



THE EFFICIENT WAY UP

Hilti system solutions
for elevators

DEMANDING PROFESSIONALS IN THE ELEVATOR BUSINESS RELY ON HILTI – WORLDWIDE



For ten years we've had a dedicated approach towards the global elevator segment, supporting significant time savings on installation without scaffolding.

Our line of cordless power tools, including dust removal technology and tailored accessories, contributes to user health and safety targets as do lightweight modular solutions for supports that avoid welding in the shaft.

We have significantly extended our portfolio of value-adding services to the elevator segment, whether fitter trainings on safety or on the efficient use of power tools.

We look forward to continuing our support of the elevator segment over the next decade.



PRODUCTIVITY

- Our innovative products and systems, with a proven track record, speed up the job and let you work more productively.

RELIABILITY

- A continuously expanding library of approvals, appraisals and test reports takes the reliability of our products to a new, unmatched level.
- Our experience, the advice we provide and the software solutions we offer make us a partner you can rely on.

HEALTH AND SAFETY

- We care about our customers. That's why effective health and safety measures and the prevention of accidents have been fundamental pillars of our efforts for many years.

HILTI ACCOUNT MANAGERS

- Two-thirds of all Hilti employees are in daily contact with our customers. This means a total of 250,000 contacts every working day with customers worldwide.
- We support them by providing advice and know-how. In selected markets we have identified elevator account specialists, based on their specific application know-how, that focus on customers in the elevator industry.



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An initial step before elevator installation is scheduled. Checking conformity of the hoistway dimensions and building axis with the elevator layout drawing.

Documenting deviations that need to be corrected by the general contractor before elevator installation can start. Placing markings to be used by the mechanic as references for installation.

Finally, signing the hoistway inspection protocol as the document of acceptance that the shaft is ready for the elevator to be installed.



CHALLENGE

- Installation without scaffolding is quickly becoming the industry standard. Thus, access to the hoistway head to hang up plumb reference lines for measuring needs installation of a temporary platform.
- Access to the back wall of the shaft, to fix the end of manual meters for measuring distances, is no longer supplied.

FEATURES

- Laser tools support survey of the shaft by a single person. Length measuring can be done from the location of the tool without access to the end of the dimension line.
- Plumb lines start from the shaft pit.
- Vertical and horizontal reference lines, of almost 360°, level themselves to the plumb.
- Different technologies provide various levels of accuracy with either red or green laser light.

ACCESSORIES

- Tripods to position the laser tools for exact placement of the reference lines.
- Extensions for the range meters to support access to locations that can't be manually reached.
- Remote controls to steer the laser tool from a distance.
- Receivers to catch laser reference beam/point if not visible to the eye.
- Calibration service to check and document accuracy over entire product lifetime.



Measuring distances

Advantages

- Single-person operation
- Built-in memory and calculation functions
- Integrated camera supports documentation of measuring results via photo
- Transfer data via Bluetooth to other mobile devices and via Wi-Fi to Dropbox cloud storage
- Android-based operating system (optional integration of software apps)

Alignment

Advantages

- Single-person operation
- Self-leveling plumb lines start from the bottom of the shaft
- Creates 3 reference lines and points
- Horizontal and vertical reference lines
- Green laser light

Positioning

Advantages

- Single-person operation
- Download construction design drawing
- Investigate exact deviation of site points to design drawing
- Marking of reference points based on design drawing



PD-CS Laser range meter



PM 40-MG Multi-line laser



PLT 300 Layout tool

Modernizing elevators often means replacing individual components like shaft doors, the complete car or only the interior, or controller and drive systems. Complete replacement has become more popular due to the old age of existing elevators. The complete guide rail system often remains in the hoistway.



CHALLENGE

- Hoist points of unknown reliability are available on the hoistway head. In order to determine the quality and reliability of installed hoist points in the shaft head, they must be verified and checked before they are considered to be safe for use.
- If new rails need to be installed, either the quality of the old concrete needs to be verified or the load distribution capacity of the anchors used in the masonry block of the shaft wall needs to be verified.

FEATURES

- Single-person operation of compact load testers to check ceiling hooks and anchors for safe use.
- Reliable hoist point systems for material winches to be installed at the right location on the machine room ceiling of an existing shaft by a single person.
- Anchoring systems that get the maximum load distribution capacity out of masonry block walls, even when cavities in the wall do not allow for the creation of expansion forces.

ACCESSORIES

- Couplers to connect the tester to different types of hooks and anchors.
- Labels to mark hooks tested for safe use.
- Cordless dispensers for quick, effortless injection of chemicals into anchor holes.
- Calibration service for the tester to check and document accuracy over the entire product lifetime.



Load capacity testing

Advantages

- Single-person operation
- Suitable for testing hoist anchors (rings) and anchors with various head shapes and diameters
- The index pointer allows identification of anchor creep, i.e. slow anchor failure

Hoist anchor points

Advantages

- System for reliable post-installed hoist points providing up to 1.15tons or 2.5tons work load limit
- Both systems suitable for single-person installation
- HAP1.15 suitable for single-person roof or wall installation, hook can be pivoted and rotated
- HAP2.5 suitable for single-person roof installation only

System to anchor in masonry block

Advantages

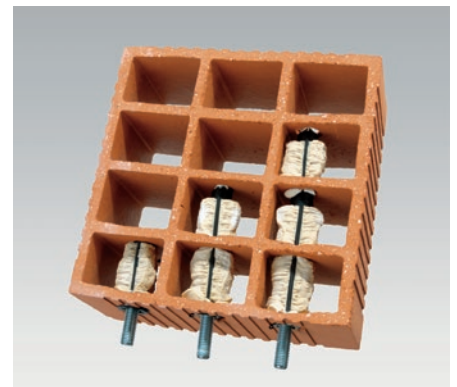
- Very easy-to-use chemical anchor system
- More than 20 years of Hilti experience in the field of chemical anchors
- Mesh sleeves connect together for various anchorage depths
- Odorless and easy to dispense (little pressure required)
- Technical data available for more than 40 types of masonry blocks used in Europe



HAT 28 Tensile tester



HAP 2.5 Hoist Anchor Point



HIT-HY 270 Injectable mortar

RAIL ANCHORING

Cordless hammer drills with dust removal system

Elevator guide rails need to be anchored to the sidewalls of the shaft. Base material is mainly concrete. After initial installation, anchorings need to be unfastened to allow rail adjustment.



CHALLENGE

- Cleaning cast-in concrete channels is a hassle and creates a great deal of dirt. Drilling anchor holes exposes the fitter to fine dust that presents a health hazard.
- Elongated holes in rail anchor brackets support adjustments but reduce the contact surface area for standard nuts and washers.
- Achieving adequate loading capacity at low anchorage depth in shallow shaft walls.
- Little space for tapping in stud anchors with a hammer.

FEATURES

- Compact cordless rotary hammers provide the performance of a corded hammer drill.
- TE-CX drill bits with carbide heads to support drilling when rebar is hit.
- HAC-V cast-into-concrete anchor channel with foam inlay which prevents concrete slurry filling the channel and is easy to remove when concrete is cured.
- Nuts and washers preassembled to anchors prevent lost parts.
- Extra large washers assembled to fasteners enlarge contact surface area in elongated holes.

ACCESSORIES

- Compact vacuum cleaners to be attached to, and operated by, the motor of the rotary hammer.
- Setting tools to use the power of the rotary hammer to install the anchor.
- Complete cast-in portfolio including scaffolding shoes, hoist points to provide the complete package for installation.
- Quick chargers which charge an empty battery to its full capacity in 30 minutes.



Mechanical rail bracket anchors

Advantages

- Screw anchor tapping a thread into smaller diameter concrete hole than needed for stud anchors
- Screw anchors can be installed using same impact drill as used for bolting
- Screw anchors do not issue expansion forces which supports anchoring in thin slabs
- Extra large washers and nuts assembled to standard stud anchor
 - fulfilling seismic/ non-seismic approval needs
 - or cost-optimized anchor line w/o approval

Hammer drilling

Advantages

- Compact lightweight 22 V Li-ion cordless rotary hammers
- Li-ion battery packs compatible across the 22 V cordless platform support efficient elevator installation
- TE-CX drill bits with carbide head support drilling when rebar is hit
- Rotation can be switched off and hammering action be used for chiseling or hammering an anchor into a hole with the appropriate insert tool
- Dust Removal System (DRS) attached to, and operated by, the hammer drill

Cast-in concrete anchor channels

Advantages

- Two different channel designs to support either high performance or competitive cost target
- The same type of T-bolt fits three different channel sizes
- Most popular channel for elevators is designed to work with M12 or M16 T-bolts
- Optimum protection to prevent channels filling with concrete slurry; easy to remove after formwork is detached



HUS3 Screw anchor



TE 6-A22 Cordless rotary hammer



HAC Cast-in anchor channel (hot-dip galvanized)

Elevator guide rails come in five-meter lengths and need to be connected using 8 bolts and a fishplate. Attachment to the wall brackets is done with bolts, and the wall brackets consist of two pieces connected with bolts to support adjustment. For various reasons a steel support structure, for rail fastening, needs to be installed in the shaft.



CHALLENGE

- Rails need to be aligned to the plumb, to an exact distance between rails and exactly facing each other.
- When hoistway inspection is done using laser tools there is no plumb reference line installed in the shaft. Installation without scaffolding does not support hanging plumb lines to the shaft head.
- I-beams used for steel support structure either require drilling through-holes on site for bolting the rail brackets, or that the rail brackets are welded to it.

FEATURES

- Cordless impact wrenches support numerous bolting work without tiring.
- Self-leveling plumb lasers provide reference lines starting from the bottom.
- A lightweight modular system of channels and connectors supports safe and flexible installation of a steel support structure, avoiding welding in the shaft.
- Flexible attachment of rail brackets to girders by bolting without drilling.

ACCESSORIES

- Calibration service to check and document accuracy over entire product lifetime of plumb lasers.
- PROFIS Installation design software supports accurate design of steel support system documenting the load capacity usage and the displacement of the support structure. The software provides a bill of material and an assembly design of the structure.



Tightening nuts and bolts

Advantages

- Compared to hand tools, saves up to an hour of labor time when installing an elevator with 5 stops
- No need to hold heads of bolts when tightening nuts
- The user maintains a more secure stance as no physical compensation of torque is required
- Intelligent adaptive torque (AT) module to equip the SIW 6AT-A22 impact wrench for controlled anchoring and bolting applications (metric and fractional) in line with relevant anchor evaluation report

Aligning guide rails

Advantages

- Laser tools provide self-leveling plumb lines starting from the bottom of the shaft
- Supports single-person operation and installation without scaffolding
- Calibration service to check and document accuracy over entire product lifetime
- Ruggedly-built tools for use on the construction site
- Variety of laser tools with different levels of accuracy and either red or green laser beam

Shaft division

Advantages

- Modular system consists of lightweight channels and connectors
- All connections done by bolting – no welding in shaft
- Girders incorporate through-holes at a regular distance and serrated C-channel profile for stepless positioning of rail brackets
- Finite Element Method (FEM) design provides load capacity calculations and details on deflection for complete structures, including the design of wall anchoring and bill of material
- Additional supply of intermediate fencing according to EN 81 20/50



SIW 6 Cordless impact wrench

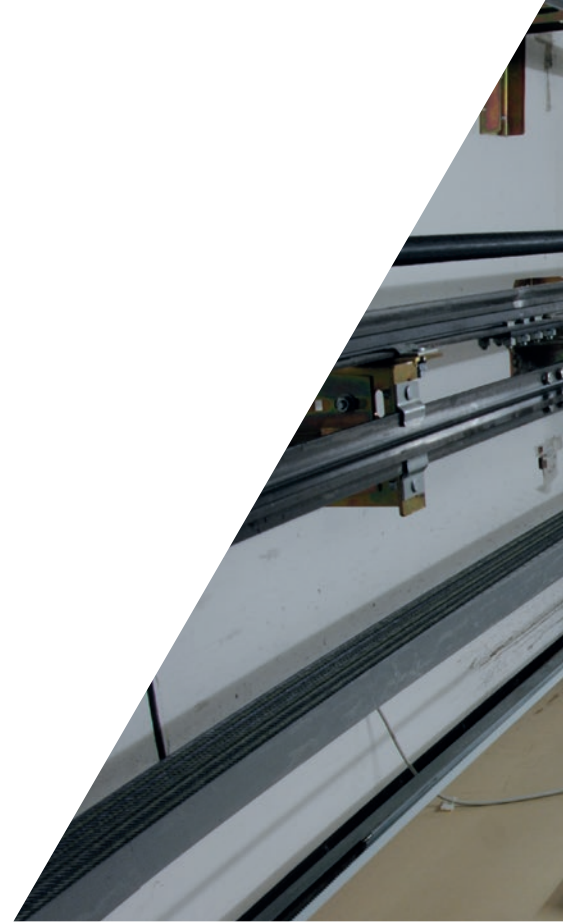


Plumb-line laser tools



MIQ Girder

Sill of elevator shaft doors is anchored to the ceiling slab. Door top header needs to be anchored to the front wall. Door sill needs to be horizontally aligned to the level of the finished floor and entire door needs to be aligned vertically to the cabin passing by.



CHALLENGE

- General contractor provides a 'one meter above finished floor level' marking on the side wall of each landing. This marking needs to be transferred horizontally to different places.
- Often, shaft survey results find that either the front wall is not suitable for anchoring the door header or does not exist.
- Attaching brackets for fastening the door header to existing steel supports.

FEATURES

- Self-leveling laser tools provide horizontal reference lines.
- Modular system can be used to build lightweight support structure to be anchored to sidewalls or top ceiling slab.
- The structure supports both flexible fastening of the door header and easy alignment at the same time.
- Quick fastening solutions to attach threaded bolts to existing steel supports.

ACCESSORIES

- Laser receiver holders to position the self-leveling laser tools at the correct heights.
- Cordless impact wrenches for assembly of shaft door and steel supports.
- Calibration service to check and document accuracy over entire product lifetime of plumb lasers.



Elevator door alignment

Advantages

- Self-leveling laser tools providing horizontal and vertical reference lines in red or green
- Reference lines travel almost 360° around the tool
- Clamping brackets or tripod to position the tool at the correct heights
- Calibration service to check and document accuracy over entire product lifetime
- Ruggedly-built tools for even the toughest jobsite conditions

Fastening door header

Advantages

- Lightweight modular system consisting of serrated C-channel and connector
- Flexible compensation of building tolerances through the 'telescopic' characteristics of the connections
- Specific push-button connections for fast connections or standard bolts to flexibly attach door header
- No welding, only push-button connections and bolts

Fastening on steel S-BT

Advantages

- The new S-BT screw stud is suitable for fastenings on coated steel and aluminum
- No through penetration > 6 mm material thickness
- No preparation and no rework of steel coating required
- Battery-driven technology – less hot work permit restrictions
- Easy and convenient to install by a single user; increased efficiency compared to welding and through bolting
- All required international approvals available



PM 2-LG Green-beam line laser



MQ-41 D Double installation channel



SB-T Screw stud

SCAFFOLD-FREE INSTALLATION

Installation systems

Using a moving working platform/false car for installation instead of fixed platforms for installation of elevators sets a new standard. It helps to reduce cost and it reduces the amount of material to be brought and assembled on site for temporary use.



CHALLENGE

- The platform needs to be adapted to the size of the shaft. It needs to be brought into the shaft in pieces and assembled there.
- Safety equipment and hoists need to be attached. The platform design should meet the current safety standards for use.
- It needs to be disassembled after installation and will be reused on the next site, to save costs and avoid leaving waste on the site.

FEATURES

- Modular plug-together system out of lightweight, serrated C-channel and push-button connectors supports fast and simple assembly/disassembly for reuse.
- Finite Element Method (FEM) software supports design and load calculations of the platforms.
- All pieces have a zinc coating protection. Worldwide parts availability.

ACCESSORIES

- Cordless circular saws to cut girders to length on site if required.
- Design support plus cutting and kitting service to provide the material in assembly-friendly packaging.



Working platforms

Advantages

- Assembly and disassembly without drilling or welding
- Time-saving on-the-spot adjustments possible
- Can be reused after disassembly
- Lightweight due to rigid, thin-gauge channels
- Serrated inner edges and special “pushbutton” connectors for quick temporary connections that can be made secure later by tightening the nuts

Barriers for door openings

Advantages

- Simple, inexpensive means of installing safety barriers at door openings
- Can be easily removed and subsequently replaced when access to the shaft is required
- Suitable for installation on the inside or outside of the door opening
- Suitable for door openings of various widths

Cast into concrete hoist points

Advantages

- Different established solutions serving various requirements
- Approved for material load satisfying EC machinery directive 2006/42/EC
- Approved for personal safety equipment Z-14.9-778
- Capacity up to 4 tons WLL



MQ Installation channel



MQ Installation channel



Pfeifer WLL load eye

FINDING REBAR BEFORE DRILLING ANCHOR HOLES

Detection systems

Cutting rebar should be avoided to save time, cost and because rebar serves a purpose. Sometimes there are pre-tensioned cables embedded into the concrete that should not be hit under any circumstances. There might be other 'embedded objects' in the concrete or behind the concrete wall that should not be damaged by drilling.



CHALLENGE

- There is not much room to maneuver with anchor holes, as fastenings need to be made at a specific location.
- Architects do not trust workers to be careful when drilling into concrete. Anchorings in occupied buildings, during renovation, face the situation that there are existing cables/pipes, etc. installations either in the wall or on the opposite side of the wall.

FEATURES

- Variety of 'finders' that support marking the exact location of cables/pipes/rebar or cavities in the concrete. Detection without damaging the concrete.
- Documentation of the findings on data file for later discussion on whether rebar will be cut or damaged when drilling. Shows the engineer that rebar in the shaft wall was detected before drilling.

ACCESSORIES

- Paper mapping and markers to mark the detected areas for later discussion.



Get a visible handle on rebar

Advantages

- Locate rebars and measure the concrete cover
- Quick, easy scanning of large areas
- Individual scans over lengths of up to 30 m
- Immediately viewable image of reinforcement shown on 2D and 3D monitor
- Cordless scanner for maximum freedom of movement

More insights fewer surprises

Advantages

- Locates objects of various kinds in concrete structures, even beneath reinforcing mesh
- Displays a clear, real-time 2D image directly on the Hilti PS 1000 display
- Processed 2D and 3D plan view or cross-sectional images are displayed in color on the 3rd advantage monitor unit for further on-the-spot evaluation of the data or printing

Economic inside insight

Advantages

- Lets you drill right the first time – knowing where to drill avoids costly repairs, saves time and drill bits
- A real problem solver that brings peace of mind in anchoring or coring applications when plans are no longer available, e.g. in renovation projects
- Built-in display for easy location of objects detected plus indication of approximate embedment depth and type of material
- Ergonomically designed, ruggedly built; shock, dust and water resistant



PS 250 Ferroskan system



PS 1000 X-Scan system



PS 50 Multidetector

**CORDLESS
JOBSITE**

**22 V cordless
platform**

**Anchor hole drilling, bolting, drilling into steel, cutting/
grinding applications need a complete set of power
tools that can be used by the worker.**



CHALLENGE

- Room on the working platform is limited.
- Cutting of power cords creates dangerous situations, disruption of the work progress and replacement costs.
- Power cords on platforms can also lead to trip hazards.

FEATURES

- Li-ion cordless power technology offers a performance similar to corded tools.
- Quick chargers charge an empty battery pack within 30 minutes.
- Same high capacity 22 V Li-ion battery pack operates a full range of tools needed by an elevator mechanic.
- One charger fits all Hilti battery packs no matter the voltage.

ACCESSORIES

- Multi-bay chargers, car charger and fast chargers.
- Three sizes of battery pack with different amp hours.
- Different sizes of rugged textile bag to carry the complete tool set.
- Robust jobsite radio with NFC for Bluetooth® pairing and featuring a charger for all Hilti 12 V - 36 V Li-ion batteries



Minimize dust exposure

Advantages

- Vacuum cleaner to be attached directly to the rotary hammer
- Compact lightweight design
- Operated by the motor of the rotary hammer
- Catches the dust directly when coming out of the hole
- Fulfills the most recent legal requirements on preventing dust exposure to workers

Control the impact wrench

Advantages

- Stops the impact wrench and signals correct torque parameter with a green light
- Control unit attached in between the battery pack and the tool body
- Parameter adjustment for Hilti fasteners by scanning the box label
- Manual adjustment based on 20 pre-defined parameter settings
- Documentation of all installations in a built-in memory

Direct fastening on battery

Advantages

- Light duty direct fastening into steel, concrete and some masonry types
- Impact power supplied by a loaded spring in the tool
- Tool operated with the standard 22 V Li-ion battery pack
- Lightweight compact tool
- No dust created and limited noise exposure compared to drilling tools



TE 4-A22 Cordless rotary hammer with DRS



SIW 6AT-A22 Cordless impact wrench



BX 3-ME 02 Battery nailer

Regular working with power tools requires a large number of insert tools that will need regular replacement.



CHALLENGE

- Using low-quality inserts reduces productivity, can create extensive wear on the power tools and safety issues.
- Shopping for insert tools keeps workers from installing elevators.

ACCESSORIES

- Store shelves and site containers.
- Ordering forms, online ordering, regular representative on-site visits.

Drilling and cutting steel

Advantages

- High quality cutting discs for safe and speedy cuts
- High performance carbide steel drill bits for speedy cuts and long lifetime
- Different packaging in practical sets

FEATURES

- Different concepts for projects and field office logistics support in-stock concepts for carrying the correct items and numbers of insert tools for use in the power tools.



Discs and bits sets



Drilling when rebar is hit

Advantages

- Carbide head for extended endurance
- Wear markings to indicate best time for replacement
- Carbide head supports drilling in case of a rebar hit

Impact

Advantages

- Bits and hexagonal sockets designed for use with power impact wrenches
- Longer lifetime without breaking
- Bits and hexagonal sockets in textile pouches tailored to customer need

Rail cutting

Advantages

- Circular saw cuts through guide rail in seconds
- Virtually no sparks
- Low noise exposure
- Tool operated with the standard 22 V Li-ion battery pack



TE-CX Hammer drill bits

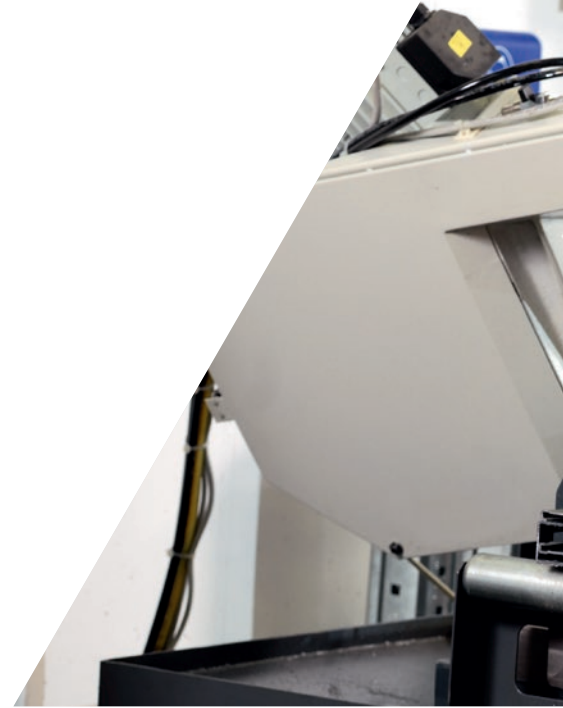


Tool bit and socket sets



SCM 22-A Cordless circular saw

We support our customers' focus on installing elevators. We want to make it easy for them to do business with us and we provide support to ensure that our customers will experience the added value we promise in our products.



CHALLENGE

- Products can be used inefficiently and unsafely due to a lack of knowledge and because the operating instructions are often not read.
- Some tools need regular checks or inspections to assure a safe and accurate function over their lifetime.
- Tools are a substantial investment and they tend to disappear in a mobile work environment.
- Many products need a design specification to make sure that they fulfill all the requirements and regulations for safe use.

Asset management

Advantages

- Robust tags are designed to withstand the toughest jobsite conditions including abrasion, corrosion, chemicals and extreme temperatures
- ON!Track works regardless of equipment manufacturer, so you won't be locked in to buying or hiring a specific brand of tool or asset
- Unlimited users can access the software 24/7 - from any location - with our mobile and desktop apps
- ON!Track experts are field-based, know the industry and can set up the system to meet your business needs

Fleet management

Advantages

- A low monthly usage fee replaces a large, upfront cash investment to tool up
- No more repair quotes as our high quality fleet tool repairs are typically returned within 3 to 5 working days
- Minimize downtime with a constant fleet of peak performing tools
- Use Hilti Tool Fleet Management Online to track and assign tools to a specific job, crew or worker
- A full Tool Fleet list helps avoid redundant purchases
- Customized labels makes tracking tools easier

FEATURES

- We extend the repair and maintenance service for our tools with concepts that support the management of the entire tool fleet.
- These concepts move beyond Hilti tools to all tools used by the customer.
- We provide design solutions and software to support our customers in creating their own design.



ON!Track Asset Management



Fleet Management



Design support

Advantages

- Complete design of support structures based on customer design drawings
- Design solution consulting based on local regulations/requirements
- Combined design solutions for supports, plus anchoring
- Design software including training, to support customer engineering of their own design solutions
- Support technical discussions with engineering and VT consultants

Fitter trainings

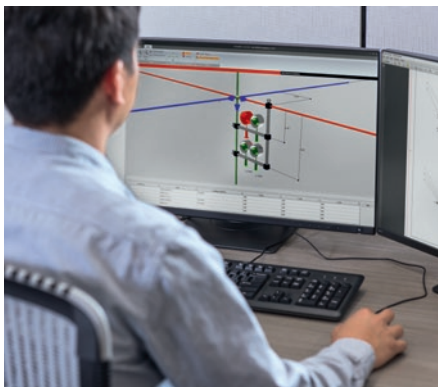
Advantages

- Training for efficient use of power tools in combination with insert tools and anchors
- Training on correct setting of anchors
- Health & safety training integrated into customer training
- Fitter training on how to assess correct anchor technology for the corresponding base material

Engineering trainings

Advantages

- Information on the most recent regulations and approval requirements
- Explanation on how this effects the design/on-site work of elevator installation
- Outlook into future regulation development
- Support to transfer to a new situation
- Detailed information on the design methods used in our PROFIS software supports the understanding and trust in the resulting reports



PROFIS Installation design software



Fitter trainings



Engineering trainings

ELEVATOR SERVICES AND MAINTENANCE

After the elevator is handed over to the owner, the journey of service & maintenance starts. This ensures that over its operational lifetime the elevator does not stall unexpectedly, stranding occupants, and that it always operates properly without generating safety risks for the user. This involves the frequent checking of applications that have little to do with construction fastening. However, regular fastening work has to be completed and dirt and dust must be regularly cleaned from the door sills and the elevator pit.



CHALLENGE

- Service technicians have many calls each day.
- To allow for rapid movement, they use efficient transport which has limited space for tools.
- Power tools that operate on cordless power.

FEATURES

- Compact, cordless lightweight power tools for light-duty fastening, bolting and cleaning applications offer powerful support without adding too much room and weight to your service tool kit.

ACCESSORIES

- Charging either possible with the quick charger for our 22 V Li-ion battery packs, with 12 V car charger or separate lightweight compact 12 V charger.
- High quality drill and screw sockets/bits.



Cleaning door sills and pit

Advantages

- Compact lightweight (<3 kg) vacuum cleaner
- Operated with 22 V Li-ion battery pack that operates all installation power tools
- Semi-auto filter cleaning to keep filter clean and suction high
- Ergonomic hose and nozzle design
- Low width, making it easy to carry via shoulder strap

Drilling into metal and masonry

Advantages

- Very compact lightweight power tool
- Hammer drilling into masonry up to 6 mm diameter
- Drilling into steel up to 35 mm diameter
- High productivity with drilling speed up to 1,500 R/ min
- Operated with compact lightweight 12 V and 2.6Ah Li-ion battery pack

Bolting

Advantages

- Very compact lightweight cordless impact driver
- Installing self-drilling screws into metal up to 4.8 mm diameter
- Installing screw anchors or plastic anchors up to 8 mm diameter
- Operated with compact lightweight 12 V and 2.6 Ah Li-ion battery pack



VC 5-A22 Cordless vacuum cleaner



SF 2H-A Cordless hammer drill driver



SID 2-A Cordless impact driver

EFFICIENT ELEVATOR INSTALLATION

For support structure modular systems are already widespread in construction. Finite element design software supports technical calculations, assembly instructions and bill of material. Lightweight components with easy push fit connectors enable fast and simple assembly without hot works on site. Clever connections allow flexible adjustments before connections are finally locked in



U-connectors safely hold beams without fasteners



Lightweight beam can be moved by single person





Locking bolts in slots after final adjustment



Attach rail connector with T-bolt in C-channel



Lock bolts after final adjustments



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