

## Ympress® S960MC

### Exceptional strength for lightweighting

Ympress S960MC is a hot-rolled, high-strength low-alloy steel developed by Tata Steel. This steel grade is ideal for applications where high strength is essential. These include loader crane booms, earthmoving equipment and truck trailers.

Ympress S960MC combines high strength with outstanding formability and consistent quality. It delivers improved weldability and excellent surface quality compared to a reverse mill plate product. Consistent product properties and reliable material thickness allow trouble-free,

repeatable processing. Ympress S960MC has specifically been designed for thermal cutting processes including laser- and (micro) plasma cutting methods.

This hot-rolled steel delivers improved load-bearing capacity without weight penalties due to its high yield strength. Its strength also enables production of lighter components for applications where weight savings are a prime consideration. Downgauging offers an additional benefit of increased yield per ton of steel.

#### Mechanical properties

The values shown for the mechanical properties apply to test samples parallel to the rolling direction.

Direction	Min. yield strength	Min. tensile strength	Min elongation after fracture A <sub>5</sub>
	R <sub>eh</sub> (N/mm <sup>2</sup> ) <sup>1</sup>	R <sub>m</sub> (N/mm <sup>2</sup> )	%
Longitudinal	960	1010-1250	8

<sup>1</sup> If R<sub>eh</sub> is not applicable then R<sub>p0.2</sub> is used.

#### Chemical composition

The following table represents the targeted composition for Ympress S960MC.

Grade	C	Mn	P	S	Si	Al <sub>sol</sub>	Nb	V	Ti	Mo	B	Ni	Cr
Ympress S960MC	≤ 0.12	≤ 1.8	≤ 0.02	≤ 0.003	≤ 0.15	≥ 0.015	≤ 0.05	≤ 0.15	≤ 0.05	≤ 0.5	≤ 0.005	≤ 0.1	≤ 0.6

All values are in weight%

#### Weldability

Ympress S960MC can be welded with all conventional welding processes. The weldability of the material is fairly good due to the relatively low carbon equivalent (typical CEV of 0.53) and low content of residual elements. The equivalent carbon content is used to understand how the different alloying elements affect hardness and weldability of the steel. The most commonly used carbon equivalents are calculated here (in weight%):

CEV	CEV	CET	Pcm
typical	max.	max.	max.
0.53	0.59	0.34	0.27

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

CET = C+ (Mn+Mo)/10 + (Cr+Cu)/20 + Ni/40

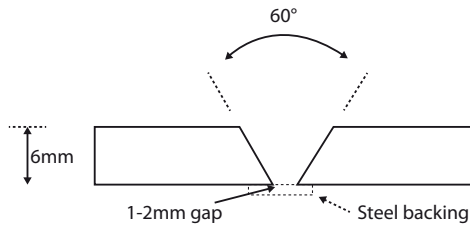
Pcm = C+Si/30+(Mn+Cu+Cr)/20+Ni/60+Mo/15+V/10+5B

To achieve a minimal 980 N/mm<sup>2</sup> cross-weld tensile strength, Tata Steel advises that heat input is kept below 0.7 kJ/mm for thickness 4-8mm and below 1.1 kJ/mm for 9-10mm.

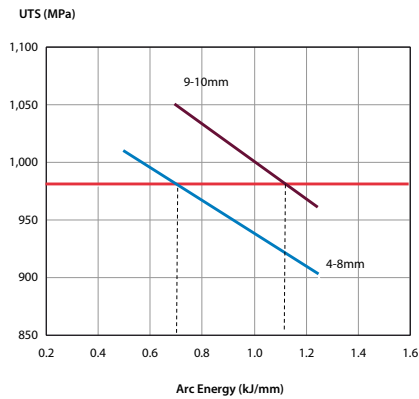
	Thickness	
	4 < t ≤ 8mm	9 < t ≤ 10mm
Arc Energy kJ/mm	0.7	1.1

Charpy test results at weld fusion line are consistently meeting minimum required energy of 40J in longitudinal direction. Matching weld wire is available.

## Weldability (continued)



R&D Weld test setup: Nil pre-heat, max interpass temperature 20°C. Union X96 wire (1.0mm), M21 gas 80/20

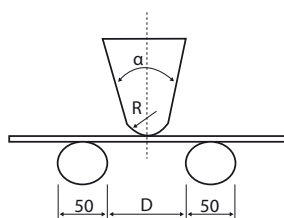


Plot of UTS vs Arc energy resulting in recommended heat input

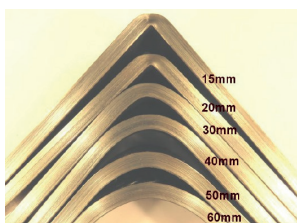
## Bendability

Direction	Min. inner bend radius	
	$4 < t \leq 8\text{mm}$	$8 < t \leq 10\text{mm}$
Transverse	3t	4t

A repeatable bending performance is realised through consistent product properties and material thickness. The 90° bend test is performed with polished edges with the bend line parallel to the rolling direction. For a thickness range of 4-8mm a 3t minimum inner bend ability is confirmed, with the bend line parallel to the rolling direction. Above this range, we guarantee a 4t bend performance.



R&D bend test setup  
 $D=2R+3t \pm (1/2t)$ ,  $R=7.5-40\text{mm}$ ,  
 $\alpha = \text{max } 45^\circ$ , aim bend angle is  $90^\circ$ .  
 Specimen size is 200x40x6 mm

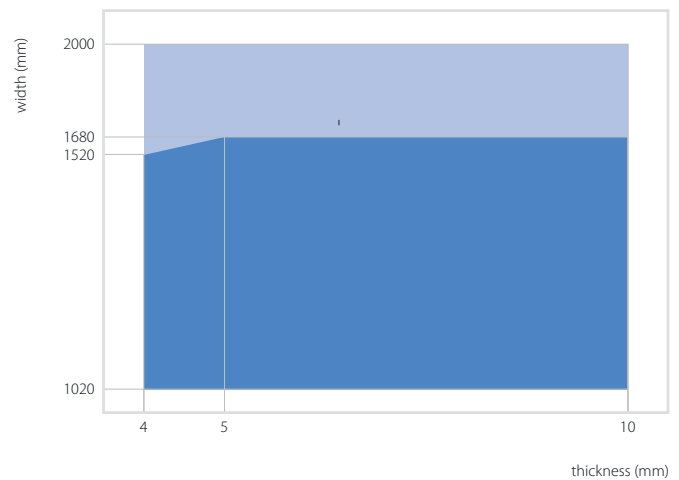


Bend samples for 6mm thickness resulting in guaranteed minimum inner bend radius

## Impact strength

Direction	Thickness	Temperature	Guaranteed
Longitudinal	6-10mm	-40°C	$\geq 27\text{J}$
Transverse	6-10mm	-40°C	$\geq 27\text{J}$

## Target dimensions



- available
- on request

Other dimensions are under development. Please enquire if you need material in dimensions outside the window that is currently available.

## Tolerances on thickness

Tolerances for strip comply with 1/2 EN 10051. Tighter tolerances are available - please contact us. Tolerances provided in the table are based on nominal thickness.

Nominal thickness (1/2 EN)	Tolerances for a nominal width of				
	$\leq 1200$	$>1200$ $\leq 1500$	$>1500$ $\leq 1800$	$>1800$	
$> 4.00$	$\leq 5.00$	$\pm 0.17$	$\pm 0.18$	$\pm 0.20$	$\pm 0.21$
$> 5.00$	$\leq 6.00$	$\pm 0.18$	$\pm 0.20$	$\pm 0.21$	$\pm 0.22$
$> 6.00$	$\leq 8.00$	$\pm 0.21$	$\pm 0.21$	$\pm 0.22$	$\pm 0.25$
$> 8.00$	$\leq 10.00$	$\pm 0.26$	$\pm 0.23$	$\pm 0.24$	$\pm 0.28$

## Product support

We want you to get the best from Ympress® products. Our technical support staff and trained sales force are always happy to answer your questions on steel selection and application. Our technical specialists are available to assist you with process and product design optimisation for improved throughput, yield and end product performance.

[www.tatasteeleurope.com](http://www.tatasteeleurope.com)

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