Technical sheet

Dierre

Extruded alloy profiles:	EN AW-6060 • EN AW 6063
Supply status:	T5 - T6
Dimensional tolerances and thicknesses:	According to EN 12020-2 standard
Profile weight:	The weight shown is theoretical and may vary depending on thickness tolerances, profile dimensions and relative density (EN 12020-2)

Profile dimensions:

The dimensions shown are theoretical and may therefore vary depending on extrusion dimensional tolerances (EN 12020-2).

This variability, which affects all profiles, can influence the coupling system, albeit minimally. Painting and oxidation, by increasing or decreasing thicknesses respectively, also contribute to variations in the dimensions of the profiles and, in particular, reduce or increase the play during coupling.

Aluminium profile surface finish:

The surfaces of the profiles are protected and finished through anodising or painting.

• Anodising is done under the European 'EURAS-EWAA/QUALANOD' brand, using a complete cycle that includes the preliminary operations of pickling, degreasing and mechanical or chemical satin finishing.

The thickness of the oxidation is guaranteed at an average value of 15 microns (class 15 microns UNI 10681-2010), unless otherwise requested by the customer.

• The European 'QUALICOAT' brand paint finish in colours according to the R.A.L. charts has a minimum thickness of 60-80 microns for visible parts and is applied using a cycle comprising:

1) acid degreasing at approximately 50°C
2) double demineralised washing
3) pickling at approximately 50°C
4) double demineralised washing
5) acid deoxidation
6) double demineralised washing
7) chromating at approximately 30°C
8) demineralised washing
9) specific demineralised washing
10) drying
11) electrostatically applied polyester powder coating that is cured in an oven at a temperature of approximately 180°C.

To guarantee durability and resistance to weather, the painting process includes specific checks to verify quality.
The most important checks include:
- Checking the curing temperature, which must be constant across all profiles.
- Adhesion control in accordance with ISO 2409.
- Bend resistance test in accordance with EN ISO 1519
- Drawing resistance test in accordance with EN ISO 1520
- Impact resistance test in accordance with ASTM D 2794.
- Gloss value control according to ISO 2813.

Technical sheet

EN AW-6060 ALLOY

PHYSICAL CHARACTERISTICS

Density: 2.69 grams/ cm^3

Lower melting point: 605 °C

Specific heat at 100°C: 0.92 Joules/gram °Kelvin

Thermal conductivity at 20°C
- in state 0: 2.09 Watts / cm. °Kelvin
- in state 6T: 1.75 Watts / cm. °Kelvin

Coefficient of linear thermal expansion:
- from 20° to 100°C: 23.10^{-6} 1 / ° Kelvin
- from 20° to 200°C: 24.10^{-6} 1 / ° Kelvin
- from 20° to 300°C: 25.10^{-6} 1 / ° Kelvin

Electrical resistivity at 20°C
- in state 0: 3.14 microOhm . cm
- in state 6T: 3.25 microOhm . cm

Modulus of elasticity E: 67 000 Newton / mm^2

CHEMICAL COMPOSITION ACCORDING TO EUROPEAN STANDARD EN 573.3

Alloy designation	Si	Fe	Cu max	Mn max	Mg	Cr max	Zn max	Ti max	Other EACH max	Other TOTAL max	Al
EN AW 6063	**0.3+0.6**	**0.1+0.3**	**0.10**	**0.10**	**0.35- 0.6**	**0.05**	**0.15**	**0.10**	**0.05**	**0.15**	**remainder**

MECHANICAL PROPERTIES ACCORDING TO EUROPEAN STANDARD EN 755.2

Type of semi-finished product	SUPPLY STATUS Denomination	SUPPLY STATUS Symbol	Wall thickness e (mm)	Tensile strength Rm (MPa)	Deviation load from proportionality Rp (0.2) (MPa)	Stretching A %	Stretching A50 mm %
Extruded profile	Water tempering + natural ageing	T 4 (*)	e ≤ 25	120 min	60 min	16 min	14 min
	Press hardening + artificial ageing	T 5	e ≤ 5 5 < e ≤ 25	160 » 140 »	120 » 100 »	8 » 8 »	6 » 6 »
	Water tempering + artificial ageing	T 6 (*)	e ≤ 3 3 < e ≤ 25	190 » 170 »	150 » 140 »	8 » 8 »	6 » 6 »

(*) mechanical properties of the indicated physical state: also obtainable with press hardening

EN AW-6063 ALLOY

PHYSICAL CHARACTERISTICS

Density: 2.71 grams/ cm^3

Lower melting point: 600 °C

Specific heat at 100°C: 0.89 Joules/gram °Kelvin

Thermal conductivity at 20°C
- in state 0: 2.09 Watts / cm. °Kelvin
- in state 6T: 1.72 Watts / cm. °Kelvin

Coefficient of linear thermal expansion:
- from 20° to 100°C: 23. 10^{-6} 1 / °Kelvin
- from 20°to 200°C: 23. 10^{-6} 1 / ° Kelvin
- from 20° to 300°C: 23. 10^{-6} 1 / °Kelvin

Electrical resistivity at 20°C
- in state 0: 3.14 microOhm . cm
- in state 6T: .3.85 microOhm . cm

CHEMICAL COMPOSITION ACCORDING TO EUROPEAN STANDARD EN 573.3

Alloy designation	Si	Fe	Cu max	Mn max	Mg	Cr max	Zn max	Ti max	Other EACH max	Other TOTAL max	Al
EN AW 6063	**0.2- 0.6**	**0.35 (max)**	**0.10**	**0.10**	**0.45- 0.9**	**0.10 (max)**	**0.10 (max)**	**0.10 (max)**	**0.05**	**0.15**	**remainder**

MECHANICAL PROPERTIES ACCORDING TO EUROPEAN STANDARD EN 755.2

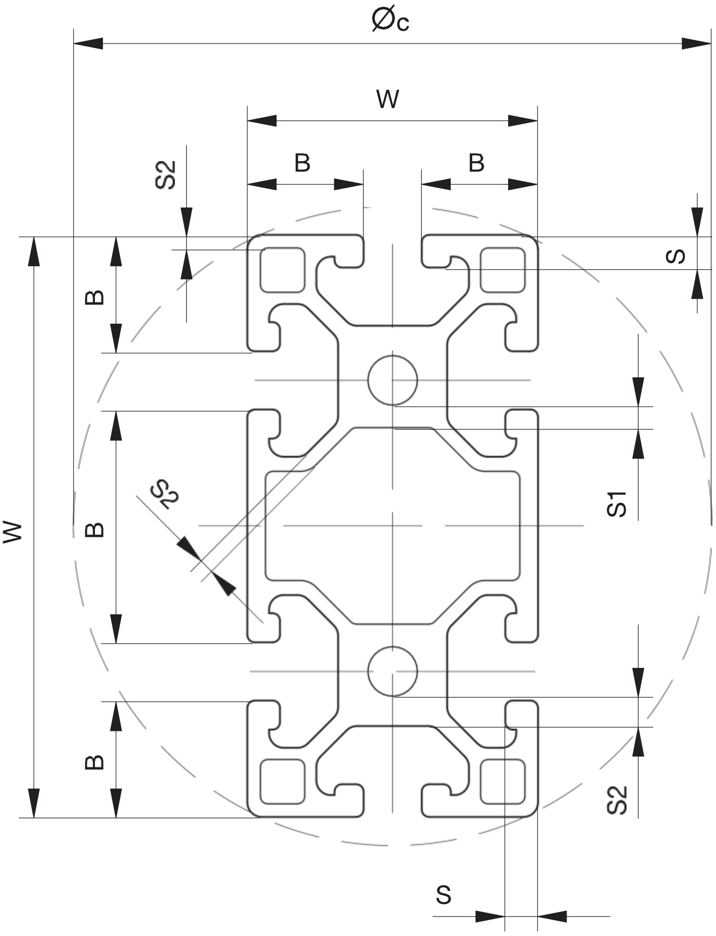
Type of semi-finished product	SUPPLY STATUS Denomination	SUPPLY STATUS Symbol	Wall thickness e (mm)	Tensile strength Rm (MPa)	Deviation load from proportionality Rp (0.2) (MPa)	Stretching A %	Stretching A50 mm %
Extruded profile	Water tempering + natural ageing	T 4 (*)	e ≤ 25	130 min	65 min	14 min	12 min
	Press hardening + artificial ageing	T 5	e ≤ 25 5 < e ≤ 25	175 » 160 »	130 » 110 »	8 » 7 »	6 » 5 »
	Water tempering + artificial ageing	T 6 (*)	e ≤ 3 3 < e ≤ 25	215 » 195 »	170 » 160 »	10 » 10 »	8 » 8 »

(*) mechanical properties of the indicated physical state: also obtainable with press hardening

Table 1 shows the W and B tolerances for cross-sections.

Dimension B or W (mm)		B or W Dimension tolerance (mm)
Over	Up to	
	10	± 0,15
10	15	± 0,2
15	30	± 0,25
30	45	± 0,3
45	60	± 0,4
60	90	± 0,45
90	120	± 0,6
120	150	± 0,8
150	180	± 1
180	240	± 1,2
240	300	± 1,5

Table 1



W	=	Dimensions relating to surfaces interrupted by grooves
B	=	Dimensions relating to continuous surfaces
S	=	Wall thickness not adjacent to cavity
S_1, S_2	=	Wall thickness adjacent to one or more cavities
Øc	=	Diameter of the circumscribed circle

Thickness tolerances: shown in Table 2.

Thickness (mm)		Tolerance on thicknesses S S1 S2 depending on the circumscribed diameter			
		S		S_1 o S_2	
over	up to	Øc≤100	Øc 100≤300	Ø≤ 100	Øc 100≤300
	1,5	± 0,15	± 0,2	± 0,2	± 0,3
1,5	3	± 0,15	± 0,25	± 0,25	± 0,4
3	6	± 0,2	± 0,3	± 0,4	± 0,6
6	10	± 0,25	± 0,35	± 0,6	± 0,8
10	15	± 0,3	± 0,4	± 0,8	± 1
15	20	± 0,35	± 0,45	± 0,1,2	± 1,5
20	30	± 0,4	± 0,5	/	/
30	40	± 0,45	± 0,6	/	/

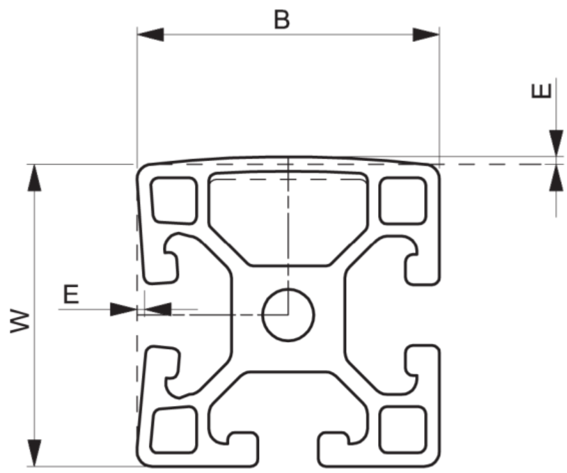
Table 2

FLATNESS TOLERANCES

The values in Table 3 apply to both dimensions B and W for grooved surfaces.

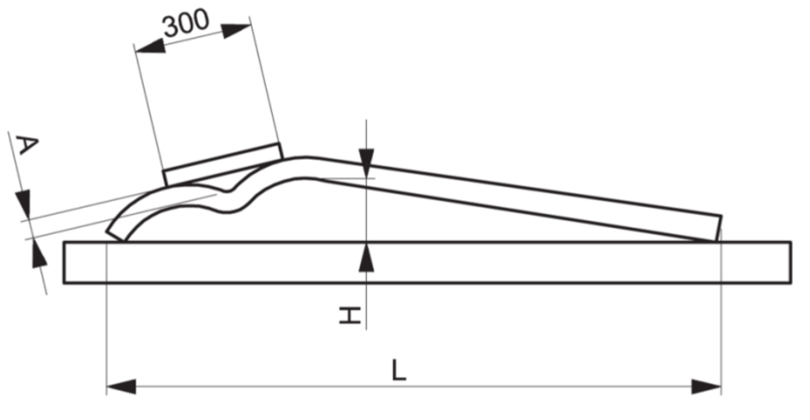
Dimension B or W (mm)		Flatness tolerance E (mm)
over	up to	
	30	0,2
30	60	0,3
60	100	0,4
100	150	0,5
150	200	0,7
200	250	0,85
250	300	1

Table 3



LONGITUDINAL STRAIGHTNESS TOLERANCES

For local deformations, deviation A, referring to a base of 300 mm, must not exceed 0.3 mm. While the overall deformation H must comply with the limits in Table 4.

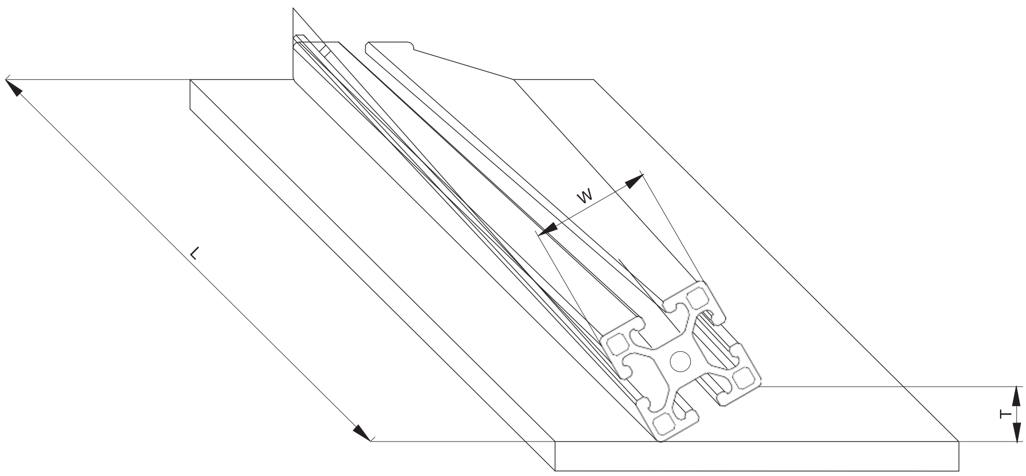


LENGTH L (mm)	up to 1000	from 1000 to 2000	from 2000 to 3000	from 3000 to 4000	from 4000 to 5000	from 5000 to 6000	over 6000
TOLERANCE H (mm)	0,7	1,3	1,8	2,2	2,6	3	3,5

Table 4

DISTORTION TOLERANCES

With the profile resting under its own weight on a flat base, the deviation T from the supporting surface, measured at any point on the lower edge of the profile, must comply with the values in Table 5.



Width W (mm)		Torsional tolerances T depending on length L (mm)						
over	up to	up to 1000	over 1000 up to 2000	over 2000 up to 3000	over 3000 up to 4000	over 4000 up to 5000	over 5000 up to 6000	over 6000
	25	1	1,5	1,5	2	2	2	according to accord
25	50	1	1,2	1,5	1,8	2	2	
50	75	1	1,2	1,2	1,5	2	2	
75	100	1	1,2	1,5	2	2,2	2,5	
100	125	1	1,5	1,8	2,2	2,5	3	
125	150	1,2	1,5	1,8	2,2	2,5	3	
150	200	1,5	1,8	2,2	2,6	3	3,5	
200	300	1,8	2,5	3	3,5	4	4,5	

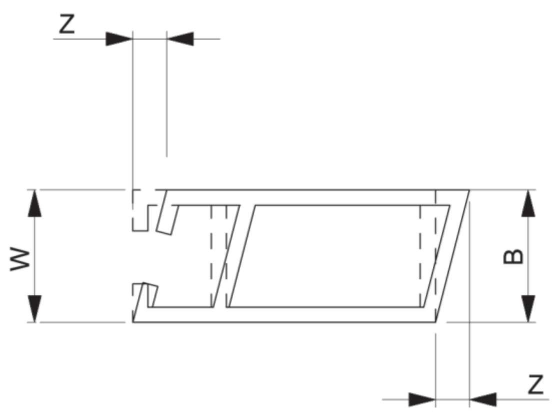
Table 5

PERPENDICULARITY TOLERANCES

In cases where the profile design includes faces at 90° to each other, the maximum Z deviation from orthogonality is shown in Table 6.

Dimension B or W (mm)		Dimension tolerance Z (mm)
over	up to	
	30	0,3
30	50	0,4
50	80	0,5
80	100	0,6
100	120	0,7
120	140	0,8
140	160	0,9
160	180	1
180	200	1,2
200	240	1,5

Table 6



CHOICE OF PROFILES FOR STRUCTURAL USE

The following notes illustrate a quick graphical calculation procedure to assist designers in selecting the profile and approximate dimensions for structural applications in which the component must withstand external bending or torsional loads. The method applies the criteria of Structural Engineering to certain basic beam designs subject to bending or torsion, and therefore this method is strictly valid if the actual use of the profile corresponds exactly to one of the designs discussed here.

I) Bending deformation testing under concentrated load.

The basic frameworks taken into consideration are those shown in the following table: Diagram (a): L length beam fixed at one end and loaded at the opposite end. Diagram (b): L length beam supported at both ends and loaded at its midpoint. Diagram (e): L length beam fixed at both ends and loaded at its midpoint.

For these, the maximum elastic deformation taken on under load F is given by the relationship: $\mathbf{f = F \times L^3 / (Ki \times E \times J)}$ where the physical meaning and units of measurement are as follows:

f= maximum elastic deflection in [mm], measured at the point where the force is applied.
F= External force applied in [Newton].

L= Beam length (= span between supports) in [mm].

Ki= Constant coefficient in [mm⁴/cm⁴], with a numerical value equal to:

for diagram (a): $K_i = K_a$ 3 x 10^4
for diagram (b): $K_i = K_b$ 48 x 10^4
for diagram (c): $K_i = K_c$ 182 x 10^4

E= Young's linear elastic modulus in [Newton per mm²].

E= 67,000 N/mm² for alloy 6060; **E**= 66,000 N/mm² for alloy 6063

J= coincides with one of the moments of inertia of the $\mathbf{J_x}$ or $\mathbf{J_Y}$ profile section in [cm^4].
With load F directed vertically along the **y**-axis, take on $\mathbf{J_x}$ if the profile is arranged with the *horizontal* **x**-axis; conversely, take on $\mathbf{J_Y}$ if the profile is arranged with the *vertical* **x**-axis.

Calculation example – see table below.

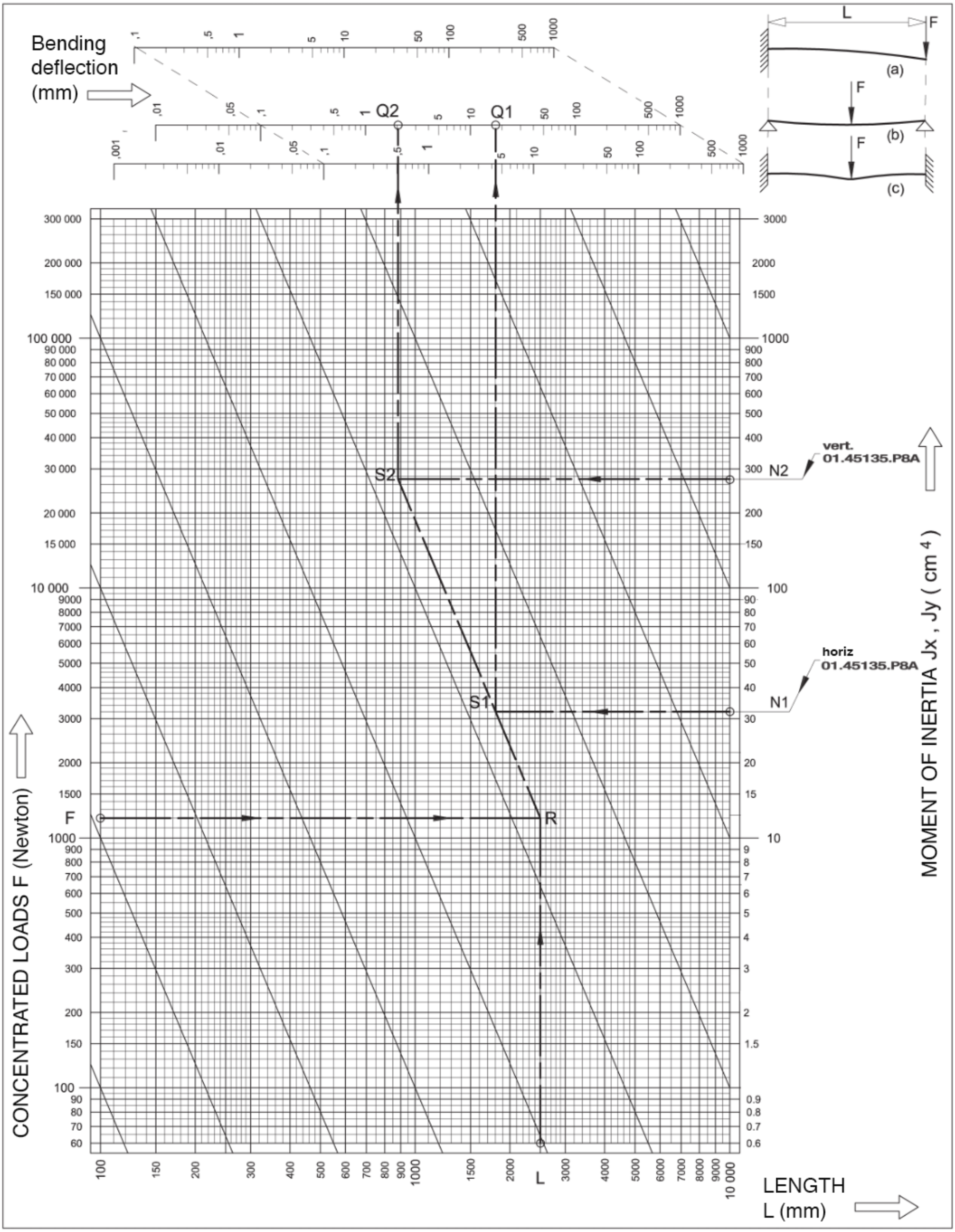
The general layout of the structure should include: concentrated load, beam layout and length. Data: 1200 Newton load directed vertically (point **F**) - diagram (b) - Length = 2500 mm (Point **L**). Furthermore, we want to use profile 01.45135.P8A because, for example, it is already available in stock.

For this profile, the following applies: $\mathbf{J_x}$ = 32.70 cm_2 when positioned horizontally (point **N1**)$\mathbf{J_Y}$ = 276.20 cm⁴ when positioned vertically (point **N2**).

From point **F** (= 1200) on the load metric scale, enter horizontally on the diagram until it intersects the vertical line emerging from point **L** at **R**. From **R**, draw a line parallel to the bundle of oblique lines already present on the diagram.
From the right side of the diagram, start from point **N1** (J_x= 32.70 cm^4) and, following the path shown, intersect the oblique line already drawn at **S1**. From S1, move vertically upwards until intersecting the metric scale of the deflections in 01, relative to diagram (b), and read the result on this scale: elastic bending deflection f = ~ 16 mm.
If this deflection is considered excessive, it is decided to arrange the profile vertically;
in this second case, we start higher up from point **N2** (J_x 276.20 cm^4), move horizontally to point **S2**, and from there vertically until intersecting the deflection scale at **Q2**, where we read the new result f = ~ 1.1 mm.

WARNING: *only intersect forces with lengths and deflections with moments of inertia. The graphical intersection of forces with deflections, or lengths with moments of inertia, is incorrect.*

ELASTIC FLEXURAL DEFORMATIONS WITH CONCENTRATED LOAD



II) Bending deformation testing under distributed load.

The basic frameworks considered differ from the previous case only in that the resulting load F is evenly distributed over the entire length of the beam; see the following table:

Diagram (d): L length beam fixed at one end and free at the opposite end.
Diagram (e): L length beam supported at both ends.
Diagram (f): L length beam fixed at both ends.

The relationship with the maximum deflection is identical to the previous one, but with different values for the constant k_i . **f = F x L³ / (Ki x E x J)**
where the physical meaning and units of measurement are as follows:

f= maximum deflection in [mm], measured at the free end in case (d) and at the midpoint in cases (e) and (f)
F= Resultant in [Newton] of external loads distributed over length L.
L= Length of the beam (= span between supports) in [mm].
Ki= constant coefficient in [mm^4/cm^4], with a numerical value equal to:

for diagram (d): $K_i = K_d = 8 \times 10^4$
for diagram (e): K_i $K_e = 76{,}8 \times 10^4$
for diagram (f): $K_i = K_f = 384 \times 10^4$

E= Young's linear elastic modulus in [Newton per mm^2].

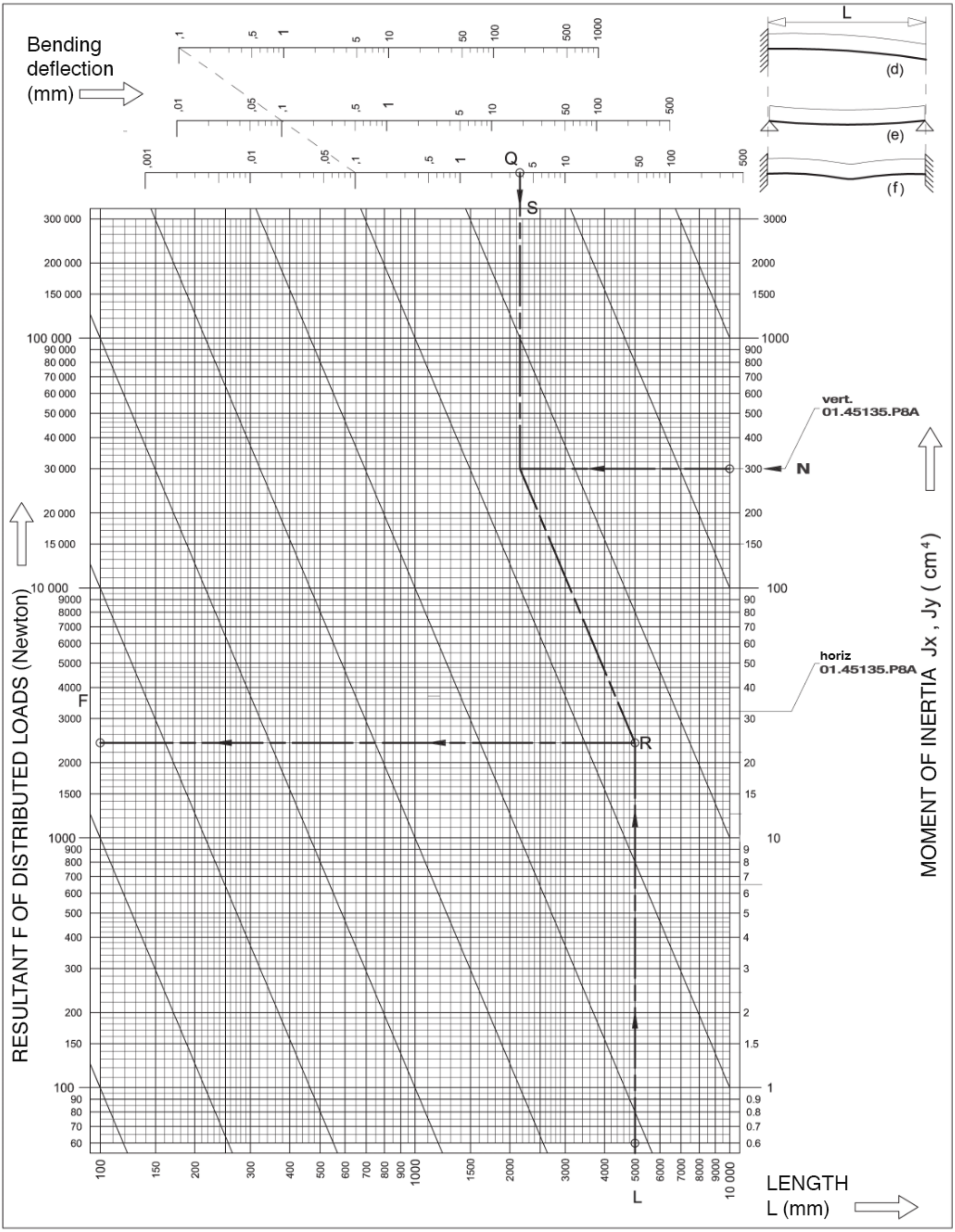
E= 67,000 N/mm^2 for alloy 6060; **E**= 66,000 N/mm^2 for alloy 6063
J= moment of inertia of the resistant section, identified between the two values J_x or J_Y as seen in the previous table

Calculation example – following table

To experiment with different ways of using the graphic process, the beam layout and length, profile and maximum permissible deflection are specified here. We want to know the external load that, distributed over the beam, causes the desired deflection. Data: diagram (**f**) - f = 4 mm - **L** = 5000 mm - profile 01.45135.P8A arranged vertically (**Jy** = 276.20 cm^4).
Point **N** On the metric scale of the deflections for diagram (**f**), point **Q** is marked with an abscissa of **f** = 4 mm. Similarly, point L with abscissa 5000 is plotted on the length scale. From point N, draw a horizontal line until it intersects the vertical line descending from **Q** at **S**. From **S**, draw a line parallel to the set of oblique lines until it intersects the vertical line emerging from point **L** at **R**. From **R**, proceed horizontally towards the graphic scale of distributed loads, where the result can be read at **F**.-2400 Newton. Subtracting the weight of the profile itself (225.7 Newton) from this value gives the useful load capacity of the beam: - 2174.3 Newton.

WARNING: *only intersect forces with lengths and deflections with moments of inertia. The graphical intersection of forces with deflections, or lengths with moments of inertia, is incorrect.*

ELASTIC FLEXURAL DEFORMATIONS WITH DISTRIBUTED LOAD



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