



## Mars<sup>®</sup> 380: Rolled Homogeneous Armor for ballistic protection & evaluation of armor-defeating ammunition

Mars<sup>®</sup> 380 is a protection steel (typical 380 HBW) designed for all vehicle structures (main battle tanks, armoured personal carriers ...) and for ammunition testing targets.

Mars<sup>®</sup> 380 steel is highly versatile, combining ease of use even in important thicknesses, with good ballistic properties against all ammunitions.

### PROPERTIES

#### STANDARDS

Mars<sup>®</sup> 380 can be ordered according to one of the following standards:

- > NF A36-800 CLA
- > MIL-DTL-12560 class 1 & 3

Or upon specific agreement according to DEF-STAN 95-13 type 1 & type 2 (with specific analysis and heat treatment)

#### CHEMICAL COMPOSITION - LADLE ANALYSIS - MAX WEIGHT%

C	S	P	Si	Mn	Ni	Cr	Mo	V	B	CE 1)
0.30	0.002	0.012	0.4	1.2	1.8	1.5	0.6	0.10	0.003	0.85

1) Carbon equivalence per ASTM A6/A6M, i.e. :  $CE = C + [Mn/6] + [(Cr + Mo + V)/5] + [(Ni + Cu)/15]$

For thicknesses > 150 mm, analysis is modified with higher Ni & Cr content.

#### MECHANICAL PROPERTIES (IN BOTH DIRECTIONS)

Below figures from MIL-DTL-12560, for information purpose only. Mechanical properties are adjusted to specified requirements (standard or on-demand).

Epaisseur mm	Dureté HBW	Charpy KV 2) @-40 °C standard 10 x 10 specimen 3)	
		J	ft.lbs
≤6,32	360-410	≥22	≥16
6,33 to ≤15,85	340-390	≥22	≥16
15,86 to ≤ 28,58	330-380	≥22	≥ 16
28,59 to ≤ 50,77	310-360	≥24	≥ 18
50,78 to ≤ 101,57	270-320	≥38	≥ 28
101,58 to ≤152,4	250-300	≥49	≥ 36
152,41 to ≤228,6	230-280	≥62	≥ 46
228,61 to ≤304,8	210-260	≥76	≥ 56

2) Average of 3 tests. Single value min 70% of specified average.

3) For nominal thicknesses under 11mm, sub-size specimens are used. The specified minimum value is then proportional to the specimen cross section. Brinell hardness test according to relevant standard (EN ISO 6506-1 / ASTM E10/E110), on each plate and in two places, one at each end of a diagonal, on a milled surface 0,5 to 1mm below plate surface.

Charpy Impact test according to relevant standard (EN ISO 148-1 / ASTM E23) on each heat and thickness from 6mm.

Tensile test according to EN ISO 6892-1, method B on each heat and thickness when specified in the standard or order.

Ultrasonic test is performed according to standard requirements or upon special agreement up to EN 10160 Class S3/E4 .

## IN SERVICE CONDITIONS

### BALLISTIC PROPERTIES

Mars® 380 meets the ballistic performance requirements of MIL-DTL-12560 for class 1 & 3 materials and NF A36-800 for CLA.

See our table of recommended minimum thicknesses for common protection levels.

Ballistic test to be performed upon request.

### PLATE PROCESSING

For all information concerning machining, cutting, forming or welding, see our userguide for Mars® protection steels.

## DELIVERY CONDITIONS

### HEAT TREATMENT

Mars® 380 is quenched and tempered at high temperature ( $\geq 500^{\circ}\text{C}$ ).

### SURFACE PROPERTIES

According to MIL-DTL-12560 or EN 10163 class B - subclass 3

Shot blasting and weldable primer application can be performed upon request

### SIZES AND TOLERANCES

Mars® 380 can be supplied as quarto plates or cut-to-length sheets (from hot strip mill) **in standard sizes or tailor made dimensions.**

	Quarto plates			Cut-to-length sheets
<b>Thicknesses</b>	5 – 304.8 mm (.197" – 12") <sup>4)</sup>			5 – 10.0 mm (.197" – .393")
<b>Thickness Tolerances</b>	Th	For width $\leq 2000\text{mm}$	For width $\leq 2400\text{mm}$	
	$\geq 5$ to $\leq 12$	0/+0.8	0/+0.8	$\geq 5$ to $\leq 8.5$ : -0/+0.4
	$>12$ to $20$	0/+1.0	0/+1.2	$> 8.5$ to $\leq 10.0$ : -0/+0.5
	$>20$ to $35$	0/+1.2	0/+1.4	
	$>35$ to $50.8$	0/+1.6	0/+1.8	
	$>50.8$ to $80$	0/+2.0	0/+2.2	
$>80$ to $152.4$	0/+2.2	0/+2.4		
<b>Width*</b>	1000 – 3500 mm (39" – 137")			1000 – 2000 mm (39" – 78")
<b>Length</b>	1600 – 8100 mm (63" – 319")			1800 – 8100 mm (71" – 319")
Shape, length, and width tolerances as per MIL-DTL-12560 or EN 10029				

4) Upon special agreement, thicknesses  $>304.8$  mm (12") and up to 406.4 mm (16") can be produced.

\* Depending on plate thickness

### FLATNESS

Maximum flatness deviation is 3mm/m when measured according to EN 10029.

## YOUR CONTACT

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Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research programme on protection steels. Therefore, we suggest that information be verified at time of enquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company. Further information may be obtained from the address opposite.