Memory-Metalle GmbH

INFO SHEET No. 10

Surface Strains in Wire, Ribbon and Sheet

Outer Fiber Strain	Ratio of Bend Diameter to Wire Diam./Thickness	Ratio of Bend Radius to Wire Diam./Thickness
1%	100.0 to 1	50.0 to 1
2%	48.9 to 1	24.4 to 1
3%	32.2 to 1	16.1 to 1
4%	23.9 to 1	11.9 to 1
5%	18.9 to 1	9.44 to 1
6%	15.5 to 1	7.74 to 1
7%	13.1 to 1	6.56 to 1
8%	11.3 to 1	5.64 to 1
9%	10.0 to 1	5.00 to 1
10%	8.83 to 1	4.41 to 1
20%	3.95 to 1	1.97 to 1
30%	2.33 to 1	1.16 to 1
40%	1.49 to 1	0.74 to 1
50%	0.99 to 1	0.50 to 1
60%	0.65 to 1	0.33 to 1
70%	0.42 to 1	0.21 to 1
80%	0.25 to 1	0.13 to 1

To use these numbers, divide the bend diameter by the wire diameter in question. Find the closest value in the middle column and read the corresponding value in the first column. For example, for a 1 mm diameter wire being bent around a rod with a diameter of 10 mm, the ratio of bend diameter to wire diameter is 10 to 1, which represents approximately 9% strain on the surface of the wire. In simple bending, this strain will be in tension along the outer surface of the wire and in compression on the inner surface of the wire. The interior of the wire will see smaller strain magnitudes with strain of approximately 0% near the midline of the wire (neutral axis).

The maximum recoverable strain limit for both superelastic and shape memory NiTi is about 6 to 8%. However, 3 to 4% is the recommended limit for product design. The ductility of NiTi wire which has been cold worked and heat treated is typically 10 to 20% in tension. Fully annealed NiTi wire has a ductility limit of about 60 to 70%.

Note: The numbers in the above table are approximate values based on general beam theory calculations for all materials. They have not been specifically calculated for NiTi alloys.