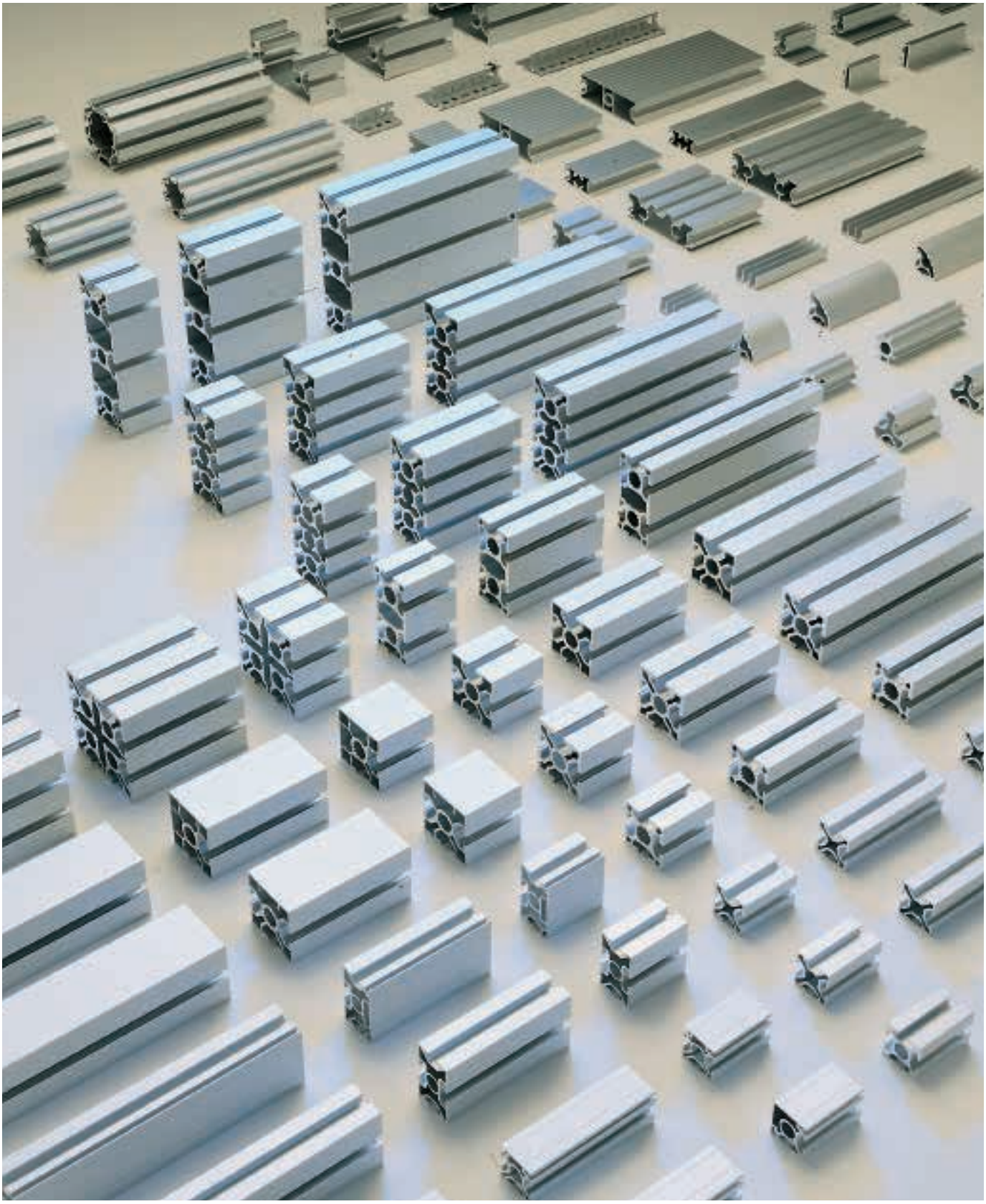
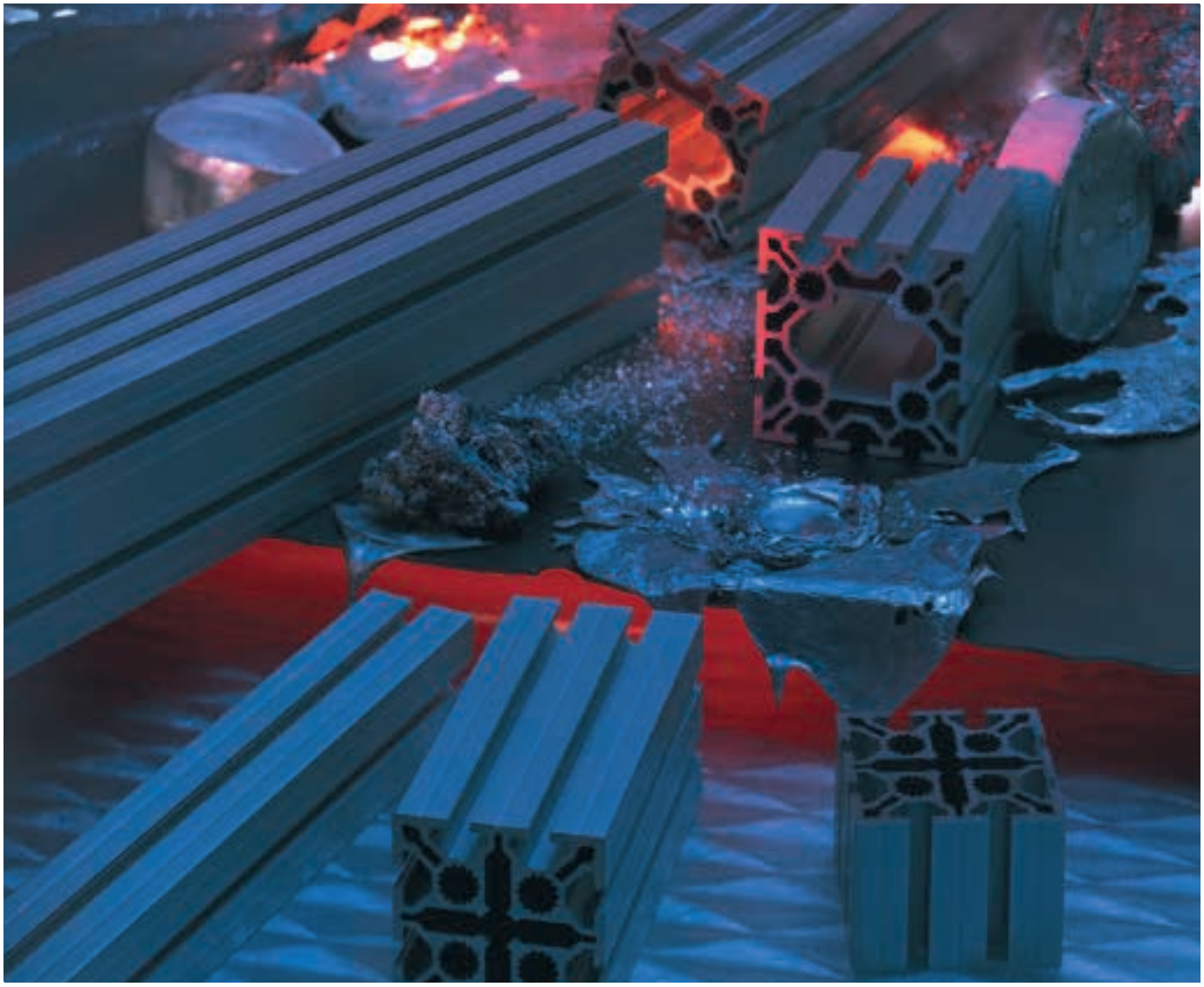


Material data of aluminium extrusions

Alloy	EN AW-6063			
Quality	T66			Temper-hardened (F25)
DIN designation	3.3206.72			
Tolerances	DIN EN 12020			
Density/weight	δ:		2.7 g/cm^3	
Tensile strength	R_m:	min	245 N/mm^2	
Yield	R_p 0.2:	min	200 N/mm^2	
Elongation	A_5:	min	10%	
	A_{10}:	min	8%	
Module of elasticity	E:		70 KN/mm^2	
Brinell hardness	HB		~75	
Surface	Natural matt anodised Layer thickness 12µ			Colour anodised or powder coated on request in accordance with the RAL table, raw
Thermal expansion	0.0232 mm/m/°Δt			

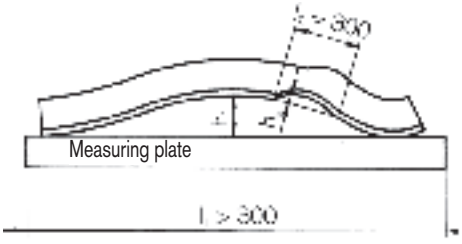


Extrusion tolerances, extract from EN 12020

1. Straightness tolerances

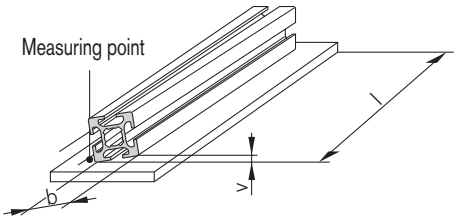
Cavity extrusions may not exceed the values stated in the table for the straightness tolerances h_1. The deviation h_2 may not exceed a maximum of 0.3 mm over any length of l_2 = 0.3 mm.

Length l_1 in m	up 1 m	up 2 m	up 3 m	up 4 m	up 5 m	up 6 m
Tolerance h_1 in mm	0.7	1.3	1.8	2.2	2.6	3.0



2. Twist tolerance v

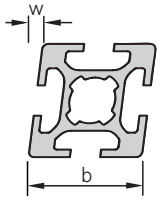
The length-dependent twist tolerance v for cavity extrusions is shown in the table.



Width b in mm	Flatness tolerance v in mm for lengths in mm – 1000	> 1000–2000	– 2000–3000	> 3000–4000	> 4000–5000	> 5000–6000
– 25	1.0	1.5	1.5	2.0	2.0	2.0
> 25 – 50	1.0	1.2	1.5	1.8	2.0	2.0
> 50 – 75	1.0	1.2	1.2	1.5	2.0	2.0
> 75 – 100	1.0	1.2	1.5	2.0	2.2	2.5
> 100 – 125	1.0	1.5	1.8	2.2	2.5	3.0
> 125 – 150	1.2	1.5	1.8	2.2	2.5	3.0
> 150 – 200	1.5	1.8	2.2	2.6	3.0	3.5
> 200 – 300	1.8	2.5	3.0	3.5	4.0	4.5

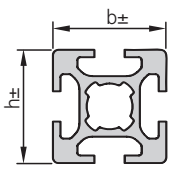
3. Inclination tolerance w

Where sides are of unequal length, inclination tolerance shall be relative to the angle of the shorter side.



Width b in mm	Inclination tolerance w in mm	Width b in mm	Inclination tolerance w in mm
– 30	0.3	> 120 – 140	0.8
> 30 – 50	0.4	> 140 – 160	0.9
> 50 – 80	0.5	> 160 – 180	1.0
> 80 – 100	0.6	> 180 – 200	1.2
> 100 – 120	0.7	> 200 – 240	1.5

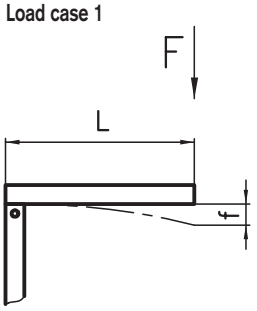
4. External tolerances



Width b, h in mm	Deviation in mm	Width b, h in mm	Deviation in mm
> 15 – 30	± 0.25	> 120 – 150	± 0.80
> 30 – 45	± 0.30	> 150 – 180	± 1.00
> 45 – 60	± 0.40	> 180 – 240	± 1.20
> 60 – 90	± 0.45	> 240 – 300	± 1.50
> 90 – 120	± 0.60		

Strength calculations

Load case 1



$$f\,[mm] = \frac{0.476 \times F\,[N] \times L^3\,[m]}{I\,[cm^4]}$$

Example:

A counterweight with a max. load of 500 N is to be fastened to an extruded arm 800 mm long. What will be the deflection of a 40x40 mm C01–1 type base extrusion?

Deflection $f = \frac{0.476 \times 500 \times 0.8^3}{11.70} = 10.42$ mm

Where:

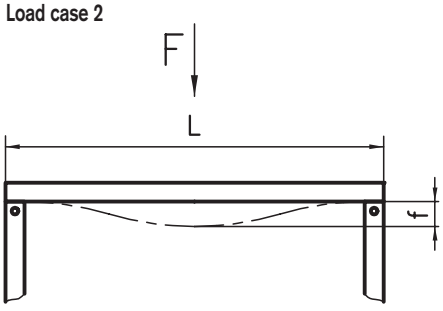
F = load in N
L = extrusion length in m
I = moment of inertia in cm^4
f = deflection in mm
a/b = distance to the load point in m
q = line load in N/m

Checking the bending stress:

$$\delta = \frac{M_b}{W \times 10^3}$$

δ = bending stress in N/mm^2
M_b = max. bending moment in Nmm
W = section modulus in cm^3

Load case 2



$$f\,[mm] = \frac{0.0074 \times F\,[N] \times L^3\,[m]}{I\,[cm^4]}$$

Example:

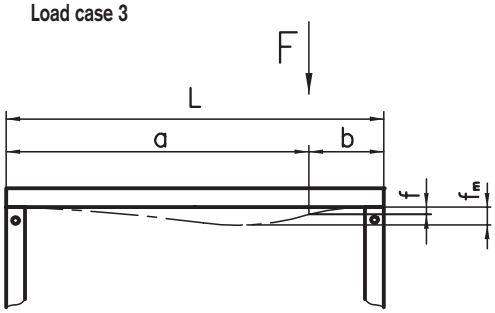
An 1800 N load is placed in the middle of a beam. The unsupported length is 1200 mm. The max. permissible deflection is 1.0 mm. What sort of extrusion should be used for the beam?

Deflection $f = \frac{0.0074 \times F \times L^3}{I} \Rightarrow I = \frac{0.0074 \times F \times L^3}{f}$

Moment of inertia $I = \frac{0.0074 \times 1800 \times 1.2^3}{1.0} = 23.02\ cm^4$

⇨ **Selection: Use a heavy duty extrusion MA1–1 where I = 29.37 cm^4**

Load case 3



$$f\,[mm] = \frac{0.476 \times F\,[N] \times a^3\,[m] \times b^3\,[m]}{I\,[cm^4] \times L^3\,[m]}$$

a > b	$f_m\,[mm] = \frac{0.952 \times F\,[N] \times a^3\,[m] \times b^2\,[m]}{I\,[cm^4] \times L^2\,[m]} \left(\frac{L\,[m]}{L\,[m] + 2a\,[m]}\right)^2$
a < b	$f_m\,[mm] = \frac{0.952 \times F\,[N] \times a^2\,[m] \times b^3\,[m]}{I\,[cm^4] \times L^2\,[m]} \left(\frac{L\,[m]}{L\,[m] + 2b\,[m]}\right)^2$

Example:

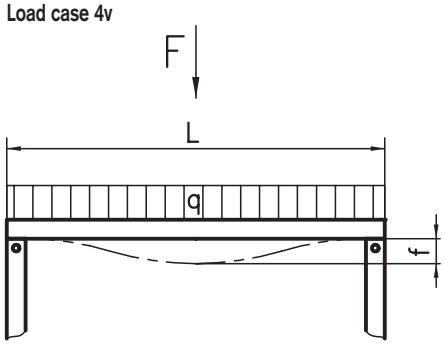
A cross-beam measuring 2500 mm in width has to support another beam 850 mm from the end of the cross-beam. The support load is 1200 N. A 50 x 100 base extrusion is used as the cross-beam. How great is the deflection at the point where the beam is placed?

Deflection $f = \frac{0.476 \times 1200 \times 1.65^3 \times 0.85^3}{149.84 \times 2.5^3} = 0.67$ mm

Where:

F = load in N
L = extrusion length in m
I = moment of inertia in cm⁴
f = deflection in mm
a/b = distance to the load point in m
q = line load in N/m

Load case 4v



$$f\,[mm] = \frac{0.0037 \times F\,[N] \times L^3\,[m]}{I\,[cm^4]}$$

F = q x L

Beispiel:

A measuring plate (whose intrinsic stability is ignored) may not bend by more than 0.4 mm. The measuring table is 1500 mm deep and the line load on each side of the table is 8000 N/lm.
Which extrusion must be used to support the measurement plate?

F = q x L = 8000 x 1,5 = 12 000 N

Deflection $f = \frac{0.0037 \times F \times L^3}{I} \Rightarrow I = \frac{0.0037 \times F \times L^3}{f}$

Moment of inertia $I = \frac{0.0037 \times 12000 \times 1.5^3}{0.4} = 374.64$ cm⁴

⇨ **Selection: Use a heavy duty extrusion MA1-5 (100 x 100) where I = 380.00 cm⁴**