

# AGE-HARDENABLE, HIGH STRENGTH AND CORROSION RESISTANT SPRING ALLOY DURATHERM® 600

**MATERIAL NUMBER: 2.4781**

**ALLOY COMPOSITION (wt. %):**

Co	Ni	Cr	Fe	W	Mo	Ti	Al
42	26	12	9	4	4	2	1



DURATHERM 600 belongs to the group of age-hardenable CoNiCr multi-phase alloys whose special features are excellent spring properties, high corrosion resistance and thermal loadability.

The prime advantage of these age-hardenable spring alloys is that in the solution annealed state („soft“) they are highly ductile. As a result, they are easy to form and machine enabling a wide design spectrum. By cold-working the strip or wire (delivery state „semi-hard“ or „hard“) their spring properties can be even further enhanced. The spring elements attain maximum mechanical properties through subsequent aging.

DURATHERM 600 exhibits excellent corrosion behaviour – in particular in a medium containing H<sub>2</sub>S – its resistance values comply with NACE MR 0175/ISO 15156-3.

Other excellent properties are high application temperatures up to 600 °C and non-magnetic behaviour.

## APPLICATIONS:

Springs and switching elements for high thermal loads, e.g. cooking plates.

Corrosion resistant membranes, e.g. in pressure gauges

Springs exposed to extreme cycles, e.g. in ABS valves, temperature and corrosion resistant plate and retention springs for the chemical industry.

## MAIN PROPERTIES (typical values):

Very high tensile strength up to **2200 MPa**

Excellent hardness up to **600 HV**

Excellent bending fatigue strength up to **680 MPa**

Maximum application temperature up to **600 °C**

**Excellent corrosion resistance**

Non-magnetic

## FORMS OF SUPPLY AND DELIVERY STATES

Strip in thicknesses from 0.05 – 1 mm.

Wire and rods Ø 0,2 – 12 mm.

Standard states of delivery „soft“, „semi-hard“ and „hard“.

Other dimensions and states on request.

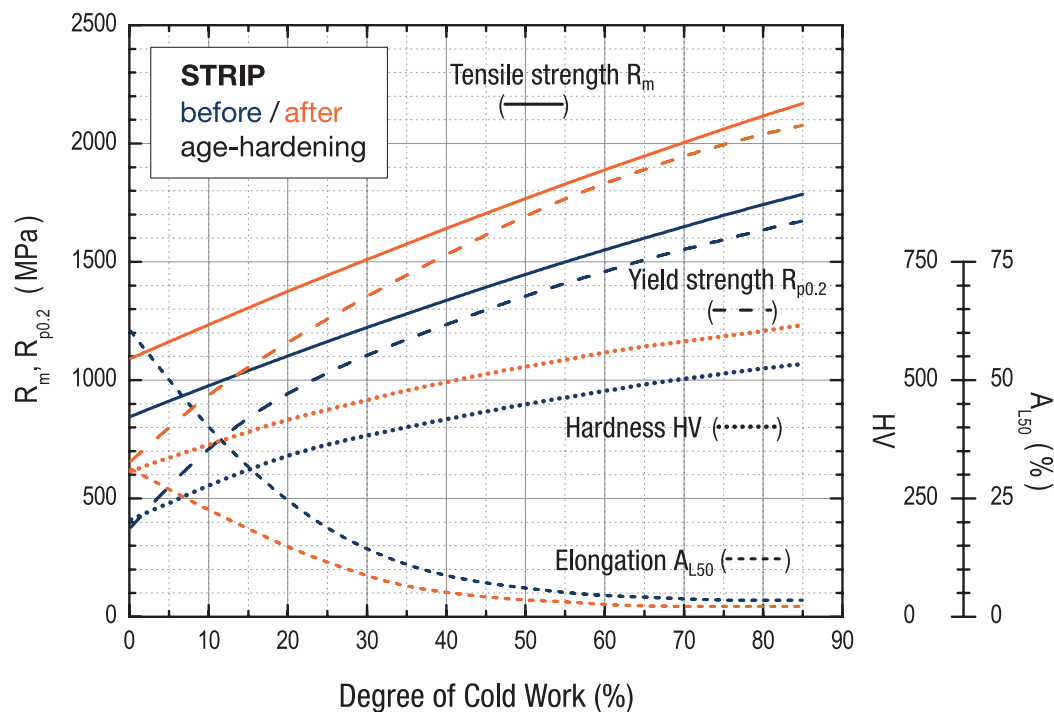
# DURATHERM® 600

FORM OF SUPPLY: **STRIP**

## MECHANICAL PROPERTIES (typical values)

Property	Unit	State of Delivery (before / <b>after</b> age-hardening)		
		soft 0	semi-hard 20	hard 60
Degree of cold work	CW (%)			
Aging conditions		4h 750 °C	4h 650 °C	2h 650 °C
Tensile strength	$R_m$ (MPa)	850 / <b>1100</b>	1100 / <b>1350</b>	1550 / <b>1880</b>
Yield strength	$R_{p0.2}$ (MPa)	380 / <b>650</b>	970 / <b>1150</b>	1450 / <b>1850</b>
Bending fatigue strength*	$\sigma_B$ (MPa)	330 / <b>380</b>	470 / <b>520</b>	580 / <b>680</b>
Hardness	HV	210 / <b>310</b>	350 / <b>420</b>	460 / <b>580</b>
Elongation	$A_{L50}$ (%)	>35 / <b>&gt;20</b>	>5 / <b>&gt;3</b>	>1 / <b>&gt;1</b>
Ratio bending radius: strip thickness for 90 ° bends	I rolling direction	0 / -	2 / -	3 / -
	II rolling direction	0 / -	3 / -	4 / -

\*) 10<sup>7</sup> load cycles, fracture probability max. 1 %

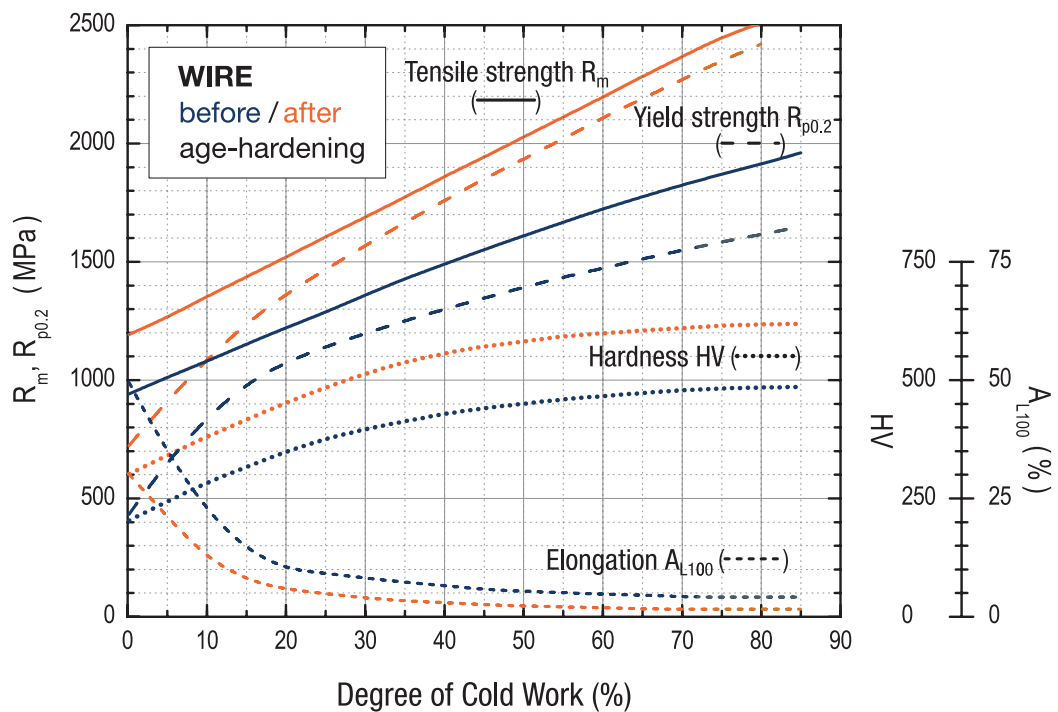


# DURATHERM® 600

FORM OF SUPPLY: **WIRE**

## MECHANICAL PROPERTIES (typical values)

Property	Unit	State of Delivery (before / after age-hardening)			
		soft 0	semi-hard 20	hard 60	
Degree of cold work	CW	(%)			
Age-hardening conditions		4h 750 °C	4h 650 °C	2h 650 °C	
Tensile strength	$R_m$	(MPa)	940 / <b>1200</b>	1250 / <b>1500</b>	1750 / <b>2200</b>
Yield strength	$R_{p0.2}$	(MPa)	420 / <b>700</b>	1140 / <b>1400</b>	1500 / <b>2150</b>
Hardness	HV		220 / <b>320</b>	380 / <b>460</b>	470 / <b>600</b>
Elongation	$A_{L100}$	(%)	>35 / <b>&gt;20</b>	>4 / <b>&gt;3</b>	>1 / <b>&gt;1</b>



# DURATHERM® 600

## PHYSICAL PROPERTIES (typical values)

Property		Unit	before / after age-hardening*
Density	$\rho$	(g/cm <sup>3</sup> )	8.45 / <b>8.5</b>
Linear expansion coefficient**	$\alpha$	(10 <sup>-6</sup> /K)	13.5 / <b>13.5</b>
Thermal conductivity	$\lambda$	(W/mK)	10 / <b>10</b>
El. conductivity	$\sigma$	(MS/m)	0.95 / <b>1.05</b>
Permeability (H = 300 A/cm)	$\mu$		1.02 / <b>1.015</b>
Young's modulus***	E	(GPa)	205 / <b>225</b>
Shear modulus***	G	(GPa)	85 / <b>93</b>

\*) delivery state „hard“, age-hardening 2h 650 °C.

\*\*) between 20 and 200 °C.

\*\*\*) parallel to rolling direction.

## CORROSION RESISTANCE (typical values)

Medium	Room Temp*	Boiling*	Medium	Room Temp*	Boiling*
sea water (synthetic)	+++	+++	nitric acid 10 %	+++	++
NaCl solution 10 %	+++	+++	nitric acid 65 %	+++	+
formic acid 10 %	+++	+++	sulphuric acid 10 %	+++	+
ammonia 25 %	+++	+++	sulphuric acid 50 %	++	-
ammonium chloride solution 10 %	+++	++	iron chloride 10 %	+++	
acetic acid 10 %	+++	+++	phosphoric acid 10 %	++	++
hydrochloric acid 10 %	++	-	phosphoric acid 85 %	+++	++

*) classification	+++	resistant	corrosion rate < 100 µm/year
	++	adequately resistant	corrosion rate < 1000 µm/year
	+	fairly resistant	corrosion rate < 3000 µm/year
	0	slightly resistant	corrosion rate < 10000 µm/year
	-	non-resistant	corrosion rate > 10000 µm/year

The corrosion rates given are nominal values, in practice the material must be tested in the relevant medium under fully operational conditions before use.

## TEMPERATURE BEHAVIOUR (typical values)\*

1000 MPa initial stress, 20 % relaxation	Unit	State of Delivery		
		semi-hard + age-hardened	hard + age-hardened	
max. application temp.				
exposure time	100 h	(° C)	440	520
	1000 h	(° C)	410	485
	3000 h	(° C)	395	470

\*) Calculated on Larson-Miller method, data refers to strip material



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### alloy information DURATHERM® 600

HT-PM H  
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