

Tenform high-strength low-alloy steel

Tenform is hot-rolled high-strength steel with enhanced properties for forming and welding. It has been specially developed to combine high strength with good formability. The products in this section are Tenform XK and Tenform XF (reduced level of sulphur).

Typical applications

- longitudinal members for chassis parts
- wheels
- seats
- airbag parts
- headrests
- safety belts
- clutch plates
- carriages for conventional and high-speed trains
- bridge construction
- light towers
- building and construction
- warehouse shelving
- silos and containers
- earth moving and agricultural machines

Standards

The nearest equivalent European specifications to Tenform products are given in table 13 below. Corus also offers steels to the exact specification shown in EN 10149-2 : 1996.

Mechanical properties

The values shown for strength and elongation in tables 14 and 15 on page 11 are for test pieces taken in the rolling direction; those for the bend test are for test pieces taken transverse to the rolling direction.

Chemical composition

Table 16 on page 11 shows the chemical composition of Tenform steels. Table 17 on page 12 shows the chemical composition of high-strength low-alloy steels to EN 10149-2 : 1996.

Dimensions

The width and thickness limits for Tenform are shown in tables 18 and 19 on page 12, and those for steel to EN 10149-2 : 1996 in tables 20 and 21 on pages 13 and 14.

Table 13: Standards: Tenform XK/XF

Corus	European	National		
	EN 10149-2 : 1996	UK	France	Germany
Grade		BS 1449	NFA 36-231	SEW 092
XK300	S315MC	HR40/30	E 315 D	QStE340TM
XK350	S355MC	HR43/35	E 355 D	QStE380TM
XK400	S420MC	HR46/40	E 420 D	QStE420TM
XK450	S460MC	HR50/45	–	QStE460TM
XF300	S315MC	HR40F30	E 315 D	–
XF350	S355MC	HR43F35	E 355 D	–
XF400	–	HR46F40	–	–
XF420	S420MC	–	E 420 D	QStE420TM
XF450	–	HR50F45	–	–
XF460	S460MC	–	–	QStE460TM
XF500	S500MC	–	E490 D	QStE500TM
XF550	S550MC	–	–	QStE550TM

Table 14: Mechanical properties: Tenform XK/XF

Grade	R_{eL} (N/mm ²)	R_m (N/mm ²)	A (%)	Bend test mandrel diameter
	Min	Min	Min	Min
			$L_0 = 80\text{mm}$	
XK300	300	400	24	2t
XK350	350	430	21	2t
XK400	400	460	18	3t
XK450	450	500	18	3t
XF300	300	400	26	0t
XF350	350	430	23	0.5t
XF400	400	460	20	0.5t
XF420	420	480	20	0.5t
XF450	450	500	20	1t
XF460	460	520	18	1t
XF500	500	550	18	1t
XF550	550	600	12	1t

Note: Material thickness, t, is in millimetres.

Table 15: Mechanical properties: EN 10149-2 : 1996

Grade	R_{eL} (N/mm ²)	R_m (N/mm ²)	A (%)	Bend test mandrel diameter	
	Min	Min-max	Min		Min
			$L_0 = 80\text{mm}$	$L_0 = 5.65\sqrt{S_0}$	
			$t < 3$	$t \geq 3$	
S315MC	315	390-510	20	24	0t
S355MC	355	430-550	19	23	0.5t
S420MC	420	480-620	16	19	0.5t
S460MC	460	520-670	14	17	1t
S500MC	500	550-700	12	14	1t
S550MC	550	600-760	12	14	1.5t

Note: Material thickness, t, is in millimetres.

Table 16: Chemical composition: Tenform XK/XF

Grade	C	Mn	P	S	Si	Micro-alloying elements (e.g. Nb)
	Max	Max	Max	Max	Max	Max
XK300/350/400/450	0.10	1.20	0.030	0.020	0.04	0.300
XF300/350/400/420/450/460	0.10	1.20	0.025	0.010	0.04	0.300
XF500	0.10	1.50	0.025	0.010	0.35	0.300
XF550	0.12	1.50	0.020	0.020	0.30	0.300

Note: Values are in weight percentages.

Table 17: Chemical composition: EN 10149-2 : 1996

Grade	C	Mn	P	S	Si	Al-total	V
	Max	Max	Max	Max	Max	Min	Max
S315MC	0.12	1.30	0.025	0.020	0.50	0.015	0.20
S355MC	0.12	1.50	0.025	0.020	0.50	0.015	0.20
S420MC	0.12	1.60	0.025	0.015	0.50	0.015	0.20
S460MC	0.12	1.60	0.025	0.015	0.50	0.015	0.20
S500MC	0.12	1.70	0.025	0.015	0.50	0.015	0.20
S550MC	0.12	1.80	0.025	0.015	0.50	0.015	0.20

Note: Values are in weight percentages.

Table 18: Dimensions: Tenform XK/XF Mill finish

Thickness		Width				
		Min	Max			
>	≤		XK/XF300	XK/XF350 XK/XF400	XF420 XK/XF450 XF460, XF500	XF550
1.50	1.60	710	1250	1100	1100	–
1.60	1.90	710	1425	1250	1250	–
1.90	2.10	710	1525	1300	1300	–
2.10	2.20	710	1600	1300	1300	–
2.20	2.40	710	1600	1375	1375	–
2.40	2.70	710	1700	1550	1550	–
2.70	2.80	710	1830	1550	1550	1275
2.80	6.00	710	1830	1600	1550	1275
6.00	6.30	710	1830	1550	1550	1275
6.30	7.00	710	1830	1500	1500	1275
7.00	8.00	710	1550	1500	1500	1275
8.00	9.50	710	1550	–	–	–
9.50	11.00	710	1400	–	–	–
11.00	12.70	710	1375	–	–	–

Note: Dimensions are in millimetres.

Table 19: Dimensions: Tenform XK/XF Pickled

Thickness		Width				
		Min	Max			
>	≤		XK/XF300	XK/XF350 XK/XF400	XF420 XK/XF450 XF460, XF500	XF550
1.50	1.60	735	1250	1100	1100	–
1.60	1.90	735	1425	1250	1250	–
1.90	2.10	735	1525	1300	1300	–
2.10	2.20	735	1550	1300	1300	–
2.20	2.40	735	1550	1350	1350	–
2.40	2.70	735	1550	1550	1550	–
2.70	5.00	735	1550	1550	1550	1275

Note: Dimensions are in millimetres.

Table 20: Dimensions: EN 10149-2 : 1996 Mill finish

Thickness		Width						
		Min	Max					
>	≤		S315MC	S355MC	S420MC	S460MC	S500MC	S550MC
1.50	1.53	700	1180	1100	1100	–	–	–
1.53	1.57	700	1210	1100	1100	–	–	–
1.57	1.60	700	1250	1117	1100	–	–	–
1.60	1.70	700	1280	1250	1250	–	–	–
1.70	1.80	700	1367	1255	1250	910	–	–
1.80	1.90	700 ¹	1442	1330	1250	1150	1150	1150
1.90	2.00	700 ¹	1517	1405	1300	1250	1250	1250
2.00	2.20	700 ¹	1592	1480	1300	1250	1250	1250
2.20	2.40	700	1730	1607	1401	1300	1250	1250
2.40	2.60	700	1806	1734	1550	1420	1350	1350
2.60	2.80	700	1882	1789	1646	1550	1550	1550
2.80	3.00	700	1958	1844	1722	1660	1550	1550
3.00	3.20	700	2034	1900	1754	1716	1555	1550
3.20	3.50	700	2070	1955	1785	1744	1675	1550
3.50	3.65	700	2070	2038	1833	1786	1716	1630
3.65	4.00	700	2070	2070	1856	1807	1736	1678
4.00	4.40	700	2070	2070	1856	1807	1736	1726
4.40	5.00	700	2070	2070	2070	1840	1780	1780
5.00	5.60	700	2070	2070	2070	1923	1862	1862
5.60	6.00	700	2070	2070	2070	2005	1943	1943
6.00	6.16	700	2070	2070	2070	2061	1998	–
6.16	6.60	700	2070	2070	2070	2070	2019	–
6.60	10.00	700	2070	2070	2070	2070	2070	–
10.00	12.70	700	2070	2070	2070	2070	–	–

Notes:

1. For thicknesses from 1.80mm to 2.20mm, in S500MC and S550MC, the minimum width is 810mm.
2. Dimensions are in millimetres.

Table 21: Dimensions: EN 10149-2 : 1996 Pickled

Thickness		Width							
		Min	Max	S315MC	S355MC	S420MC	S460MC	S500MC	S550MC
>	≤								
1.50	1.53	735	1180	1100	1100	–	–	–	–
1.53	1.57	735	1210	1100	1100	–	–	–	–
1.57	1.60	735	1250	1117	1100	–	–	–	–
1.60	1.70	735	1280	1250	1250	–	–	–	–
1.70	1.80	735	1367	1255	1250	910	–	–	–
1.80	1.90	735 ¹	1442	1330	1250	1150	1150	1150	1150
1.90	2.00	735 ¹	1517	1405	1300	1250	1250	1250	1250
2.00	2.20	735 ¹	1592	1480	1300	1250	1250	1250	1250
2.20	2.40	735	1730	1607	1401	1300	1250	1250	1250
2.40	2.60	735	1806	1734	1550	1550	1350	1350	1350
2.60	2.80	735	1882	1789	1646	1550	1550	1550	1550
2.80	3.00	735	1958	1844	1722	1660	1550	1550	1550
3.00	3.20	735	2034	1900	1754	1716	1555	1550	1550
3.20	3.47	735	2070	1955	1785	1744	1675	1550	1550
3.47	3.65	735	2070	1972	1833	1786	1786	1630	1630
3.65	4.00	735	2070	1800	1800	1800	1800	1678	1678
4.00	4.40	735	2070	1636	1636	1636	1636	1636	1636
4.40	4.83	735	2070	1490	1490	1490	1490	1490	1490
4.83	5.00	735	2000	1440	1440	1440	1440	1440	1440
5.00	5.25	750	1904	1371	1371	1371	1371	1371	1371
5.25	5.50	750	1818	1309	1309	1309	1309	1309	1309
5.50	5.80	750	1724	–	–	–	–	–	–
5.80	6.00	750	1574	–	–	–	–	–	–

Notes:

1. For thicknesses from 1.80mm to 2.20mm, in S500MC and S550MC, the minimum width is 810mm.
2. Dimensions are in millimetres.