alform®

alform® M SERIES

Thermomechanically rolled steels with excellent cold formability

Thermomechanically rolled alform® steels have a low-carbon. fine-grained microstructure. The steel can be stress-relief-annealed between 530 and 580 °C. Annealing above 580 °C is not permitted and would result in diminished minimum yield strength. Should heat treatment above 580 °C be necessary, please contact our quality control department. These steel grades comply with all requirements of comparable steels pursuant to EN 10149-2.

Convincing advantages:

- Very good cutting, punching and forming capability
- Very good weldability because of low carbon equivalent
- Improved properties with narrower limits than those of comparable standard steels

Chemical composition

Ladle analysis in weight percent 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 [1]	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	0.18
315 M [1]	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	0.22
340 M [1]	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	0.26
355 M [1]	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	0.28
380 M [1]	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	0.30
420 M [1]	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	0.34
460 M [1]	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	0.36
500 M [1]	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	0.38
550 M [1]	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	0.40
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	0.42
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	0.44
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	0.46

[1] When these steel grades are to be **galvanized as Class 1**, the following restrictions apply:
Si 0.03% max. and P 0.018% max.; CEV = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

Mechanical properties: Tensile test

Test direction: longitudinal, minimum values for R_{eH} und R_m also apply in cross direction.

$R_{p0.2}$ applies for the yield strength in case of missing R_{eH} and in arbitrary cases
A_{80} for thicknesses < 3 mm
A_5 for thicknesses ≥ 3 mm

alform®	Yield strength R_{eH} [MPa]	Tensile strength R_m [MPa]	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 [2]	≥ 650	700 – 850	12	15
700 M [2]	≥ 700	750 – 930	11	14

[2] The yield strength may be lower by 20 MPa for thicknesses > 8 mm.

Mechanical properties: Notch impact energy, edging radii, bending mandrel diameter

alform®	Notch impact energy [3] A_v [Joule] M Test temperature -20 °C	Notch impact energy [3] A_v [Joule] ME Test temperature -40 °C [5]	Edging radii [4] Ri min. at 90° edging s < 3 mm	Edging radii [4] Ri min. at 90° edging s 3-6 mm	Edging radii [4] Ri min. at 90° edging s > 6 mm	Bending mandrel diameter BgD min. (transverse test specimens) Sheet thickness = s
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	0.8 s	1.2 s	1.6 s	1.0 s
550 M (ME)	40	27	0.8 s	1.2 s	1.6 s	1.5 s
600 M (ME)	40	27	0.8 s	1.2 s	1.6 s	1.5 s
650 M (ME)	40	27	0.8 s	1.2 s	1.6 s	1.5 s
700 M (ME)	40	27	0.8 s	1.2 s	1.6 s	1.5 s

[3] A_v minimum mean value from three samples (ISO-V, longitudinal) as related to full-size specimen (10 x 10 mm).
[4] Smallest permissible inside radius at 90° edging, Ri min
[5] Values at -40 °C are guaranteed for limited dimension ranges and material is labeled **ME** upon request.

Notch impact energy can be measured from a plate thickness ≥ 3 mm upon request.
Note: Notch impact energy tests in thicknesses < 6 mm do not conform with applicable Euronorm standards.

Dimensions

Examples of maximum width per thickness

alform®	Thickness [mm] 2.0	2.5	3.0	3.5	4.0	6.0	12.0	15.0
280 M	1620	1620	1620	1620	1620	1620	1620	1620
315 M	1620	1620	1620	1620	1620	1620	1620	1620
340 M	1620	1620	1620	1620	1620	1620	1620	1620
355 M	1500	1620	1620	1620	1620	1620	1620	1620
380 M	1500	1620	1620	1620	1620	1620	1620	1620
420 M	1360	1620	1620	1620	1620	1620	1620	1620
460 M	1360	1620	1620	1620	1620	1620	1620	1620
500 M	1280	1480	1620	1620	1620	1620	1620	1500
550 M	1280	1480	1620	1620	1620	1620	1620	1500
600 M	1250	1380	1500	1620	1620	1620	1620	1500
650 M	1250	1380	1500	1620	1620	1620 [6)]	1620 [6)]	1500
700 M	1250	1380	1500	1620	1620	1620 [6)]	1620 [6)]	1500

[6)] Available only as cut sheets in unpickled condition.

Additional dimensions upon request.
Depending on the dimensions and strength, we also supply pickled, oiled and trimmed

Steel strip		Slit steel strip		Cut sheets		Cut shapes
Width:	900 - 1620 (1750) mm	Thickness:	bis 8 mm	Thickness:	up to 20 mm	Upon request
Weight/Width:	18 - 20 kg/mm	Strip widths:	beginning at 30 mm	Length:	up to 12 m (18 m)	

Please find further information and downloadable files at the following link:
www.voestalpine.com/alform

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