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ZEHNTNER
TESTING INSTRUMENTS

Instruction manual

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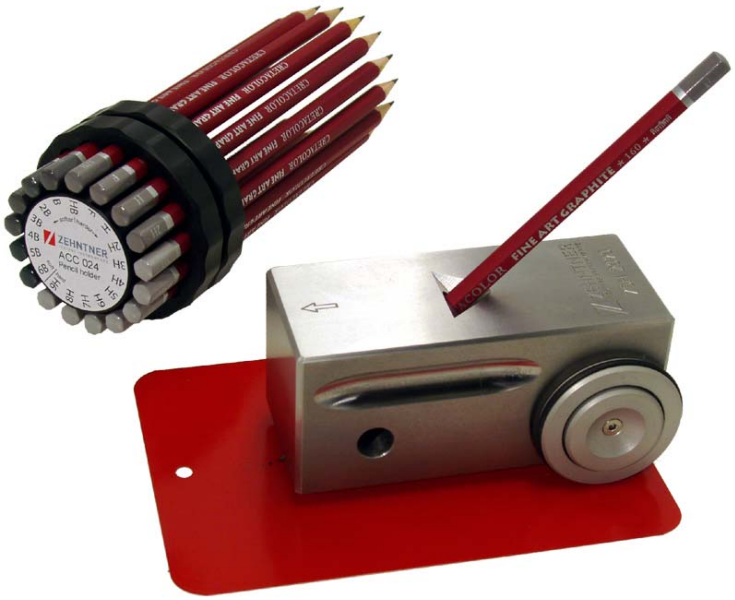
ZSH 2090
Pencil hardness tester



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Exclusion of liability

The figures and descriptions as well as the technical data correspond to the present operating instructions at the time of printing. Changes of any type, resulting from technical progress, modified design or similar, are reserved.

The operating instructions have been prepared with the greatest care. Nevertheless, errors cannot be completely excluded. The manufacturer cannot be made liable for any errors in these operating instructions and possible damage resulting from these.

The manufacturer is always grateful for suggestions, proposals for improvement and indications of errors.

1. Safety notes

1.1 Dangers

Attention!
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.

Caution
This note comprises instructions to be observed in order to comply with guidelines, instructions, notes and the proper procedure of the work, and to avoid damaging or destruction of the apparatus.

1.2 Safety notes

- The ZSH 2090 is exclusively intended for the determination of the scratch hardness. Any other application is not in accordance with the regulations. For damages resulting thereof the manufacturer is not liable; the risk for this is taken by the user alone.
- Avoid any mode of operation that could affect the security working with the ZSH 2090. Especially the determination of the scratch hardness must take place as described in this operating manual.
- Only spare parts provided by the manufacturer may be used. When using other than by Zehntner provided parts with the ZSH 2090, Zehntner may not be hold responsible for defects or damages.
- Reconstruction without permission and modifications of the ZSH 2090 are not permitted. The warranty expires therewith. For damages resulting thereof the manufacturer is not liable; the risk for this is taken by the user alone.

2. Delivery of device

2.1 Damages during carriage

During carriage the ZSH 2090 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. Pushes during carriage are to be avoided.

At the destination take out the device of the packaging and check immediately for any damages from the transport; if there are any damages your authorized ZEHNTNER trader or **Zehntner GmbH Testing Instruments** directly should be informed immediately.

2.2 Extent of delivery

The following parts are included in the delivery:

- 1 pencil-hardness-tester
- 1 set pencils of 17 hardness degrees (6B to 9H)
- 1 sharpener for releasing cylindrically the lead
- 1 pencil holder
- 1 set emery paper No. 400
- 1 carrying case

2.3 Optional accessories

- ZKZ 013 calibration and certification (incl. certificate)

3. Preliminaries

3.1 Pencils

- Remove the wood on a length of approximately 5-6 mm from the pencil, make sure not to damage the lead.
- Rub the lead against the emery paper (No.400) maintaining an exact angle of 90° to the paper until a flat circular surface is obtained.
- Repeat this procedure with the pencil after each test.

By aid of the sharpener for releasing cylindrically the lead, the wood can be removed from the pencil and by doing that take care of not damaging the lead:

- Sharpen the pencil carefully (as with a normal sharpener).
- The remaining wood can be removed by a fingernail.
- Rub the lead against emery paper (as described above)

3.2 Inserting the pencils

Insert the pencils in the hardness tester as follows:

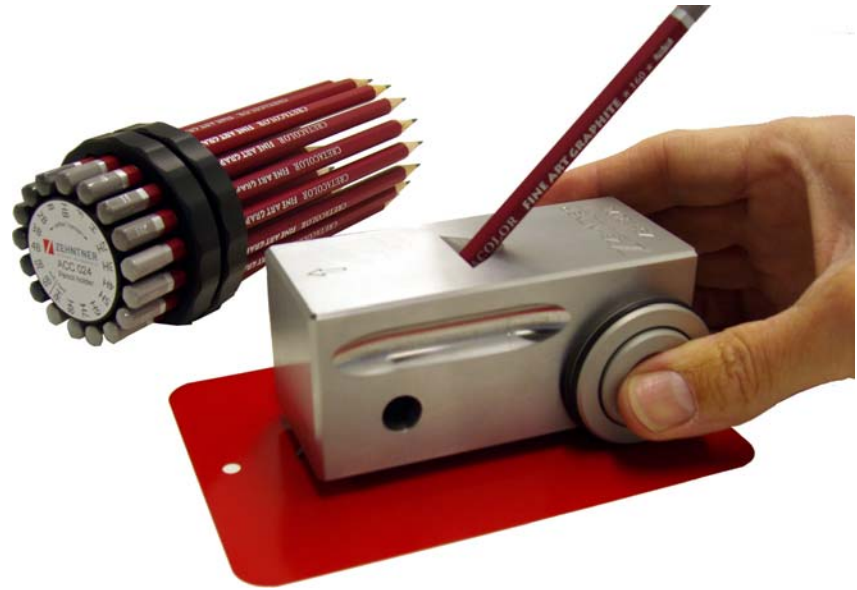
- Place the instrument with the wheels upwards onto its front end.
- Insert the pencil in this way, that the lead touches the surface.
- Fasten the pencil with the clamping knob.

4. Test procedures

Test has to be done under laboratory conditions.

In the different standards, the test is carried out differently. Here, the procedure is described when starting with a hard pencil or lead.
Please note that the procedure might have to be carried out in the reverse order of succession!

- Start testing with a hard pencil.
- Place the instrument on the level test surface.
- Hold the instrument by the wheel hubs and push forward at a speed of 5-10 cm/s for a distance of at least 7 mm (cf. arrow).
- Examine the test surface with the naked eye for indentation or scratching.
- Repeat the process down the hardness scale until a pencil is found that will not cut the film to the substrate (either metal or a previous coat) for a distance of at least 3 mm.
- Continue the process until a pencil is found that will neither cut nor scratch the surface of the film (any defacement other than a cut or gouge is considered a scratch.



5. Determining the degree of hardness

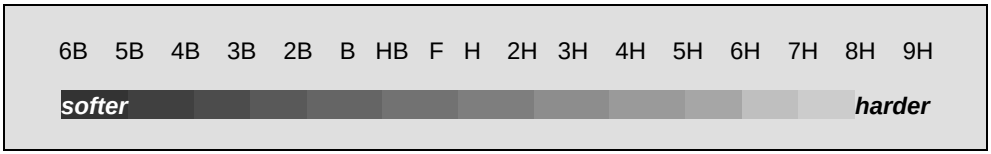
Record each end point for gouge and scratch hardness. With some films, the two end points will be identical.

gouge hardness:	The degree of hardness of the hardest pencil that will leave the film uncut for a stroke length of at least 3 mm.
scratch hardness: (pencil hardness)	The hardest pencil that will not rupture or scratch the film.
Wolff-Wilborn hardness:	The degree of hardness of the softest pencil which damages the surface.

Please mention in your test report which standard the measurement results refer to.

6. Table with the degree of hardness

The following degrees of hardness are available:



7. Technical data

Material:	steel
Dimensions:	110 mm x 80 mm x 58 mm (LxWxH)
Weight:	2,1 kg net 2,7 kg incl. accessories
Standards:	ISO 15184, EN 13523-4, ASTM D 3363, NEN 5350, SIS 184187, SNV 37113, ECCA-T 4, MIL C 27 227
Warranty:	2 years guarantee