

WIRE

DATA SHEET ZAPP X750



ZAPP IS CERTIFIED ACCORDING TO ISO 9001

Zapp X750 is an austenitic precipitation hardening nickel alloy with good spring properties up to 600 °C (1110 °F) and good resistance to gas corrosion at high temperature. The maximum service temperature is dependent on as-delivered condition and heat treatment.

STANDARDS
_ UNS: N07750

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P	S	Cr	Ni	Mo
≤ 0.030	0.3	0.5	≤ 0.015	≤ 0.015	16.0	72.0	-

FORMS OF SUPPLY

Surface finish	Dimension, mm
Annealed	0.10 - 5.00
Soft-drawn, bright surface	0.10 - 5.00
Hard-drawn, bright surface	0.10 - 5.00
Hard-drawn, coated surface	0.40 - 5.00

DELIVERY FORMS

Standard delivery forms are:

- _ Coils with weight up to 150 kg
- _ Spools of various types with wire weight up to 1,000 kg
- _ Compact coils with weight up to 1,200 kg
- _ Straightened lengths up to 4 m

MECHANICAL PROPERTIES

Tensile strength at 20 °C in delivered condition

	Nominal tensile strength	Nominal proof strength R _{p0.2}	Elastic modulus, E	Shear modulus, G	Elongation %
	MPa	MPa	MPa	MPa	A ₅₀
Annealed	800	400	193,000	74,000	35
Soft drawn, final reduction 15 % (No 1 temper)	1,000	800	193,000	74,000	20
Hard drawn, final reduction 65 % (Spring temper)	1,600	1,500	180,000	70,000	2

Tensile strength at 20 °C after heat treatment

	Nominal tensile strength	Nominal proof strength, R _{p0.2}	Elastic modulus, E	Shear modulus, G
	MPa	MPa	MPa	MPa
Annealed	1,200	800	216,000	83,000
Soft drawn, final reduction 15 % (No 1 temper)	1,350	1,150	220,000	85,000
Hard drawn, final reduction 65 % (Spring temper)	1,100	650	212,000	81,500
Hard drawn, final Reduction 65 % (Spring temper)	1,850	1,750	211,000	81,500

SHEAR STRESS

Shear stress for springs at high temperatures after the recommendations in the datasheet section Heat treatment.

Temperature		Shear stress MPa Classification		
°F	°C	A, B	C	D
-500	-260	480	380	690
500 - 600	260 - 320	480	380	620
600 - 700	320 - 370	480	380	585
700 - 800	370 - 430	480	380	-
800 - 850	430 - 450	415	380	-
850 - 900	450 - 480	345	380	-
900 - 950	480 - 510	310	380	-
950 - 1,000	510 - 540	275	380	-
1,000 - 1,050	540 - 570	170	345	-
1,050 - 1,100	570 - 590	-	345	-
1,100 - 1,150	590 - 620	-	275	-
1,150 - 1,200	620 - 650	-	205	-

PHYSICAL PROPERTIES

Density: 8.3 g/cm³, 0.30 lb/in³

SPECIFIC HEAT CAPACITY

420 - 460 J/kg °C	in the temperature range 20 - 100 °C
540 J/kg °C	in the temperature range 50 - 900 °F

THERMAL CONDUCTIVITY

Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
100	16.3	210	-
300	19.8	570	-
500	25.6	930	-
700	30.2	1,290	-
900	37.2	1,650	-

RESISTIVITY

Temperature, °C	μΩm	Temperature, °F	μΩin.
20	1.20	70	-
100	1.25	210	-
200	1.25	390	-
300	1.25	570	-
500	1.30	930	-
700	1.30	1,290	-

THERMAL EXPANSION ¹⁾

Temperature, °C	per °C	Temperature, °F	per °F
30 - 100	12.2	85 - 210	-
30 - 300	13.4	85 - 570	-
30 - 500	13.8	85 - 930	-
30 - 700	14.9	85 - 1,290	-
30 - 900	16.5	85 - 1,650	-

¹⁾ Mean values in temperature ranges (x10⁻⁶)

Permeability, μ_{max}: 1.004

HEAT TREATMENT

Heat treatment is made after the spring coiling operation. Depending on the desired mechanical properties and service temperature of the spring, the following grouping is made.

Classification	Delivery program	Service temperature, °C	Service temperature, °F
A	Annealed	≤540 ¹⁾	≤1 000
B	Soft drawn, final reduction 15 % (No 1 temper)	430 ¹⁾ , 540 ²⁾	800 ¹⁾ , 1,000 ²⁾
C	Hard drawn, final reduction 65 % (Spring temper)	480 – 650 ¹⁾ , 540 – 705 ³⁾	900 – 1,200 ¹⁾ , 1,000 – 1,300 ³⁾
D	Hard drawn, final reduction 65 % (Spring temper)	≤ 370 ^{1 and 3)}	≤ 700 ^{1 and 3)}

¹⁾ In accordance with MIL-S-23192

²⁾ In accordance with AMS 5698

³⁾ In accordance to AMS 5699

The optimum relaxation resistance for tension springs is made by a warm pre-setting after ageing. The springs are loaded to a certain tension at 25 °C (80 °F) above service temperature however minimum 350 °C (660 °F). Time and tension of the warm pre-setting is depending on the designed spring.

HEAT TREATMENT RECOMMENDATIONS

Classification	Delivery program	
A	Annealed	730 °C (1,350 °F) / 16 h Air cooling
B	Soft drawn, final reduction 15 % (No 1 temper)	730 °C (1,350 °F) / 16 h Air cooling
C	Hard drawn, final reduction 65 % (Spring temper)	1 150 °C (2,100 °F) / 2 h ¹⁾ 840 °C (1,540 °F) / 24 h 700 °C (1,300 °F) / 24 h Air cooling after all steps
D	Hard drawn, final reduction 65 % (Spring temper)	650 °C (1 200 °F) / 4 h Air cooling

¹⁾ In accordance with MIL-S-23192

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