



User Manual

PCE-1000N Barcol Hardness Tester



User manuals in various languages (Deutsch, français, italiano, español, português, nederlands, türk, polski, русский, 中文) can be downloaded here:

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1 Safety notes

Please read this manual carefully and completely before you use the device for the first time. The device may only be used by qualified personnel and repaired by PCE Instruments personnel. Damage or injuries caused by non-observance of the manual are excluded from our liability and not covered by our warranty.

- The device must only be used as described in this instruction manual. If used otherwise, this can cause dangerous situations for the user and damage to the meter.
- The instrument may only be used if the environmental conditions (temperature, relative humidity, ...) are within the ranges stated in the technical specifications. Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or moisture.
- Do not expose the device to shocks or strong vibrations.
- The case should only be opened by qualified PCE Instruments personnel.
- Never use the instrument when your hands are wet.
- You must not make any technical changes to the device.
- The appliance should only be cleaned with a damp cloth. Use only pH-neutral cleaner, no abrasives or solvents.
- The device must only be used with accessories from PCE Instruments or equivalent.
- Before each use, inspect the case for visible damage. If any damage is visible, do not use the device.
- Do not use the instrument in explosive atmospheres.
- The measurement range as stated in the specifications must not be exceeded under any circumstances.
- Non-observance of the safety notes can cause damage to the device and injuries to the user.

We do not assume liability for printing errors or any other mistakes in this manual.

We expressly point to our general guarantee terms which can be found in our general terms of business.

If you have any questions please contact PCE Instruments. The contact details can be found at the end of this manual.



2 Specifications

2.1 Technical Specifications:

| | |
|---|---|
| Parameters | Barcol Hardness (Hba) Brinell Hardness (HB) Vickers Hardness (HV) Webster Hardness (HW) Rockwell Hardness (HRB/HRE/HRF/HRH) |
| Measurement range | 0~100 HBa, equivalent to a Brinell hardness of 25~150HB |
| Resolution | 0.1 HBa |
| Measurement error | 81~88 HBa \pm 1 HBa 42~48 HBa \pm 2 HBa |
| Repeatability error | 81~88 HBa \pm 1.5 HBa 42~48 HBa \pm 2.5 HBa |
| Operating conditions - temperature - humidity | 0~50°C <50%RH |
| Power supply | 2 x 1.5 V AAA batteries |
| Dimensions | 170 x 63 x 82 mm |
| Weight | 390g (without batteries) |

2.2 Delivery Contents:

- 1 x Barcol hardness tester PCE-1000N
- 2 x spare pins
- 2 x calibration plates
- 1 x Phillips screwdriver
- 1 x slot screwdriver
- 1 x small slot screwdriver
- 1 x wrench
- 1 x carrying case
- 1 x instruction manual

3 System description

3.1 Device

The PCE-1000N is a digital indentation hardness tester for measuring the hardness of aluminium. It comes with many different features, such as a digital display, good stability, a maximum and average value function. It is mainly used in the aluminium processing industry for testing aluminium castings and forgings. It can also be used for softer metals, such as copper or lead, as well as for fibre-reinforced plastics. The device meets the following standards: ASTM B648-00, ASTM HD2583-07 and GB / T 3854-2005.

Features:

- The device is portable due to its small dimensions and can be operated with one hand only.
- The device has a wide measuring range and can measure hard aluminium alloys as well as soft pure aluminium and other softer metals, such as copper and lead. The effective measuring range is equivalent to a Brinell hardness of 25~150HB.
- The max hold function shows the maximum value during the measurement.
- The PCE-1000N can be used for measuring not only Barcol hardness, but also Brinell hardness (HB), Vickers hardness (HV), Webster hardness (HW) and Rockwell hardness (HRB/HRE/HRF/HRH).
- With its average function, the device can calculate an average value of up to 29 readings.

With its standard load spring and standard pressure pins, the PCE-1000N can be used for a variety of different materials, such as aluminium, aluminium alloy, copper, copper alloy, fibre-reinforced plastics (glass, steel), other reinforced plastics, non-reinforced hard plastic, and other materials. The typical hardness range is 25 – 135 HBW (500kg, 10mm). The following chart shows typical Barcol hardness values of different aluminium alloys:

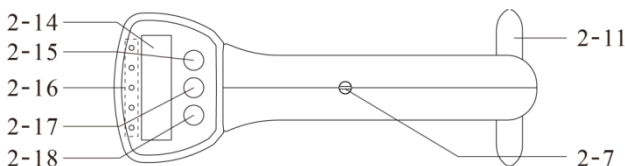
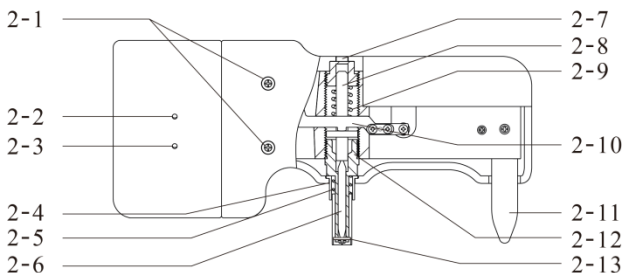
| | | | | |
|--------------------------|--------|---------|---------|--------|
| Alloy and heat treatment | 1100-0 | 3003-0 | 3003H14 | 2024-0 |
| Barcol Hardness | 35 | 42 | 56 | 60 |
| Alloy and heat treatment | 5052-0 | 5052H14 | 6061T6 | 2024T3 |
| Barcol hardness | 62 | 62 | 80 | 85 |

3.2 Structure and function Keys

The PCE-1000N measures the indentation hardness by pressing a specific pressure pin with a specific pressure into the surface of the sample. The hardness is calculated via the indentation depth. The device uses the following formula:

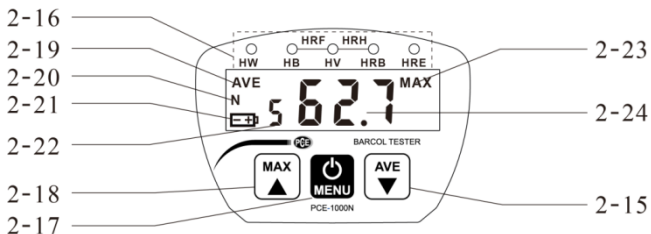
$$HBa = 100 - h / 0.0076$$

HBa Barcol hardness value
 H indentation depth (mm)
 0.0076 indentation depth at 1 Barcol



- 2-1 housing screws
- 2-2 high end calibration button
- 2-3 low end calibration button
- 2-4 spring tube
- 2-5 lower spindle spring
- 2-6 pressure pin
- 2-7 main spindle adjusting screw
- 2-8 upper spindle
- 2-9 upper spindle spring
- 2-10 lever
- 2-11 supporting feet
- 2-12 lower spindle connecting screw
- 2-13 shield ring
- 2-14 display
- 2-15 average/minus button
- 2-16 hardness scale
- 2-17 power/menu button
- 2-18 max/plus button

3.3 Display



- 2-19 average indicator
- 2-20 statistical number indicator
- 2-21 battery indicator
- 2-22 number of recorded measurements
- 2-23 maximum indicator
- 2-24 measurement reading

4 Getting started

4.1 Power supply

When the low battery indication is displayed, you need to replace the batteries. Open the battery cover and take out the batteries. Insert two new AAA batteries and close the cover of the battery compartment. Mind the correct polarity.

4.2 Preparation

- To **power on** the tester, just press the Power / Menu key. There are 2 methods to power off the tester: automatic power-off and manual power-off. Press and hold the Power / Menu key for about 3 seconds to power off the device. After 10 minutes of idling time, the tester shuts down automatically.
- To **check the tester's accuracy**, place the supplied hardness blocks on a hard, flat surface and take a measurement. The reading should be in the indicated range of two hardness blocks. If it is out of the range, a calibration according to chapter 6 is needed.
- **The sample surface** should be smooth, clean and without any mechanical damage. The sample surface can be slightly polished to eliminate scratches or coatings.
- **The specimen thickness** should be not less than 1.5 mm and there should not be any obvious deformation on the supporting surface after testing.
- The size of the sample should ensure that the minimum distance between the pin tip and any edge is not less than 3 mm.
- Make sure that there are no previous test indentations in a radius of 3 mm around the current test position.
- In order to ensure the accuracy of the measurement, the pin must be perpendicular to the surface of the sample.
- Test samples should be placed stably. Small samples should be placed on a solid surface. (e. g., steel, glass, etc.).
- During the measurement, the sample should not be tilted. The sample should also be protected against slipping and deformation.



5 Operation

5.1 Measurement

Place the device on the sample and push it down on the surface with enough pressure. Read out the hardness value from the display.

5.2 Further functions

5.2.1 Max hold function

Press the Maximum / Plus key. The 'MAX' indication appears in the upper right corner of the display. The maximum value since the activation of the function is shown on the display. To exit the max hold function, just press the Power / Menu Key. The 'MAX' indication disappears.

5.2.2 Average function

Press the Average / Minus key. The statistical measurement number indication 'N' and the 'MAX' indication appear on the display. Additionally, a '0' appears on the left side of the display and '0.0' appears on the right side. The left value is the number of measurements taken. The right value is the reading of the last measurement.

Take measurements until the number of measurements taken reaches the set value of the statistical measurement number 'N'. Now the device calculates the average value of the measurements taken. The result is shown on the right side of the display. In addition, an 'AVE' indication appears and the device emits an acoustic signal.

5.2.3 Setting the statistical measurement number 'N'

To set the statistical measurement number, press and hold the Power / Menu key for about 6 seconds until the **no.** indication appears on the display. Press the Maximum / Plus key or Average / Minus key to adjust the measurement number. The statistical measurement number can be set between 1~29. Press the Power / Menu Key to return the standard measurement mode.

Use the method of calculating the average of several measurements to figure out the measurement value. The softer the sample is, the more measurements should be included. The suggested number of measurements can be seen in the following tables:

Suggested number of measurements for aluminium alloys
(According to ASTM B648-2000)

| Barcol hardness value | Min. number of measurements |
|-----------------------|-----------------------------|
| 50 | 6 |
| 60 | 5 |
| 70 | 4 |
| 80 | 3 |

Suggested number of measurements for reinforced and non-reinforced plastic (According to GB/T3854-2005)

| Non-reinforced plastic (hard plastic) | Min. number of measurements | Reinforced plastic (glass, steel) | Min. number of measurements |
|---------------------------------------|-----------------------------|-----------------------------------|-----------------------------|
| 20 | 9 | 30 | 29 |
| 30 | 8 | 40 | 22 |
| 40 | 7 | 50 | 16 |
| 50 | 6 | 60 | 10 |
| 60 | 5 | 70 | 5 |
| 70 | 4 | | |
| 80 | 3 | | |

6 Calibration

6.1 Calibration of the PCE-1000N

The calibration considers the high-end value. You can also calibrate the displayed value. The device comes factory calibrated (without documentation). If the reading is out of the indicated range when checking the accuracy or after replacing the pressure pin, you need to re-calibrate the device.

NOTE: It is necessary to loosen the main spindle adjusting screw before performing a high-end calibration.

6.2 High end calibration

Use a small screw driver to loosen the main spindle adjusting screw in counter-clockwise direction until the end. Place the tester on a solid flat surface, such as a glass plate. Push the tester so that the pin draws back completely into the pin tube: '100.0' should be shown on the display. If the reading deviates, press and hold the power/menu key for approx.. 9 s until 'CAL' is displayed. Release the key. The meter automatically calibrates to 100.0. The high-end calibration is now completed.

6.3 Display value calibration

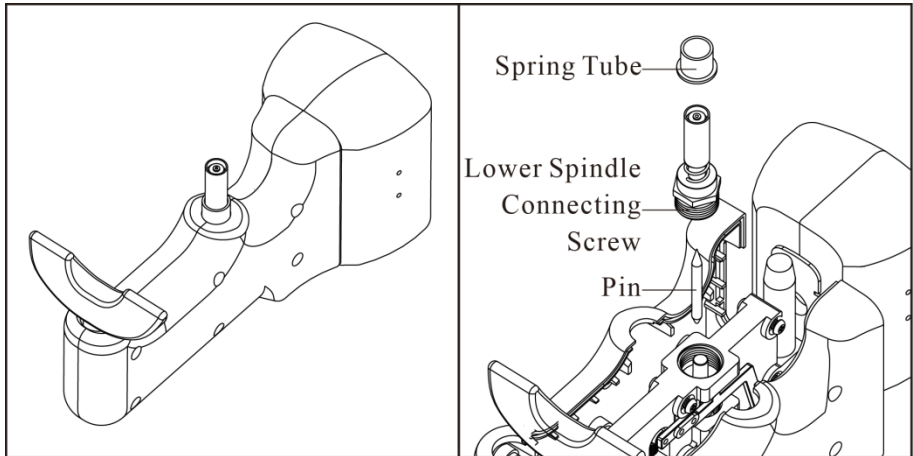
Use a small screw driver to adjust the main spindle adjusting screw. The display value decreases when turning it clockwise and increases when turning it counter-clockwise. Adjust the screw until the measured value is in the indicated range of the 2 standard blocks.

7 Troubleshooting

With the frequent use of the tester, the pressure pin will be worn out slightly. When this happens, the measurement value will deviate. So it is necessary to check the wear of the pressure pin on a regular basis. If you do not get two readings which lie within the indicated range of the two calibration blocks when performing a display calibration, this means that the pressure pin is worn out and needs to be replaced. After that, the device needs to be calibrated again.

7.1 Pin replacement

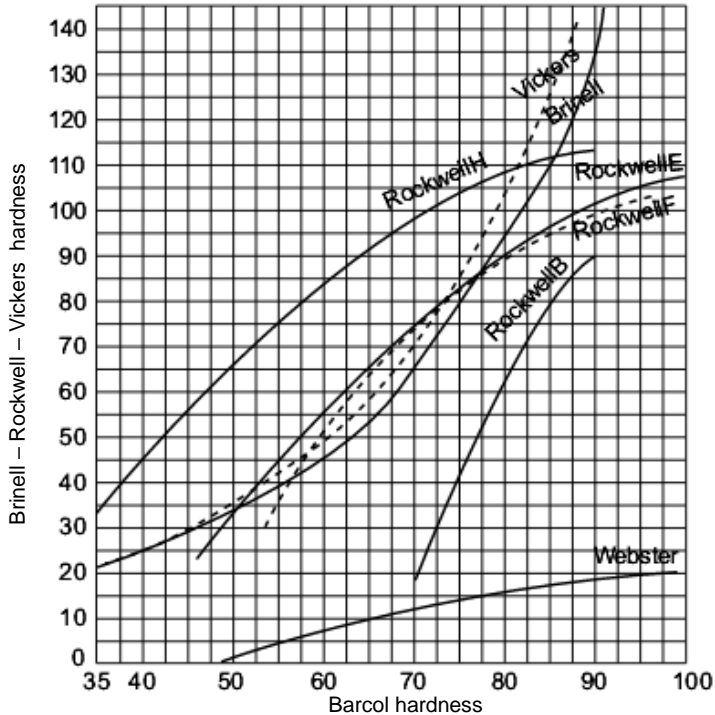
Loosen the screws on both sides of the handle with a small screwdriver (a total of 12). Take off the case and take out the spring tube. Loosen the lower spindle connecting screw with a spanner and take out the lower spindle. Now you can remove the used pin and replace it with a new one, then reinstall the lower spindle and lock it with the spanner. Put on the spring tube, remount the case and lock it with the screws. See the following picture for reference. After replacing the pressure pin, you need to calibrate the device again.



When the tester is used over a longer period of time, especially when measuring soft aluminium alloy materials, some material might remain on the pin which might affect the accuracy of the device. To eliminate this error, make sure to check and clean the top of the measuring pin on a regular basis.

8 Further information

8.1 Approximate conversion curve



8.2 Hardness conversion

NOTE: Due to the properties of soft metal materials, a consistent conversion between different hardness systems is not possible. Therefore, the following conversion table is for reference only. It is recommended to determine the actual hardness values by taking measurements.

| Barcol OU2800S | Brinell 10mm 500kg | Vickers 5kg | Webster W-20 | Rockwell | | | |
|-------------------|--------------------------|----------------|-----------------|----------|---|---|----|
| | | | | B | E | F | H |
| 35 | | 21 | | | | | 32 |
| 36 | | 22 | | | | | 35 |
| 37 | | 23 | | | | | 37 |
| 38 | | 24 | | | | | 40 |
| 39 | | 25 | | | | | 42 |
| 40 | 25 | 26 | | | | | 45 |
| 41 | 25 | 27 | | | | | 47 |

| | | | | | | | |
|----|-----|-----|------|----|-----|-----|-----|
| 42 | 26 | 28 | | | | | 49 |
| 43 | 27 | 29 | | | | | 51 |
| 44 | 27 | 30 | | | | | 54 |
| 45 | 28 | 30 | | | | | 56 |
| 46 | 29 | 31 | | | | | 58 |
| 47 | 30 | 32 | | | 23 | | 60 |
| 48 | 30 | 33 | 0.7 | | 26 | | 62 |
| 49 | 31 | 34 | 1.3 | | 28 | | 64 |
| 50 | 32 | 35 | 1.9 | | 31 | | 66 |
| 51 | 33 | 36 | 2.5 | | 34 | | 68 |
| 52 | 34 | 38 | 3.1 | | 36 | | 70 |
| 53 | 35 | 39 | 3.6 | | 39 | 30 | 72 |
| 54 | 37 | 40 | 4.2 | | 41 | 34 | 73 |
| 55 | 38 | 41 | 4.7 | | 44 | 37 | 75 |
| 56 | 39 | 43 | 5.3 | | 46 | 40 | 77 |
| 57 | 40 | 44 | 5.8 | | 48 | 43 | 78 |
| 58 | 42 | 45 | 6.3 | | 50 | 46 | 80 |
| 59 | 43 | 47 | 6.8 | | 53 | 48 | 82 |
| 60 | 45 | 49 | 7.3 | | 55 | 51 | 83 |
| 61 | 46 | 50 | 7.8 | | 57 | 54 | 85 |
| 62 | 48 | 52 | 8.3 | | 59 | 56 | 86 |
| 63 | 50 | 54 | 8.8 | | 61 | 59 | 88 |
| 64 | 51 | 56 | 9.2 | | 63 | 61 | 89 |
| 65 | 53 | 58 | 9.7 | | 65 | 63 | 90 |
| 66 | 55 | 60 | 10.1 | | 67 | 66 | 92 |
| 67 | 57 | 62 | 10.6 | | 69 | 68 | 93 |
| 68 | 60 | 65 | 11.0 | | 71 | 70 | 94 |
| 69 | 62 | 67 | 11.4 | | 73 | 72 | 95 |
| 70 | 64 | 70 | 11.8 | 17 | 75 | 74 | 97 |
| 71 | 67 | 72 | 12.2 | 23 | 76 | 75 | 98 |
| 72 | 69 | 75 | 12.6 | 28 | 78 | 77 | 99 |
| 73 | 72 | 78 | 12.9 | 33 | 80 | 79 | 100 |
| 74 | 75 | 81 | 13.3 | 38 | 81 | 80 | 101 |
| 75 | 78 | 85 | 13.7 | 42 | 83 | 82 | 102 |
| 76 | 80 | 88 | 14.0 | 47 | 84 | 83 | 103 |
| 77 | 84 | 92 | 14.3 | 51 | 86 | 85 | 104 |
| 78 | 87 | 95 | 14.7 | 55 | 87 | 86 | 105 |
| 79 | 90 | 99 | 15.0 | 59 | 89 | 88 | 106 |
| 80 | 94 | 103 | 15.3 | 63 | 90 | 89 | 106 |
| 81 | 97 | 108 | 15.6 | 66 | 91 | 90 | 107 |
| 82 | 101 | 112 | 15.9 | 70 | 92 | 91 | 108 |
| 83 | 105 | 117 | 16.2 | 73 | 94 | 92 | 109 |
| 84 | 109 | 121 | 16.4 | 76 | 95 | 93 | 109 |
| 85 | 113 | 126 | 16.7 | 79 | 96 | 94 | 110 |
| 86 | 117 | 131 | 16.9 | 81 | 97 | 95 | 111 |
| 87 | 121 | 137 | 17.2 | 84 | 98 | 96 | 111 |
| 88 | 126 | 142 | 17.4 | 86 | 99 | 97 | 112 |
| 89 | 130 | | 17.6 | 88 | 100 | 98 | 112 |
| 90 | 135 | | 17.8 | 90 | 101 | 98 | 113 |
| 91 | 140 | | 18.0 | | 102 | 99 | 114 |
| 92 | 145 | | 18.2 | | 103 | 100 | |

| | | | | | | | |
|-----|--|--|------|--|-----|-----|--|
| 93 | | | 18.4 | | 103 | 100 | |
| 94 | | | 18.6 | | 104 | 101 | |
| 95 | | | 18.7 | | 105 | 102 | |
| 96 | | | 18.9 | | 106 | 102 | |
| 97 | | | 19.0 | | 106 | 103 | |
| 98 | | | 19.2 | | 107 | | |
| 99 | | | 19.3 | | 107 | | |
| 100 | | | 19.4 | | | | |



9 Contact

If you have any questions, suggestions or technical problems, please do not hesitate to contact us. You will find the relevant contact information at the end of this user manual.

10 Disposal

For the disposal of batteries in the EU, the 2006/66/EC directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose.

In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law.

For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations.

If you have any questions, please contact PCE Instruments.



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