

« CCM 2 » CALCIUM CARBIDE TESTER KIT

Ref. 93265

ROMUS

OPERATING INSTRUCTIONS



PREFACE

The CCM 2 is an ideal moisture measuring instrument for determining the residual moisture of foundation materials in accordance with existing DIN regulations and/or ZTV SIB 90. They are also suitable for rapid determination of the moisture of other materials that do not react with calcium carbide.

As in all measuring methods based on a chemical reaction, special care is required in conducting moisture determination according to the Calcium Carbide Method. Please study these operating instructions prior to initial operation and follow in particular the safety instructions.

Persons who are not familiar with the operating instructions should not use the measuring instruments.

WARRANTY

The manufacturer provides you with a 1-year warranty from the date of purchase on defective parts as well as products with production flaws, apart from expendable material.

Important!

Please keep the operating instructions in a safe place. You can ascertain if any spare parts are required on the basis of the parts list.

Proper use and application on the basis of the operating instructions is binding for product liability and product warranty. Repair attempts by the user shall invalidate warranty claims.



- 1) Lum hammer
- 2) Flat chisel
- 3) Sampling spoon
- 4) Cleaning brush
- 5) Scale, mechanical up to 100 g
- 6) Set of balls
- 7) Crushing bowl
- 8) Sample cup incl. lid, 2 sets
- 9) Sundries set and hearing protection
- J) Vials with Calcium Carbide, 25 pcs
- K) Tested pressure bottle, standard with surface thermometer
- L) Weighing rod
- M) CLASSIC manometer up to 2.5 bar with lid, instructions, sample bag
- N) Metal case with insert

REFERENCES TO HAZARDS

Before you conduct measurements with the CCM-Set ECO, please read the manual carefully. If you follow the instructions precisely, there is no risk of accidents. Therefore, please comply with the following instructions for use:

- Always use the CCM-Set ECO in accordance with the operating instructions. The pressure in the CCM pressure bottle is produced by the formation of small quantities of acetylene. After a measurement open the CCM pressure bottle so it is pointing **away from your face** and allow the **gas to escape slowly** (you will then have fewer problems with the manometer because its mechanics are subject to less stress).
- The escaping gas is **flammable**:
 - a) Do not open the CCM pressure bottle in closed rooms.
 - b) Do not smoke and do not work near an open flame or electrical installations.
 - c) If fire breaks out, smother it with sand or a blanket, do not extinguish with water.
- Do not use any samples with more **than 1.5g of water** (excessive pressure may result, leading to an uncontrolled gas release through the manometer head or the seals).
- **Conduct measurements using the CCM 2 unit only with the materials provided for this purpose.** If other materials are to be used, please send us a sample together with a description so we can advise you.

MEASURING INSTRUCTIONS

- 1) First insert the precisely weighed sample quantity and the 4 steel balls into the CCM pressure bottle. Then hold the CCM pressure bottle at an angle and carefully let a CCM ampoule slide in.
- 2) The CCM pressure bottle is sealed with the cover and subsequently the CCM ampoule is smashed by **shaking vigorously**. It is advisable to note the time at the beginning of the measurement.
- 3) After that make circular movements with the CCM pressure bottle **for at least the first minute** in order to break up the sample material even more and mix it with the calcium carbide. Repeat this process every 5 minutes.
- 4) Prior to completion of the measurement (which typically takes place after 15 to 20 minutes) the CCM pressure bottle is shaken vigorously for at least 15 seconds and circular movements are carried out one more time just to be on the safe side. If the pressure has not changed significantly, the measurement can be regarded as completed. For the usual original sample weights of 20g (red scale), 50g (green scale) and 100g (blue scale) the water concentration (H₂O [%]) can be directly read off the manometer.



Unless specifically stated otherwise by the screed manufacturer, the measurement must be terminated after 10 minutes in the case of calcium sulphate screeds since a further pressure rise could occur. This rise is attributable to chemically bound water and must be ignored.

Important!

Differing measuring instructions of the manufacturer must be complied with in all cases.

The CCM pressure bottle must not be exposed to **direct solar radiation** during the measurement. The temperature of the CCM pressure bottle must not exceed or drop below 20 ± 5 °C at the beginning and end of a measurement.

5) Draw up a hand-written log (see Page 20 --> Log form) 10 record the measurement result.

This **conversion table:** [CM%] is based on an ambient temperature of 20°C.

Manometer : scale (bar)	Original sample weight			
	10g	20g red	50g green	100g blue
	Water concentration (CM%)			
0,2	1,9	0,9	0,38	0,19
0,3	2,9	1,5	0,58	0,28
0,4	3,9	2	0,78	0,38
0,5	4,9	2,5	0,98	0,47
0,6	5,9	3	1,18	0,57
0,7	6,9	3,5	1,37	0,66
0,8	7,9	4	1,57	0,76
0,9	8,9	4,5	1,76	0,85
1	10	5	1,96	0,95
1,1	11	5,5	2,16	1,05
1,2	12	6	2,35	1,14
1,3	13	6,5	2,55	1,23
1,4	14	7	2,74	1,33
1,5	15	7,5	2,94	1,42

FIRST AID MEASURES

- In case of skin contact:** Brush off well before you rinse with a large amount of water.
- In case of eye contact:** Rinse out the eyes with a large amount of water.
- In case of causticization:** This usually occurs only if adhering calcium carbide is not removed. In any case notify a doctor and show him the label from your calcium carbide box.

FINAL REMARKS

The data in the operating instructions conform with our current know-how and are intended to provide information on our products and their possible applications. They are not a guarantee of certain properties of the products or their suitability for a specific application. Any existing industrial property rights must be taken into consideration. We are constantly endeavouring to improve our products. Therefore, we reserve the right to make changes and improvements to the products described in these operating instructions without prior notification.

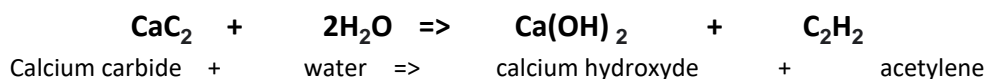


TECHNICAL INFORMATION

1) General informations of the carbide method (CM)**Measuring principle:**

The calcium carbide (moisture-sensitive, granular) in the CCM ampoules reacts with water -moisture of the samples - and forms acetylene thereby (flammable, gaseous), calcium hydroxide (alkaline, powdery) as well as energy (the energy released can be perceived by virtue of the fact that the pressure bottle gets hotter).

The equation below describes the reaction:

**Course of the reaction :**

The above described reaction takes place exclusively on the sample surface. The water must reach the surface from the interior of the sample in this case in order to be able to react (like a drying sponge). The reaction becomes increasingly slower if the water has to travel a long distance to the surface.

Reacted carbide, on the other hand, forms a dust layer (calcium hydroxide) on the carbide surface (like the adhering ash of a burning cigarette). The carbide underneath is thus screened and can no longer react; the pressure increase is thus slower.

To **prevent these effects**, you need the steel balls, which have three effects:

- 1) They **break** the carbide ampoule ==> **start effect**
- 2) They **crush** the sample material and the carbide ==> **grinding effect**
- 3) They **mix** the two solids together ==> **mixing effect**

Consequence:

Correct use of the steel balls enables the two solid substances **to mix with each other again and again and the reaction to continue. This means less lime is required for the measurement.**

The acetylene that is formed builds up pressure in the pressure bottle that can be described on the basis of the law of gases. The water concentration of the weighed sample can be determined by means of the law of gages. Since the temperature also exerts an influence on the pressure in the bottle, a reference temperature of 20 °C was specified. This means that measurements must be conducted at 20°C as far as possible (however, the error remains small as long as the measurement is conducted within a range of 20 ± 5 °C –for example, the pressure at 15 °C is 1.7% lower than at 20 °C. See also Error assessments, Page 18).

Law of gases : $\Delta p \cdot V = n \cdot R \cdot T$

Δp	en increase in pressure in the bottle
V	bottle volume
n	gas volume in the bottle
R	gas constant
T	temperature in the bottle

To ensure a reliable determination of the moisture, it is imperative that ail components of the equipment are complete (set of steel balls) and in flawless condition (weighing device, manometer and seals). An incomplete set of balls or a set replaced by other objects leads to a change in the bottle volume and thus results in incorrect results.

The CCM 2 units were designed for measurements at a temperature of 20 °C. For this reason, measurements should be conducted at this temperature ± 5 °C as far as possible.

Sampling:

Sampling must be **representative** to ensure reliable determination of the soil moisture. It is advisable to localize the moistest point first with an electric test apparatus (e.g. Caisson VI-D1) provided that no measuring point is provided (in the case of heating screeds). The sample must be extracted, crushed, weighed and transferred to the bottle in short time in order to minimize the risk of premature evaporation of water. The lower section (e.g. screed) contains the most moisture during the drying phase (in the explanations regarding DIN 18365 and the comments on DIN 18356, inter alia, it is recommended that the sample be removed from the lower to middle screed layer).

2) Operating instructions

- **Sample preparations :**

Crush the average sample taken in the dish to such an extent that complete comminution can be performed in the CCM unit with the balls. The sample can be crushed in controlled manner by carefully striking it with the machinist's hammer.

- **High-precision weighing device with weighing cup :**

The high-precision weighing device is supplied with 2 weighing cups that can be fixed on the weighing device clamp. Despite its precision (max. error 0.3%) the weighing device is extremely rugged. The 20g control weight is used to check the accuracy of the weighing device. The weighing device with weighing cup must be adjusted precisely before the control weight is placed in the cup.

The maximum error of the 20g control weight is around $\pm 2,5$ mg.



Freely turning scale :
Turn clip and align scale to the front.



Taring :

Mount the weighing device rod into the grip of the sledge Hammer and hang up the weighing device as shown. Empty and mount clean sample cup.

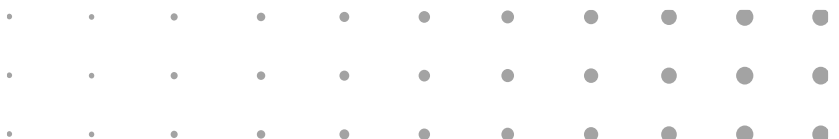


Adjust zero point while weighing device is suspended.
Eyes must be at the height of the scale (otherwise the value is read off incorrectly).



Weighing cup :

The weighing cup is suitable for transferring the weighed sample material **directly into the CCM pressure bottle**. No other aids are required.



- Manometer :

The manometer is equipped with a colour reading aid which allows you to read off the moisture [CM%] for the weights 20, 50 and 100g directly at the manometer.

The mechanical manometers used here are designed such that the middle display range is most precise. Therefore, it is recommended that in the case of a pressure of less than 0.2 bar the measurement be repeated with a larger original sample weight and in the case of a pressure greater than 1.5 bar it be repeated with a smaller original sample weight.

3) Maintenance instructions

The manometer is a bourdon tube pressure gauge. The maximum deviation (or accuracy) of the manometer is around 1.6 % (quality class 1.6) based on the end value of the pressure scale. This means that at a real pressure of 1.60 bar you may obtain a maximum displayed pressure of 0.0256 bar above or below that.

Important !

- 1) Downfalls can damage the manometer. In such a case, check the manometer accuracy prior to judge any of the measurement results.
- 2) Never blow out the manometer with compressed air because the pressure used is frequently greater than the permissible 1.6 bar and the manometer may be damaged.
- 3) Always unscrew the manometer only with a spanner (size 13) screwdriver, never by hand! The housing may otherwise be bent and damaged.
- 4) We recommend that the CCM pressure bottle always be opened after a measurement such that the pressure can escape slowly for the protection of the manometer.

Utilisation de l'ampoule de contrôle Pour vérifier l'aptitude au fonctionnement du manomètre et les joints, le Kit CCM contient dans le coffret trois ampoules pour le contrôle contenant chacune 1,0 ml d'eau.

Use of the test ampoule

To check that the manometer and seals are in proper operational order, the CCM unit contains three test ampoules with 1.0 ml of water in the case.

Preparation: Prior to execution of the functional check, you must check whether the CCM pressure bottle is clean and dry and the bottle seal is undamaged. Otherwise it must first be cleaned and dried again and the bottle seal must be replaced if necessary.

Execution: To carry out this check, first insert the 4 steel balls in the CCM pressure bottle and then, instead of sample material, carefully let an ampoule with 1.0 ml of water as well as a CCM ampoule slide in. After that seal the CCM pressure bottle with the cover and proceed as described under the point regarding "Measuring instructions". After the reaction time the manometer should display 1.00 ± 0.05 bar. If the pointer indicates a pressure outside this range, the two seals must be replaced and the functional check repeated.

If the pressure range is not reached in the second test either, it must be assumed that the manometer is defective.

Note:

The displayed pressure may be too low if you wait too long or if splashes of water have accumulated under the cover. The latter are caused by too vigorous shaking at the beginning of the measurement. If the bottle is "laid flat" and turned, this water may react with calcium carbide.

Important: There is a risk, however, that powder may penetrate into the manometer and impair its service life!

We recommend that the manometer be checked at least once a year. You can do this yourself with a test ampoule (in accordance with the above description) or you can send the manometer along with the cover to your dealer, who will carry out the check for you and put a new inspection sticker on the manometer.



4) Maximum moisture content

Maximum moisture content of heat and levelling screed recommended for laying of flooring:

	Moisture contents (vH) for :	
	Cement screed	Anhydride screed
Vapour slowing coverings (underfloor heatings)	Less than 1.8	Less than 0.3
Vapour slowing coverings	Less than 2.0	Less than 0.5
Vapour-permeable coverings	Less than 2.5	Less than 1.0

Source : Inter alia Bundesverband Estrich und Belag (BEB)
(Screed and Flooring Association)

5) Technical data on the manometer

Measuring range : 0 to 1,6 bar
 Display (scaling) : 0,05 bar
 Overload proof up to 2 bar
 Accuracy : ± 1,6 % typ.

Operating temperature : -10 to 80°C
 Housing : Steel panel black
 Type of protection : IP32

6) Error assessments

Manometer

The indicating accuracy of the manometers is specified in accordance with DIN in so-called accuracy classes (e.g. Class 1.6).

This specifications of the class refers to the maximum error (in %) of the manometer at is full-scale value.

This error applies to the entire scale range of the manometer, i.e. also 0.3 bar.

Example : →

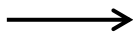
		Abs. error at 0,3 bar Final pressure	
Class	Full scale value bar	With portion 20g CM%	With portion 100g CM%
1,6	1,6	0,13	0,02

Temperatur

Owing to the Gas Law (which was described under "General informations of the Carbide Method), the temperature may influence the pressure and, thus, the measurement result. The error is approx. 1.7% for instance if measurement is conducted at 25° C instead of at 20° C.



A few examples :



Temp. °C	Error with respect to reference pressure (bei 20° C) %	Abs. error at 0,3 bar Final pressure	
		With portion 20g CM%	With portion 100g CM%
30	3,41	0,05	0,01
25	1,71	0,03	0,00
15	-1,71	-0,03	0,00

Weigher

Weighing the portion precisely is one of the most important factors in water determination with our measuring instruments. Consequently, when designing the weigher, we paid particular attention to ensuring that we developed a **very accurate and rugged** product. Thus, the maximum error is less than 0.3% of the weighed portion if the weigher is used correctly.

Besides product quality, the influence of the operator is also of great importance.

A few examples :



Accuracy of the weigher %	Operator's portion weighing error en g	Abs. error at 0,3 bar Final pressure	
		With portion 20g CM%	With portion 100g CM%
0,3	0	0,00	0,00
0,3	1	0,08	0,00
1	1	0,09	0,01

7) Cleaning

CCM pressure cylinder

The pressure cylinder must be cleaned dry using the supplied brush after each measurement. Cleaning directly after the measurement prevents reagent residue solidifying (scaling), thus changing the volume of the cylinder. Should you ever detect solidified residue, please treat the cylinder with a descaling agent.

Set of balls

The set of balls must be cleaned dry with the supplied cleaning cloth after each measurement. Cleaning directly after the measurement prevents reagent residue solidifying (scaling), thus changing the volume of the ball. Should you ever detect solidified residue, please treat the balls with a mild descaling agent.





Operating principle

The water contained in a sample reacts with the carbide forming a gas. If this reaction takes place in a constant volume vessel, the pressure inside the vessel increases in accordance with the amount of water in the sample.



1) Take and crush the sample

Identify the sampling zone. You should be at least 10cm from a marker in the case of floors with hot water under-floor heating.

- the sample must not contain any aggregates,
- on concrete media sampling must be carried out at a minimum depth of 4cm of the medium.
- on a screed, sampling must be carried out at a depth greater than half its thickness.

In the cup, crush the sample taken from all the lower parts of the floor covering using a hammer or a pestle.

Avoid working in sunshine or in a current of air (this could result in an under-estimate of the water content).



2) Weigh the sample

First zero the balance with the sample beaker.

Then transfer the crushed sample using the spatula, ensuring that the exact quantity required is taken.

For calcium based floating coverings : 100 g

For cement coverings: 20 g

For determining the degree of maturity: 50 g



3) Transfer the sample

After weighing transfer the sample to the clean, dry flask.



4) Add the steel balls

Then add the complete set of steel balls (4 balls) to the flask.

The steel balls must be present in order to give the correct flask volume



5) Carbide ampoule

Hold the tilted flask (at about 45°) and then slide in the carbide ampoule.

Avoid breaking the glass ampoule before you close the vessel.

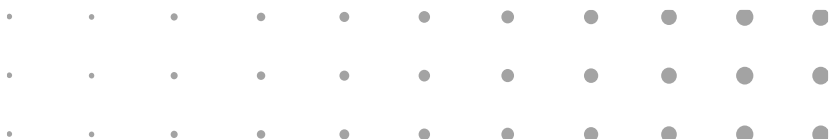


6) Close the flask

Close the flask and fix the gauge to the flask held at an angle.

Shake vigorously for 5 minutes making circular movements with an amplitude of about 30 cm. Wait 10 minutes, then read the pressure indicated on the gauge.

After 5 minutes check that there has been no further change in pressure. If there is, wait another five minutes and read the value. Take the final value as the result.



7) Read the result

Convert the reading to obtain the percentage of residual water using the conversion chart below :

Gauge reading (bar)	Sample			
	10g	20g red	50g green	100g blue
	Water content (CM%)			
0,2	1,9	0,9	0,38	0,19
0,3	2,9	1,5	0,58	0,28
0,4	3,9	2	0,78	0,38
0,5	4,9	2,5	0,98	0,47
0,6	5,9	3	1,18	0,57
0,7	6,9	3,5	1,37	0,66
0,8	7,9	4	1,57	0,76
0,9	8,9	4,5	1,78	0,85
1	10	5	1,96	0,95
1,1	11	5,5	2,15	1,05
1,2	12	6	2,35	1,14
1,3	13	6,5	2,55	1,23
1,4	14	7	2,74	1,33
1,5	15	7,5	2,94	1,42

A PVC covering can be laid on the floor when the residual moisture level **is less than or equal to 4.5 %**.

For calcium sulphate based screeds, a covering can be laid when the residual moisture level is less than or equal to 0.5 % by weight.

Note : a fall in the pressure over time indicates that there is a leak. In this event change the seal and repeat the measurement (this could result in a under-estimate of the water content pressure).

Do not smoke or work with any heat source in the vicinity of the apparatus during measurements.

8) Open and clean the flask

After the measurement reading has been taken, open the flask cautiously. Carefully remove the sample and remains of the carbide ampoule and clean the interior of the flask using a dry brush.

