

P0180, Density Kit

Determining the density of solids and liquids is an inseparable part of work of the laboratories. Traditional method of density determination requires from the operator many measurements and a lot of complex calculation. In result the operator ends with a density determination result which can be saddled with calculation and systematic errors. Additionally time that needs to be devoted to density calculation is long. In case of determining the density of solids and liquids with application of MRC density determination kit, the whole procedure is very much simplified and speeded up. Time till the operator receives the density measurement is very short, as all the calculation is performed by the software of the weighing instrument, & operator's activities is limited to:

- operation of the keyboard of weighing instrument
- placing the samples on the weighing pans of the kit
- hanging the plunger

Density determination kit is Optional accessories offered to MRC laboratory balances. The software for determination of density has following basic features:

- simplicity of usage (all activities are described on the display of the balance)
- reliability (all calculation is automatically performed by the balance's software)
- fast data processing (result is obtained after determination of sample mass in water or plunger mass in liquid)
- accurate data processing (before every measurement of mass, display indication is automatically zeroed, this proves the density determination result to be reliable and real).

Selection of the appropriate test weight for your balance

A balance can never be more accurate than the test weight used to adjust it, it depends on its tolerance.

Accuracy of the test weight: Should correspond to the readout d of the balance, rather than something better.

Nominal weight value: This is shown in adjust mode "CAL" in the balance display. Given the choice, the heaviest weight is the most suitable for accurate measurement.

OIML Directive

The key points from the OIML Directive

OIML (Organization International de Metrologies Legal) has established the exact metrological requirements for weights in verified applications in approx. 100 states all over the world. The OIML recommendation R111 (2004 Edition) for weights relates to sizes 1mg-50 kg. Statements are made on the accuracy, materials, geometric shape, marking & storage of the weights.

Error limits for weights of classes E1 to M3

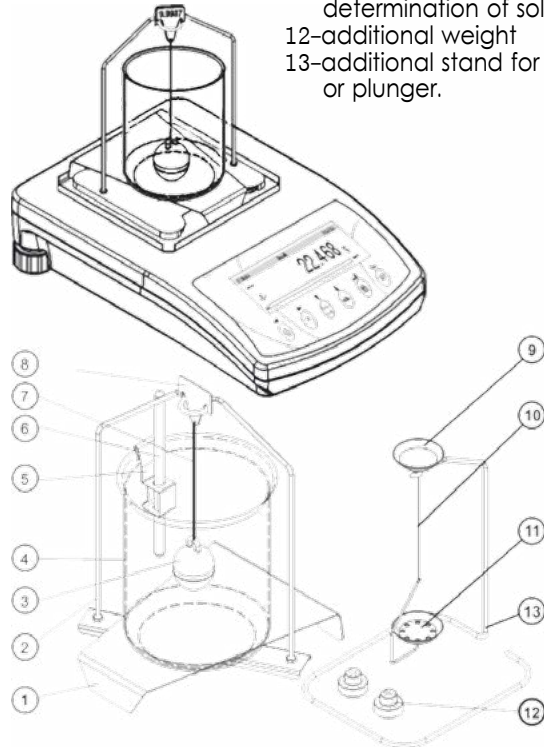
The error limit classes are in fixed hierarchical levels in the proportion of 1:3, where E1 is the most accurate and M3 is the least accurate weight class. When testing weights with other weights, the correct test class is the next highest class.

Error limit classes (= tolerances)

The values given in the table below (tolerances ± ... mg) are the respective permitted fabrication tolerances. They are to be equal to the measuring uncertainty of the weight, if no DKD calibration certificate is available.

- 1-beaker base
- 2-pans suspension
- 3-plunger
- 4-beaker
- 5-thermometer holder
- 6-thermometr

- 7-plunger string
- 8-hook
- 9-upper pan of the set for density determination of solids
- 10-pan string
- 11-lower pan of the set for density determination of solids
- 12-additional weight
- 13-additional stand for set of pans or plunger.



Nominal Value	OIML Max. permissible errors for weights=permissible tolerances "Tol ± mg"				
	E1	E2	F1	F2	M1
1mg	±0.003mg	±0.006mg	±0.020mg	±0.06mg	±0.20mg
2mg	±0.003mg	±0.006mg	±0.020mg	±0.06mg	±0.20mg
5mg	±0.003mg	±0.006mg	±0.020mg	±0.06mg	±0.20mg
10mg	±0.003mg	±0.008mg	±0.025mg	±0.08mg	±0.25mg
20mg	±0.003mg	±0.010mg	±0.03mg	±0.10mg	±0.3mg
50mg	±0.004mg	±0.012mg	±0.04mg	±0.12mg	±0.4mg
100mg	±0.005mg	±0.016mg	±0.05mg	±0.16mg	±0.5mg
200mg	±0.006mg	±0.020mg	±0.06mg	±0.20mg	±0.6mg
500mg	±0.008mg	±0.025mg	±0.08mg	±0.25mg	±0.8mg
1g	±0.010mg	±0.03mg	±0.10mg	±0.3mg	±1.0mg
2g	±0.012mg	±0.04mg	±0.12mg	±0.4mg	±1.2mg
5g	±0.016mg	±0.05mg	±0.16mg	±0.5mg	±1.6mg
10g	±0.020mg	±0.06mg	±0.20mg	±0.6mg	±2.0mg
20g	±0.025mg	±0.08mg	±0.25mg	±0.8mg	±2.5mg
50g	±0.03mg	±0.10mg	±0.3mg	±1.0mg	±3.0mg
100g	±0.05mg	±0.16mg	±0.5mg	±1.6mg	±5.0mg
200g	±0.10mg	±0.3mg	±1.0mg	±3.0mg	±10mg
500g	±0.25mg	±0.8mg	±2.5mg	±8.0mg	±25mg
1kg	±0.5mg	±1.6mg	±5.0mg	±16mg	±50mg
2kg	±1.0mg	±3.0mg	±10mg	±30mg	±100mg
5kg	±2.5mg	±8.0mg	±25mg	±80mg	±250mg
10kg	±5.0mg	±16mg	±50mg	±160mg	±500mg
20kg	±10mg	±30mg	±100mg	±300mg	±1000mg
50kg	±25mg	±80mg	±250mg	±800mg	±2500mg
100kg		±160mg	±500mg	±1600mg	±5000mg
200kg		±300mg	±1000mg	±3000mg	±10g

Example of Calibration certificate:

mrc
 Calibration laboratory accredited by
 Polish Centre for Accreditation, a signatory to EA MLA and ILAC MRA
 that include recognition of calibration certificates.
 Accreditation No AP 089

PCA
 Polish Centre for Accreditation
 ><<
 WARSZAWA
 AP 089
ILAC-MRA

CALIBRATION CERTIFICATE

Date of issue: 12-th November 2009 Certificate No: [redacted] Page: 1 / 2

OBJECT OF CALIBRATION
 Non-automatic electronic weighing instrument
 Model: AS 60C/2 Serial No: [redacted]
 Manufacturer: MRC Ltd.
 Characteristics:
 Max capacity Max: 60g Raedibility σ : 0.01mg

APPLICANT
 [redacted]

USER
 [redacted]

PLEASE OF CALIBRATION
 [redacted]

CALIBRATION METHOD
 Calibration Procedure PW-01 Rev. V - 10-th January 2007.

ENVIRONMENTAL CONDITIONS
 Air temperature [°C]: (21.1-21.5) ± 0.5
 Relative air humidity [%]: (48.1-48.5) ± 2.5

DATE OF CALIBRATION
 10-th November 2009

TREACEABILITY
 Calibration results were referred to national mass standard maintained in polish metrology institut - Główny Urząd Miar (GUM) with the application of mass standards numbers: 147.

CALIBRATIONS RESULTS
 The results have been presented on page 2 of this certificate including uncertainty of measurement.

UNCERTAINTY OF MEASUREMENT
 Uncertainty of measurement has been evaluated in compliance with EA-4/02. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$.

This certificate may by presented or copied as a whole document only



Sets of masses

Ordering Information:

Model: Weight-S - [] - []

- E1 1mg - 500mg (12pcs)
- E2 1g - 100g (9pcs)
- F1 1g - 200g (11pcs)
- F2 1g - 500g (12pcs)
- M1 1g - 2kg (15pcs)
- 1kg - 5kg (4pcs)



Ordering Information:

Weight-1- [] - []

- E1 1mg
- E2 2mg
- F1 5mg
- F2 10mg
- M1 20mg
- 50mg
- 100mg
- 200mg
- 500mg



Ordering Information:

Weight-2- [] - []

- E1 1mg
- E2 2mg
- 5mg
- 10mg
- 20mg
- 50mg
- 100mg
- 200mg
- 500mg



Single standard masses

Ordering Information:

Model: Weight - [] - []

- E2 1g, 200g
- F1 2g, 500g
- F2 5g, 1kg
- M1 10g, 2kg
- 20g, 5kg
- 50g, 10kg
- 100g, 20kg