



## Extruded alloys- tempers & mechanical properties:

Standard alloys in production include:

EN-AW 6060 (Al MgSi0,5) DIN 3.3206  
 EN-AW 6063 (Al Mg0,7Si) DIN 3.2315  
 EN-AW 6005A (Al MgSi0,7) DIN 3.3210  
 EN-AW 6082 (Al Si1MgMn) DIN 3.2315  
 EN-AW 6061 (Al Mg1SiCu) DIN 3.3211\*

\* Only available with a prior notice of 5 weeks and a minimum ordered quantity of 22 tons dispatched in one go.

| Alloy chemical composition as per EN 573-3:2-13 |           |           |           |           |           |           |      |      |       |       |      |
|-------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------|------|-------|-------|------|
| Alloy                                           | Si        | Fe        | Cu        | Mn        | Mg        | Cr        | Zn   | Ti   | Other |       | Al   |
|                                                 |           |           |           |           |           |           |      |      | Each  | Total |      |
| <b>6060</b>                                     | 0,30-0,60 | 0,10-0,30 | 0,10      | 0,10      | 0,35-0,60 | 0,05      | 0,15 | 0,10 | 0,05  | 0,15  | Rest |
| <b>6063</b>                                     | 0,20-0,60 | 0,35      | 0,10      | 0,10      | 0,45-0,90 | 0,10      | 0,10 | 0,10 | 0,05  | 0,15  | Rest |
| <b>6005A</b>                                    | 0,50-0,90 | 0,35      | 0,30      | 0,50      | 0,40-0,70 | 0,30      | 0,20 | 0,10 | 0,05  | 0,15  | Rest |
| <b>6082</b>                                     | 0,70-1,30 | 0,50      | 0,10      | 0,40-1,00 | 0,60-1,20 | 0,25      | 0,20 | 0,10 | 0,05  | 0,15  | Rest |
| <b>6061*</b>                                    | 0,40-0,80 | 0,70      | 0,15-0,40 | 0,15      | 0,80-1,20 | 0,04-0,35 | 0,25 | 0,15 | 0,05  | 0,15  | Rest |

| Available combinations of Alloys & Tempers |             |              |             |             |
|--------------------------------------------|-------------|--------------|-------------|-------------|
| <b>6060</b>                                | <b>6063</b> | <b>6005A</b> | <b>6082</b> | <b>6061</b> |
| O                                          | O           | O            | O           | O           |
| T4                                         | T4          | T4           | T4          | T4          |
| T5                                         | T5          | -            | T5          | -           |
| T6                                         | T6          | T6           | T6          | T6          |
| T66                                        | T66         | -            | -           | -           |

| Temper designation EN 515:2017 |                                                                                                                                                                                                                                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| O                              | Annealed wrought alloys                                                                                                                                                                                                        |
| T4                             | Solution heat treated & naturally aged.                                                                                                                                                                                        |
| T5                             | Cooled from an elevated temperature forming operation & artificially aged (precipitation hardened)                                                                                                                             |
| T6                             | Solution heat treated & artificially aged (precipitation hardened).<br>Press quenching required.                                                                                                                               |
| T66                            | Cooled from an elevated temperature forming operation & artificially aged (precipitation hardened) to a higher level of mechanical properties through special control of manufacturing processes.<br>Press quenching required. |

| Physical properties                | Alloys EN-AW |             |              |             |             |
|------------------------------------|--------------|-------------|--------------|-------------|-------------|
| Alloys EN-AW                       | <b>6060</b>  | <b>6063</b> | <b>6005A</b> | <b>6082</b> | <b>6061</b> |
| Melting range °C                   | 585-650      |             | 585-650      | 585-650     | 580-640     |
| Density g/cm <sup>3</sup>          | 2,70         | 2,70        | 2,70         | 2,70        | 2,70        |
| Electrical Conductivity MS/m       | 34-38        |             | 26-32        | 24-32       | 22-30       |
| Thermal Conductivity W/(m K)       | 200-220      |             | 180-220      | 170-220     | 170-200     |
| Specific Heat J / (Kg K)           | 898          |             |              | 896         |             |
| Thermal Expansion Values           |              |             |              |             |             |
| -50 to 20 °C (10 <sup>-6</sup> /K) | 21,8         | 23,4        | 23,4         | 23,4        | 23,0        |
| 20 to 100 °C (10 <sup>-6</sup> /K) | 23,4         |             |              |             |             |
| 20 to 200 °C (10 <sup>-6</sup> /K) | 24,5         |             |              |             |             |
| 20 to 300 °C (10 <sup>-6</sup> /K) | 25,6         |             |              |             |             |
| Young's Modulus MPa                | 69500        | 69500       | 69500        | 70000       | 70000       |
| Shear Modulus MPa                  | 26100        | 26100       | 26200        | 26400       | 26300       |

**Mechanical properties as per EN 755-2:2016 (EXTRUDED PROFILES)**

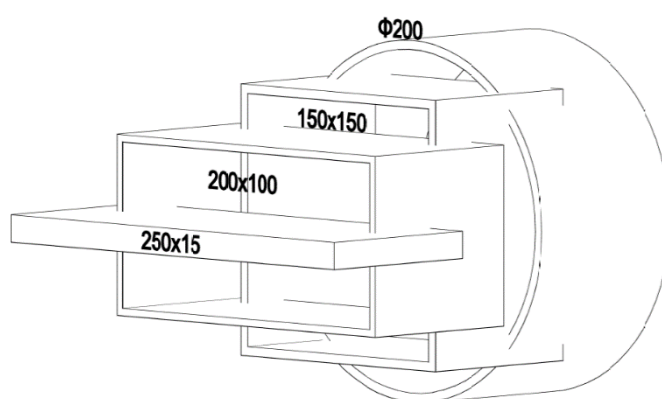
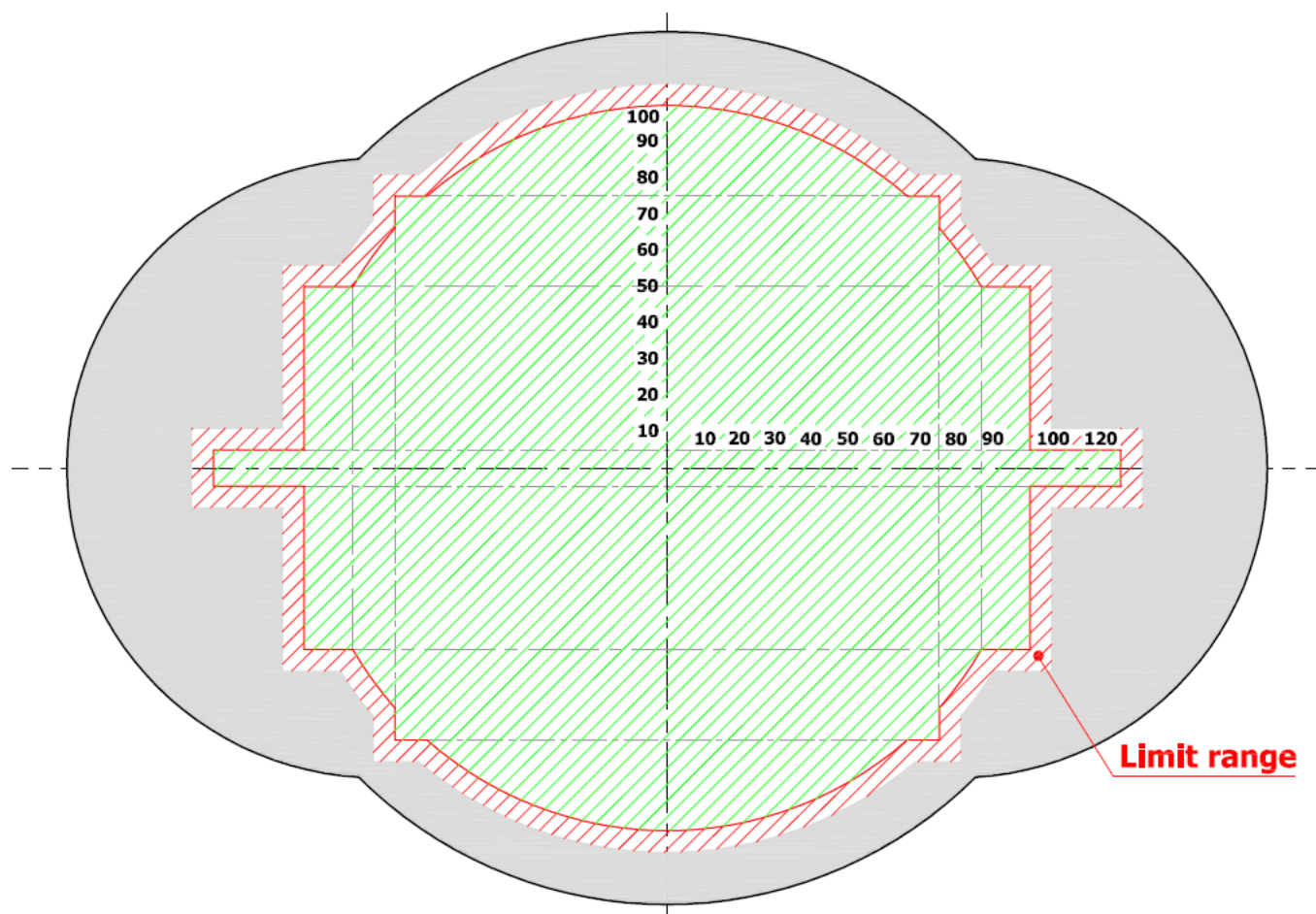
| Alloy       | Temper    | Wall Thickness | Tensile strength             | Yield strength                  | Elongation    |                            | Brinell Hardness |
|-------------|-----------|----------------|------------------------------|---------------------------------|---------------|----------------------------|------------------|
|             |           | e mm*          | R <sub>m</sub><br>MPa<br>min | R <sub>p0,2</sub><br>MPa<br>min | A<br>%<br>min | A <sub>50mm</sub><br>% min | HB**             |
| EN-AW 6060  | T4        | e ≤ 25         | 120                          | 60                              | 16            | 14                         | 50               |
|             | T5        | e ≤ 5          | 160                          | 120                             | 8             | 6                          | 60               |
|             |           | 5 < e ≤ 25     | 140                          | 100                             | 8             | 6                          | 60               |
|             | T6        | e ≤ 5          | 190                          | 150                             | 8             | 6                          | 60               |
|             |           | 5 < e ≤ 25     | 170                          | 140                             | 8             | 6                          | 60               |
|             | T66       | e ≤ 5          | 215                          | 160                             | 8             | 6                          | 75               |
|             |           | 5 < e ≤ 25     | 195                          | 150                             | 8             | 6                          | 75               |
| EN-AW 6063  | T4        | e ≤ 25         | 130                          | 65                              | 14            | 12                         | 50               |
|             | T5        | e ≤ 10         | 175                          | 130                             | 8             | 6                          | 65               |
|             |           | 10 < e ≤ 25    | 160                          | 110                             | 7             | 5                          | 65               |
|             | T6        | e ≤ 10         | 215                          | 170                             | 8             | 6                          | 75               |
|             |           | 10 < e ≤ 25    | 195                          | 160                             | 8             | 6                          | 75               |
|             | T66       | e ≤ 10         | 245                          | 200                             | 8             | 6                          | 80               |
|             |           | 10 < e ≤ 25    | 225                          | 180                             | 8             | 6                          | 80               |
| EN-AW 6005A | T4 open   | e ≤ 25         | 180                          | 90                              | 15            | 13                         | 50               |
|             | T4 hollow | e ≤ 10         | 180                          | 90                              | 15            | 13                         | 50               |
|             | T6 open   | e ≤ 5          | 270                          | 225                             | 8             | 6                          | 90               |
|             |           | 5 < e ≤ 10     | 260                          | 215                             | 8             | 6                          | 85               |
|             |           | 10 < e ≤ 25    | 250                          | 200                             | 8             | 6                          | 85               |
|             | T6 hollow | e ≤ 5          | 255                          | 215                             | 8             | 6                          | 85               |
|             |           | 5 < e ≤ 15     | 250                          | 200                             | 8             | 6                          | 85               |
| EN-AW 6082  | T4        | e ≤ 25         | 205                          | 110                             | 14            | 12                         | 35               |
|             | T5 open   | e ≤ 5          | 270                          | 230                             | 8             | 6                          | 90               |
|             | T5 hollow | e ≤ 5          | 270                          | 230                             | 8             | 6                          | 95               |
|             | T6 open   | e ≤ 5          | 290                          | 250                             | 8             | 6                          | 95               |
|             |           | 5 < e ≤ 25     | 310                          | 260                             | 10            | 8                          | 95               |
|             | T6 hollow | e ≤ 5          | 290                          | 250                             | 8             | 6                          | 95               |
|             |           | 5 < e ≤ 15     | 310                          | 260                             | 10            | 8                          | 95               |
| EN-AW 6061  | T4        | e ≤ 25         | 180                          | 110                             | 15            | 13                         | 65               |
|             | T6        | e ≤ 5          | 260                          | 240                             | 9             | 7                          | 95               |
|             |           | 5 < e ≤ 25     | 260                          | 240                             | 10            | 8                          | 95               |

\* For a profile having different wall thicknesses, the lowest specified values of properties shall be considered as valid for the whole profile cross section. \*\* The values for the HB hardness are indicative only.

**Bendability classes to standardised tempers (EN 15088:2005)**

| Alloy       | T4                                                                                                                                                                                                                                           | T5 | T6 | T6510 | T64 | T66 |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-------|-----|-----|
| EN-AW 6060  | -                                                                                                                                                                                                                                            | B3 | B3 | B3    | B2  | B3  |
| EN-AW 6063  | -                                                                                                                                                                                                                                            | B3 | B3 | B3    | -   | B3  |
| EN-AW 6005A | -                                                                                                                                                                                                                                            | -  | -  | B3    | B3  | -   |
| EN-AW 6082  | B2                                                                                                                                                                                                                                           | B3 | B3 | -     | -   | -   |
| EN-AW 6061  | B2                                                                                                                                                                                                                                           | -  | B3 | B3    | -   | -   |
| <b>B2</b>   | Material is in mid strained hardened/naturally aged/partially aged hardened. Bendability for simple symmetrical sections with medium radii is possible. Thin walled or complicated sections may require special devices or bending machines. |    |    |       |     |     |
| <b>B3</b>   | Material is in hard/fully age hardened. For simple symmetrical sections bendability is possible only with relatively large radii. Thin walled or complicated sections may require special devices or bending machines.                       |    |    |       |     |     |

## Profile size production range



Maximum extrusion dimensions per standard profile (shape) category.

| 01<br>Square | 02<br>Rect | 03<br>Round | 04<br>Angle | 05<br>Angle | 06<br>T-section | 07<br>U-Section | 09/12<br>Square | 10/13<br>Rect. | 11<br>Round |
|--------------|------------|-------------|-------------|-------------|-----------------|-----------------|-----------------|----------------|-------------|
|              |            |             |             |             |                 |                 |                 |                |             |
| 61x61        | 250x15     | 70          | 150x150x13  | 240x40x14   | 150x150x13      | 40x240x40x12    | 150x150x6       | 200x100x6      | 200x5       |

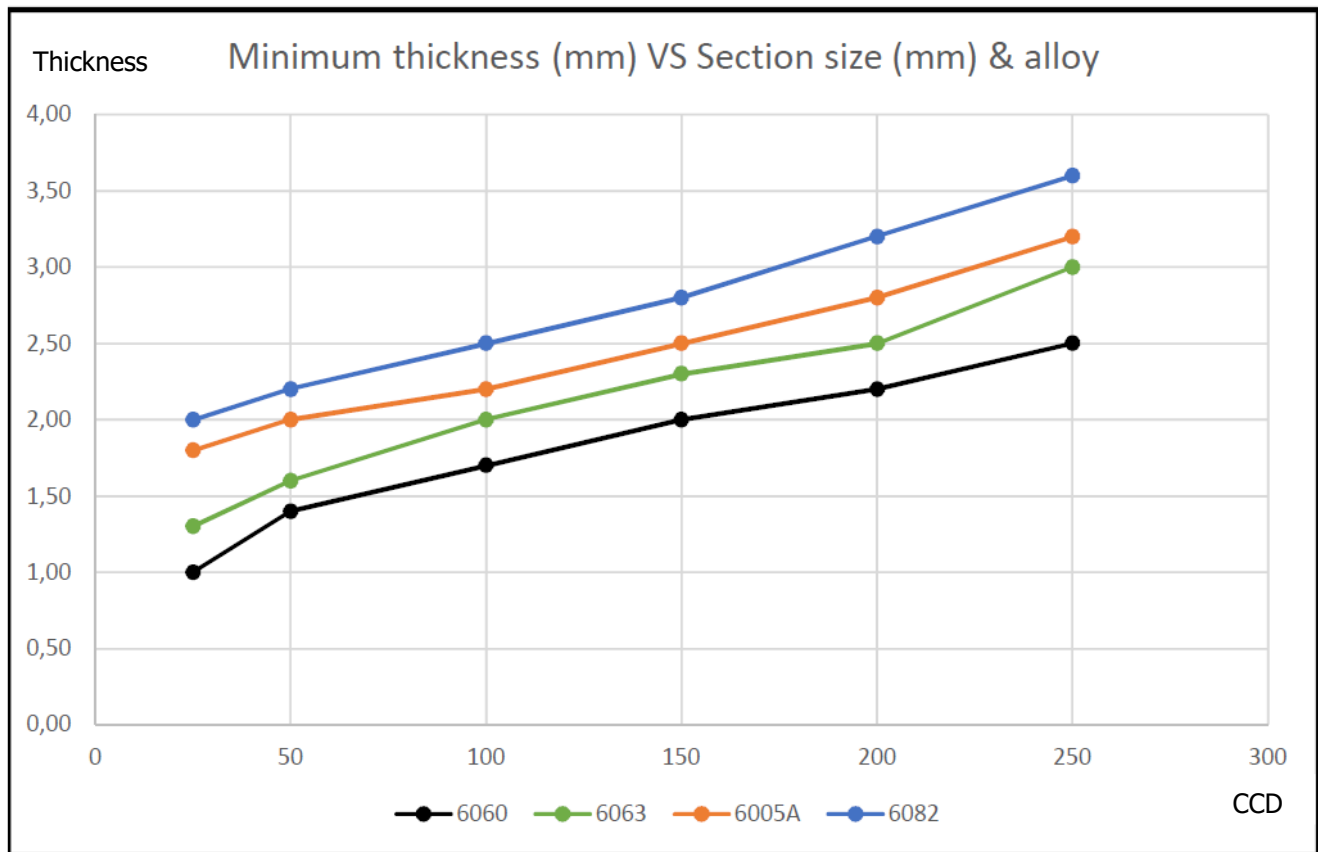


## Profile weight production range

| Minimum    | Maximum    |
|------------|------------|
| 0,100 Kg/m | 10,00 Kg/m |

## Thickness vs Alloy

Depending on the size of the section (Circumscribed Circle Diameter, horizontal axis) and the alloy to extrude, the minimum thickness should follow the trend indicated by the chart below (vertical axis):



## Product forms & Applications

| Alloys     | Forms                           | Characteristic properties                                                                       | Applications                                                                                                                                                                                                                                           |
|------------|---------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN-AW 6060 | Extruded bars<br>Extruded tubes | V.good corrosion resistance, weldability, Medium strength, Complex sections, Anodising quality. | Architectural sections, windows, doors, curtain walls, lightings, railing, ladders, furniture, fences, truck flooring, heat sinks, irrigation, cooling pipes, electronic modules.                                                                      |
| EN-AW 6063 | Extruded profiles               | V.good corrosion resistance, weldability, Medium strength, Complex sections, Anodising quality. | Architectural sections, windows, doors, curtain walls, lightings, railing, ladders, furniture, fences, truck flooring, heat sinks, irrigation, cooling pipes, electronic modules, electric motor housings, office equipment, special machine elements. |

## EXPERTS IN ALUMINIUM™

|             |                                                                                                                                                    |                                                                                                                                                                  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN-AW 6005A | V.good corrosion resistance, V.good weldability, ,Medium-high strength, Complex sections, Anodising quality.                                       | Bus and railway profile structures, structural engineering, pylons, platforms, pipeline,...                                                                      |
| EN-AW 6082  | V.good corrosion resistance, V.good weldability, Medium-high strength, good machinability, formability in T4,Medium-high strength, Simple sections | Heavy duty structures in rail coaches, truck frames, ship building, offshore, bridges, boiler making, mast and beams for ship building, scaffolding, motorboats. |
| EN-AW 6061  | V.good corrosion resistance, V.good weldability, Medium-high strength, good machinability, formability in T4,Medium-high strength, Simple sections | Heavy duty structures in rail coaches, truck frames, ship building, offshore, bridges, boiler making, mast and beams for ship building, scaffolding, motorboats  |

## Quality control

Cosmos follow the inspection rules and control the shape quality characteristics and mechanical properties of the extruded sections under the following European norms:

| EN Standard                                                                   | Description                                                                                            |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Aluminium &amp; aluminium alloys- Extruded rod/bar, tubes and profiles</b> |                                                                                                        |
| EN 755-1                                                                      | Technical conditions for inspection & delivery                                                         |
| EN 755-2                                                                      | Mechanical properties                                                                                  |
| EN 515                                                                        | Temper designation                                                                                     |
| EN 573-3                                                                      | Chemical composition and form of products                                                              |
| EN 755-3                                                                      | Round bars, tolerances on dimension & form                                                             |
| EN 755-4                                                                      | Square bars, tolerances on dimension & form                                                            |
| EN 755-5                                                                      | Rectangular bars, tolerances on dimension & form                                                       |
| EN 755-6                                                                      | Hexagonal bars, tolerances on dimension & form                                                         |
| EN 755-8                                                                      | Porthole square, rect, hex, Oct, & round tubes, tolerances on dimension & form                         |
| EN 755-9                                                                      | Profiles, tolerances on dimension & form                                                               |
| EN- 12020-1                                                                   | Technical conditions for inspection & delivery (for precision profiles only)                           |
| EN- 12020-2                                                                   | Tolerances on dimension & form (for precision profiles only)                                           |
| <b>Metallic products- materials</b>                                           |                                                                                                        |
| EN ISO 6892-1                                                                 | Tensile testing- part 1: Method of test at room temperature                                            |
| EN- 10204                                                                     | Inspection certificates 2.3, 3.1, 3.2                                                                  |
| <b>On special request</b>                                                     |                                                                                                        |
| ASTM B 221M-07 (Metric)                                                       | Standard specification for Aluminium and Aluminium alloy Extruded Bars, Rods, Wire, Profiles and Tubes |
| ASTM B 429M-06                                                                | Standard specification for Aluminium alloy Extruded Structural Pipe or Tube.                           |
| BS EN ISO 8493:2004                                                           | Tube- Drift- expanding test                                                                            |

## Certifications

Cosmos aluminium is holding the following certificates:

| Cosmos Certificates                                                                       |
|-------------------------------------------------------------------------------------------|
| ISO 9001                                                                                  |
| ISO 14001                                                                                 |
| ISO 50001                                                                                 |
| OSHAS 18001                                                                               |
| Certificate of Conformity of Factory Production Control- No 0038/CPR/PIR1007756/A- Lloyds |
| LR Approved- No MD00/4306/0004/6a- Lloyds                                                 |
| REACH                                                                                     |
| RoHS                                                                                      |