IPCO 1650SM

Martensitic stainless steel belt

02-2020

Belt grade characteristics

The IPCO 1650SM belt grade is made of low carbon, martensitic, precipitation hardened, stainless steel of type 15-7 PH and is characterised by:

- Excellent static strength
- Excellent fatigue strength
- Good corrosion resistance
- Very good wear resistance
- Very good repairability

IPCO 1650SM is a high strength steel with excellent mechanical properties. This, in combination with good corrosion resistance, makes it the ideal choice for applications in very harsh conditions. Another advantage is that it is easy to repair.

Chemical composition (typical), %

C	Si	Mn	Cr	Ni	Cu	Ti	Mo
0.04	1.5	0.5	14.0	7.0	0.7	0.3	0.8

Standards

EN.	No standard
AISI	No standard

Forms of supply

The belts are, as standard, delivered in a precipitation hardened condition with a mill finish and have well-rounded edges. If required practically any surface finish can be supplied. Perforated belts are also available.

The belts are levelled and straightened to obtain optimal flatness and straightness. The belts can be supplied in open lengths, with the ends prepared for welding on site, or in endless condition with a welded joint.

For tracking, the belts can be provided with V-ropes, either rubber or in the form of a specially designed steel spiral. If required, the product side of the belt can be fitted with retaining strips to keep the conveyed material on the belt or with transverse flights to prevent material from sliding backwards when the belt is steeply inclined.

Different tolerance grades are available to ensure that the best belt can be selected from an economic point of view.

Recommendation and advice are available from your local IPCO office.

Mechanical properties

Static strength at 20 °C (68 °F), typical values

Position	Yield strength $R_{p0.2}$		Tensile strength R_m		Elongation A (%)	Weld factor $R_{m\,weld}/R_m$	Hardness HV5
	MPa	ksi	MPa	ksi			
Parent material	1 580	229	1 600	232	5		480
Transverse weld (not heat treated)	1 100	160	1 150	167	5	0.72	*
Transverse weld (heat treated)	1 250	181	1 300	188	3	0.81	*

*See figure 1 on page 2.

At high temperatures, typical values

Temperature		Proportional limit		Yield strength $R_{p0.2}$		Tensile strength R_m		Elongation A (%)
°C	°F	MPa	ksi	MPa	ksi	MPa	ksi	
100	212	1 500	218	1 440	209	1 450	210	4
200	392	1 370	199	1 350	196	1 360	197	5
300	572	1 310	190	1 290	187	1 310	190	5
400	752	1 160	168	1 180	171	1 190	173	6.5

An increase in mechanical strength (hardness) and brittleness can be noticed after long term use between 350–450 °C (660 – 840 °F).

Hence the following recommendation: If an operation temperature of or above 350 °C (660 °F) is considered, your local IPCO office should be contacted for technical assistance.

Impact properties

This belt grade is not recommended for use at low temperature, i.e. such as in freezing operations.

Dynamic strength

The fatigue limit is defined as the reverse bending stress at which 50% of the test specimens withstand a minimum of 2×10^6 load cycles. These values refer to 20 °C (68 °F), a normal dry atmosphere and standard prepared specimen. The fatigue limit for the parent material is approximately ± 630 MPa (91 ksi).

Physical properties

Density, ρ, at 20 °C (68 °F)
7 740 kg/m³, 0.28 lb/in³

Modulus of elasticity, E, at 20 °C (68 °F)
197 000 MPa (28 600 ksi)

Thermal conductivity, λ

Temp	°C	20	100	200	300	400
	°F	68	212	392	572	752
	W/mK	15	16	18	19	20
	Btu/ft h °F	8.7	9.2	10.4	11.0	11.6

Specific heat capacity, C_p

Temp	°C	20	100	200	300	400
	°F	68	212	392	572	752
	kJ/kgK	0.50	0.50			
	Btu/lb °F	0.12	0.12			

Thermal expansion, α

Temp	°C	20 – 100	20 – 200	20 – 300	20 – 400
	°F	68 – 212	68 – 392	68 – 572	68 – 752
	10^{-6}/ °C	10.9	11.5	11.7	11.9
	10^{-6}/ °F	6.1	6.4	6.5	6.6

Resistivity, ρ at 20 °C (68 °F)
0.8 μΩm

Magnetic properties

Remanence, B_r	0.087 Wb/m²
Coercive force, H_c	1 190 A/m
Max relative permeability, μ_r	50

The thermal conductivity of precipitation hardening steel is comparable to austenitic stainless steels, but the thermal expansion is much lower. This makes the precipitation-hardened steel less sensitive to thermal strain and buckling caused by uneven temperature.

Corrosion resistance

General corrosion
IPCO 1650SM shows a very good corrosion resistance in rural and mild industrial atmosphere and almost equal good when exposed to coastal atmosphere.

It has good resistance to:
- Organic acids, such as acetic acid, up to high concentrations and high temperatures and formic acid at low concentrations and high temperatures.
- Inorganic acids, e.g. sulphuric acid at low concentration and phosphoric and nitric acids at moderate concentration and temperatures.
- Ammonium hydroxide up to boiling point and sodium hydroxide at moderate concentrations and temperatures.

IPCO 1650SM is not suitable to use in any concentration of hydrochloric acid, or in phosphoric and nitric acids of high concentration and high temperature, and sulphuric acid of moderate and high concentration at elevated temperatures.

Pitting and crevice corrosion
The steel may be sensitive to pitting, even in solutions of a relative low chloride content. When continuous operation at room temperature, IPCO 1650SM has good resistance to pitting providing that the belt is kept clean.

Stress corrosion cracking
Stress corrosion cracking, although occurring relatively infrequently, can be cause of failure in stainless steels. It occurs at temperatures above about 70 °C (160 °F), if the steel is subjected to tensile stresses and comes into contact with certain solutions, particularly those containing chlorides.

Hydrogen embrittlement
Hydrogen embrittlement is a potential danger to all high strength martensitic steels whenever the reduction of hydrogen ions to atomic hydrogen occurs. If this is the case, contact your local IPCO office.

Hardness HV

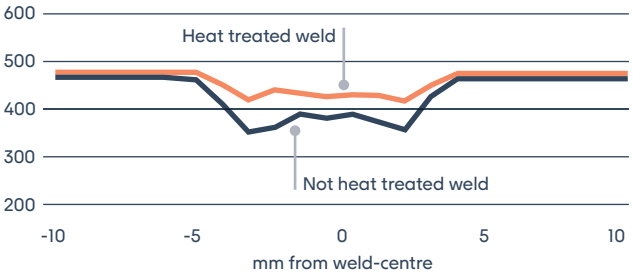

Figure 1. Example of hardness profile across a transverse weld, with and without heat treatment in a IPCO 1650SM belt.

Welding

Joints with very good strength and toughness can be formed in IPCO 1650SM. A suitable fusion welding method is gas-shielded arc welding, with the TIG method as first choice. If welding wire is needed, IPCO 1650SM should be used.

Further information concerning method and equipment etc. required can be obtained from your local IPCO office.