Selection of the appropriate test weight for your balance

A balance can never be more accurate than the test weight that is used to adjust it, it all depends on its tolerance. **The accuracy of the test weight should correspond to the readout [d] of the balance, or rather be more precise.**

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

Once accuracy and nominal weight value are specified, the suitable test weight is selected according to the tolerances "Tol" of the individual accuracy classes E2 – M3, see column "Tol ± mg" at the respective weight and table at page 196.

Example:
Balance with weighing range [Max] 2000 g = 2 kg
and readout [d] = 0,01 g = 10 mg

- The accuracy of the required test weight is determined by readout [d]: max. tolerance ± 10 mg.
- Displayed weight size on "CAL" mode: 1000 g or 2000 g. The required test weight has a 2 kg weight size.
- Suitable test weights with ± 10 mg tolerance and 2 kg weight size, can be found in accuracy class F1. KERN-No 326-12 or KERN-No 327-12, see page 203.

Exception: analytical balances (readout [d] ≤ 0,1 mg):
E1 test weights are recommended. Depending on the safety requirements, E2 test weights with a DAkkS calibration certificate will also be sufficient.

From finely turned to polished stainless steel – the right test weight for every situation

Test weight Features →	Knob shape with lifting knob, polished stainless steel	Compact shape with carrying grip, polished stainless steel	Knob shape with lifting knob, polished stainless steel	ECO shape, polished stainless steel	Knob shape with lifting knob, finely turned stainless steel
Conforms to OIML:R111	yes	yes	yes	yes	yes
Available classes	E1, E2	E2	F1	F1	F2, M1
Upper surface	polished	polished	polished	polished	finely turned
Material	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel
Adjusting cavity	no	no	yes	yes, from 50 g, readjustment can only be carried out by KERN	yes, from 20 g
Marking (Milligram weights, generally none)	none	none	Nominal value, etched	Nominal value, etched	F2: Class + nominal value, etched; M1: Class + nominal value, adopted
Verification possible	yes (E2)	yes	yes	no	yes (M1)
Checking equipment for verification purposes	approved (E2)	approved	approved	approved	approved (M1)
Ideal as checking equipment in QM systems (e.g. ISO 9000 ff)	yes	yes	yes	yes	yes
Benefits	• High-quality test weight for analytical and precision balances • Highly-refined surface • Ideal shape of the top for good grip	• Affordable test weight for analytical and precision balances • Highly refined surface	• Ideal, high-quality test weight for precision balances • No visible adjustment chamber • High long-term stability • Ideal shape of the top for good grip	• Affordable test weight for analytical and precision balances • Highly refined surface • Optimum shape of the top for good grip	• Ideal test weight for commercial and industrial scales • Ideal shape of the top for good grip

Composition table, valid for all KERN test weight sets from 1 mg

Individual weights per set																													
1 2 2 5 10 20 20 50 100 200 200 500 (mg)												1 2 2 5 10 20 20 50 100 200 200 500 (g)												1 2 2 5 10 (kg)				

Test weight set

Test weight set	Sum
1 mg–500 mg	∑ = 1,11 g
1 mg–50 g	∑ = 111,11 g
1 mg–100 g	∑ = 211,11 g
1 mg–200 g	∑ = 611,11 g
1 mg–500 g	∑ = 1.111,11 g
1 mg–1 kg	∑ = 2.111,11 g
1 mg–2 kg	∑ = 6.111,11 g
1 mg–5 kg	∑ = 11.111,11 g
1 mg–10 kg	∑ = 21.111,11 g

OIML Norm R111:2004 for Test Weights

The key points from the OIML norm R111:2004

OIML (Organisation Internationale de Métrologie Légale) has established the exact metrological requirements for weights in verified applications in approx. 100 states all over the world.

The OIML guideline R111 (2004 Edition) for weights relates to sizes 1 mg – 5000 kg. Statements are made on the accuracy, materials, geometric shape, marking and 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
▸ *DAkkS calibration certificate* is available.

Conventional mass

The problem is the air buoyancy, which makes the weight appear lighter. In order to avoid this "distortion" in daily use, all weights are adjusted to the unit specifications as given in R111, e.g. it is accepted that: material density of the weights is 8000 kg/m³, air density is 1.2 kg/m³ and measuring temperature is 20 °C.

KERN test weights:

Unless otherwise specified, they conform to OIML R111:2004 in every detail.

▸ *See the Glossary*

Nominal value	OIML R111:2004 Maximum permissible errors for weights = permissible tolerances "Tol ± mg"						
↓	E1	E2	F1	F2	M1	M2	M3
1 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
2 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
5 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
10 mg	± 0,003 mg	± 0,008 mg	± 0,025 mg	± 0,08 mg	± 0,25 mg	-	-
20 mg	± 0,003 mg	± 0,010 mg	± 0,03 mg	± 0,10 mg	± 0,3 mg	-	-
50 mg	± 0,004 mg	± 0,012 mg	± 0,04 mg	± 0,12 mg	± 0,4 mg	-	-
100 mg	± 0,005 mg	± 0,016 mg	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	-
200 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	± 0,6 mg	± 2,0 mg	-
500 mg	± 0,008 mg	± 0,025 mg	± 0,08 mg	± 0,25 mg	± 0,8 mg	± 2,5 mg	-
1 g	± 0,010 mg	± 0,03 mg	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg
2 g	± 0,012 mg	± 0,04 mg	± 0,12 mg	± 0,4 mg	± 1,2 mg	± 4,0 mg	± 12 mg
5 g	± 0,016 mg	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg
10 g	± 0,020 mg	± 0,06 mg	± 0,20 mg	± 0,6 mg	± 2,0 mg	± 6,0 mg	± 20 mg
20 g	± 0,025 mg	± 0,08 mg	± 0,25 mg	± 0,8 mg	± 2,5 mg	± 8,0 mg	± 25 mg
50 g	± 0,03 mg	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg
100 g	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg	± 50 mg
200 g	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg	± 100 mg
500 g	± 0,25 mg	± 0,8 mg	± 2,5 mg	± 8,0 mg	± 25 mg	± 80 mg	± 250 mg
1 kg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg	± 50 mg	± 160 mg	± 500 mg
2 kg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg	± 100 mg	± 300 mg	± 1 000 mg
5 kg	± 2,5 mg	± 8,0 mg	± 25 mg	± 80 mg	± 250 mg	± 800 mg	± 2 500 mg
10 kg	± 5,0 mg	± 16 mg	± 50 mg	± 160 mg	± 500 mg	± 1 600 mg	± 5 000 mg
20 kg	± 10 mg	± 30 mg	± 100 mg	± 300 mg	± 1 000 mg	± 3 000 mg	± 10 g
50 kg	± 25 mg	± 80 mg	± 250 mg	± 800 mg	± 2 500 mg	± 8 000 mg	± 25 g
100 kg	-	± 160 mg	± 500 mg	± 1 600 mg	± 5 000 mg	± 16 g	± 50 g
200 kg	-	± 300 mg	± 1 000 mg	± 3 000 mg	± 10 g	± 30 g	± 100 g
500 kg	-	± 800 mg	± 2 500 mg	± 8 000 mg	± 25 g	± 80 g	± 250 g
1 000 kg	-	± 1 600 mg	± 5 000 mg	± 16 g	± 50 g	± 160 g	± 500 g
2 000 kg	-	-	± 10 g	± 30 g	± 100 g	± 300 g	± 1 000 g
5 000 kg	-	-	± 25 g	± 80 g	± 250 g	± 800 g	± 2 500 g