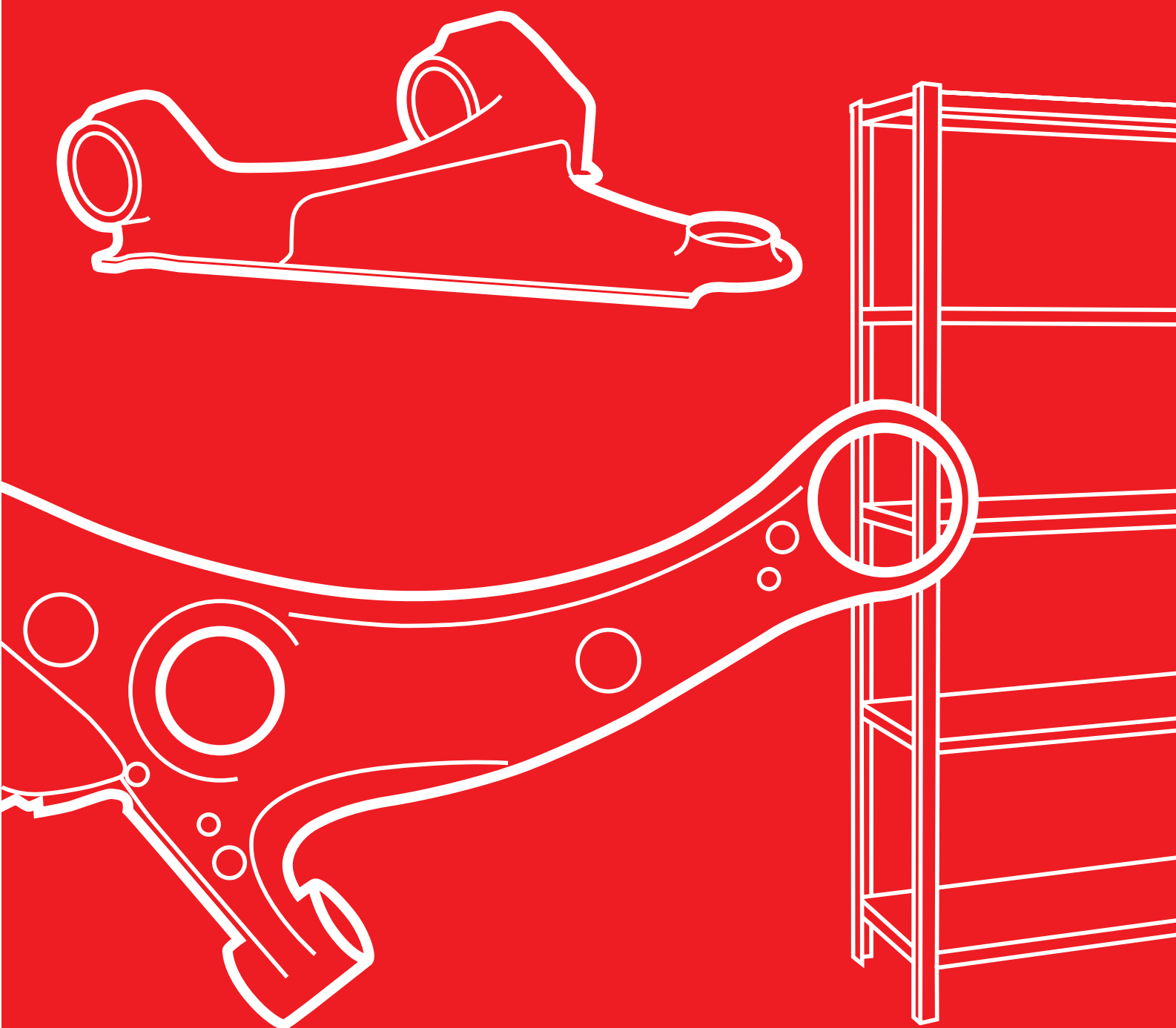


Corus Strip Products UK

# Tenform XF350

Hot-rolled high-strength low-alloy steel



# General

## Description

Tenform XF350 is hot-rolled high-strength low-alloy steel with enhanced properties for forming and welding. It has been specially developed to combine high strength with good formability.

## Applications

- Automotive chassis and underbody components
- Warehouse shelving
- Building and construction

## Benefits

The high strength of Tenform XF350 allows the user to increase the strength of the finished component or to reduce the steel thickness, or both. This property means that the output from each tonne of steel can be increased. Products can be made stronger, lighter and safer under load.

## Standard and grade

EN 10149-2 : 1996, S355MC.

# Basic properties

## Mechanical properties

Table 1: Mechanical properties					
Grade	R <sub>eL</sub> (N/mm <sup>2</sup> )	R <sub>m</sub> (N/mm <sup>2</sup> )	A <sub>80</sub> (%) <small>(note 1)</small>	Bend test mandrel diameter <small>(note 2)</small>	Hole expansion (%) <small>(note 3)</small>
XF350	≥350	≥430	≥23	≥0.5t	–
S355MC	≥355	430-550	≥19	≥0.5t	–
Typical properties					
XF350 (2-3mm thick)	393	469	27		60

### Notes:

1. The index of elongation indicates the original gauge length used, expressed in millimetres, e.g. A<sub>80</sub> indicates an 80mm gauge length.
2. Material thickness, t, is in millimetres.
3. A 12mm diameter hole is expanded using a 50mm diameter flat-nosed punch. The test is stopped when a visible crack is observed on the circumference of the hole.  
Hole expansion ratio=(D<sub>f</sub>-D<sub>i</sub>/D<sub>i</sub>) x 100  
Where D<sub>f</sub>=final hole diameter and D<sub>i</sub>=initial hole diameter.
4. The values shown in this table are for test pieces taken in the rolling direction.

## Chemical composition

Table 2: Chemical composition							
Grade	C	Mn	Si	P	S	Al	Nb
XF350	≤0.10	≤1.20	≤0.04	≤0.025	≤0.01	≥0.02	≤0.3

Note: Values are in weight percentages.

## Dimensions

Table 3: Dimensions			
Mill finish			
Thickness		Width	
>	≤	Min	Max
1.50	1.60	710	1100
1.60	1.90	710	1250
1.90	2.20	710	1300
2.20	2.40	710	1375
2.40	2.80	710	1550
2.80	6.00	710	1600
6.00	6.30	710	1550
6.30	8.00	710	1500
Pickled			
1.50	1.60	735	1100
1.60	1.90	735	1250
1.90	2.20	735	1300
2.20	2.40	735	1350
2.40	3.00	735	1525
3.00	5.00	735	1550

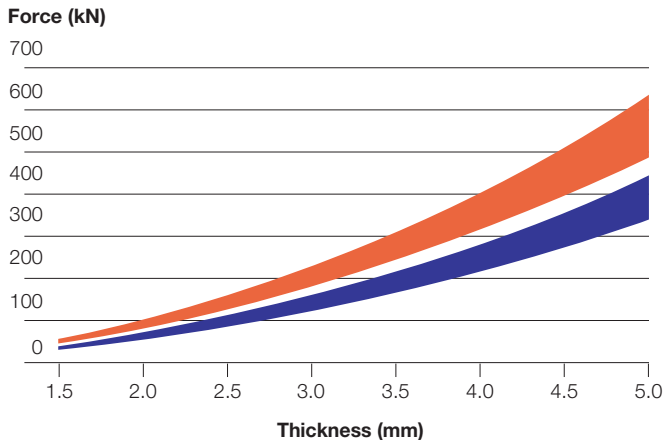
### Notes:

1. Widths refer to mill edge. A side-trimmed product is available in the pickled condition only.
2. For dimensions outside the ranges shown, consult Corus.
3. Dimensions are in millimetres.

# Advanced properties

## Blanking performance

Figure 1: Limits of theoretical shearing force



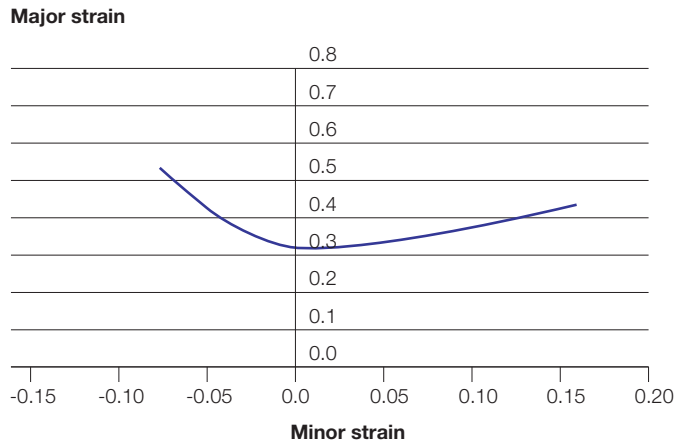
**Key**

- Tenform XF350
- DD14

Note: Calculated from 2003 plant data (knife angle 0.5°).

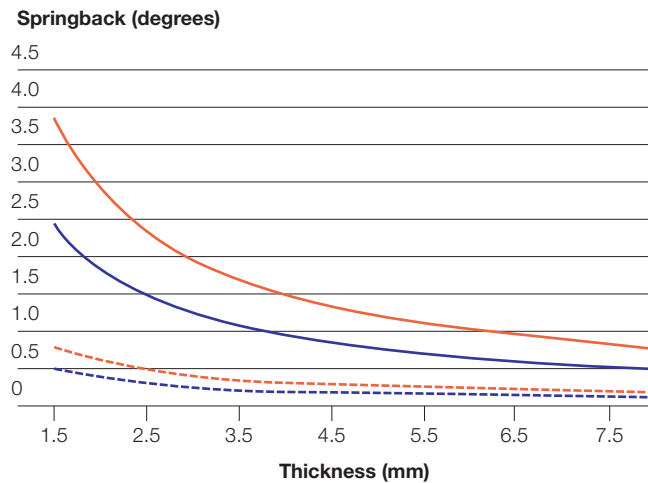
## Formability

Figure 2: Forming limit curve for 2.0mm Tenform XF350



## Springback

Figure 3: Comparison of theoretical springback for a bending angle of 90°

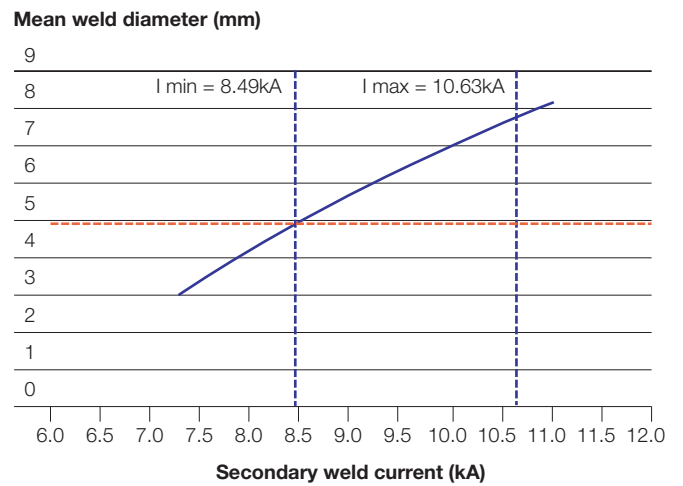


**Key**

- 10mm bend radius:
  - Tenform XF350
  - DD14
- 2mm bend radius:
  - - - Tenform XF350
  - - - DD14

## Spot welding

Figure 4: Weld growth curve for 2.0mm Tenform XF350



**Key**

- Tenform XF350
- - - Welding range,  $3.5\sqrt{t}$  to splash=2.14kA
- - -  $D_{min}=3.5\sqrt{t}=4.95\text{mm}$

Note: The curve is calculated on the basis of ISO 14373.

**Table 4: Mechanical properties of the spot weld in figure 4**

Grade	General			Lap shear	Cross tension		
	Thickness	Welding range 3.5√t-splash	Max weld size	Failure strength 5√t	Failure mode	Failure strength 5√t	Failure mode
	(mm)	(kA)	(mm)	(kN)		(kN)	
XF350	2.0	2.14	7.75	17.94	Face	14.61	Plug

**Note:**

1. Single spot-welded samples were used for the lap shear and cross-tension tests.
2. Material thickness, t, is in millimetres.

### High strain rate properties

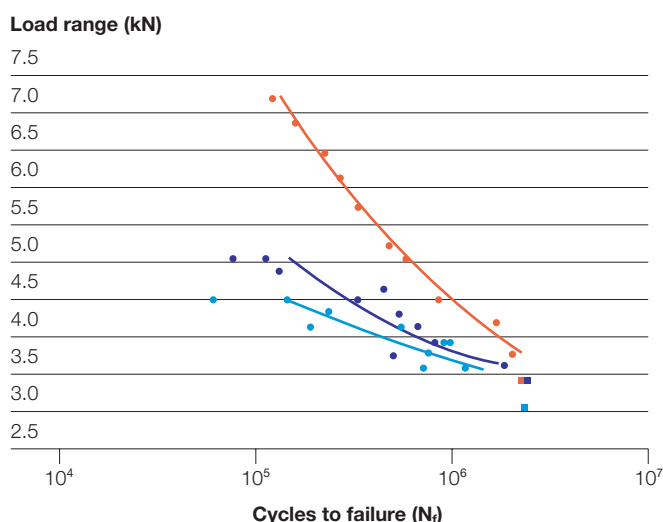
**Table 5: Strain rate values: 2.0mm Tenform XF350**

Strain rate	R <sub>p0.2</sub>	R <sub>m</sub> (max)
(1/s)	(N/mm <sup>2</sup> )	(N/mm <sup>2</sup> )
0.001	394	575
100	530	679

**Notes:** Strain rate values were calculated using Bergström law.

### Fatigue

**Figure 5: Weld fatigue curves for Tenform XF350**



**Key**

Data point Tenform XF350:

- 3.5√t
- 4√t
- 5√t

Runout curve Tenform XF350:

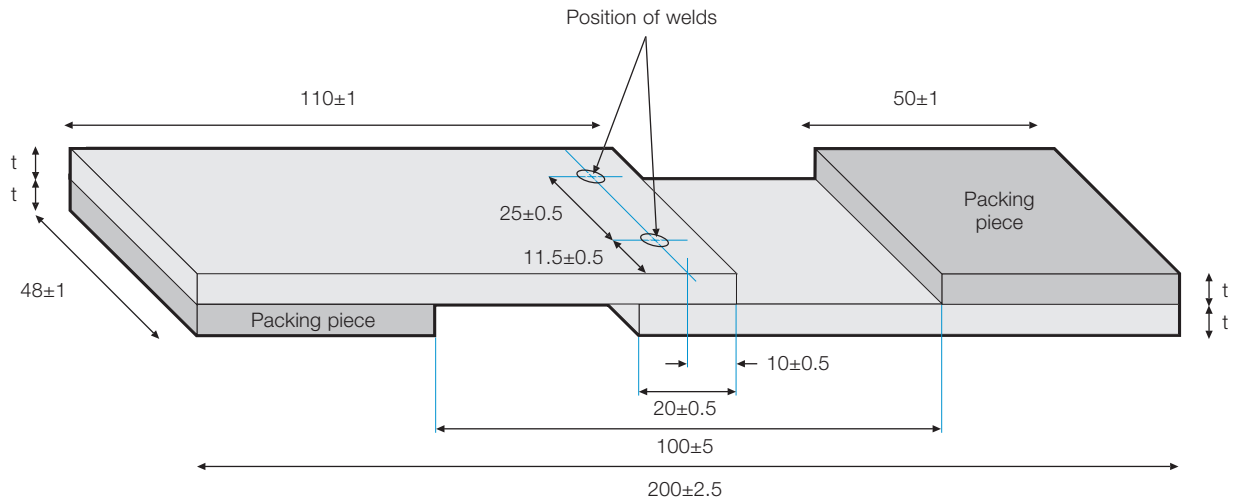
- 3.5√t
- 4√t
- 5√t

Fitted Tenform XF350:

- 3.5√t:  $\Delta F = 13.82x^{-0.0953}$
- 4√t:  $\Delta F = 24.93x^{-0.1359}$
- 5√t:  $\Delta F = 110.85x^{-0.2333}$

**Note:** Curves were determined using uniaxial high-cycle fatigue testing on single spot-welded samples with a ratio of maximum load to minimum load (R value) of 0.1. The dimensions of the fatigue samples are shown in figure 6.

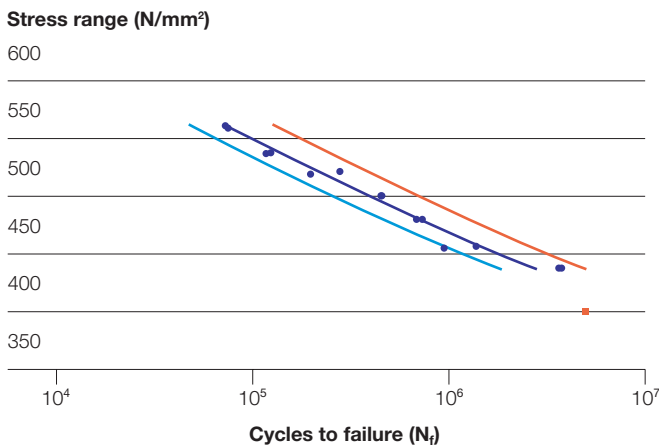
**Figure 6: Dimensions of samples used for SN spot-weld fatigue curves**



**Notes:**

1. 't' is material thickness.
2. Dimensions are in millimetres.

**Figure 7: SN fatigue curves for Tenform XF350**



**Key**

- Data point Tenform XF350
- Runout Tenform XF350

- Fitted curve:  $\Delta\sigma = 1162.75x^{-0.0652}$
- 1% certainty of survival:  $\Delta\sigma (1\%) = 1195.93x^{-0.0652}$
- 99% certainty of survival:  $\Delta\sigma (99\%) = 1130.5x^{-0.0652}$

**Note:** Curves were determined using uniaxial high-cycle fatigue testing with a ratio of maximum load to minimum load (R value) of -1.

**Health and safety**

Tenform XF350 is covered by *Product health and safety data sheet no. 2*.

**More information**

For more information about this product, contact Corus at the address on the back cover.

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# www.corusgroup.com

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