



alform® x-treme

High-strength and ultra-high-strength heavy plates

Successful light-weight design requires the utilization of high-strength and ultra-high-strength steels. The innovative steel grades of voestalpine provide exceptional advantages in reduced weight and processability.

The high-strength steel grades alform plate 620 M, alform plate 700 M and the ultra-high-strength steel grades alform plate 900 M x-treme, alform plate 960 M x-treme and alform plate 1100 M x-treme are thermomechanically rolled fine-grained structural steels with excellent weldability and good bending properties.

The alloying concept provides very low carbon contents and low carbon equivalents, which aims in very good weldability. The high strength provide special advantages in areas, where weight savings are of great importance, e.g. for mobile cranes, concrete pump cars, steel construction industry and architecture, penstocks and vehicles.

Convincing advantages

- » Excellent weldability
- » Optimum processability
- » Structural components and vehicles with higher lifting and load capacity and with lower dead weight
- » Improved environmental compatibility, lower fuel consumption

Chemical composition

Heat analysis in mass %

| alform® | C max. | Si max. | Mn max. | P max. | S max. | Al _{tot} min. | Cr max. | Mo max. | Ni max. | V ¹⁾ max. | Nb ¹⁾ max. | Ti ¹⁾ max. | B max. |
|----------------------|--------|---------|---------|--------|--------|------------------------|---------|---------|---------|----------------------|-----------------------|-----------------------|--------|
| plate 620 M | 0.12 | 0.50 | 2.00 | 0.020 | 0.008 | 0.020 | 1.50 | 0.50 | 2.00 | 0.12 | 0.06 | 0.05 | 0.005 |
| plate 700 M | 0.12 | 0.60 | 2.10 | 0.020 | 0.008 | 0.020 | 1.50 | 0.50 | 2.00 | 0.12 | 0.06 | 0.05 | 0.005 |
| plate 900 M x-treme | 0.12 | 0.60 | 1.70 | 0.020 | 0.008 | 0.020 | 1.50 | 0.70 | 2.00 | 0.12 | 0.06 | 0.05 | 0.005 |
| plate 960 M x-treme | 0.12 | 0.60 | 1.70 | 0.020 | 0.008 | 0.020 | 1.50 | 0.70 | 2.00 | 0.12 | 0.06 | 0.05 | 0.005 |
| plate 1100 M x-treme | 0.18 | 0.60 | 2.10 | 0.020 | 0.008 | 0.020 | 1.50 | 0.80 | 2.00 | 0.12 | 0.06 | 0.05 | 0.005 |

¹⁾The total of Nb, V und Ti must not exceed 0.22%.

The chemical composition of alform plate 700 M is according to EN 10149-2 for steel grade S700MC. The chemical composition of alform plate 900 M x-treme is according to EN 10025-6 for steel grade S890QL. The chemical composition of alform plate 960 M x-treme is according to EN 10025-6 for steel grade S960QL.

Carbon equivalent

Standard values for carbon content and carbon equivalent

| alform® | Plate thickness [mm] | C [%] | CEV ²⁾ [%] | CET ³⁾ [%] | PCM ⁴⁾ [%] |
|----------------------|----------------------|-------|-----------------------|-----------------------|-----------------------|
| plate 620 M | 15 | 0.06 | 0.51 | 0.30 | 0.21 |
| | 40 | 0.06 | 0.52 | 0.31 | 0.21 |
| plate 700 M | 15 | 0.04 | 0.43 | 0.26 | 0.18 |
| | 40 | 0.06 | 0.47 | 0.26 | 0.19 |
| plate 900 M x-treme | 12 | 0.08 | 0.56 | 0.31 | 0.24 |
| | 20 | 0.08 | 0.60 | 0.33 | 0.25 |
| plate 960 M x-treme | 12 | 0.08 | 0.56 | 0.31 | 0.24 |
| | 20 | 0.08 | 0.60 | 0.33 | 0.25 |
| plate 1100 M x-treme | 20 | 0.13 | 0.70 | 0.40 | 0.31 |

²⁾CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15, according to IIW

³⁾CET = C + (Mn + Mo)/10 + (Cr + Cu)/20 + Ni/40, according to SEW 088

⁴⁾PCM = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + 5*B, according to API 5L

The steel grades are characterized by excellent weldability as a result of their low carbon equivalent. Due to the very low carbon content the steel grades provide a high cold cracking resistance according to Graville.

Mechanical properties: Tensile test

| alform® | Plate thickness [mm] | Yield strength R _{p0,2} [MPa] min. | Tensile strength R _m ⁵⁾ [MPa] | Fracture elongation A ₅ ⁵⁾ [%] min. |
|----------------------|----------------------|---|---|---|
| plate 620 M | 8 ≤ 50 | 620 | 700 - 890 | 15 |
| | 6 ≤ 15 | 700 | 770 - 1,050 | 10 |
| plate 700 M | > 15 ≤ 50 | 680 | 770 - 1,050 | 12 |
| | > 50 ≤ 60 | 650 | 770 - 1,050 | 12 |
| plate 900 M x-treme | 6 ≤ 30 | 900 | 940 - 1,100 | 11 |
| plate 960 M x-treme | 6 ≤ 30 | 960 | 980 - 1,150 | 10 |
| plate 1100 M x-treme | 8 ≤ 20 | 1,100 | 1,120 - 1,300 | 8 |
| | > 20 ≤ 25 | 1,080 | 1,100 - 1,300 | 8 |

⁵⁾Tensile test in accordance with EN ISO 6892-1 on transverse samples.

Mechanical properties: Notch impact energy/Edging radii

| alform® | Plate thickness [mm] | Notch impact energy ⁶⁾ A _v [Joule] min. | | Edging radii Ri min. at 90° edging (s = plate thickness) Position of the bending edge to the rolling direction | |
|----------------------|----------------------|--|---|--|------------|
| | | Testing direction Longitudinal Test temperature -40 °C | Testing direction Transverse Test temperature -40 °C | Longitudinal | Transverse |
| plate 620 M | 8 ≤ 50 | 40 | 30 | 4 s | 3 s |
| | 6 ≤ 15 | 40 | 30 | 4 s | 3 s |
| plate 700 M | > 15 ≤ 50 | 40 | 30 | 4 s | 3 s |
| | > 50 ≤ 60 | 30 | 27 | 4 s | 3 s |
| plate 900 M x-treme | 6 ≤ 30 | 30 | 27 | 5 s | 4 s |
| plate 960 M x-treme | 6 ≤ 30 | 30 | 27 | 5 s | 4 s |
| plate 1100 M x-treme | 8 ≤ 25 | 30 | 27 | 6 s | 5 s |

⁶⁾Notch impact bending test in accordance with EN ISO 148-1 on Charpy-V longitudinal samples at -40 °C. The mean value from 3 individual samples must reach the specified requirements. No individual value may be below 70% of the guaranteed mean value. For thicknesses < 10 mm, subsize-specimen with dimensions of 10 x 7.5 mm or 10 x 5 mm are tested. The guaranteed value is reduced in proportion to the sample cross-section.

The mechanical properties of alform plate 620 M are according to EN 10025-6 for steel grade S620QL. The mechanical properties of alform plate 900 M x-treme are according to EN 10025-6 for steel grade S890QL. The mechanical properties of alform plate 960 M x-treme are according to EN 10025-6 for steel grade S960QL.

Available dimensions

Maximum width per thickness; minimum width 1,500 mm

| alform® | Plate thickness [mm] | Max. width [mm] | Max. length [mm] | As-delivered condition ⁸⁾ |
|----------------------|----------------------|---------------------|------------------|--------------------------------------|
| plate 620 M | 8 ≤ 15 | 3,000 | 18,700 | TM + DIC |
| | > 15 ≤ 20 | 3,500 | 18,700 | |
| | > 20 ≤ 50 | 3,800 ⁷⁾ | 18,700 | |
| plate 700 M | 6 < 8 | 2,500 | 18,700 | TM + DIC |
| | 8 ≤ 15 | 3,000 | 18,700 | |
| | > 15 ≤ 20 | 3,500 | 18,700 | |
| | > 20 ≤ 50 | 3,800 ⁷⁾ | 18,700 | |
| plate 900 M x-treme | > 50 ≤ 60 | 3,800 ⁷⁾ | 16,000 | TM + DIC + A |
| | 6 ≤ 30 | 2,500 | 16,000 | TM + DIC + A |
| | 6 ≤ 30 | 2,500 | 16,000 | TM + DIC + A |
| plate 960 M x-treme | 8 ≤ 15 | 2,000 | 16,000 | TM + DIC + A |
| plate 1100 M x-treme | > 15 ≤ 25 | 2,500 | 16,000 | TM + DIC + A |

⁷⁾ Max. width of 3,750 mm for weight per piece > 15 t

⁸⁾ TM ... thermomechanically rolled; DIC ... direct intensive cooling; T ... tempered

Weight per plate is max. 19.5 t.
Additional dimensions upon request.

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