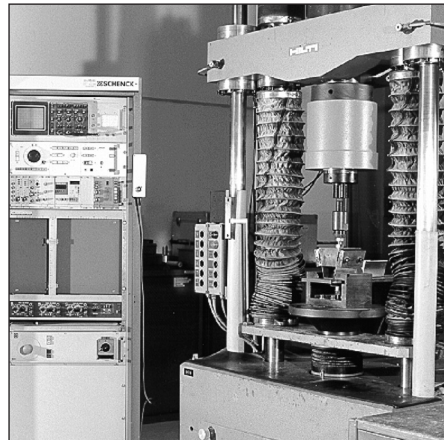
3.2 Fastening safety

Fastening safety depends on a correct prediction of the loads and the conditions to which the fastening is subjected and a correct prediction of fastening performance. The necessary conditions for predictable fastening performance are:

1. The fastening system must have been engineered and tested for the application.
2. The quality of the fastening system components used must correspond to the quality of those originally tested.
3. The fastenings must be made as foreseen in the engineering of the system or in the same way as when the system was tested.

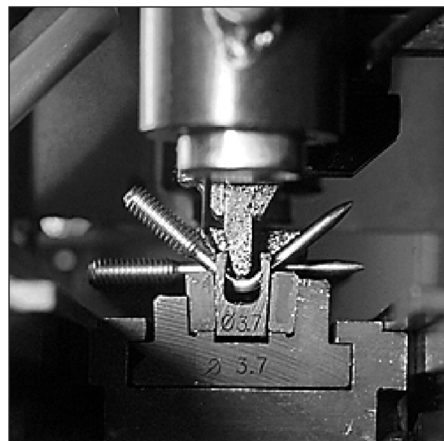
Engineering and testing

Sources of information about the engineering and testing of a fastening system are the manufacturer's technical literature, test reports, official approvals and publications in technical journals. If an "or equal" clause is used in the specification, then approval of any alternate fastening system should be made contingent on provision of documentation showing that the proposed fastening system has been engineered and tested for the given application.



Production quality

The need for the materials used on the job-site to correspond to the design of the product and to be of the same quality as those tested is clear. This requires the manufacturer to have a production quality control system, which is necessary for ISO 9001 certification.



Quality of installation

The use of fastening systems for which the manufacturer provides application guidelines and a technical advisory service helps ensure that fasteners will be installed correctly. The concept of controlling the quality of the work must include some feature that can be measured and that feature must indicate the performance of the fastenings.

The primary means of checking the quality of a powder-actuated fastening is by checking the stand-off over the surface of the fastened material. For fasteners that do not allow an accurate visual check of the stand-off, the use of a stand-off template is recommended. In some cases tensile testing of fasteners on jobsites is necessary. Threaded studs and some decking fasteners with suitable head design can be tensile-tested in their final position on a jobsite. Other fasteners like simple flat-headed nails have to be driven through a pull-over test specimen and then tested.



Checking the standoff of an X-EDN 19 roof deck fastening with a plastic template



Pull-out test of an ENP fastening with a Mark V tester and ENP adapter

3.3 Functional safety

Construction professionals demand fastening systems that are dependable under the toughest jobsite conditions. The goal of functional reliability has to be integrated into the development, manufacture, sales and service of a fastening system. The development of a new fastening system must consider the operating conditions and the degree of reliability required. During development, system components and prototypes are tested to determine if they will function reliably. Pilot production lots are tested by contractors on their jobsites to ensure that the design can be produced in a quality that will function. Quality control is integrated in the manufacturing process to ensure that all components are manufactured according to specifications. Salespersons are trained so that they can advise their customers as to the proper system to use for the application. Tool repair and maintenance training help keep the fastening systems functioning.



Lifetime testing of the DX powder-actuated tool with nail magazine

3.4 DX Cartridge safety

Important information about cartridges for powder actuated fastening tools

Only use Hilti cartridges or cartridges of equivalent quality.

The use of cartridges of inferior quality in Hilti tools may lead to build-up of unburned powder, which may explode and cause severe injuries to operators and bystanders.

At a minimum, cartridges must:

1. be confirmed by their supplier to meet the "Combustion residue test" according to EU standard EN 16264,

or

2. bear:

- The CE conformity mark
- The proof mark of fire-arm test house
- The tool designation
- The identification number of the EU notified body
- The number of the type test

For example:

CE conformity mark	Proof mark of fire arm test house	Tool designation	ID proof house	Number of type test
		DX 460 DX 462 DX 351 CT	PTB Sy	812 HR73 808 HR63 817 HR13 809 HR83

3.5 DX Tools safety

Approvals for powder actuated fastening tool:

Hilti Powder Actuated Fastening tools are designed and tested according to "Directive 2006/42/EC" and are CIP approved.

Identifications on the Hilti DX tools:

