HARDNESS TESTING INSTRUMENTS MANUFACTORY I SINCE 1954

Instruction Manual

for metalTest

(07510000)

Summary

1_ Instrument overview ... 3
Conformity declaration ... 4

2_ General description and application fields ... 5
.a Technical specifications ... 6
.b Introduction to the hardness testing ... 6
.c The DIN 50157 standard ... 8

3_ How it looks
.a Package content ... 9
.b External dimensions ... 9
.c Instrument and description ... 10

4_ Setting up the instrument
.a Standard base mounting ... 11
.b Reference mounting ... 12
.c Indenter mounting ... 12

5_ Using the instrument
.a Instrument switch on/off ... 13
.b Test scale selection ... 13
.c Performing a test ... 14
.d Mean value visualization ... 14
.e Battery level ... 14

6_ Maintenance
.a Battery ... 15
.b Instrument ... 15
.c Periodical control and calibration ... 15
.d Scale correction ... 16
.e Instrument repeatability test ... 17
.f Notes for the hardness tester's correct operation ... 19
.g Troubleshooting ... 19
.h Spare parts ... 20
.i Instrument disposal ... 20

7_ Glossary ... 21

8_ General warranty conditions ... 22

9_ Accessories available upon request ... 23
.a Special bases ... 23
.b Portables and bench support ... 25

10_ Hardtest ... 28
.a Hardtest support mounting ... 28
.b Bram ring mounting ... 30

User notes ... 31

1 Instrument presentation

metalTest*: portable instrument to test hardness with the Rockwell, Brinell* and Vickers scale

The instrument can be used to test most metals: chromed and nitrite surfaces, aluminum, brass, copper, bronze, metal wires and hard and soft steel.

It measure the real depth indentation as the real Bench hardness tester with a diamond indenter and constant load force controlled by internal calibrated load cell as per DIN 50157 Standard
(it is not a rebound system nor ultrasonic)
It is able to measure very thin material up to 0.08 mm as well coating material
It is not affected by the thickness of the testing material

The multi-scale included offer a very large measuring range on very soft material as 20 HV and very hard material up to 1800 HV

It comes with different support bases (1 standard, and many other optional) so as to adapt it to any type of surface: from spherical surfaces with a diameter greater than 2000 mm (2m) to round surfaces with a limited diameter up to testing surfaces hard to reach with other types of instruments.

Thanks to the optional accessories (see chapter 9) it is possible to test steel strips, pipes, spring wire, extruders and anything else you need to test. All we need is a drawing of your item to be tested and we will design and develop the appropriate accessory.

When combined to its support *(art. 073.0.000),* metalTest can become a convenient bench instrument to test small sized items, for example in a laboratory where a small, economic and reliable instrument like metalTest finds its proper place.

The instrument is very easy to use: simply apply a light pressure on the probe to start the test; the software is user-friendly and the quick function buttons speed up its use.
As described hereafter, the instrument has many functions so it is a complete instrument.

We thank you for your choice, and we congratulate you for having purchased such excellent product.

**: the Brinell and Vickers test values are obtained by conversion.*

General information:

Instrument model: metalTest

Type of Instrument: Portable Hardness tester

Reference number: 075.10.000 Year of construction: _____

Instrument serial #:_____ Probe serial #: _____

We hereby declare that a tag indicating the instrument model and serial number, the EC mark, the supply voltage and the manufacturer's data is fixed on the bottom of the instrument.
Such information, together with the conformity declaration, form an integral part in compliance with EEC regulations.

It is therefore forbidden to remove any such tag.

Via Monte Tagliaferro, 8
21056 Induno Olona – Varese – Italia
Tel. +39 0332.200.546 Fax +39 0332.203.704

CE

Declaration of Conformity

We declare, under our own responsibility, that the following instrument:

Instrument model: metalTest Type of Instrument: Hardness tester

Serial Number: _____ Year of construction: _____

as described in the attached documentation, complies with the following Directives:

EN	50081-1	dd	1992.
EN	55011	dd	1991.
EN	50082-1	dd	1992.
EN	61000-3-2	dd	1994.
EN	61000-3-3	dd	1994.
EN	801-2	dd	1991.
EN	801-3	dd	1994.

Name: Davide
Last Name: Affri
Position: Legal Representative

Place and date: Induno Olona, _____ Signature_____

2 General description and application fields

2.a Technical specifications

Working principle	Depth indentation micro Rockwell
Application fields	All metals
Minimum testable thickness	0.08 mm/0.003 inch
Reading scales	Rockwell *"HMMHRA"; "HMMHRB"; "HMMHRC"; "HMMHR15N"; "HMMHR30T"* Brinell *"hb5"; "hb30"* Knoop *"hH"* Vickers *"hV"* Tensile Module *"r"*
Standard	DIN 50157:2008
Indenter type	100° diamond
Mechanic	High precision with static load
Preload	10 N
Load	54 N
Instrument resolution	0.1 HRC
Instrument repeatability	± 0.5 HRC
Electronic	Microcontroller
Data output	n/d
Test functions	Mean value
System functions	Battery level, calibration
Display	4 cyphers, 7 segments.
Statistics	Mean value
Test results memorization	Up to 200 tests
Folder management	n/d
Statistics info	n/d
Test results printing	n/d
Printer	n/d
Power supply	9 Volt battery E type-Block MN1604
Autonomy	2500 tests
Energy saving	Stand-by after 20 seconds of non use
External dimensions	Instrument: 115 x 135 x 60 mm Box: 184 x 102 x 197 mm
Weight	Instrument: 400 g Boxed instrument: 1,5 Kg
Working temperature	10°C ÷ 45°C*
Stocking temperature	-10°C ÷ 50°C
Humidity	~ 52%

*: the temperature range describes the necessary conditions for the instrument to work. This range is not valid for a normalized test.

2 General description and application fields

2.b Introduction to the hardness testing

Among these mechanical features of a metal and an alloy, the hardness is, without any doubt, the one more interesting for the operator. Oppositely to what we can believe, this is not due to its physical importance because the hardness doesn't represent a physical feature or can be applied for a precise use of a material.
The wear resistance was always compared to the hardness (the harder material that wears the other). In fact, this hypothesis is not always true, (plastic bearings can wear the hardened steel; a sewing wire or nylon one are able to cut rings having a hard chrome coating). The same notion of hardness is enough intuitive and the first hardness scale, proposed by MOHS in 1820 for mineralogists, corresponds to the following definition: a body is harder than another when it can break it. Starting from this definition, Mohs proposed a scale with 10 minerals selected in order that one of these minerals can break the previous one and can be broken by the next.

Hardness scale Mohs	
Mineral	***Coefficient***
Talc	1
Plaster	2
Calc spar	3
Fluorspar	4
Apatite	5
Orthoclase	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

Note: In this scale, the hardened high speed steel would have the coefficient 8,5, the extra steel 3,5 and the copper 2,5.
Actually, the best definition for hardness is the deformation resistance that offers a material. But, in practice, it's not possible to find a hardness universal scale, because a material deformation is very complex and depends on different factors.
The plastic and elastic deformations exist.
As the performed test considers the plastic deformation, the elastic one or a combination of the two deformations, the material classification can be different. In this way, the hardness degree of a rubber as per its form, after having doffed the load, will be infinite, because the form is null. In this case the deformation will merely be elastic. The hardness measured on a material has not an absolute feature and has a meaning only when we know all the parameters that define the test: test type, nature, form of the indenter and load.
From other point of view, in order to preserve reproducibility and a satisfactory copy, the conventional character of the measurements obliges us following precise operative methods.
So, we can deduce the regulations importance about the tests regarding this range.

3 General description and application fields

2.b Introduction to the hardness testing

After all the considerations about the physical meaning of the hardness notion, we request us if the use of said tests has an interest for the metallurgic and mechanical industry; in fact, instead of their imperfections, the hardness tests are very important for different reasons:

- check of the inlet materials for the material type identification,
- thermal treatments quality check: cementation temper.

The hardness is only a reference point. This reference point allows us comparing an alloy to another one, a valid bundle with a less valid one, a treatment with another.
Alternatively, we would carry out a specific exam on the sample product:

a traction test to find the product resistance or a chemical analysis to detect the precise material type that composes our sample. The hardness test is an indirect test that, examining the product physical features, allows going back to the metal type and the treatment to which it have to support.

The main interest towards the hardness test in this field comes from:

- the easiness of the tests;
- the possibility to perform test on pieces and not only on samples, as happens for other mechanical tests;
- the non-destructive purpose of the test.
- the limited dimension of the form offers to the metallurgic industry a mean for choosing the local exploration of a piece or a sample: study of the localized treatments, superficial wire drawing or the micro-hardness: measurement on hardness coverings, study of the facilities, and exploration of alloys during the different phases. For all these reasons, the hardness tests are indispensable for all the people working metallic materials, but, because of their conventional feature, it's necessary to remember that said tests must be performed following precise operative methods, such as the regulations. Unfortunately, said regulations aren't always respected and, even if the hardness tests are the most used, they are always the worst used.

2 General description and application field

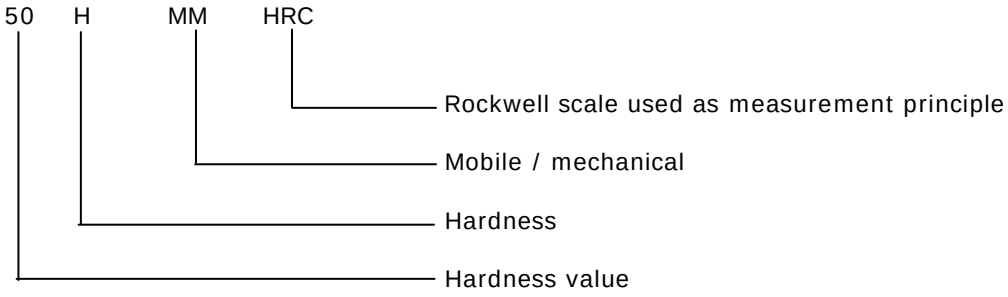
2.c The DIN 50157 standard

The portable hardness testers are used to measure the hardness of test pieces, when they are too large or too heavy to be measured on a fixed hardness.
Classic tests such as Rockwell , Vickers, Brinell hardness test and others are not feasible with portable so a new procedure for measuring had to be made and this essentially means that a new scale of hardness had to be introduced.
If such methods should indicate hardness values measured in the usual Rockwell, Vickers or Brinell scales, then values must be converted. These hardness values are not, however, real Rockwell, Vickers or Brinell values because they were not measured by the proceedings under Rockwell, Vickers or Brinell.

The DIN 50157 standard is a testing method base on the depth of the indention and its related to the hardness testing on metals using portable instruments. The loads used are on the 50 to 1000N range with a preload on the 10 to 100N.
The portable instruments are based on the Rockwell testing method where an indenter is made penetrate vertically on the testing samples applying a crescent load until a fixed maximum value. The indention depth is then measured and this reading is used by the instrument to find the hardness value of the testing sample.

Even if the DIN 50157 standard is based on the Rockwell principle, it's not a standard Rockwell test so when declaring the measurement you must follow some rules.

Example: after a hardness test we obtain a 50 Rockwell points value; on the display "50 hrc" will appear but if the value has to be written down as "50 HMMHRC" where:



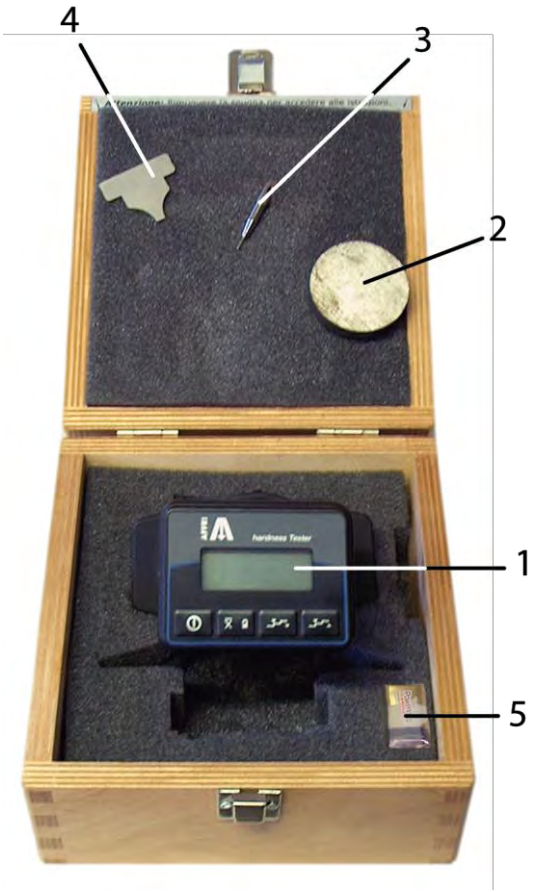
Here below, at table of the most commonly used testing scales and their application fields:

Material based scale selection table

Test scale	*Test method*	*Display*	*Test Range*		*Material*
HMMHRA	Rockwell	hrA	20÷92	HMMHRA	Carburized steel > 0.7 mm
HMMHRB	Rockwell	hrB	26÷100	HMMHRB	Soft steel and non ferrous metals
HMMHRC	Rockwell	hrC	0÷80	HMMHRC	Hardnened steel > 1.2 mm
HMMHR15N	Rockwell S.	hr15N	69÷93	HMMHR15N	Hardnened steel > 0.20 mm
HMMHR30T	Rockwell S.	Hr30T	16÷83	HMMHR30T	All soft metals > 0.35 mm

3 How it looks

3.a Package contents



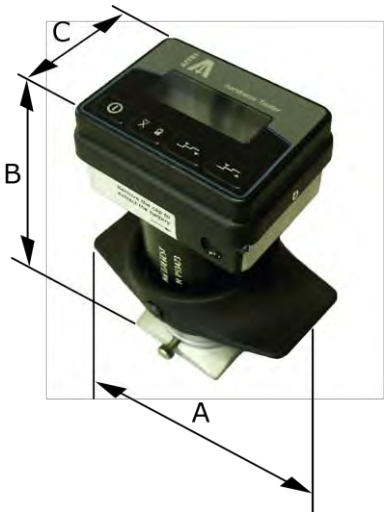
List of contents:

1. Hardness tester
2. Calibrated sample
3. Maintenance key
4. Gauge
5. Battery

- Instructions
- Certificates
- Warranty
- Instrument box

3.b External dimensions.

Box | AxBxC = 184x102x197



Instrument | AxBxC = 115x135x60

3 How it looks

3.c Instrument

Description:

1	LCD Display	
2	Keyboard	
2a	- Switch on\off	
2b	- Mean | Battery level	
2c	- Decrease \ Scroll down	
2d	- Increase \ Scroll up	
3	Battery access panel	
4	Handles	
5	Standard square base	

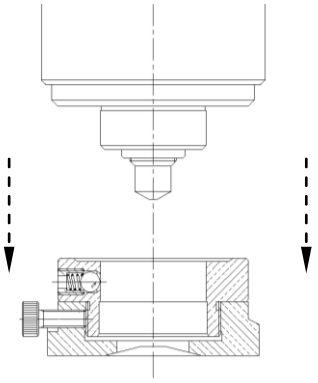
4 Setting up the instrument

The hardness tester is bundled with an indenter, a reference and an assembled standard base. However, for proper use, you have to follow these steps.

Below we describe the procedures for the dismantling of three components.

4.a Standard base mounting

The standard base (bundled with the instrument) is composed by 3 single pieces: the base itself ("foot" *(a))*, the locking screw *(b)* and the bush*(c)*; When using the term "base" on this manual, we always refer to the complete standard "base" if not stated differently.

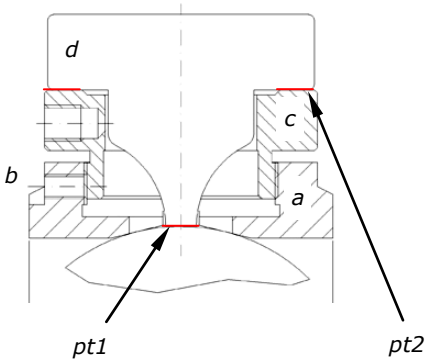


Unmounting the base:

- Hold with one hand the standard base and hold the body of the instrument with the other hand; now, gently pull the base.

Mounting the base:

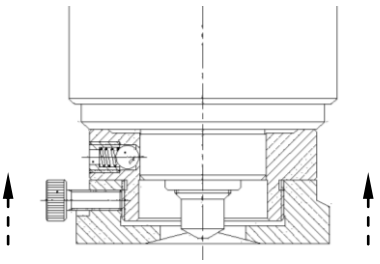
Rest the base on the surface to be tested, loosen the knurled screw, insert the gauge and register the bush so that the gauge rests both on the test surface and on the bush. Tighten the knurled screw.



Insert the probe in the desired base (the square base comes as a standard, other types of bases are available upon request) and make sure that the two bodies are one against the other.

*: The test surface can be plane or rounded

For rounded surfaces, be sure that the round surface of the object to test is tangent with the "V" shaped insert on the foot.
With the standard base is possible to perform test on round objects up to Ø200 mm.
For plane surfaces, make sure that the "foot" *(a)* and the "bush" (c) are packed together, with no gap between them (as visible on the picture on the right) so that the total height is 22.5mm ±0.1.



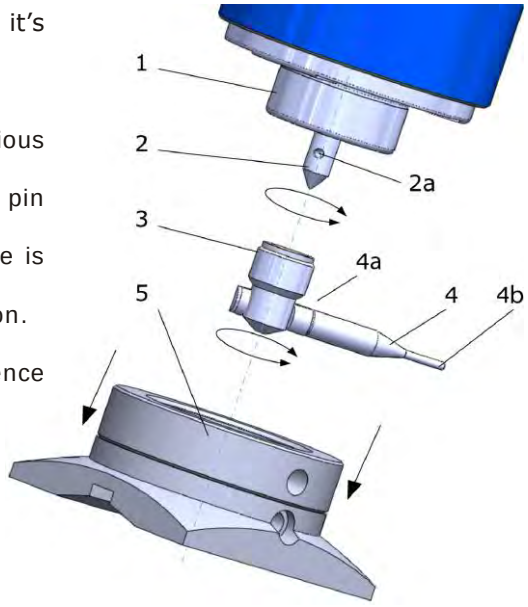
4 Setting up the instrument

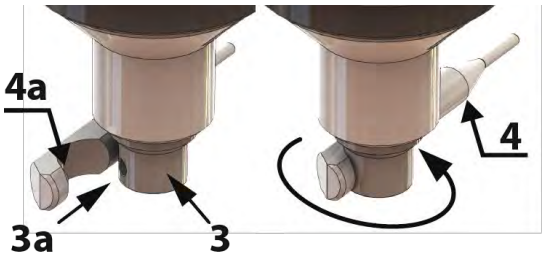
4.b Reference mounting

The reference *(3)* wraps the indenter (2) and it's visible removing the base (5)

To remove the reference proceed in this way:
- Remove the base *(5)* as seen on the previous chapter;
- Use the maintenance key *(4)* and insert its pin (4a) on the reference hole (3a);
- Rotate counter-clockwise until the reference is fastened;
- Remove the reference continuing the rotation.

To mount the reference again, repeat the sequence listed before on reverse.



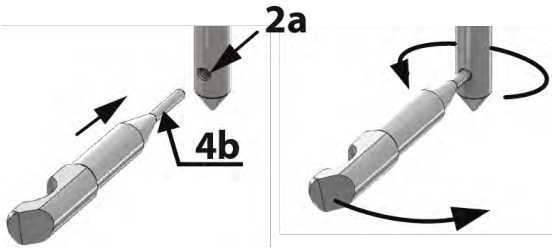


4.c Changing the indenter

The removal of the indenter must be performed with absolute care to avoid any damage to the indenter.

- Remove the metalTest base (5).
- Using the maintenance key (4), insert the pin (4a) into the hole (3a) on the reference (3) and unscrew it as seen in the previous paragraph.
- Remove the reference
- Using the lever of the maintenance key (4b) unscrew the indenter by inserting the lever on the indenter's hole (2a) and rotating counter-clockwise.
- Change the indenter, and screw all the components you removed.

Remark: this process is the same using the extension kit.



5 Using the instrument

5.a Instrument switch on/off

Press the ⏻ key (ON/OFF) on the panel; the instrument is now ready for use and will switch in standby mode after 20 seconds of non use. The last test scale used will be loaded automatically.

5.b Selecting the test scale

To change the test scale, use the ▼ and ▲ keys scrolling down the scale list; the instrument doesn't need a confirmation for the chosen test because the hardness tester automatically sets the scale selected (and visible) on the screen.

Order and available scales:

HRA » HRB » HRC » HR15N » HR30T » HB5 » HB30 » HV » HK » N2N*

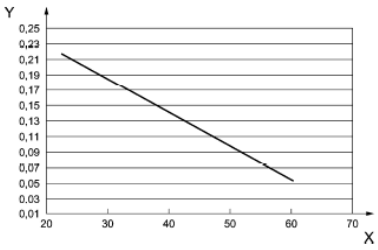
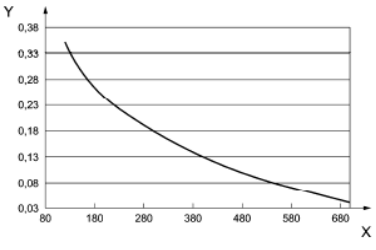
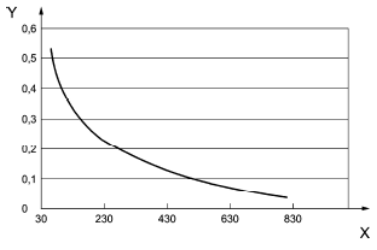
To choose the right scale for each material and minimum thickness testable, refer to the table below.

Material based scale selection table

Test scale	*Test method*	*Display*	*Test Range*		*Material*
HMMHRA	Rockwell	hrA	20÷92	HMMHRA	Carburized steel > 0.7 mm
HMMHRB	Rockwell	hrB	26÷100	HMMHRB	Soft steel and non ferrous metals
HMMHRC	Rockwell	hrC	0÷80	HMMHRC	Hardnened steel > 1.2 mm
HMMHR15N	Rockwell S.	hr15N	69÷93	HMMHR15N	Hardnened steel > 0.20 mm
HMMHR30T	Rockwell S.	Hr30T	16÷83	HMMHR30T	All soft metals > 0.35 mm
HB5	Brinell*	hb5	5÷205	HB5	Bronze, Copper e light alloys
HB30	Brinell*	hb30	66÷884	HB30	Carbon steel
HV	Vickers*	hv	13÷1865	HV	All materials
Knoop	Knoop	hk	25÷97	HK	Hard materials
Tensil module	-	r	226÷2898	N/mm²	Soft materials

*: *Comparative reading*

Minimum thickness scale selection table

HRC scale	*HBW1/30 scale*	*HV5 scale*
		
X: Hardness value *Y: Minimum thickness*	*X: Hardness value* *Y Minimum thickness*	*X: Hardness value* *Y: Minimum thickness*

5 Using the instrument

5.c Performing a test

Turn on the instrument by pressing the  . The instrument is ready to run an hardness test. Please note that the measurement scale is the same one used in the previous test; therefore make sure that it is the appropriate one.

- Take hold of the instrument (on which you already have assembled the correct base, see chapter ‘4.a, page 11’) and stably put it on the surface to be tested (that must be cleaned and prepared before starting any test).
- Press slowly on the handle until the indenter is in contact with the work piece surface then apply a constant pressure on the handles until the indenter stops.
- Keep the pressure for at least 2-3 seconds, then relax slowly the pressure.
- Read the hardness value on the display. The value will be displayed till the next measurement.

The hardness value will be obtained after the load is released. During the test performance is possible that "Hi" or "Lo" messages will appear on the display; this means that the hardness value is out of scale. Change the hardness scale and perform the test again.

This instrument is based on the DIN 50157 standard, so all the hardness values obtained must be written on the way explained on "chapter 3.c" page 8.

5.d Mean value visualization

To visualize the mean value of the test performed, shortly press the  key; If there are at least two legit measurements, the hardness tester will show on the LCD screen, "AvG" followed by the numeric value of the mean.
After a couple of seconds, the instrument will return to test mode and the chosen test scale will be shown on the LCD screen.

5.e Battery level

Press and keep pressing for at least one second the  button; On the LCD, a "b" will appear followed by a number between 0 e 100. The number is the percentage of the battery left.

6 Maintenance

6.a Battery

The metalTest is supplied by a 9 V Alcaline E-Block battery. When the display shows « LO BAT » (1), change the battery. In order to change the battery, slide the protection shield (3). Insert a screwdriver in the hole behind the housing and push the battery.
Insert the new battery taking care of the polarity. Slide the protection shield back and start the metalTest.

6.b Instrument

OMAG hardness testers do not require specific or particular maintenance, however, to obtain precise and reliable tests it is necessary to follow these few precautions:

- About every 500 tests check the hardness tester's gauging by running a few tests on control samples (operation suggested by the manufacturer, but which should also be considered in line with the ISO 9000 certification. Methods and times are at the user's discretion).
- Every 500 tests check the condition of the indenter with a magnifying lens. If it is nicked, return it to the manufacturer to be sharpened.
- Before reassembling the indenters make sure they are in no way damaged.

Periodical inspections and adjustments:

- Check the hardness tester's calibration using the appropriate test sample that comes with the machine. The hardness tester is considered to be properly calibrated if the results do no exceed the tolerances indicated in the INTERNATIONAL GAUGING STANDARDS chart.
  Otherwise, replace the indenter with an original one which we will provide upon request. It is fundamental to use original parts so as not to damage the hardness tester's inner components and to obtain precise and guaranteed values.
- Every 500 tests clean the indenter with a cloth.
- Always put the test samples in their appropriate cases.
- Keep the anvil blocks clean, eliminate any trace of oxide and remove any surface dent.

6.c Periodical inspections and calibration

- A frequent and diligent inspection of the instrument's calibration with the use of the test samples (that come with a calibration certificate), is the only way to ensure a constant reliability of the hardness tester's test results. The test samples that come with the official certificate are the only instruments that can guarantee the above.
  The instrument must be calibrated in compliance with the applicable international regulations. If the instrument should give results beyond regulatory tolerances, it will be necessary to immediately look for and eliminate the problem.
  Any re-calibration or repair carried out by someone different from the manufacturer, will result in the immediate termination of any warranty and the manufacturer will be released from any direct or indirect liability.

- Check the hardness tester's calibration with the appropriate test sample that comes with the instrument. 2 or 3 tests on the test sample are sufficient. The hardness tester is calibrated if the results do no exceed the tolerances indicated in the charts of the INTERNATIONAL CALIBRATION REGULATIONS. In case of non-compliant results, replace the indenter (or the probe) asking the manufacturer for an original one.
  It is essential to use original parts in order to avoid damage to the hardness tester's inner components and to obtain precise and guaranteed results. If after having replaced the indenter (or probe) the calibration should not comply with the regulatory tolerances, send the instrument to our technical department for a total overhaul.

6 Maintenance

6.d Scale correction

Hardness test values must be in the 20 - 70 HRC range and cannot differ more than 3 HRC from the sample hardness value. If the hardness tester doesn't succeed in this test, follow the procedure listed below:

- Take two sample for every scale used (A low hardness value one and a higher hardness value one)
- Execute 5 test for every sample and find the mean value between them.
- Check the test values with the nominal ones: if the difference between nominal and test values (mean) is similar for both the types of sample (low and high hardness), just use the Scale Correction tool (137) to fix the difference (scale offset); if the difference between the two types of sample is not similar, contact our customer service to require a new calibration of the hardness tester.

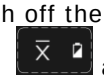
  Example:

  Higher hardness value sample: Nominal value 60 Mean value: 58
  Lower hardness value sample: Nominal value: 20 Mean value: 18

  The difference between the nominal and the mean value is 2 points for both samples; in this case it's enough to use the Scale Correction tool. If the difference between the high and the low hardness was different, the hardness tester would require a new calibration.

Scale Correction mode

To enter the "Scale correction" mode follow the steps listed below:

– Switch off the instrument
– Press  and –keeping pressed the key- press  to switch on the instruments
– The message "code" will be shown on the display for a couple of seconds, then a "0"
– Press  to start inserting the Scale Correction code (8 2 5)
– "1 0 0" will be shown on the display; Press  to change the first cipher with  and  keys, scroll up to the necessary number (the first cipher of the code is 8) and confirm by pressing 
– ; Instrument will move to the second number.
– With  and  keys, scroll up to the necessary number (the second cipher of the code is 2) and confirm by pressing 
– Repeat the last passage and confirm the last number (5); The instrument will move in the "Scale Correction mode", on the HRC scale.
– With  and  keys, chose the scale to correct and press 
– using  and  keys, increase or decrease the offset value; The shown number is directly proportional to the hardness value measured (every 0.1 point of the offset value, you'll get a 0.1 point correction on the hardness value)
– Press  to confirm the chosen value; the instrument will remain on Scale Correction mode, returning on the scale selection
– Repeat the same procedure for every scale you want to correct.
– When finished, switch off the instrument; At the next start, the hardness tester will start on Test mode.

6 Maintenance

6.e Instrument repeatability test

The indirect test must be performed on a temperature of 23 ±5°C using certified samples.
For an indirect verification, the instrument must be mounted on a stand. This way, the user can avoid wrong measurements caused by accidental movements of the instrument during the test performance and a vertical load and indention is garantueed.

Execution
For an indirect verification please provide at least 3 test samples for each scale to be verified. As listed in the table below, the 3 samples must cover the <25 to >60 hrc hardness range:

For conic indenters

Low values	*Average values*	*High values*
≤ 25 HRC	from 40 HRC to 55 HRC	> 60 HRC

On each sample a minimum of 5 tests must be performed.
The test must be performed accordingly to the DIN 50157-1 standard. Hardness testing value has to be read with a 0,2 points precision for Rockwell scales and 1 point precision for Brinell scales. Before starting any test, perform 2 preliminary test to verify that the instrument is working correctly. Don't use these two tests as an official measurement.

Repeatability

For each test sample, values from H1 to H5 represent the 5 tests performed on the sample where H1 is the lowest hardness value obtained and H5 is the highest.
The instrument repeatability is expressed by the "***r***" variation that is a percentage referred to the 5 tests performed on the sample.

$$r = \frac{H_5 - H_1}{\overline{H}} \times 100$$

$\overline{H}$ is the mean hardness value of the 5 tests performed:

$$\overline{H} = \frac{H_1 + H_2 + H_3 + H_4 + H_5}{5}$$

where H1, H2, H3, H4, H5 are the 5 hardness values as stated before.

The instrument repeatability is confirmed if "***r***" satisfies all the conditions and it's not higher than the reference value listed on table 1 (on the next page).

6 Maintenance

6.e Instrument repeatability test

Instrument deviation

The instrument deviation limit "***E***" on test conditions is obtained by:

$$E = \frac{\overline{H} - H}{H} \times 100$$

where:

H represents the hardness of the sample used

$\overline{H}$ represents the mean value of hardness measured on 5 different indents.

$$\overline{H} = \frac{H_1 + H_2 + H_3 + H_4 + H_5}{5}$$

The instrument deviation limit is a percentage number referred to the certified hardness of the testing sample and it can't be higher then the values listed on the table below:

Table 1 – Admitted repeatability and instrument deviation limit

Hardness scale	***Hardness values range for test samples***	***Deviation limit***	***Admitted repeatability***
HRC	from 20 HRC to 70 HRC	± 2,0 HMMHRC	≤ 0,03 or 1,0 HTMHRC[a]
HBW	≤ 125 HBW 125 HBW to 225 HBW > 225 HBW	± 4 % ± 3 % ± 2,5 %	4 % 3 % 2,5 %

[a] Consider the highest between the two values.

Interval between verifications

The specifications for the direct verifications of hardness testing machines are given in the table below (table 2). The indirect verification must be performed every 12 months and every direct verification.

Table 2 – Direct verification for hardness testing instruments

Requirements of verification	***Force***	***Measuring system***	***Indenter[a]***
Before setting to work first time	X	X	X
After dismantling and reassembling, if force, measuring system or test cycle are affected	X	X	
Failure of indirect verification	X	X	
Indirect verification > 14 months ago	X	X	

[a] In addition, it is reccomended to directly verify the indenter after 2 years of use.
[b] Direct verification of these parameters may be carried out sequentially (until the machine passes indirect verification) and is not required if it can be demonstrated (e.g. by test with a reference indenter) that the indenter was the cause of the failure.

6 Maintenance

6.f Notes for the hardness tester's correct operation

Before starting the test – make sure that the item is stably resting on a plane and that the surface to be examined is perpendicular to the probe.

- Accurately clean all the surfaces on which the calibration test sample rests, the anvil and the indenter. To clean them, use a cloth soaked with alcohol or gasoline, removing any trace of oil or grease. After having cleaned them, make sure that all the surfaces do not present any roughness since this could compromise test results.
- In case of uncertainties about measurements, run a few tests on the reference test sample that comes with the instrument; if the measurements are incorrect try running the tests with a different scale, or test sample or probe. If with these new tests the values are correct, replace the malfunctioning probe.
  Ask the manufacturer for a new probe.
- The indenter is a tool which must always be in perfect conditions.
  To obtain reliable results, everyday run a few tests on the test sample that comes with the instrument and if there should be a variation in the reading, ask for a new original indenter (or probe); this will avoid undesirable instrument malfunctions.
- Do not calibrate the electronic system, it is equipped with an automatic calibration control.
- Do not vary the test load and do not try to modify the calibration. In case of improper measurements please contact our technical assistance service:
  Tel. +39 0332.200.546 - Fax +39 0332.203.704

  www.omagaffri.com ~ info@omagaffri.com

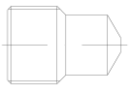
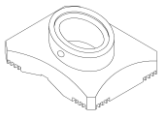
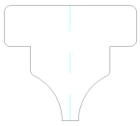
6.g Troubleshooting

Defect	Possible issue	Possible solution
Pressing ⏻ doesn't switch on the tester	Power supply issue	Replace the battery
	Damaged control panel	Ask our technical assistance
Performing a test doesn't change the hardness value displayed	Test results not confirmed	Switch off the instrument and switch on again.
	Transducer not working correctly	Ask our technical assistance
You get different results from the expected value	Uncorrect use of the instrument	Check if all the instrument components are mounted correctly. Check if the selected scale is correct for the application field of our test.
	Damaged indenter	Perform 3 test on the calibration sample: if the results are a lot different from the certified hardness value of the sample replace the indenter (Ask our technical assistance). Do not attempt to use not-original components. For components replacement always ask our technical assistance.

6 Maintenance

6.h Spare parts

We offer the possibility to order spare parts of some metalTest components.

				
100° diamond indenter *cod. 07503351*	Maintenance key *cod. 0330R085*	Reference *cod. 07503086*	Standard square base *cod. 07503160*	Gauge *cod. 07503406*

If needed, just write us your requests (fax, e-mail or ordinary mail) with the spare part code, instrument serial number and your personal details.
The spare parts will be sent to you as soon as possible.

6.i Instrument disposal

Environment respect

Always observe the local rules and laws about the recycling or disposal of packaging materials and batteries.

Recycling and disposal

Instructions on how to dispose of old instruments:

The **Waste Electrical and Electronic Equipment Directive** (WEEE Directive) is the European Community directive 2002/96/EC on waste electrical and electronic equipment (WEEE). The directive imposes the responsibility for the disposal of waste electrical and electronic equipment on the manufacturers of such equipment. The companies are compelled to use the collected waste in an ecologically-friendly manner, either by ecological disposal or by reuse/refurbishment of the collected WEEE using the best methods and technologies, to ensure no risks to people's health and an high environment protection. Your product was designed with high quality materials that can be recycled.

To dispose of your instrument you can:

1. Bring the instrument (with all the components, including cables and accessories) to an authorized WEEE center.

2. If you buy a new product, simply send your old product to the manufacturer that will provide to manage the instrument disposal.

7 Glossary

Indenter

It is the point with the appropriate shape and size to cut into the material to be examined, weighed down by a fixed load.
Indenters come in different shapes and sizes, each has been designed and approved for the various test scales.

Test load

It is the force that presses on the indenter to make it penetrate into the material to be tested.

Reading scale

The degree of hardness obtained after having penetrated the material with an indenter and a test load.

Calibration test sample

It is the reference check to verify that the instrument is perfectly calibrated.
The distance between one test and another must be at least 2 mm.
When the test samples are full of impressions, ask the manufacturer for a new original one.

8 General warranty conditions

With this customer warranty, OMAG guarantees the instrument – at the conditions here below – for a period of 12 months from the date of shipment or from the date of purchase from an Authorized dealer.

OMAG guarantees that this product is free from material or manufacturing defects.

This is the only customer warranty and is valid only and exclusively:

- if every part of the guarantee slip here attached is filled in indicating the customer's complete and detailed name and address, the instrument model and serial number indicated on the tag attached to the instrument ;
- if the guarantee slip is promptly sent to manufacturer by the customer or by the authorized dealer.

The warranty consists in:

- the repair or replacement of those parts or items which are defective – either because of the materials with which they are made or for manufacturing reasons – which are identified as such by an inspection exclusively carried out by OMAG or by the Authorized Dealer's Technical Assistance Service Technicians.

The warranty does not cover:

- transport costs for sending the instrument back and forth;
- labor costs for the repairs;
- periodical inspections, calibration, maintenance and ordinary maintenance repairs, normal wear of parts such as indenters, calibration test samples, grips or outer protections.

The warranty shall unexceptionally lapse:

- if the instrument has not been installed properly as indicated in the user's manual or by the regulations provided by the manufacturer;
- if the instrument is used for applications different from those for which it was constructed;
- if any repair has been carried out by unauthorized persons;
- if the instrument has been tempered with by the user or by any person who has not been authorized by the Technical Assistance Service.

OMAG and his Distributor shall not be responsible for any accidental or indirect damage deriving from an incorrect use of the instrument or for any malfunction of the instrument which may cause any damage.

9 Accessories available upon request

9.a Special bases

OMAG s.a.s. offers a set of accessories which can be combined with the metalTest.

The range of accessories goes from single bases to complete support systems.
Hereafter is a description of the standard models, but it is possible to ask for custom made accessories, designed and created according to customer specifications.

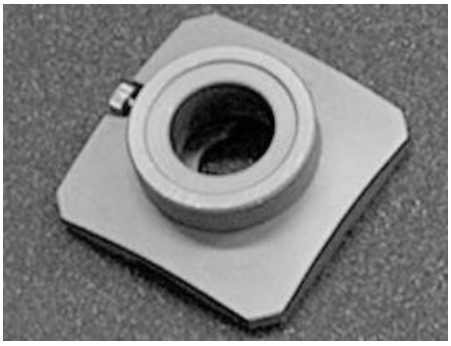
For other types of accessories please view our website: www.omagaffri.com

Square Base 65x65 (art 076A0154)

This base is particularly useful to run tests on round surfaces with a diameter from 60 to 200 mm.

It is very easy to use:
- Loosen the knurled screw.
- Rest only the base on the surface to be tested.
- Register the bush using the gauge, and follow the instructions for the standard square base.
- Tighten the knurled screw.
- Assemble the base to the instrument.

It is now possible to run a test.



Art 076A0154 – Base to test items with a diameter from 60 to 200 mm

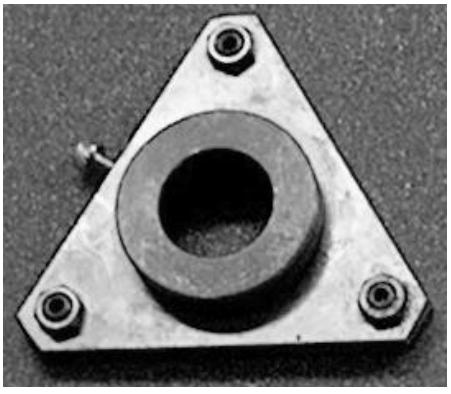
3 points base (art 2315)

This base is particularly useful when running tests on irregular flat surfaces or round items with a diameter greater than 2000 mm.

It is very easy to use:
- Remove the 3 nuts so as to free the support dowels.
- Place only the base on the item's surface and adjust the 3 dowels so as to have a fixed support on the 3 points.

WARNING: when running tests on irregular surfaces, the surface of the base must be adjusted in such a way so obtain orthogonality between the instrument's axis and the surface.
- Tighten the 3 fastening nuts.
- Loosen the knurled screw.
- Register the bush using the gauge, and follow the instructions for the standard square base.
- Tighten the knurled screw.
- Insert the base.

It is now possible to run a test.



Art 2315 – Base with three points to test items with a diameter greater than 2000mm and irregular surfaces.

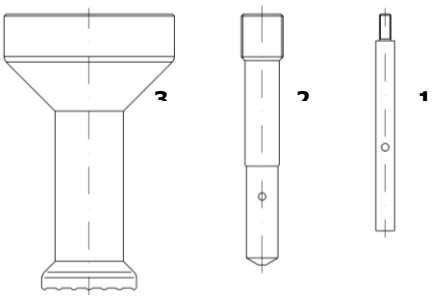
9 Accessories available upon request

Extension kit (art A015.5.000)

Useful basis to carry out tests on uneven surfaces (up to 70mm) that would be difficult to reach with the instrument in standard configuration.

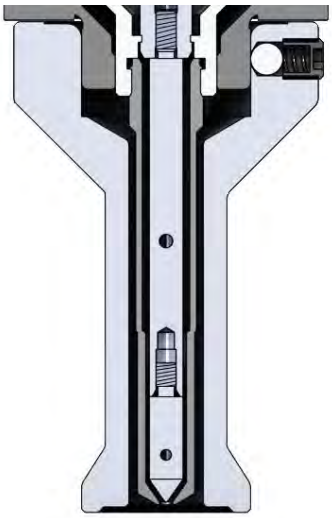
Operation is very simple:
- Remove the base mounted on the instrument
- Remove (unscrew) the reference with the maint. key
- Remove (unscrew) the indenter with the maint. key
- Fit (screwing) the extension to the indenter (1)
- Fit (screwing) the extension to the reference (2)
- Fit (screwing) the reference to the extension
- Engage the long base (3)

It is now possible to run a test.



Art A015.5.000 – Extension kit up to 70 mm height

.

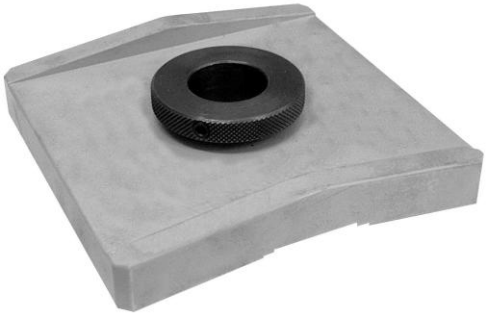


Base for big round items (art 2310)

This base is useful to run tests on round surfaces with a diameter greater than 200 mm.

It is very easy to use:
- Loosen the knurled screw.
- Rest only the base on the surface to be tested.
- Register the bush using the gauge, and follow the instructions for the standard square base.
- Tighten the knurled screw.
- Assemble the base to the instrument.

It is now possible to run a test.



Art 2310 – Base to test items with a diameter greater than 200mm.

Long base for round items (art 2316)

This base is useful to run tests on long round items with a diameter from 10 to 110 mm.

Its particularity is its length: it offers a stable support on surfaces or items with a considerable dimension, such as extrusion screws.

It is very easy to use:
- Loosen the knurled screw.
- Rest only the base on the surface to be tested.
- Register the bush using the gauge, and follow the instructions for the standard square base.
- Tighten the knurled screw.
- Assemble the base to the instrument.

It is now possible to run a test.

Art 2316 - Base for round items with a diameter from 10 to 110mm and with a particular shape

9 Accessories available upon request

9.b Portable and bench supports

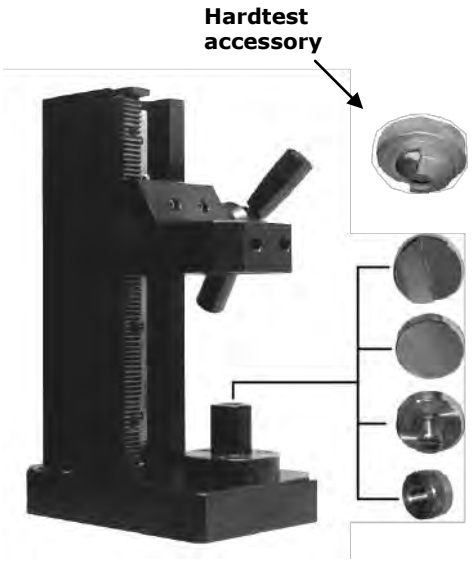
Sliding bench support (art 2312)

This support is very useful in laboratories or to test not very thick or large items.

The accessory comes with 2 small bases, a BRAM metal ring and 4 anvils with which to test a multitude of items.

This support can be used only with Hardtest (speciall metalTest version)

For other types of accessories please view our website www.omagaffri.com



Art 2312 – Sliding bench support and its standard accessories

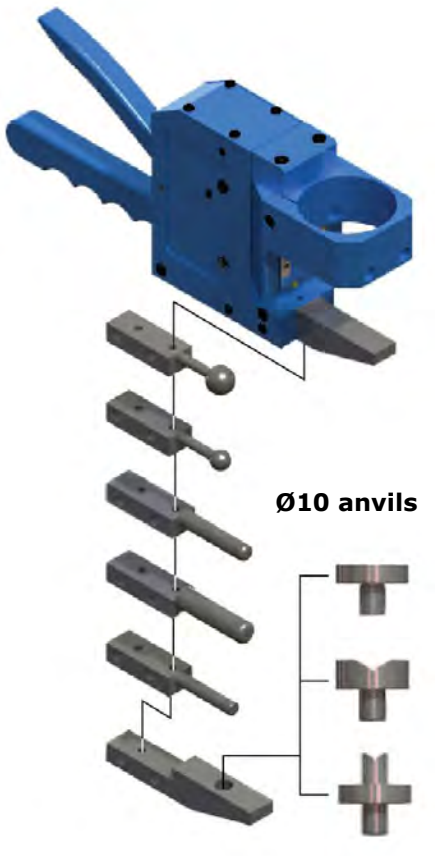
Portable clamp like support (art 23631)

Portable clamp like support.
This accessory's main characteristics are the light weight and stability. With this accessory it is possible to test items with a small size and thickness keeping the instrument completely portable.

The accessory comes with standard supports to test a multitude of items.

This support can be used only with Hardtest (special metalTest version)

For other types of accessories please view our website www.omagaffri.com



Art 23631 – Clamp like support

Vice like support (art 076A0157)

Portable or bench support with a vice like structure.

With this accessory it is possible to test items with a small size and thickness whenever the item needs to be locked in place.

The accessory comes with shaped vices to test a multitude of items.

This support can be used only with Hardtest (special metalTest version)

For other types of accessories please view our website www.omagaffri.com

Art 076A0157 – Vice like support

10 Hardtest

10.a Hardtest supports mountiing

Hardtest is a special version metalTest (the body is blocked) that can be used with sliding or special support as clamp or bench supports (not possible with standard metalTest). To use the Hardtest on these supports you most follow some required steps:

– Unfasten (rotating counter-clockwise) the screws that lock the handles to the instrument' body and remove them

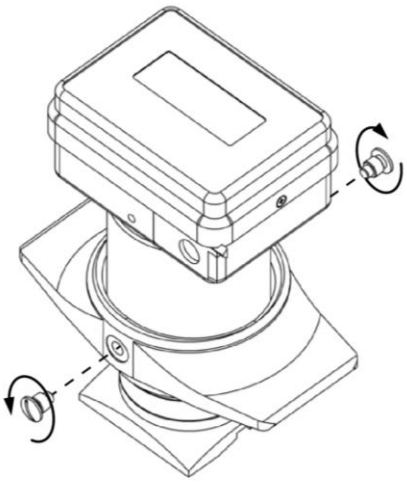
– Remove both the standard base (as seen in chapter) and the handles (now free to move)

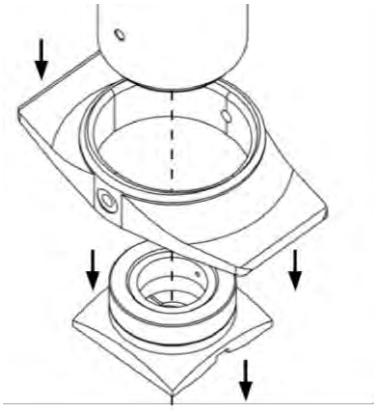
– Unfasten (rotating counter-clockwise) the screws that lock the handle to the instrument' body and remove them

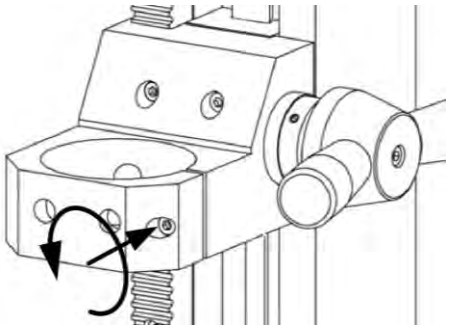
– Unfasten the screw on the support rotating counter-clockwise. This is necessary to make the instrument body fit in the support.

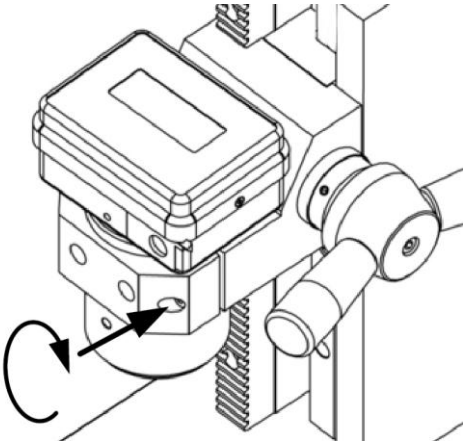
– Put the metalTest into the support and tighten the screw. Don't exceed on the pressure to avoid any damage to the instrument. Make sure that the instrument can't slide up or down on its own. To remove the metalTest unfasten the screw by rotating it counter-clockwise

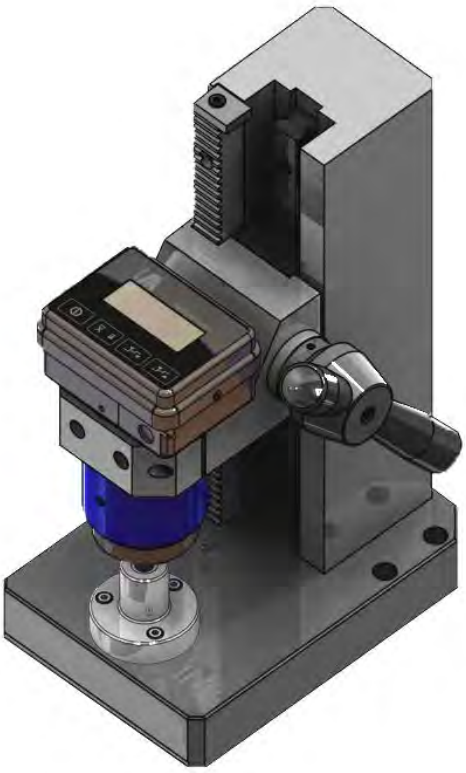
– Make sure that the instrument is positioned correctly, with the keyboard clearly visible with the battery access panel on the front.







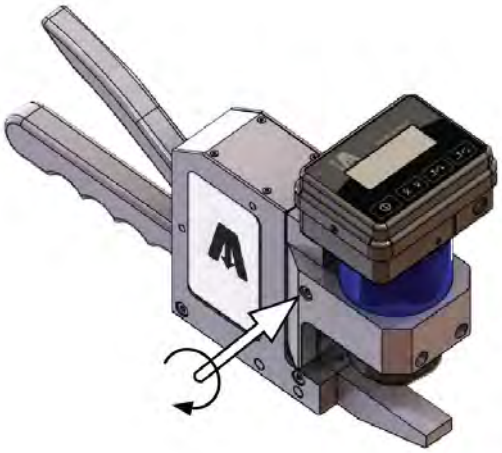




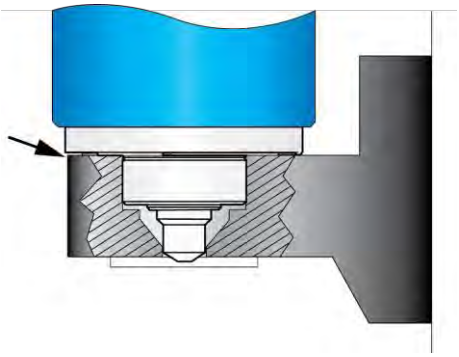
10 Hardtest

10.a Hardtest supports mountiing

For the clamp like support do the same operations done before with the metalTest. When it's time to tighten the metalTest support of the clamp, just tighten rotating clockwise the screw on the left side of the clamp (as visible on the picture). To remove the metalTest, unfasten the screw by rotating it counter-clockwise.



For the vice like support do the same operations done before with the metalTest then simply insert the metalTest into its housing on the vice. There is no need to lock it because the vice is studied to avoid the necessity to tighten the housing. Make sure (as visible in the second picture) that the two pieces are in contact. To do this, simply push the metalTest into the housing applying a small force. The Instrument will automatically settle into the housing.



10 Hardtest

10.b Bram ring mounting

Bram ring is an optional accessory that is very useful if you want to perform test on inaccessible areas with the reference mounted.
To mount the Bram ring just follow these steps:

- Remove the base
- As visible in the first picture, press the bottom of the instrument applying a little pressure.
- As the bottom physically stops his movement, mount the Bram ring and tighten by rotating it clockwise.
- The instrument is ready

Note: _____