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ZEHNTNER
TESTING INSTRUMENTS

Instruction Manual

version 1.3 dated 09.10.2013

ZST 2095
Mar resistance tester

Index

Enclosures:

- Certificate of manufacturer

Exclusion of liability

The features described in this instruction manual represent the complete technology of this instrument. Those features are either included in the standard delivery or available as options at additional costs.

Illustrations, descriptions as well as the technical specifications conform to the instruction manual in hand at the time of publishing or printing. However, Zehntner GmbH Testing Instruments policy is one of continuous product development. All changes resulting from technical progress, modified construction or similar are reserved without obligation for Zehntner to update.

Some of the images shown in this instruction manual are of a pre-production model and/or are computer generated; therefore the design/features on the final version of this instrument may differ in various aspects.

This instruction manual has been drafted with the utmost care. Nevertheless, errors cannot be entirely excluded. The manufacturer will not be liable for errors in this instruction manual or damages resulting from any errors.

The manufacturer will be grateful at any time for suggestions, proposals for improvement and references to errors.

1. Description of device

The ZST 2095 Zehntner-Mar resistance tester is a handy pocket tester for determination of scratch resistance on painted or plastic surfaces.

Application areas:

- For several branches of industry such as the paint, furniture and vehicle industry
- For all kinds of varnish or plastic surfaces
- Quality control
- The test can be carried out in the lab and in production

The following features distinguish the ZST 2095:

- Three colour coded pressure springs exert an adjustable force onto the test disc
- By means of the colour code on the scale the adjusted power can be read off easily

2. Safety precautions and warning notes

2.1 Dangers

Caution!

This note is included in this instruction manual wherever it is warned about dangers which will arise to life and limb of persons if the apparatus is handled improperly. Observe these notes and be particularly careful in these cases. Also inform other users on all safety notes. Besides the notes in these instruction manual the generally applicable safety instructions and regulations for prevention of accidents have to be taken into account.

Note

This symbol marks instructions you should take notice of in order to follow directions, specifications and the correct working process as well as to avoid damage or destruction of the apparatus.

2.2 Notes regarding safety at work

- Every person working with the ZST 2095 or maintaining the ZST 2095 must read and understand the manual completely. In particular the safety precautions and warnings.
- The ZST 2095 is exclusively designed for determination of scratch resistance on painted or plastic surfaces. Any other application is not in accordance with the regulations. The manufacturer is not liable for damage resulting from inappropriate application. The user bears the full responsibility.
- Only spare parts and optional components provided by the manufacturer may be used in combination with the ZST 2095. If components other than provided by Zehntner are used with the ZST 2095, there is no guarantee by Zehntner for resulting damages, defects or malfunctions.
- Unauthorised modifications and changes of the ZST 2095 are not allowed. These will invalidate the guarantee. The manufacturer is not liable for damages resulting from unauthorised modifications; the user bears the full responsibility.
- For the operation of the ZST 2095 apply all local safety regulations.

3. Delivery of device

3.1 Damages during carriage

During carriage the ZST 2095 is to be handled with the usual care. To ensure carriage without damages the device is to be transported in the original packaging and under normal freight conditions. If the device was supplied in a carrying case or storage box, this original packaging needs to be used also for later shipments. Pushes during carriage are to be avoided.

At the receipt of the goods, you have to check if there are any visible damages at the outer packaging. If the packing is alright, you can sign the receipt documents. If you even suspect by your visual impression that damage has occurred, make a note of the suspected damage on the delivery receipt or freight papers and get the carrier to sign it. Moreover, the forwarding agent/courier service must be held responsible for the damage in writing.

If a hidden damage is discovered while unpacking, you have to inform and must held the forwarding agent / courier service immediately in the following way: "When opening the parcel we had to notice that .... etc. etc." This superficial checking of the goods has to be done before the time limit of the forwarding agent / courier service expires which is normally within 7 days. However, the period could be less. Hence, it is recommended to check the exact time limit when receiving the goods.

If there are any damages inform also immediately your authorized Zehntner trader or **Zehntner GmbH Testing Instruments** directly

3.2 Standard delivery

The following parts are included in the delivery:

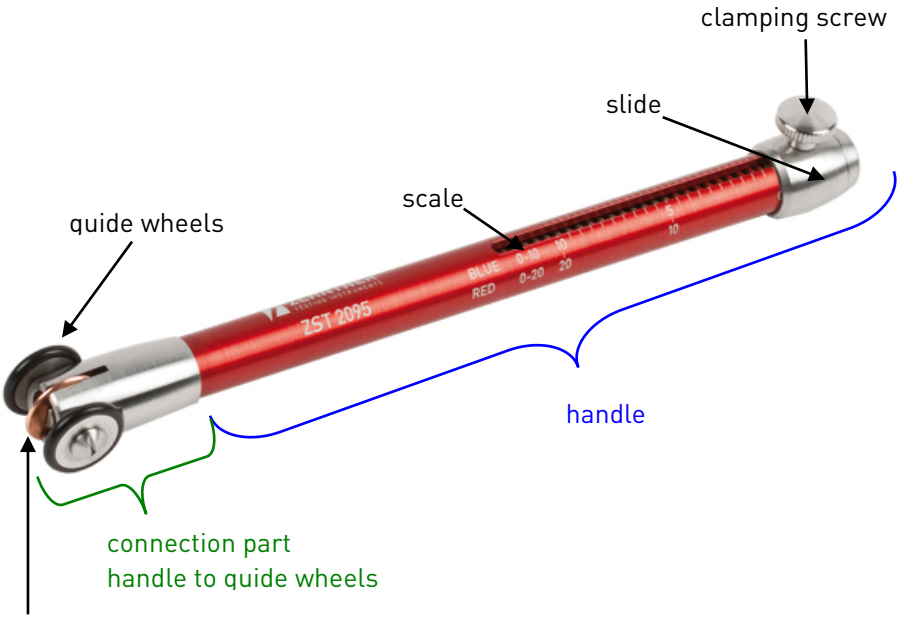
1 mar resistance tester	
1 test disc duroplast acc. to DIN 55656	
1 test disc copper acc. to DIN 55656	
1 test disc steel acc. to DIN 55656	
1 allen key ACC1100	
1 white pressure spring 0-3 N (graduation: 10 g)	
1 blue pressure spring 0-10 N (graduation: 50 g)	
1 red pressure spring 0-20 N (graduation: 100 g)	
1 certificate of manufacturer	
1 carrying case	

3.3 Options

• ACC572 adapter for use with ZAA 2300	
• ACC926 test discs PMMA acc. to DIN 55656 (set of 10 pieces)	
• ACC150 test discs PVC (set of 10 pieces)	
• ZPV 2030 Precision-vacuumplates	
• ZPH 2035 Specimen holder	

Zehntner GmbH Testing Instruments refuses all warranty and liability claims for damages caused by usage of the ZST 2095 in combination with **non-original accessories**, or accessories from 3rd party suppliers.

4. Outline of the instrument



test disc steel

test disc duroplast

5. Test discs

5.1 General

Test disc material	Application areas
steel	Determination of scribe resistance. A scribe in accordance with DIN 55656 is a line shaped damage of the coating caused by stressing and moving the test disc over the coating.
copper	Determination of metal trace resistance. A metal trace according to DIN 55656 is a trace caused by a metal disc and is covered with abraded metal disc material.
Duroplast	Determination of writing effect. („mar resistance"). The writing effect according to DIN 55656 is smoothing the surface profile of a coating by the impact of a test disc which is moved across a coating.
PMMA (optional available)	Determination of writing effect. („finger nail test"). The writing effect according to DIN 55656 is smoothing the surface profile of a coating by the impact of a test disc which is moved across a coating. This test disc is especially used in the automotive interior industry.
PVC (optional available)	Determination of writing effect. („mar resistance"). The writing effect is smoothing the surface profile of a coating by the impact of a test disc which is moved across a coating.

The test discs wear on the used place. Therefore the initial point has to be marked by scratching on the side. This has to be done before the first use.

Take care the outer edge of the test disc will not be affected.

sidewise marking of the initial point

5.2 Shifting of the test discs

Due to the wastage the test disc has to be shifted 2 mm (0.08") after approx. 100 determinations. Mark the next test coupon of the test disc.

sidewise marking of the initial point

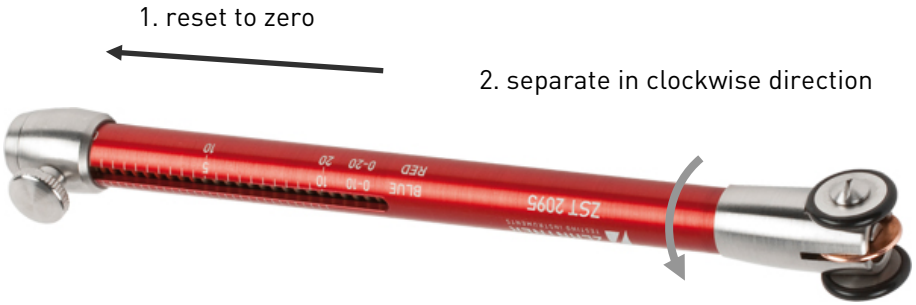
marking of new test coupon

As you need to mark the next coupon, you need to take out the test disc and insert it again. Hence, the shifting has to be carried out analogue to the exchange of the test disc which is explained detailed in the following chapter.

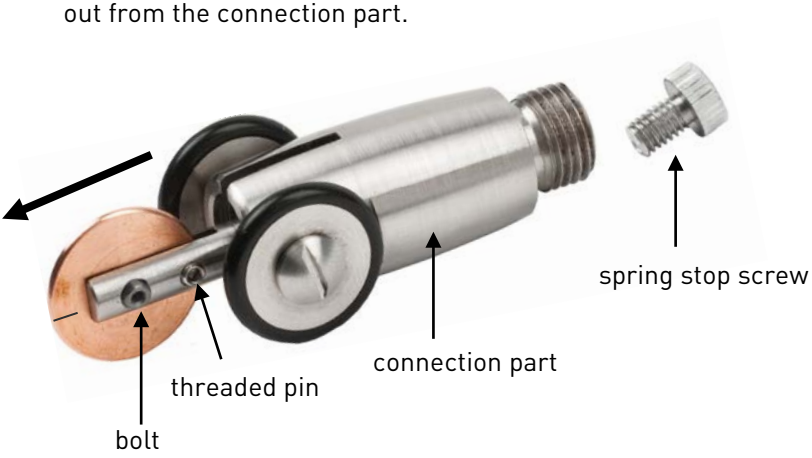
If the test disc has been used all around, it has to be replaced.

5.3 Exchange of test discs

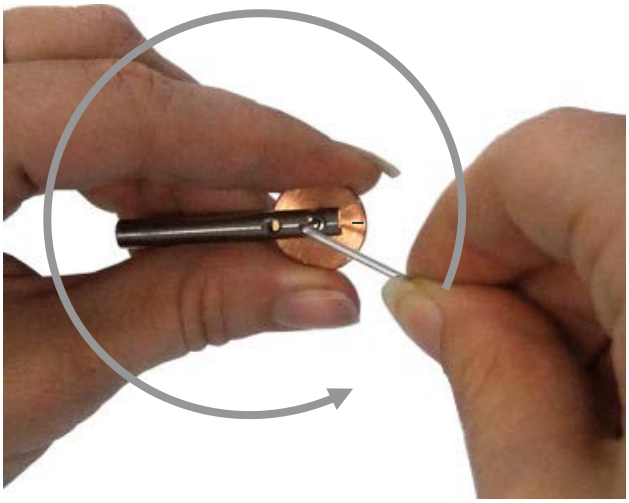
- Always reset the spring tension to zero before exchanging the test disc. Afterwards separate the connection part from the handle. To do so, turn the connection in clockwise direction.



- Unscrew the spring stop screw and pull out the cylinder with test disc out from the connection part.



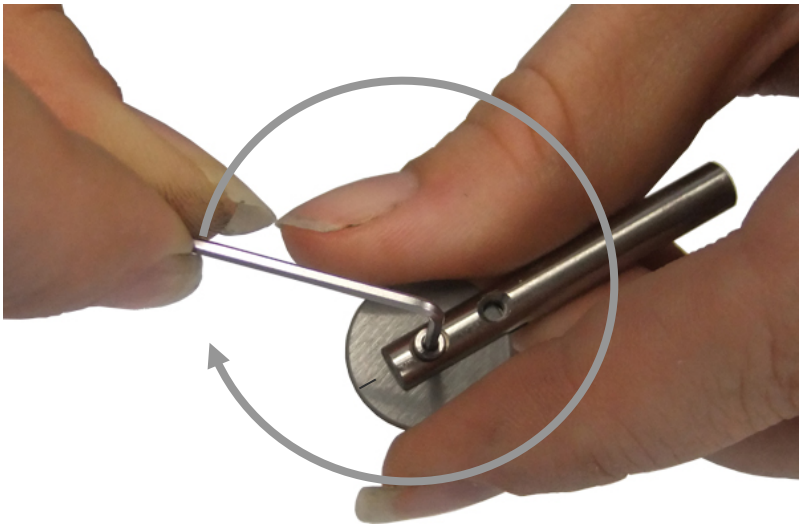
- Unscrew the threaded pin with the supplied allen key.
- Remove the bolt using the supplied allen key.



- The test disc can be removed now.
- Insert the desired test disc for example copper, center it with the bolt.

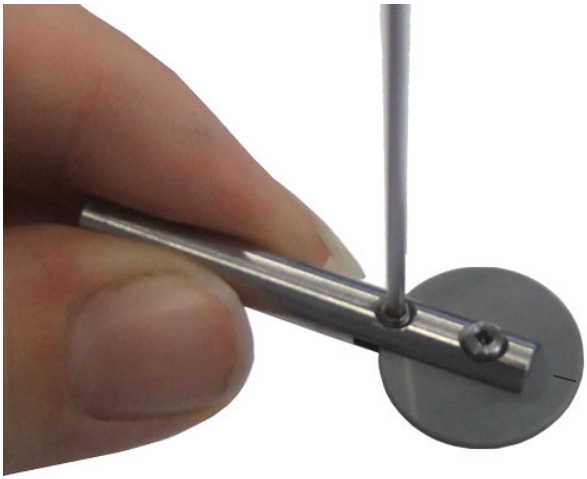
- Tighten the bolt with the supplied allen key in clockwise direction.

Take care that the last marking is exactly vertically.

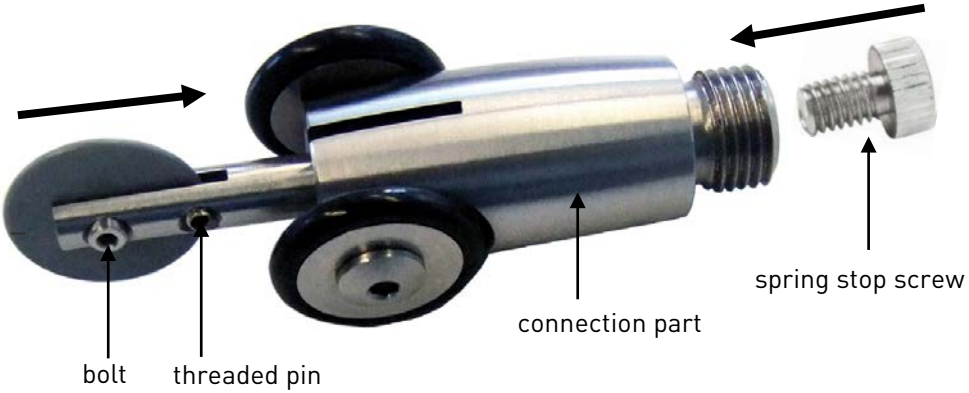


- Fix the test disc with the threaded pin with the supplied allen key in clockwise direction.

The test disc must not move!



- Put the cylinder with the test disc in the connection part as far as it will go and hold it there. Insert the spring stop screw and tighten it.



- Tighten the connection part with the handle.

tighten counterclockwise

6. Changing the pressure springs

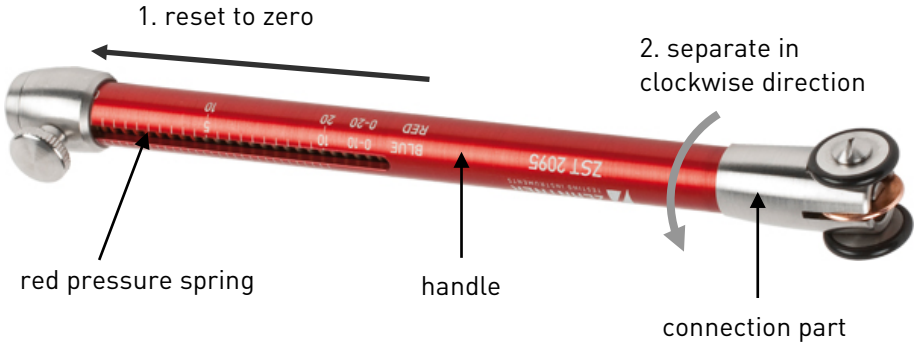
In the standard delivery are included three pressure springs:

- 1 white pressure spring 0-3 N (graduation: 10 g)
- 1 blue pressure spring 0-10 N (graduation: 50 g)
- 1 red pressure spring 0-20 N (graduation: 100 g)

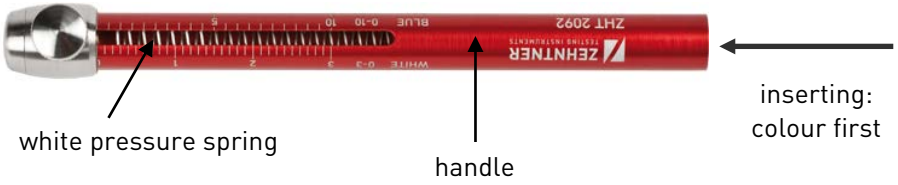
The colours fit with the three different test ranges on the handle.

For changing the pressure spring the following steps have to be carried out:

- Always reset the spring tension to zero.
- The handle has to be separated from the connection part.



- Change the pressure spring: hold the handle vertical, so that the pressure spring will fall down. Then put the desired pressure spring e.g. white pressure spring with the colour first into the sleeve.



- Tighten the handle with the connection part counterclockwise.

7. Handling in accordance with DIN 55656

7.1 Test specimens

7.1.1 Dimensions

The surface needs to be at least 50 mm x 150 mm (1.97" x 5.91").
The minimum distance between test line and sample edge needs to be at least 10 mm (0.39") and the distance between two test lines needs to be at least 5 mm (0.20).

7.1.2 Dry film thickness

Determine the dry film thickness as described in DIN EN ISO 2808 e.g. by use of the ZPI 2195 Zehntner-Paint inspection gauge.

7.1.3 Conditioning

Before testing, condition the coated panels at a temperature of 23 °C ± 2 °C (73.4° F ± 3.6° F) (and a relative humidity of 50 % ± 5 % (see ISO 3270), unless otherwise agreed, for a minimum period of 16 h. Carry out the test procedure as soon as possible but in any case not later than 30 min after removal the test panels from conditioning.

7.2 Type of mar resistance test

The mar resistance test can be carried out as:

- Test specification I: "pass/fail" test
  by carrying out the test with a single specified test discs and test force, to assess compliance with a particular requirement. The test is carried out three times. If the coating is damaged at one or several of these tests, the coating did not pass.
- Test specification II: „test series"
  for the determination of the force to cause failure with a specific test disc. The test specification II starts with test force which will not damage the coating. The test force is continuously increased until the coating gets damaged. The test is carried out three times. The smallest final test force in Newton causing of all three tests is indicated as test result.

7.3 Test conditions

Unless otherwise agreed, carry out the test at a temperature of 23° C ± 2° C (73.4° F ± 3.6° F). Measure the relative humidity during the test and state it in the test report.

7.4 Mar resistance test procedure

- Check the sample if it requires the DIN 55656 requirements as described in chapter 7.1 “Test specimens” on page 17.

- Determine the type of mar resistance test (“test specification I: pass/fail test” or “test specification II: test series”) as described in chapter 7.2 “Type of mar resistance test” on page 17.

  - If necessary change or turn the test disc as described in chapter 5 “Test discs” on page 10.

The disc must not move during the test.

- By using the colour code, choose the adequate pressure spring according to the estimated resistance.

  - If necessary change the pressure spring as described in chapter 6 “Changing the pressure springs” on page 15.

- Adjust the spring tension by using the clamping screw.

- Secure the test specimen on a suitable support.

- Place the ZST 2095 so that the test discs will be pressed into the connection part so that the guide wheels touch the test surface.

- Move the ZST 2095 at uniform speed (approx. 100 mm/s (3.94")) vertically on the test surface and keep up the contact pressure and draw a line of at least 100 mm (3.94").

- Carry out a damage evaluation as described in chapter 7.5 "Damage evaluation" on page 20.

- Repeat the test procedure three times.

Always reset the spring force to zero after test procedures.

- Issue a test report as described in chapter 7.6 "Test report" on page 20.

7.5 Damage evaluation

Check the damage in accordance with DIN EN ISO 13076 and define the type of damage (scribe, metal trace, writing effect). The slide position on the scale indicates the force (N) and the measuring value corresponds to the hardness.

7.6 Test report

The test report needs to include at least the following indications:

a) All details necessary details for identifying and characterisation of the test specimen. This means:
   1. coating information (manufacturer, product name, batch number, type of application, drying conditions, weathering conditions etc.)
   2. substrate information (material, thickness, shape, dimensions, amount of curvature etc.)

b) dry film thickness

c) reference to DIN 55656

d) mention of method B (use of ZST 2095 Zehntner-Mar resistance tester, method A uses ZHT 2092 Zehntner-Pocket hardness tester or ZHT 2093 Zehntner-Pocket hardness tester with rubber guiding wheels)

e) used test disc

f) used type of mar resistance test (test specification I: “pass/fail test” or test specification II: “test series”)

g) at the “pass/fail test” the agreed test force in Newton

h) relative humidity in percent during the test

i) test result
   1. the “pass/fail” result or the smallest latest test force in Newton
   2. the type of damage (scribe, metal trace, writing effect)
   3. designation of the test

j) each deviation of the defined test procedure

k) each unusual occurrence (deviations) during the test procedure

l) name of operator and company who carried out the test procedure

m) test date

8. Maintenance and cleaning

8.1 Maintenance and cleaning work that can be carried out by the user

By the user himself only the following maintenance and cleaning work can be carried out:

- Outer cleaning of the device (see sub-clause 8.2)

All other maintenance and repair work shall only be carried out by **Zehntner GmbH Testing Instruments** or your authorized Zehntner agent, otherwise all the guarantee and liability claims will expire.

8.2 Cleaning of the device

For cleaning of the **aluminium housing or test discs**, use a proper, soft cloth and commercially available cleaning agents such as cleaning agent for glass, benzine or diluent for cellulose lacquers.

Do not use strongly acidic or alkaline liquids!

Do not use acetone!

9. Technical specification

Material pressure springs:	Spring steel
Material test discs:	Duroplast, Copper, Steel
Material optional test discs:	PMMA, PVC
Dimensions (Lx Ø):	190 mm x Ø 15 mm (7.48″ x Ø 0.59″)
Weight, net:	84 g – 86 g (approx. 0.19 lbs), depending on test disc and pressure spring
Weight, gross incl. accessories:	339 g (0.75 lbs)
Standards	DIN 55656
Warranty	2 years

Glossary

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