Elcometer 181

Concrete Test Hammer

Operating Instructions

English

elcometer®

A copy of this Instruction Manual is available for download on our Website via www.elcometer.com/downloads.

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Thank you for your purchase of this Elcometer 181 Mechanical Concrete Test Hammer. Welcome to Elcometer.

Elcometer are world leaders in the design, manufacture and supply of inspection equipment for concrete and coatings.

Our concrete inspection products include a comprehensive range of concrete, and civil engineering inspection equipment. Our coatings products cover all aspects of coating inspection, from development through application to post application inspection.

The Elcometer 181 Mechanical Concrete Test Hammer is a world beating product. With the purchase of this product you now have access to the worldwide service and support network of Elcometer. For more information visit our website at www.elcometer.com

1 ABOUT YOUR TEST HAMMER

The Elcometer 181 Mechanical Concrete Test Hammer is a simple to use gauge which provides an estimate of the strength and quality of concrete.

Formerly, masons and construction workers used to check the set and state of concrete by striking the surface with a hammer. They assessed very roughly the set and resistance of the concrete by the nature of the metallic sound produced and of the rebound. The Elcometer 181 replaces this unreliable method of testing with a hand held tool which gives quantifiable and reproducible test results.

Your Elcometer 181 Mechanical Concrete Test Hammer consists of a spring loaded mass which, when released, causes a plunger to impact the concrete surface with fixed and constant energy. During the rebound stroke, the mass moves a pointer along a scale on the body of the test hammer. This scale is marked in units of rebound number.

Charts on the body of the test hammer allow the rebound number to be converted into the compression strength of the concrete.

To maximise the benefits of your Elcometer 181 Mechanical Concrete Test Hammer, please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.

1.1 Features

- Non-destructive testing
- Quick and easy test to perform
- Determine compression strength using charts on body of gauge
- Low cost gauge
- Supplied with grinding stone for surface preparation

If you require more advanced features such as a digital display, statistics, readings memory and an RS232 output, the Elcometer 182 Digital Concrete Test Hammer provides these facilities. Contact Elcometer or your local Elcometer supplier for more details of this gauge.

1.2 Standards

The Elcometer 181 Mechanical Concrete Test Hammer can be used in accordance with the following National and International Standards:

ASTM C805	EN 12504-2	DIN 1048-2
JIS A 1155	UNI 9189	

1.3 What the box contains

- Elcometer 181 Mechanical Concrete Test Hammer
- Plastic storage case
- Grinding stone
- Operating instructions

2 IDENTIFYING THE PARTS OF YOUR TEST HAMMER

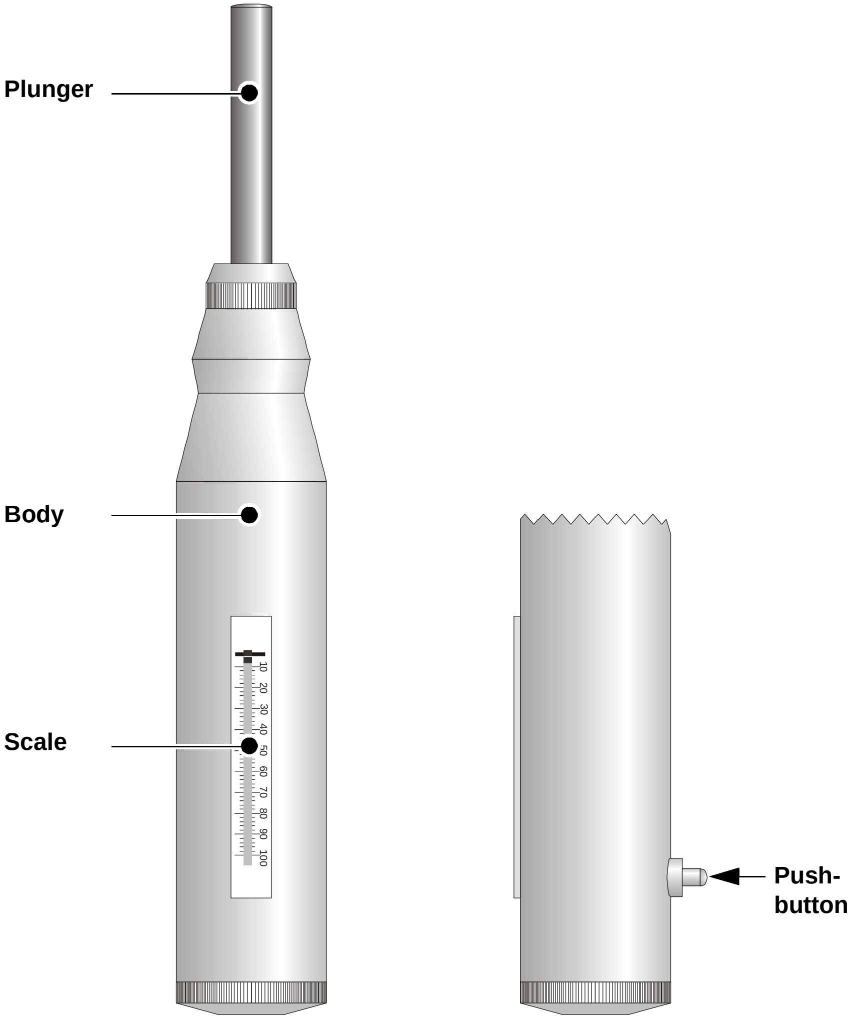


Figure 1. The parts of your test hammer

3 TAKING A READING

This section explains where to take readings, how to prepare the concrete surface and how to take a reading using your test hammer.

3.1 Where to take readings

If possible, test vertical surfaces. Avoid joints, honeycombs and porous areas. Take great care with walls that are less than 10 cm thick and columns that are less than 12 cm thick since they could give misleading readings on account of their resilience.

Low-grade concrete will result in larger rebound numbers at the bottom progressing to smaller rebound numbers at the top. For this reason, it will be necessary to carry out several tests at a number of locations to obtain a reliable average.

Take readings in at least five separate locations within the test area and calculate the average of these readings. When calculating the average, discard any readings which are significantly different from others (more than 5 points on the scale). Low values usually correspond to impacts made in porous areas, whilst high values may correspond to impacts on large pieces of aggregate.

3.2 Surface preparation

The test surface can be used only when all grout, plaster or other coatings have been removed and the concrete surface is exposed and smooth.

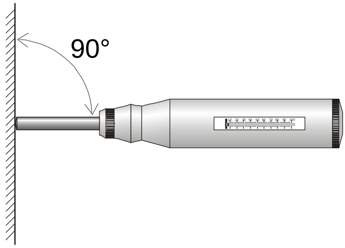
Slightly uneven surfaces caused by wooden forms can be removed with the grinding stone supplied with your test hammer.

Old, and consequently hardened, concrete will also have to have the surface ground down to a depth of 10 mm over an area of at least 10 cm^2 (sufficient to carry out 5 to 10 impact tests).

A grinder can be used for removal of large amounts of coating or hard concrete. We recommend that a 750 W grinder is used with a grinding wheel diameter of approximately 120 mm at a speed of 6000 rpm.

3.3 Procedure

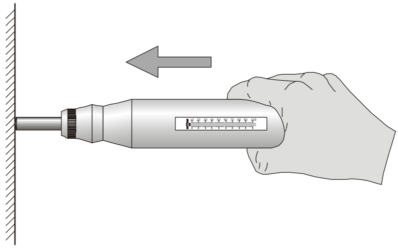
1. Remove the test hammer from the plastic storage case.
2. Hold the body of the test hammer firmly and press the end of the plunger against a hard surface until a click is heard. Move the test hammer away from the surface; the plunger will extend to its full extent.

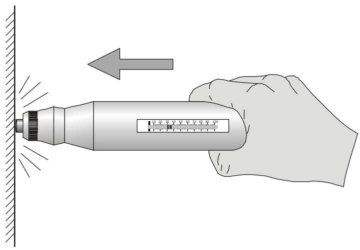


3. Place the plunger against the test surface ensuring that the test hammer is perpendicular to the test surface.
4. Press the test hammer in a continuous and even manner against the surface until the internal mass is released and strikes the plunger.

   Do not press the push-button during this stage of taking a reading.

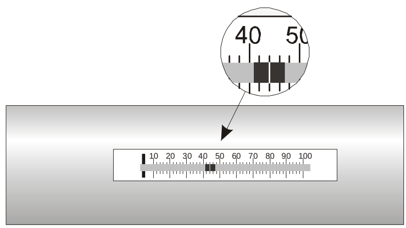
   After impact, the internal mass rebounds and moves the reference pointer along the scale.





5. Press and hold the push-button and then move the test hammer away from the test surface.
6. Release the push-button and record the rebound number on the scale next to the pointer.

   To convert the rebound number to concrete compression strength, see "Determining concrete compression strength" on page 7.



To take another reading, repeat steps 2 to 6.

3.4 After the test

Ensure the test hammer is clean and dry and then place in the plastic storage case together with the grinding stone.

4 DETERMINING CONCRETE COMPRESSION STRENGTH

To convert the rebound number from your test hammer to concrete compression strength, use the chart on the body of the test hammer. The chart gives **cube** compression strength; to convert to **cylinder** compression strength, multiply the value obtained from the chart by 0.85.

4.1 Using the chart

There are five curves on the chart. Each curve represents a different test angle. Choose the curve corresponding to the angle at which the test hammer was held while the readings were taken (Figure 2).

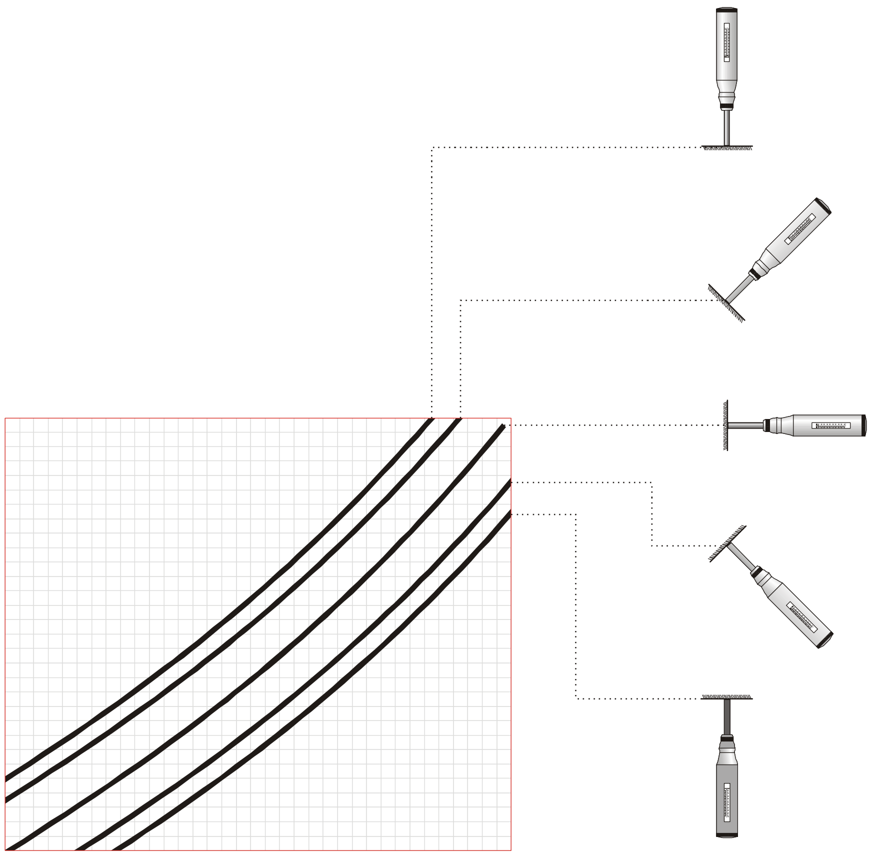


Figure 2. Choose the correct curve

Locate the rebound number along the bottom axis. Draw a line up from this number to the correct curve and then across as illustrated to obtain the concrete cube compression strength (Figure 3). To convert to cylinder compression strength, multiply the value obtained from the chart by 0.85.

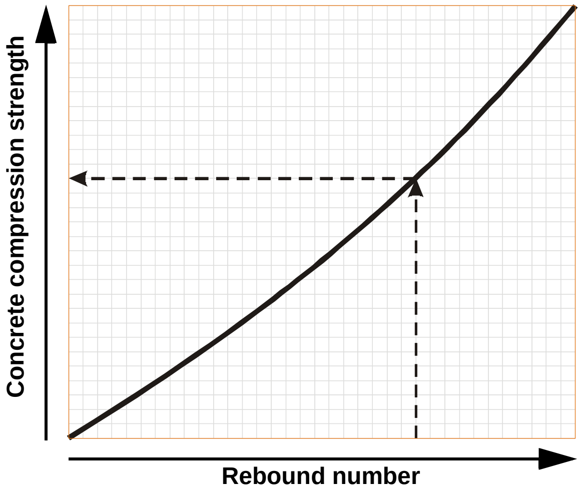


Figure 3. Converting rebound number to concrete compression strength

The average error of the concrete compression strength can be determined from the scale on the right of the chart. (Figure 4)

Draw a line from the concrete compression strength across to the average error scale.

The width of the scale at this point gives the average error (±) of the concrete compression strength.

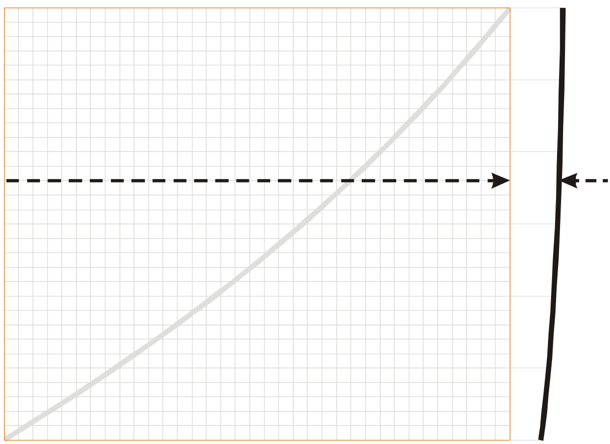


Figure 4. Determining the average error of the concrete compression strength

Note: *The chart applies to concrete made with Portland cement, sand and good quality aggregate, age 14 to 56 days. Surfaces must be smooth and dry.*

4.2 Chart accuracy

The chart has been produced using measurements taken on a large number of concrete cubes which were first checked with a concrete hammer and then compression tested on a test machine. All cubes used were made with concrete consisting of good quality aggregate and Portland cement.

Before carrying out the compression test, each cube was held between the plates of the test machine and then tested by 10 impacts on one side. Experience has shown that the chart is not affected by the cement content, granulometric composition, aggregate diameter and water/cement ratio.

Differences were noted on the other hand in the following cases:

1. Small-sized artificial stones products or concrete made with unusual compositions. In these cases it is considered advisable to carry out a series of preliminary tests to determine the relationship between the rebound value and the quality of the material.
2. Concrete made of low strength, lightweight or cleavable aggregate. In this case the actual strength of the concrete is lower than that corresponding to the calibration curve (e.g. pumice stone, expanded clay, gneiss, etc.).

   When in doubt, the relationship between the rebound value and actual strength will have to be assessed experimentally.
3. Concrete made of gravel with excessively smooth and polished surface that is of no use for high strength concrete. Since the rebound value in this case depends entirely on the mortar, it is difficult to establish the strength of the concrete.
4. Concrete containing dirty or clayish aggregate. Since the rebound value in this case depends entirely on the mortar, it is difficult to establish the strength of the concrete.
5. Concrete which is poor in sand content and has a low water/cement ratio, inadequately processed with the consequent honeycomb formation which cannot be seen from outside but which will most definitely negatively affect rebound values.
6. Concrete from which the form has just been removed, or wet concrete. The surface should be allowed to dry before carrying out tests.
7. Very old, dried out concrete. The surface is always disproportionately hard and consequently the test hammer reading is higher than the actual value. In this case, grind down the surface for a depth of about 10 mm and carry out the hardness tests taking care not to strike the larger pieces of aggregate.

5 MAINTENANCE

The Elcometer 181 Mechanical Concrete Test Hammer is designed to give many years reliable service under normal operating and storage conditions.

The instrument requires no particular routine maintenance other than keeping it clean and removing concrete deposits from the end of the plunger.

After long periods of service (about 20 000 impacts), the inside of the test hammer should be cleaned in the following manner:

1. Hold the body of the test hammer firmly and press the end of the plunger against a hard surface until a click is heard. Move the test hammer away from the surface; the plunger will extend to its full extent.
2. Referring to Figure 5, unscrew the plunger ring with its felt gasket and remove the two-part ring.

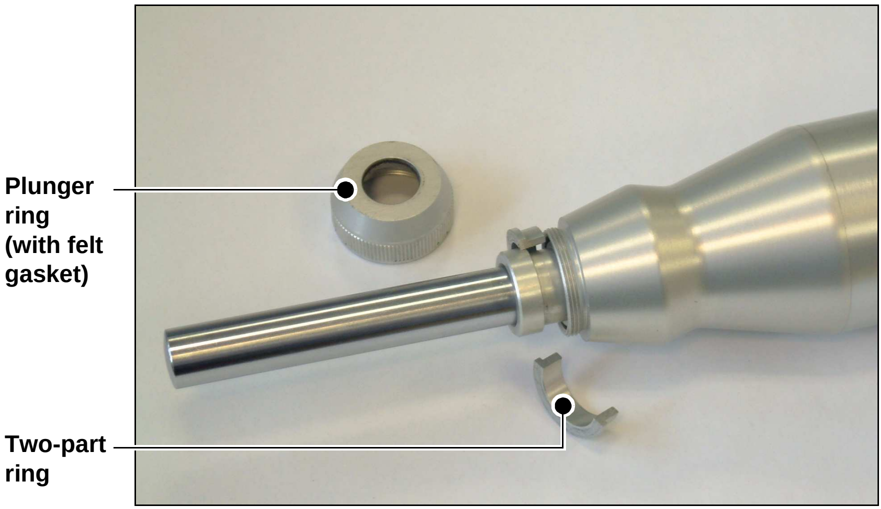


Figure 5. Removing plunger rings

3. Referring to Figure 6, unscrew the end cap and remove the spring and all other internal moving components with the exception of the scale and sliding pointer.

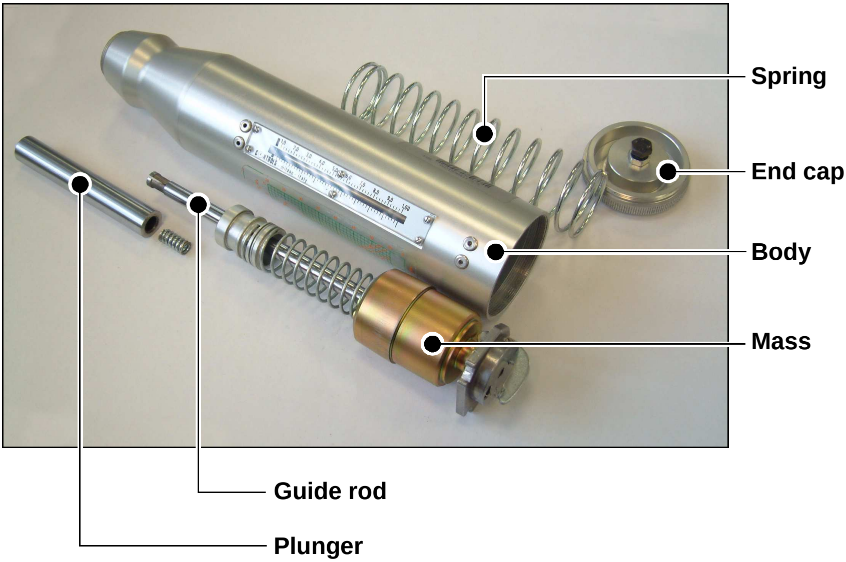


Figure 6. Removing internal components

4. Strike the plunger a few light blows with the mass to separate the plunger from the guide rod. Remove the small spring from inside the plunger.
5. Clean the guide rod and the impact surfaces of the mass and the plunger. Clean out the bore of the plunger with a wire brush.
6. To assemble the instrument, proceed in reverse sequence remembering to fit the small spring inside the plunger and the felt gasket on the inside of the plunger ring. The guide rod should be lubricated lightly with vaseline oil or similar.

   The scale sliding pointer and guide rod should never be lubricated since this would affect the slip properties and consequently cause inaccurate readings.

6 CALIBRATION

Your Elcometer 181 Mechanical Concrete Test Hammer was calibrated at the time of manufacture. Regular calibration checks over the life of the test hammer are a requirement of quality management procedures such as ISO 9000 and other standards.

6.1 Checking calibration

The calibration of the test hammer can be checked by the user. A calibration anvil will be required for this purpose (see “Accessories” on page 13 for ordering information).

1. Place the calibration anvil on a solid surface such as a rugged table or a concrete floor.
2. Fit the test hammer into the calibration anvil and take a number of readings in the normal manner.

   The readings should be between 78 and 82. If the readings are below 78, the test hammer is probably dirty and should therefore be cleaned - see “Maintenance” on page 10.

If the reading differs considerably from the nominal value of 80, and it is not possible to correct this difference by cleaning and checking the hammer, an allowance must be made for the difference in order to obtain accurate test results.

The following formula should be used for the correct interpretation of test results:

$$R = \text{Average of readings} \times \frac{80}{R_a}$$

where:

R = the corrected reading

R_a = the reading obtained from the calibration anvil

Note: *This formula can only be used if $R_a \geq 72$.*

If a calibration anvil is not available and a new or recently adjusted concrete test hammer is available, it is possible to check the hammer by conducting comparison tests on similar anvils as hard as possible, blocks of natural stone that have a hard, homogeneous and polished surface, etc.

6.2 Adjusting calibration

If the calibration of your test hammer needs adjusting, contact Elcometer or your local Elcometer supplier.

7 TECHNICAL SPECIFICATION

Impact energy:		2.207 Nm
Accuracy:		Better than ± 2 rebound number (when tested on calibration anvil at 80)
Range:		10 to 100 rebound number
Weight (with case):		1.5 kg (3.3 lb)
Dimensions,	test hammer (extended):	355 mm x 55 mm (14" x 2.2")
	storage case:	340 mm x 78 mm (13.4" x 3")

The Elcometer 181 Mechanical Concrete Test Hammer is packed in a cardboard and foam package. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Consult your local Environmental Authority for further guidance.

8 ACCESSORIES

The Elcometer 181 Mechanical Concrete Test Hammer is complete with all the items required to get started and take measurements.

The following optional accessory is available from Elcometer, or your local supplier.

Calibration anvil with Test Certificate : TW99919563

9 RELATED EQUIPMENT

In addition to the Elcometer 181 Mechanical Concrete Test Hammer, Elcometer produces a wide range of other concrete and coatings inspection equipment. Users of the Elcometer 181 may also benefit from the following Elcometer products:

- Elcometer Rebar Locators
- Elcometer Concrete Covermeters
- Elcometer Adhesion and Bond Strength Testers
- Elcometer Surface Contamination Test Kits
- Elcometer Surface Roughness Gauges and Test Kits
- Elcometer Climatic Condition Meters
- Elcometer Crack Width Gauges

For further information contact Elcometer, your local supplier or visit www.elcometer.com