Hybrid Steel 55 and 60

Hybrid Steel® is a low carbon steel and contains a number of carefully controlled alloying elements, most importantly chromium, molybdenum, vanadium, nickel and aluminium. These enable it to develop its full properties after tempering at elevated temperature (500–620°C). The chromium and aluminium content also improves corrosion resistance.

Hybrid Steel offers superior mechanical and fatigue strength compared to conventional steels at elevated temperatures

- Excellent elevated temperature strengths
- Flexible hardness, achieved by an aging treatment in the temperature range 500–620°C
- Extremely good dimensional stability during the aging
- High uniformity of properties also for large components
- Good weldability, no preheating necessary
- Corrosion resistance compared to AISI 440C

Chemical composition

		C	Si	Mn	Cr	Ni	Mo	V	Al
Hybrid Steel 55	Engineering Steel	0.18	0.1	0.3	5	6	0.7	0.5	2
Hybrid Steel 60	Bearing Steel	0.28							

Mechanical Properties

Hybrid Steel 55. Tempered at 580°C for 3 hours. 56HRC

(in aged condition)		RT	150°C	250°C	350°C	450°C	550°C
Elastic modulus	MPa	216759	204911	201327	191994	182503	159849
Yield strength	MPa	1706	1605	1514	1420	1280	930
Tensile strength	MPa	1890	1782	1715	1610	1410	1056
A_5	%	10	8.6	10.1	10.3	10.3	10.1
Z	%	36	21	51	55	59	63

Heat Treatment

Hybrid Steel 55

		HV
As-rolled		450
Soft annealing	800°C/3h slow cooling from 800°C to 600°C <20°C/h	260
Hardening	950°C/45min air cool or quenched in oil	450
Aging	500–620°C 1–20h	400–600

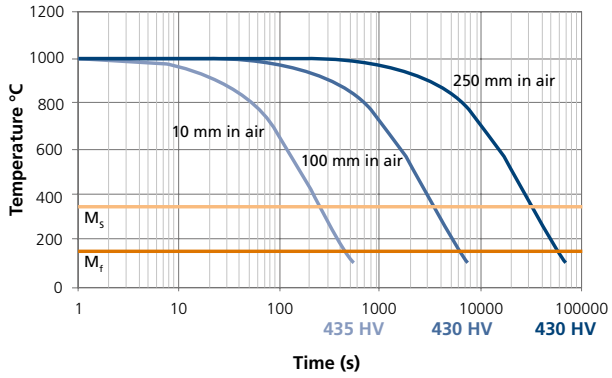
Hybrid Steel 60

		HV
As-rolled		550
Soft annealing	800°C/3h slow cooling from 800°C to 600°C <20°C/h	300
Hardening	1020°C/45min air cool or quenched in oil	550
Aging	500–620°C 1–20h	430–700

Transformation temperatures

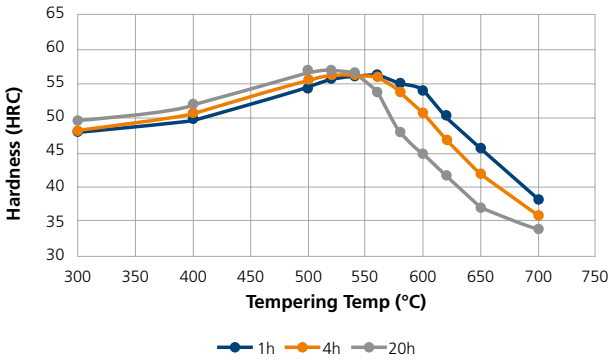
	Temperature °C
MS	350
Mf	150
AC3	950 (Hybrid Steel 55) to 1020 (Hybrid Steel 60)

Hardenability

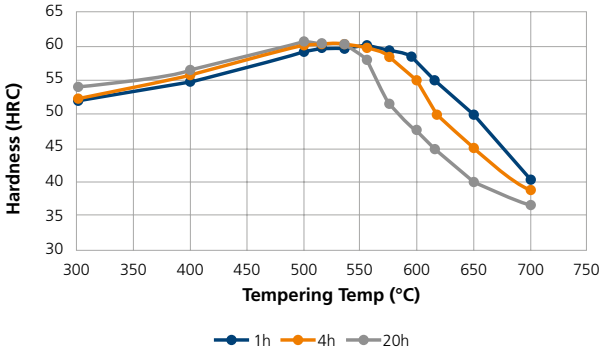


Tempering Characteristics

Hybrid Steel 55. Hardened at 950°C for 45 min.



Hybrid Steel 60. Hardened at 1020°C for 45 min.



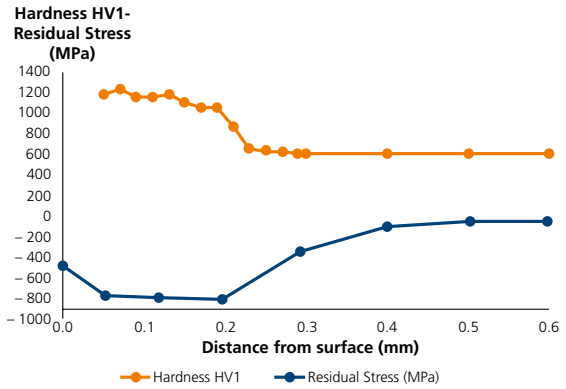
Thermal Properties

Hybrid Steel 55. Tempered at 580°C for 3 hours.
56HRC

(in aged condition)		RT	100°C	200°C	300°C	400°C	500°C
Linear Thermal Expansion	10^{-6} °C^{-1}		11.6	12.0	12.4	12.7	13.1
Thermal Conductivity	W m^{-1} °C^{-1}	18.4	21.0	22.5	24.1	24.9	26.1
Thermal Diffusivity	10^{-6} m^2 s^{-1}	5.37	5.56	5.69	5.67	5.54	5.28
Specific Heat	J g^{-1} °C^{-1}	0.45	0.49	0.53	0.56	0.60	0.66
Density	kg m^{-3}	7582					

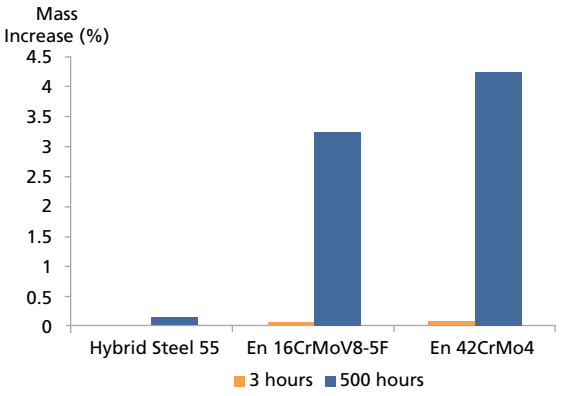
Nitriding

Hybrid Steel 55. Tempered to 55 HRC.
Plasma Nitrided at 520°C for 20 hours



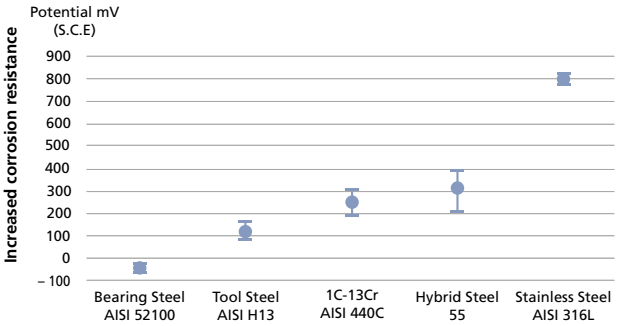
Oxidation Resistance

Oxidation response at 700°C for 3h and 500 hours



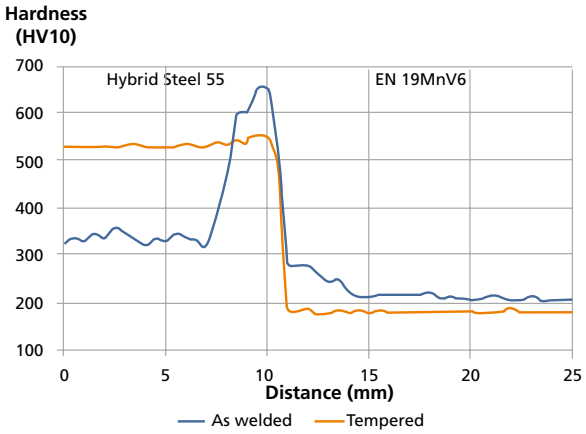
Corrosion Resistance

ISO 15158 Corrosion of metals and alloys.
10mV/min in 0.01M NaCl



Welding

Friction welding. One piece rotating and one static.
Initial heating (22bar)
Max temperature (56bar)
Friction weld (79bar)



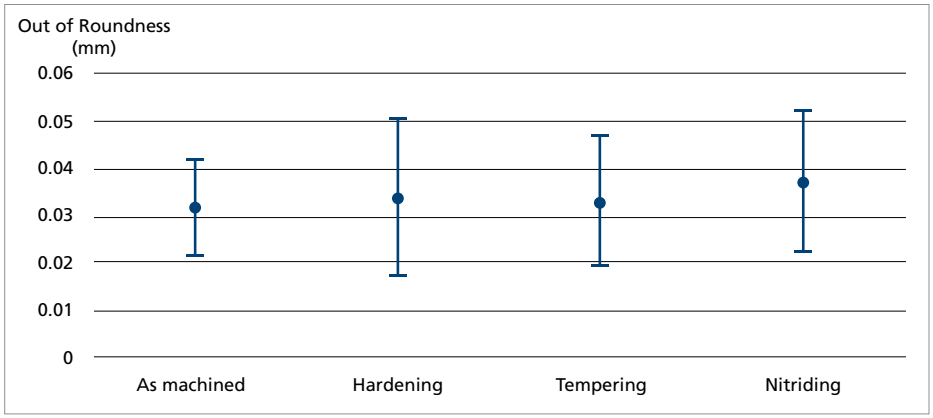
Machinability

Soft-annealed Hybrid Steel 55 (260HV).
Rough turning Ø65mm bar.

Tool	Vc	F	Ap
DNMG 150608-QR	340	0.4	2

Distortion

Rings with dimension 140*120*20 mm were
machined from soft-annealed Hybrid steel 55. Out of roundness was measured after each process step.



Contact us

Would you like to know more about our offers?
Contact: Fredrik Lindberg, email: fredrik.lindberg@ovako.com, telephone: +46 8 622 1300.
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