

HAT 28 pull-out tester

It is essential that the operating instructions are read before the tool is operated for the first time.

Always keep these operating instructions together with the tool.

Ensure that the operating instructions are with the tool when it is given to other persons.

Pull-out tester **1**

- ① Grip
- ② Crank
- ③ Coupling
- ④ Displacement indicator scale
- ⑤ Loading claw foot

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1. General information

1.1 Safety notices and their meaning

-CAUTION-

Draws attention to a potentially dangerous situation that could lead to minor personal injury or damage to the equipment or other property.

-NOTE-

Indicates instructions and other useful information.

1.2 Pictograms

Warning signs



General warning

Obligation signs



Wear eye protection



Wear a hard hat



Wear protective gloves

Symbols



Read the operating instructions before use



Return waste material for recycling

1 The numbers refer to the illustrations. The illustrations can be found on the fold-out cover pages. Keep these pages open while you read the operating instructions.

In these operating instructions, the designation "the tool" always refers to the HAT 28 pull-out tester.

Location of identification data on the tool

The type designation and serial number are printed on the type plate on the tool. Make a note of this information in your operating instructions and always refer to it when making an enquiry to your Hilti representative or service department.

Type: _____

Serial no.: _____

2. Description

The HAT 28 pull-out tester is a purpose-made system for testing fastenings. It consists of a mechanical screw arrangement acting through a hydraulic load cell which measures the load applied to the fastener directly. The load value is then indicated by the strain gauge. The HAT 28 pull-out tester is supplied as an integral part of the HAT 28 "Basic", "Master" and "Scaffold" testing sets which are designed specifically for testing most small and medium-sized fastenings. A range of accessories is also available, thus further increasing the scope of possible testing applications (see Section 3, "Tools and accessories").

2.1 Use of the tool as directed

The tool is intended for use by skilled personnel with the appropriate training and knowledge of the applicable safety precautions.



- Modification of the tool, or tampering with its parts, is not permissible.
- To avoid the risk of injury, use only genuine Hilti fasteners, cartridges, accessories and spare parts or those of equivalent quality.
- Observe the information printed in the operating instructions applicable to operation, care and maintenance.
- The tool and its ancillary equipment may present hazards when used incorrectly by untrained personnel or not as directed.

3. Tools and accessories

No.	Part	Item no.
HAT 28 Basic Set		355337
1	HAT 28 pull-out tester, complete	285523
2	Oil bottle	285530
3	Strain gauge, 0–20 kN / 4497 lbf	285528
5	Adapter set: 4.5, 5.5, 6.5, 8.5, 10.5, 12.5 mm	285546
6	Adapter set: 1/4", 5/16", 3/8", 1/2"	285549
7	Adapter set : M4, M5, M6, M8, M10, M12	285543

No.	Part	Item no.
17	Spacer	285531
18	Load-distribution bridge 150	285533
19	Threaded legs set, 50 mm	285534
21	Ratchet attachment nut, 22 mm AF	285524
22	Set of screws: M6, M8, M10, M12, M16	
23	Hex. socket wrench set: 2.5, 3	
24	Adjustable wrench, 0–29 mm	
25	Ratchet, 22 AF	
26	Toolbox type 20	311874

Examples of products that can be tested

Threaded studs

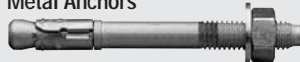


X-CRW (on steel)



X-CR (on concrete)

Metal Anchors



HST / HSA / HKB Anchors



HKD / HDI Flush Anchors

Chemical Anchors



HVU



HAS



HIT-HY

Flathead Nails



X-CR

Plastic Anchors



HUD

Suitable for testing fasteners with the following threads:

M4 / M5 / M6 / M8 / M10 / M12

Whitworth :

1/4", 5/16", 3/8", 1/2"

Suitable for testing the following nails and fasteners:

Flat-head nails with a shank diameter of: 4.5 / 5.5 / 6.5 / 8.5 / 10.5 / 12.5 mm
X-IE fasteners

Pull-out load range:
0–20 kN / 4497 lbf

No.	Part	Item no.
HAT 28	Master Set	355338
1	Mark 5 pull-out tester, complete	285523
2	Oil bottle	285530
3	Strain gauge, 0–5 kN/1124 lbf, complete	285525
4	Strain gauge, 0–25 kN/5620 lbf VDM+ISF, complete	285529
5	Adapter set 4.5, 5.5, 6.5, 8.5, 10.5, 12.5 mm	285546
6	Adapter 1/4", 5/16", 3/8", 1/2" Satz	285549
7	Adapter set M4, M5, M6, M8, M10, M12	285543
8	Adapter for scaffold ring bolts	285551
9	Adapter M5	285553
10	Adapter M6	285555
11	Adapter M8	285556

No.	Part	Item no.
12	Adapter M10	285557
13	Adapter M12	285558
14	Adapter M16	285559
15	Adapter M20	285560
16	Adapter X-IE	285561
17	Spacer	285531
18	Load-distribution bridge 150	285533
19	Threaded legs set, 50 mm	285534
20	Threaded legs set, 100 mm	285565
21	Ratchet attachment nut, 22 mm AF	285524
22	Set of screws M6, M8, M10, M12, M16	
23	Hex. socket wrench set: 2.5, 3	
24	Adjustable wrench, 0–29 mm	
25	Ratchet, 22 AF	
26	Toolbox type 20	311874

Examples of products that can be tested

Threaded Studs

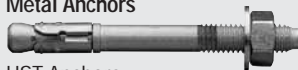


X-CRW (on steel)



X-CR (on concrete)

Metal Anchors

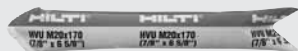


HST Anchors



HKD Flush Anchors

Chemical Anchors



HVU

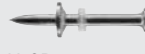


HAS



HIT-HY

Flathead Nails



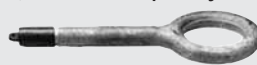
X-CR

Plastic Anchors



HUD

a) Tube and Coupled System



ST



HKD



HTA

b) Rapid Scaffold System Anchors



GRS



GD

Suitable for testing fasteners with the following threads:

M4 / M5 / M6 / M8 / M10 / M12 M16 / M20

Whitworth:

1/4", 5/16", 3/8", 1/2"

Suitable for testing the following nails and fasteners:

Flat-head nails with a shank diameter of: 4.5 / 5.5 / 6.5 / 8.5 / 10.5 / 12.5 mm
X-IE fasteners

Pull-out load range:

0–5 kN / 1124 lbf
0–25 kN / 5629 lbf

No.	Part	Item no.
HAT 28	Scaffold Set	355339
1	HAT 28 pull-out tester, complete	285523
2	Oil bottle	285530
3	Strain gauge, 0–20 kN / 4497 lbf, complete	285528
14	Adapter M16	285559
8	Adapter for scaffold ring bolts	285551
17	Spacer	285531
18	Load distribution bridge, 150 mm	285533

No.	Part	Item no.
19	Threaded legs set, 50 mm	285534
20	Threaded legs set, 100 mm	285565
21	Adjustable wrench, 0-29 mm	285524
22	Hex. socket wrench set: 2.5, 3	
24	Adjustable wrench, 0–29 mm	
25	Ratchet, 22 AF	
26	Toolbox type 20	311874

Examples of products that can be tested

a) Tube and Coupled System



HSA



HST



HKD



HLC

b) Rapid Scaffold System Anchors



GRS

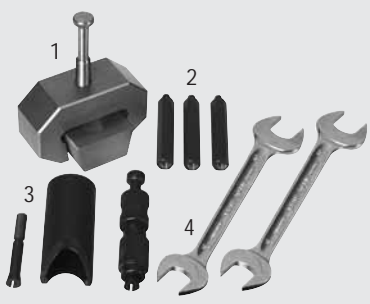


GD

Suitable for testing fasteners with the following threads:
M16 scaffold ring bolts

Pull-out load range:
0–20 kN / 4497 lbf

No.	Part	Item no.
HAT 28	DX Accessory Set	285593
1	Threaded legs set, 100 mm	285565
2	Adapter for pull-over tests	285563
3	Adapter for X-ENP / ENP2 / ENP2H / NPH, complete	285564
4	2 open-end wrenches, 27 mm AF	285541



Examples of products that can be tested

Nails



X-ENP, ENP2, ENPH2, ENP2K



ENK



X-EDNI

Insulation Fastener



X-IE

No.	Part	Item no.
Strain gauge		
1	Strain gauge, 0–5 kN / 1124 lbf, complete	285525
	Strain gauge, 0–10 kN / 2248 lbf, complete	285526
	Strain gauge, 0–15 kN / 3372 lbf, complete	285527



No.	Part	Item no.
Adapters / load distribution bridges		
1	Gunite test adapter set (6 / M6)	285562
2	Load distribution bridge 250, complete	285567
3	Load distribution tripod, complete	285568



No.	Part	Item no.
Miscellaneous		
1	Crank	285569
2	Swiveling feet set	285566
3	HAT 28 pull-out tester, 100 mm stroke, complete	285570



4. Technical data

Tool (HAT 28 Basic Set)	
Pull-out load range	0–25 kN
Weight	2.2 kg
Stroke	50 mm / 100 mm
Stroke scale	
Strain gauge	Interchangeable type with quick-release coupling
Casing	Aluminium
Loading claw foot	Pivotable through 360°, with automatic return

Strain gauge	
Indication of maximum pull-out load	
Calibrated in kN	
Calibration certificate supplied with each strain gauge	
Protective plastic cover	
Impact-resistant glass	
Designed to withstand sudden load relief (e.g. sudden failure of the fastening)	

5. Safety rules

5.1 Basic safety rules

All of these instructions must be read before using the tool and kept for future reference.

5.2 Precautions at the workplace



- Ensure that the working area is well lit.
- Keep the workplace tidy. Objects which could cause injury should be removed from the working area. Untidiness at the workplace can lead to accidents.
- Use the specified protective equipment. Wear protective glasses.
- It is recommended that non-slip shoes and rubber gloves are worn when working outdoors.
- Keep other persons, children in particular, away from the working area.
- Avoid unfavorable body positions. Work from a secure stance and stay in balance at all times.
- Do not work from a ladder.

5.3 General safety precautions



- Use only the genuine Hilti accessories or ancillary equipment listed in the operating instructions. Use of accessories or ancillary equipment other than the items listed in the operating instructions may present a risk of personal injury.

5.3.1 Mechanical hazards



- Observe the instructions concerning care and maintenance.

5.4 Requirements to be met by users

- The tool is designed for professional use.
- The tool may be operated, serviced and repaired only by authorized, trained personnel. This personnel must be informed of any special hazards that may be encountered.
- Always concentrate on your work. Proceed carefully and do not use the tool if your full attention is not on the job.

6. Operation



6.1 Basic testing procedure 2

6.1.1 The testing procedure for standard situations 3

1. Fit the appropriate adapter to the fastener to be tested.
2. Slide the slot in the cylindrical section of the spacer over the adapter until the fastener axis and spacer axis are in alignment.
3. If necessary, adjust the length of the threaded legs until the head of the spacer can be passed through the opening in the load distribution bridge. Check that the head of the spacer is centered in the tester.

4. Position the tester so that the gauge can be read conveniently.
5. Adjust the length of the threaded legs so that all three are in contact with the base material and only slight clearance exists between the adapter and the pull-out tester (less than 2 mm). Check that the pull-out force acts in the fastener axis and parallel to the threaded legs.

-CAUTION-

Any significant misalignment at this stage will result in the threaded legs bending as the test proceeds.

6. Set the red pointer of the strain gauge to zero. Hold the tester by the grip while increasing the load on the fastener by turning the crank in a clockwise direction.

-CAUTION-

Hold the tester securely by the grip as long as the fastener is under load.

When the load on the fastener increases, note the reading on the displacement scale on the tester.

Indication of failure of the fastener may be obtained by comparing the current reading on the displacement scale with the original reading.

7. Increase the load until the minimum specified load is attained.
8. Release the load on the fastener by turning the crank counter-clockwise and pushing it down until the original position is reached.
9. Remove the tester and the adapter.

6.1.2 Using the spacer 4

The spacer is used either with threaded or slotted knob adapters or, without an adaptor, for testing fasteners with a diameter of 16 mm diameter.

It consists of a cylindrical section and an M12 threaded rod to which an M12 adapter can be attached. The adapter for the fastener to be tested fits into a slot in the cylindrical section of the spacer.

One of the load distribution bridges or the load distribution tripod is required for all applications using the spacer.

In exceptional cases (e.g. X-CRM fastener on steel), the tester can be used with the M4, M5, M6, M8, M10 or M12 adaptors without the spacer. The procedure is then exactly the same as described below for the M12, M16 and M20 adapters. However, in order to achieve the desired results, it is essential that the fastener is driven correctly before the adapter is fitted.

6.1.3 Using the knob adapters

(M4, M5, M6, M8, M10, M12) 5

For testing threaded fasteners (e.g. stud anchors or threaded DX stud fasteners).

-NOTE-

If the length of thread protruding is sufficient, the fastener may be tested without first removing the component fastened. In this case, however, the load applied to the fastener by the component (e.g. its own weight) must also be taken into account as this load, in addition to the load applied by the pull-out tester, also acts on the fastener and increases the probability of failure.

When fitting the adapter, check that a secure connection is made between the adapter and the threaded stud or anchor.

6.1.4 Using the slotted knob adapter

(4.5, 5.5, 6.5, 8.5, 10.5, 12.5 mm) 6

For testing fasteners where a connection is made to the head of the bolt or anchor.

-NOTE-

The fastenings achieve the required load values only when the specified torque has been applied at the time of installation.

The 6 slotted knob adapters are suitable for testing fastenings within the 4 to 12 mm diameter range.

These adapters are fitted under the head of the bolt or anchor in place of the item usually fastened.

They can also be used for testing sleeve anchors. In this case it is necessary to slacken the anchor slightly after it has been installed in accordance with instructions, so that the adapter can be fitted. The anchor can be tested once it has been retightened. This method, however, is not recommended as slackening (and retightening) the anchor may cause a drop in the load value obtained.

-CAUTION-

Take care to ensure that the adapter is not damaged by testing on an uneven concrete surface. We strongly recommend placing a large washer or steel plate between the adapter and the concrete.

6.1.5 Use of the adapters (M5, M6, M8, M10) 7

The M5 and M6 threaded rod adapters are equipped with an external M12 thread for use in conjunction with the M12 threaded knob adapter. They are used primarily for testing remedial wall ties.

The M8 and M10 threaded rod adapters are equipped with an external M16 thread and can be used with a normal M16 nut without any additional adapter.

1. Connect the threaded rod adapter complete with the M12 threaded knob adapter to the end of the wall tie, taking care to avoid further tightening of the outer leaf expansion nut.
2. If necessary, adjust the length of the threaded legs and the height of the knob adapter / nut so that the adapter can be passed through the hole in the load distribution bridge fitted to the tester and into the loading claw foot. While doing so, check that the adapter is centered in the pull-out tester.
3. Adjust the threaded legs to minimize any play between the adapter and the pull-out tester and ensure that the pull-out force acts along the axis of the wall tie being tested.

The threaded legs are not designed for applying a load to the fastener!

6.1.6 Using the adapters (M12, M16, M20) 8

Suitable for testing sleeve and stud anchors.

After the anchor has been set in accordance with the applicable instructions, a suitable threaded rod is screwed into the anchor and the adaptor then fitted. The length of threaded rod to be screwed into the anchor must be at least equal to the diameter of the anchor.

6.1.7 Using the X-IE adapter 9

1. Remove the insulation around the X-IE fastener.
2. Bring the tester with the X-IE adapter into position.

The testing operation is facilitated by proper adjustment of the threaded legs.

6.1.8 Using the ratchet attachment nut (22 mm AF)

10

1. Unscrew and remove the standard crank.
Take care to avoid moving the underlying washer and bearing.
2. Screw on the ratchet attachment nut in place of the crank.

This nut can then be used with a 22 mm ratchet (supplied in the sets) for better access in confined spaces and for easier operation.

6.2 Testing scaffold anchors

6.2.1 Basic setup for testing scaffold anchors **11**

1. Screw the threaded legs supplied with the load distribution bridge all the way through the bridge.
2. Screw the 100 mm threaded legs (hand tight) onto the threaded legs so that the end of the hexagonal section is in contact with the load distribution bridge.
3. Screw the swiveling feet onto the ends of the 100 mm threaded legs.
4. Use the cap screws and hex. socket wrench to attach the pull-out tester to the load distribution bridge so that the cut-out in the base of the tester is in alignment with the cut-out in the load distribution bridge and the legs of the load distribution bridge are on the side of the bridge opposite the tester.
5. Check that the ring in the centre of the chain securing the pin is attached to the adapter and then screw on the M12 knob adapter so that full thread engagement is achieved
6. Adjust the threaded legs so that their length is approximately equal. Fine adjustment must be carried out before beginning the test.

6.2.2 Using the adapter for scaffold anchor tests **12**

1. Withdraw the pin, place the adaptor over the head of the ring bolt and then replace the pin, passing it through the ring.

-CAUTION-

Any significant misalignment at this stage will result in the threaded legs bending as the test proceeds.

6.3 Using the X-ENP adapter **13**

6.3.1 Basic setup for pull-over tests **14**

Only the tester equipped with a strain gauge (load range up to 25 kN recommended) is required for this test.

6.3.2 Using the X-ENP adapter

1. Bring the collet chuck assembly into the initial position (1 to 2 cm space between the collet sleeve and the loading claw).
2. Holding the collet chuck assembly at a 45° angle to the nail axis, press it onto the nail head and bring the assembly into line with the nail axis. If necessary, use a hammer (500 g) to tap it on.
3. Tighten the collet sleeve against the loading claw as far as possible (hand tight).

4. Use two 27 mm open-end wrenches to tighten the sleeve fully against the claw (slippage of the nail head in the collet chuck will cause unnecessary wear).
5. Place the tube over the chuck with the tapered end below. The end of the loading claw should protrude from the tube.
6. Bring the tester into position on the claw. Apply the load (as shown in fig. 1).
7. After pulling out the nail, use the open-end wrench to return the assembly to the initial position.
8. Remove the pulled-out nail from the chuck. **Tip:** Insert the point of the nail in the nail hole and turn the assembly to the side.

-CAUTION-

The maximum load is limited to 16 kN!

6.4 Pull-over testing **15**

This setup can be used for:

- Pull-over testing
- Flat-headed nails driven flush with the surface which cannot be gripped directly
- Fasteners for which there are no adapters (e.g. EDN 19, EDNK 22, etc.)

6.4.1 Basic setup for pull-over tests **16**

As described at 3.2.1 "Basic setup for scaffold anchor testing", but without the adaptor for testing scaffold anchors.

6.4.2 Using the adapter for pull-over tests **17**

1. Drive a fastener through one or more strips of sheet metal (ideal size: 5 × 14 cm) (see fig. 1).

-NOTE-

When testing the fastener pull-out load it may be necessary to use two or more layers of sheet metal in order to prevent the sheet metal being pulled over the head of the nail (DX Kwik fasteners, for example, typically withstand a pull-out load of 10-16 kN). If only one layer of 1 mm sheet metal is used, the sheet metal will fail and will be pulled over the head of the nail at a force of about 10 kN. The max. pull-out force for the fastener therefore cannot be tested with a single layer of sheet metal.

2. Place the pull-over testing wedge on the sheet metal.
3. Slide the pull-over testing yoke over the sheet metal from the side.

After completing these steps, the adapter should appear as shown in fig. 2.

-NOTE-

If the test is being carried out on a vertical surface, it is helpful to pull the yoke by hand so that the sheet metal is gripped tightly between the yoke and wedge. The parts then remain in place while the tester is brought into position.

4. Adjust the length of the legs so that all three are in contact with the base material and there is only slight pull between the adapter and the tester (less than

1–2 mm). The line of action of the pull-out force applied by the tester must be parallel to the threaded legs of the load distribution bridge.

-CAUTION-
Any significant misalignment at this stage will result in the threaded legs bending as the test proceeds.

7. Care and maintenance

7.1 Care of metal parts

Remove any dirt adhering to parts and wipe the surfaces of the tool from time to time with a damp cloth.

7.2 Refilling with oil

Oil requires to be refilled (topped up) only if the tester suffers damage or develops a leak.

When refilling oil, clamp the tester in a vice with the coupling in the vertical position.

Connect the oil bottle (containing light hydraulic oil) to the coupling on the tester.

Force any air out of the system by pushing the piston in fully. Then use a suitable hook to pull the piston back out. The system then fills itself with oil from the bottle.

NOTE: Pull the piston out a maximum distance of 12 mm. If necessary, repeat this step several times until all air has been removed from the system.

Then remove the oil bottle and check the operation of the tester on a fastener that has been tested previously.

8. Disposal



Most of the materials from which Hilti tools are manufactured can be recycled. The materials must be correctly separated before they can be recycled. In many countries, Hilti has already made arrangements for taking back your old tools for recycling. Please ask your Hilti customer service department or Hilti representative for further information.

Should you wish to return the tool yourself to a disposal facility for recycling, proceed as follows: Dismantle the tool as far as possible without the need for special equipment. Use absorbent paper to wipe oily parts clean and to collect any oil that runs out. This paper must also be disposed of correctly. **On no account should oil be allowed to enter the waste water system or to find its way into the ground.**

Part / assembly	Main material	Recycling
Toolbox	Plastic	Plastics recycling
Strain gauge	Plastic / steel	
Adapter	Steel	Scrap metal
Spacer	Steel	Scrap metal
Load distribution bridge	Steel	Scrap metal
Screws, small parts	Steel	Scrap metal
Oil	Oil	Used oil disposal point

9. Warranty

Hilti warrants that the product supplied is free of defects in material and workmanship. This warranty is valid as long as the product is operated and handled correctly, cleaned and serviced properly and in accordance with the Hilti operating instructions, all warranty claims are made within 12 months (unless other mandatory national regulations prescribe a longer minimum period) from the date of sale (invoice date) and the technical system is maintained, i.e. only original Hilti consumables, accessories and spare parts are used with the product.

This warranty provides the free-of-charge repair or replacement of defective parts only. Parts requiring repair or replacement as a result of normal wear and tear are not covered by this warranty.

Additional claims are excluded, unless mandatory national regulations prohibit such exclusion. In par-

ticular, Hilti is not obligated for direct, indirect, incidental or consequential damages, losses or expenses in connection with, or by reason of, the use of, or inability to use the product for any purpose. Implied warranties of merchantability or fitness for a particular purpose are specifically excluded.

Send the product and/or related parts immediately upon discovery of a defect to the local Hilti marketing organization for repair or replacement.

This constitutes Hilti's entire obligation with regard to warranty and supersedes all prior or contemporaneous comments and oral or written agreements concerning warranties

10. EC declaration of conformity

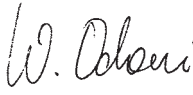
Designation:	Pull-out tester
Type:	HAT 28
Year of design:	2004

We declare, on our sole responsibility, that this product complies with the following directives or standards: 98/37/EC.

Hilti Corporation



Raimund Zaggl
Senior Vice President
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09 / 2004



Dr. Walter Odoni
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