



alform<sup>®</sup>

## Hot-rolled steel strip

# alform<sup>®</sup> M series

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### Thermo-mechanically rolled steels with excellent cold formability

Thermo-mechanically rolled alform<sup>®</sup> steels have a low-carbon, fine grained microstructure. The steels are well suited to cold-forming and welding because of their chemical composition (low carbon equivalent). They also demonstrate excellent cuttability and blanking capacity. The steel can be stress-relief-annealed between 550 and 580 °C. Annealing above 580 °C is not permitted and would result in diminished minimum yield strength. The listed steel grades comply with all requirements of comparable steels pursuant to EN 10149-2.

### Convincing advantages

- Excellent cold formability
- Edging radii smaller than those of standard steels of comparable strength
- Excellent weldability
- Amount of pre-heating either reduced or completely eliminated
- Clean surface resulting from fine and homogeneous secondary scale

## Chemical composition

Heat analysis in mass % and carbon equivalent

alform®	C max.	Si max.	Mn max.	P max.	S max.	Al min.	Cr max.	Ni max.	Mo max.	Cu max.	V max.	Nb max.	Ti max.	B max.	CEV max.
280 M <sup>1)</sup>	0.10	0.05	0.70	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.28
315 M <sup>1)</sup>	0.10	0.05	0.90	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.30
340 M <sup>1)</sup>	0.10	0.05	1.20	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.32
355 M <sup>1)</sup>	0.10	0.05	1.20	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.34
380 M <sup>1)</sup>	0.10	0.05	1.20	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.36
420 M <sup>1)</sup>	0.10	0.05	1.40	0.020	0.010	0.020	0.3	0.3	0.08	0.3	0.05	0.05	0.05	0.003	0.38
460 M <sup>1)</sup>	0.10	0.05	1.50	0.020	0.008	0.020	0.3	0.3	0.08	0.3	0.07	0.07	0.07	0.003	0.40
500 M <sup>1)</sup>	0.10	0.05	1.60	0.020	0.008	0.020	0.3	0.3	0.08	0.3	0.07	0.07	0.07	0.003	0.42
550 M <sup>1)</sup>	0.12	0.05	1.70	0.020	0.008	0.020	0.3	0.3	0.08	0.3	0.07	0.07	0.15	0.003	0.44
600 M	0.12	0.50	1.90	0.020	0.008	0.020	0.3	0.3	0.30	0.3	0.07	0.07	0.15	0.005	0.46
650 M	0.12	0.50	2.00	0.020	0.008	0.020	0.3	0.3	0.30	0.3	0.07	0.07	0.15	0.005	0.48
700 M	0.12	0.50	2.10	0.020	0.008	0.020	0.3	0.3	0.30	0.3	0.15	0.08	0.20	0.005	0.50

<sup>1)</sup> For orders with **Class 1 galvanization**: Si max. 0,03 % und P max. 0,018 %;

$$CEV = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15$$

## Mechanical properties: Tensile test

Longitudinal testing; minimum values for  $R_{eH}$  and  $R_m$  also apply in cross direction.

alform®	Yield strength $R_{eH}$ [MPa]	Tensile strength $R_m$ [MPa]	Fracture elongation [%] min.	
			$A_{80}$	$A_5$
280 M	280 – 400	370 – 470	24	28
315 M	315 – 440	390 – 490	22	26
340 M	340 – 470	420 – 520	20	24
355 M	355 – 480	430 – 530	20	24
380 M	380 – 510	450 – 550	20	24
420 M	420 – 550	480 – 580	18	22
460 M	460 – 590	520 – 640	16	19
500 M	500 – 650	550 – 680	15	18
550 M	≥ 550	600 – 740	14	17
600 M	≥ 600	650 – 800	13	16
650 M <sup>2)</sup>	≥ 650	700 – 850	12	15
700 M <sup>2)</sup>	≥ 700	750 – 930	11	14

A yield strength of  $R_{p0.2}$  applies for non-distinct arbitrary cases.

$A_{80}$  for thicknesses < 3 mm  
 $A_5$  for thicknesses ≥ 3 mm

<sup>2)</sup> The yield strength may be lower by 20 MPa at thicknesses > 8 mm.

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## Mechanical properties: Notch impact energy/edging radii

alform®	Notch impact energy <sup>3)</sup> Av [Joule]		Edging radii <sup>4)</sup> Ri min at 90° edging			Mandrel diameter Minimum mandrel diameter (transverse test specimens) Sheet thickness = s
	M Test temperature -20 °C	ME Test temperature -40 °C <sup>5)</sup>	s < 3 mm	s 3-6 mm	s > 6 mm	
280 M	40	-	0.25 s	0.5 s	0.8 s	0 s
315 M	40	-	0.25 s	0.5 s	0.8 s	0 s
340 M	40	-	0.25 s	0.5 s	0.8 s	0 s
355 M (ME)	40	27	0.25 s	0.5 s	0.8 s	0 s
380 M (ME)	40	27	0.25 s	0.5 s	0.8 s	0.5 s
420 M (ME)	40	27	0.5 s	1.0 s	1.0 s	0.5 s
460 M (ME)	40	27	0.5 s	1.0 s	1.4 s	1.0 s
500 M (ME)	40	27	1.0 s	1.2 s	1.6 s	1.0 s
550 M (ME)	40	27	1.0 s	1.2 s	1.8 s	1.5 s
600 M (ME)	40	27	1.0 s	1.5 s	1.8 s	1.5 s
650 M (ME)	40	27	1.0 s	1.5 s	2.0 s	2.0 s
700 M (ME)	40	27	1.2 s	1.5 s	2.0 s	2.0 s

<sup>3)</sup> Av minimum mean value from three samples (ISO-V, longitudinal), full samples (10 x 10 mm)

<sup>4)</sup> Smallest permissible inside radius at 90° edging, Ri min.

<sup>5)</sup> Values at -40 °C are guaranteed when stipulated in the contract for limited dimension ranges and material is labeled ME.

If requested in the order, the notch impact energy can be calculated from a plate thickness of 3 mm.

Note: Notch impact energy tests in thicknesses < 6 mm do not conform to applicable Euronorm (EN) standards.

## Available dimensions

Maximum width per thickness; minimum width 900 mm for hot-rolled strip

alform®	Thickness [mm]						
	2.00	2.50	3.00	3.50	4.00	6.00	12.00
280 M	1360	1620	1620	1620	1620	1620	1620
315 M	1360	1620	1620	1620	1620	1620	1620
340 M	1360	1620	1620	1620	1620	1620	1620
355 M	1360	1620	1620	1620	1620	1620	1620
380 M	1360	1620	1620	1620	1620	1620	1620
420 M	1250	1530	1620	1620	1620	1620	1620
460 M	1250	1530	1620	1620	1620	1620	1620
500 M	1250	1380	1620	1620	1620	1620	1620
550 M	1250	1380	1620	1620	1620	1620	1620
600 M	1250	1380	1510	1620	1620	1620	1620
650 M	1250	1380	1510	1620	1620	1620 <sup>6)</sup>	1620 <sup>6)</sup>
700 M	1250	1380	1510	1620	1620	1620 <sup>6)</sup>	1620 <sup>6)</sup>

<sup>6)</sup> Available only as cut sheets in unpickled condition

Available dimensions upon request

Please find further information and downloads on the Internet at  
[www.voestalpine.com/alform](http://www.voestalpine.com/alform).

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