

Operating Manual

Device for Measuring the Density of Fresh or Hardened Concrete

in accordance with DIN EN 12390-7





Important: Do not place this device into operation until all persons who will operate it have sufficiently learned its functions and the position of all control elements.

Table of contents:

- 1. Basic instructions 3**
 - 1.1 Purpose for which this system was designed 3
 - 1.2 Conditions under which this system may not be used 3
 - 1.3 Safety instructions 4
 - 1.3.1 Responsibility of the user / operator 4
 - 1.3.2 Dangers in work with this system 4
 - 1.3.3 Safety features 4
 - 1.4 Scope of delivery 5
 - 1.5 Description of the system 5
 - 1.6 Acceptance of delivery from a freight carrier; transport 5
 - 1.6.1 Receiving the system from a freight carrier 5
 - 1.6.2 Transport 6
- 2. Placing the system into operation 6**
- 3. Operation of the system 7**
 - 3.1 Extract from the relevant standards 7
 - 3.2 Preparation for testing 7
 - 3.3 Mass under water 8
 - 3.4 Mass in the air 8
 - 3.5 Calculation of the volume 9
 - 3.6 Calculation of the bulk density 9
 - 3.7 Test results 9
- 4. Cleaning and maintenance 10**
- 5. Warranty 10**
- 6. After-sales service 12**
 - 6.1 Date of this version of the Operating Manual 12
 - 6.2 Copyright 12
 - 6.3 Spare parts and technical help 12

1. Basic instructions

1.1 Purpose for which this system was designed

This Operating Manual contains the information required to operate the system described below, for the purposes for which it has been designed. This Operating Manual is intended to be used only by technically qualified staff.

Such staff are defined as those persons who – as a result of their training; their experience; the instructions which they have received; as well as their knowledge of the relevant standards, regulations, accident-prevention regulations, and conditions of product operation in the company – have been authorized by the person responsible for the safety of the company facilities to carry out the activities and actions required for operation of the products described below, and who can recognize and prevent any possible dangers arising from such operation (this definition of technically qualified staff has been provided in IEC 364).

This testing system is intended only for the measurement of the specific weight (density) of fresh or of hardened concrete, as well as of concrete aggregate. This system is designed for operation in dry rooms. It can be operated from the left or from the right side. The maximum load capacity is limited to 50 kg.

The user must by all means observe the requirements and limit values, as well as all safety instructions, given in this Operating Manual. Any use of this device not in conformity with these stipulations shall be considered to be in violation of the use for which this system was intended. If this device must be operated under special conditions, or with special modes of operation, then this shall be authorized only after consultation with the manufacturer, and after obtaining his prior and express approval.

1.2 Conditions under which this system may not be used

The following activities are not allowed with this system:

- The lifting of freely portable loads of more than 50 kg.
- Setting up the system and/or using it under ambient conditions that are not in conformity with Section 1.1 above.
- Transporting persons
- Working under the lifting apparatus.

1.3 Safety instructions

1.3.1 Responsibility of the user / operator

The person using or operating this system is responsible for ensuring that he/she does not endanger himself/herself, or any other persons.

Only those persons may operate this system that have received sufficient instruction in its proper operation.

If deficiencies or damages to the system endanger its operating safety, the user must immediately take it out of operation and may put it back into operation only after such deficiencies or damages have been corrected.

1.3.2 Dangers in work with this system

This system has been designed and constructed in accordance with the state of the engineering art and in conformity with recognized, good engineering practice. During its application, however, it is possible for dangers to arise for the life and safety of the user, or for third parties, and for damage to occur to its mechanical engineering parts or other objects of property.

This system may be used only:

- For the purposes for which it was designed
- In fully satisfactory condition from the standpoint of technical safety.

If any malfunctions arise which impair the safety of operation, the user must immediately correct them. Do not use the winch for this system until any such damages or malfunctions have been corrected.

1.3.3 Safety features

The winch is provided with an anti-kickback safety lock, and with slide bearings that require no maintenance. The hand crank can be removed.

1.4 Scope of delivery

Base frame:	Width with the hand crank =	720 mm
	Depth =	530 mm
	Height without the balance =	850 mm
Vertical lifting apparatus		
Hand-crank handle		
Optional accessories (not included in the standard scope of delivery):		
A balance with a suspension system for weighing beneath the scales unit		
Plastic water tank		
Carrying handle (density basket)		

1.5 Description of the system

The base frame is made of standard steel profile sections and folded sheet metal that have been welded together. The lifting action takes place by means of the winch, which is operated by a hand crank. The maximum allowed load is 50 kg.

1.6 Acceptance of delivery from a freight carrier; transport

1.6.1 Receiving the system from a freight carrier

When accepting delivery of the system, first inspect it for its outer, visible condition. If the results of this inspection are satisfactory, the machine may be accepted from the freight carrier (railways or other haulage company).

If you assume or suspect transport damage, immediately make a report of the conditions as they exist.

Request that the freight carrier fully confirm in writing the exact extent of the outer visible damages that have been determined. Please describe the extent of the damage as exactly as possible on the bill of lading, or on some other document. If this is not possible, do not accept the delivery. If you determine transport damages after you have accepted delivery, then notify the freight carrier immediately: by telephone, fax, or e-mail. As soon as possible, prepare a report of damage onsite, together with the freight carrier or with his agent.

Important	Do not make any changes at all to the equipment before submitting such a report of damages. After you have made a report of the transport damage, and after the freight carrier or his agent has signed this report, please send us immediately an exact report of the nature and the extent of the damage.
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On the basis of this report, we will take action as follows:

- Deliver spare parts to you, or

- Send a specialized fitter/installer to your plant, or
- Ask that you return the machine to us for repair.

If you have no complaint or transport damage to report, then use the bill of delivery to confirm that the delivery is full and complete.

1.6.2 Transport

The system will be delivered in a suitable carton packing, standing on a pallet. To prevent damage during transport, the remaining hollow space of the outer packing will be filled with light, bulk material.

For purposes of loading or transport, the system can be moved by hand. Or, it can be placed on a pallet and moved by a fork-lift truck or other handling equipment that reaches under the pallet.

Do not use cables or any similar lifting apparatus to lift the system – unless you can assure that lateral forces will not act on the packing or on any parts of the system while it is being lifted.

The frame of the system can also be moved to its required place by hand. It weighs approx. 62 kg.

2. Placing the system into operation

Important: This system may be operated only in dry rooms. Please ensure that the ambient conditions of the rooms lie within the following limits:

Conditions	Applicable standard	Minimum limit	Maximum limit
Ambient temperature:	DIN EN 60204-1, 4.4.2	+15°C	+40°C
Relative humidity:	DIN EN 60204-1, 4.4.3	30%	95%

Place the system on a level surface that can sufficiently support its weight. Then adjust the frame system so that it is level.

3. Operation of the system

3.1 Extract from the relevant standards

The standard EN12390 T7 describes a technique for determining the bulk density of hardened concrete.

This standard distinguishes among three techniques for determination of the volume of a test specimen:

- a. By water displacement
- b. By calculation from the actually measured dimensions of the specimen
- c. By calculation from the given dimensions of test cubes that have been verified.

The most exact method for determination of the volume of a test specimen is the water-displacement method (a).

The test specimen must be in a water-saturated state. This technique can be applied to test specimens of all forms. It is the only test procedure that can be applied to test specimens of irregular shape.

This technique is not suited for test specimens made of the following: single-grained (like-grained) concrete, lightweight-aggregate concrete with large pores, and concrete whose moisture content may not change. It is possible, however, to use this technique for these kinds of concrete after applying a layer to the concrete that is impervious to water.

3.2 Preparation for testing

The following description explains the preparations for the measurement of the bulk density of concrete cubes. To set up the system, you require the following equipment:

- A balance with a suspension system for weighing beneath the scales unit
- A supporting wire hanger for the concrete specimen
- A plastic container for the water.

After you have placed the system frame at its place of operation, remove the transport protection items. The vertical lift apparatus is in its lowest (bottom) position. Place a balance (for weighing beneath the scales unit) on top of the frame, as shown in the picture on the first page of this Operating Manual. Position the balance so that the support for below-platform weighing is located directly above the circular cut-out. Then attach a hook or an eyelet in the support hanging below the balance. Then place the plastic container on the platform under the support and hook (or eyelet), and fill the container with water. Fill the container until the water level is approximately 5 cm over the top (uppermost) bend in the wire support hanger, when the empty hanger for the concrete specimen is hanging in place (i.e., make sure that the wire hanger can be fully submerged for testing). Next, place

the supporting wire hanger in the hook or the eyelet. See the picture on the first page of this Operating Manual for the final configuration.

Now insert the supplied crank handle into the winch mechanism, as far as it will go. The lifting action takes place by turning the crank handle in a clockwise direction. To lower a specimen with the cube, turn the crank handle in an anti-clockwise direction (counter-clockwise). If you release the crank handle while raising or lowering the specimen in any position, the specimen will be securely held in place.

3.3 Mass under water

Measure the mass of the test sample under water, as follows:

1. Lower the specimen-supporting wire hanger, without concrete test specimen, into the water of the container. Do not allow the wire hanger to touch the bottom of the water tank. The ruler attached to the leg of the system frame will help you in making your reading.
2. Record the apparent mass m_{st} of the wire hanger in kg.
3. The apparent mass of the wire hanger can also be determined, as alternative, by using the tare function on the balance.
4. Place the concrete sample into the supporting wire hanger, and lower it into the water, at exactly the same depth used earlier for the empty wire hanger.
5. For orientation, use the ruler attached to the leg of the frame.
6. Remove any bubbles that may cling to the side of the concrete sample, and to the wire hanger.
7. Record the weight of the fully submerged sample as supported by the wire hanger. Record the apparent mass (m_{st+m_w}) in kg, where:

m_{st} = apparent mass of the submerged support wire hanger [in kg]

m_w = apparent mass of the submerged test specimen [in kg]

3.4 Mass in the air

Measure the mass of the test specimen in the air as follows:

1. Immediately after removing the test sample from the wire hanger, wipe off all surplus water from the concrete sample by using a moist cloth.
2. Weigh the mass of the sample in air, and record this value (m_a) in kg.

3.5 Calculation of the volume

Use the following equation to calculate the volume of the concrete test sample:

$$V = \{m_a - [(m_{st} + m_w) - m_{st}]\} / \rho_w$$

Where:

- V = volume of the test specimen [in m^3]
 m_a = mass of the test specimen in the air [in kg]
 m_{st} = apparent mass of the submerged support wire hanger [in kg]
 m_w = apparent mass of the submerged test specimen [in kg]
 ρ_w = density of the water at 20°C (use the assumed value of 998 kg/m^3)

3.6 Calculation of the bulk density

Use the following formula to calculate the bulk density of the concrete sample from the values measured as described above for the sample:

$$\rho = m / V$$

Where:

- ρ = the concrete bulk density [in kg/m^3], with reference to the condition of the test sample and to the method used for determination of the volume
 M = the mass [in kg] of the test sample, in its condition at the time of the test
 V = the calculated volume [in m^3]

3.7 Test results

In the test report, please indicate the method used for determination of the volume. Record the result of the bulk density calculation to the nearest 10 kg/m^3 .

The test report must contain the following data:

- The exact designation (identification) of the test sample
- The location at which the testing took place
- Description of the test sample: e.g., concrete cube, concrete core sample, etc.
- Information on how the test sample was prepared for testing
- Description of the condition of the test sample at the time of testing

- Indication of the method used to determine the volume of the test sample
- Date of the testing
- The calculated bulk density of the test sample
- Any deviations from the stipulated testing methods
- A formal declaration by the person technically responsible for the testing that the tests were conducted in conformity with the relevant standards.

4. Cleaning and maintenance

A suitably qualified person must inspect the hand-operated winch at an interval of at least once a year, but more often if required by the conditions of use and by company operations. This is the annual Operational Safety Inspection as required by the German Accident Prevention Regulation VBG8 (§ 23). If the wire cable of the winch has become worn, it must be handled, serviced, and exchanged in accordance with the specifications set forth in DIN 15020 T1.

At the manufacturer's plant, the gear mechanism has been filled with high-quality, long-duty grease. The bearing points have been equipped with slide bearings, which require no service or maintenance. Under conditions of normal use, the lubrication provided by the manufacturer should be sufficient for about five (5) years. If the system is subjected to hard use, open the gear mechanism every two (2) years and replace the lubrication grease. If the winch shows conditions of extreme wear, it must be exchanged. In operational condition, there must always be at least two (2) turns of the cable around the drum of the winch at all times.

5. Warranty

Our General Terms of Sales and Delivery apply in all cases.

The manufacturer guarantees that this Operating Manual has been prepared in conformity with the technical and functional parameters of the system as delivered. The manufacturer reserves the right to add supplementary information to this Operating Manual.

The manufacturer provides a guarantee of six (6) months. This guarantee does not cover wear-and-tear parts.

The manufacturer shall not be liable for damages that may occur if the delivered system is used for purposes for which it is not intended, or if the user does not observe the instructions and rules for operation as set forth in this Operating Manual.

No claims for damages may be lodged against the manufacturer if the system delivered is modified in its structural or constructional characteristics without the prior written consent of the manufacturer, or if its functional characteristics are modified without such consent.

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- Reproduced, or
- Distributed, or
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Any person acting in violation of the above stipulations may be prosecuted before a court of law.

6. After-sales service

Great care was taken to assure that this Operating Manual was properly prepared. We cannot, however, guarantee that it has no mistakes, or that all data are complete and correct in the event of technical modifications.

6.1 Date of this version of the Operating Manual

Version no. 4
Jun. 2005

6.2 Copyright

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6.3 Spare parts and technical help

If you have any questions of technical nature, or if you need spare parts, please get in touch with the following address:

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