

A close-up, low-angle shot of a hydraulic cylinder. The central focus is the polished, cylindrical rod extending upwards. Below the rod is the dark, textured head of the cylinder, which features several black, cylindrical ports or seals. The background is a warm, orange-brown color, suggesting an industrial or construction environment. The lighting is dramatic, highlighting the metallic surfaces and creating strong shadows.

CROMAX[®] 180X

OVAKO

**THE ECONOMIC CHOICE FOR CONVENTIONAL
HYDRAULIC CYLINDER APPLICATIONS**



YOUR PARTNER IN HYDRAULICS

Cromax products from Ovako are the preferred choice for many hydraulic-cylinder manufacturers and OEM:s worldwide. Ovako's research and development coupled with its extensive metallurgical know-how has resulted in hard-chrome-plated products with unsurpassed quality and consistency, in terms of both base materials and surfaces. For conventional applications Cromax 180X is the optimal choice, combining economic benefits with entirely new design and manufacturing opportunities.

PERFORMANCE YOU CAN RELY ON

Ovako Cromax is a qualified supplier of hard-chrome-plated bars and tubes with control over the entire manufacturing process from raw materials to finished article. The result is value-added products with consistent quality. Testing of every batch guarantees excellent reliability and traceability while safeguarding productivity at the customer. Research and development initiatives over many years within the Cromax operations have resulted in surface executions compatible with a broad range of hydraulic-cylinder applications. Furthermore, Cromax operates in close collaboration with its customers to understand their needs and create value with tailored service concepts and support in their product and process development.

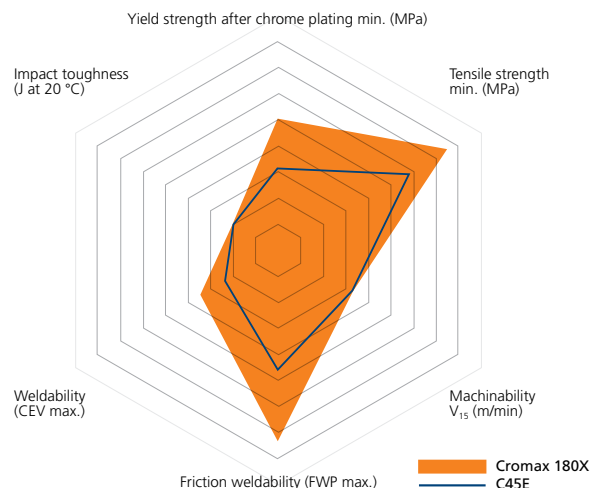
COMPARISON OF PERFORMANCE CHARACTERISTICS FOR CROMAX 180X VS. C45E

	Cromax 180X	C45E
Yield strength after chrome plating min. (MPa)	500	305
Tensile strength min. (MPa)	750	590
Machinability V ₁₅ (m/min)	320*	320*
Friction weldability (FWP max.)	2.78	5.38
Weldability (CEV max.)	0.62	0.77
Impact toughness (J at 20°C)	20*	20*

*Indicative value, no guarantee.

ECONOMIC BENEFITS IN CONVENTIONAL APPLICATIONS

Cromax 180X is developed to be the economical choice for conventional hydraulic cylinders. The mechanical characteristics of 180X are significantly better when compared with traditional steels used for piston rods in such applications, for example C45E. All of these improvements have been achieved without compromise in terms of machinability and weldability. This offers economic benefits combined with entirely new design and manufacturing opportunities. To further increase the resistance to buckling and external impact, Cromax 180X can be supplied in an induction-hardened execution. In addition and for applications requiring extra high strength, the product is also available in a cold-drawn version. All mechanical properties are guaranteed in the finished plated condition.



CROMAX[®] 180X / 180X CD

Cromax 180X is a hard-chrome-plated product based upon a medium-carbon, micro-alloyed steel.

In comparison with all traditional grades used in conventional hydraulic-cylinder applications, for example C45E, 19MnVS6 (20MnV6) or 38MnVS6, Cromax 180X offers equivalent or significantly higher strength in combination with superior processing characteristics.

Cromax 180X CD is a hard-chrome-plated product, the base steel in which has been cold drawn to achieve higher strength. The chemical composition is the same as Cromax 180X.

Typical chemical analysis Cromax 180X

C %	Mn %	V %	S %	CEV max*
0.38	0.7	0.08	0.020	0.62

*CEV = C % + Mn %/6 + (Cr % + Mo % + V %)/5 + (Ni % + Cu %)/15

Mechanical properties

Cromax	Size (Ø) (mm)	Yield strength R _e * (MPa)	Tensile strength R _m (MPa)	Elongation A ₅ (%)	Hardness HB
180X	20–90	≥ 500	≥ 750	≥ 16	220–270
180X CD	20–90	≥ 690	≥ 800	≥ 10	250–300

* R_e: Upper yield stress R_{eH} or, if no yield phenomenon occurs, the 0.2 % proof stress R_{p0.2}.

1 MPa = 1 N/mm²

All mechanical properties are guaranteed in the finished (plated) condition.

Induction hardened

Cromax 180X can be supplied in an induction-hardened execution. When such is the case, the hardness immediately beneath the chrome layer is min. 55 HRC. The depth of hardening, defined as the distance from the surface at which the hardness has dropped to 400 HV1, is as tabulated.

Dimension (Ø) (mm)	Hardening depth (mm)
< 40	1.0–1.6
40–90	1.4–2.0

Weldability

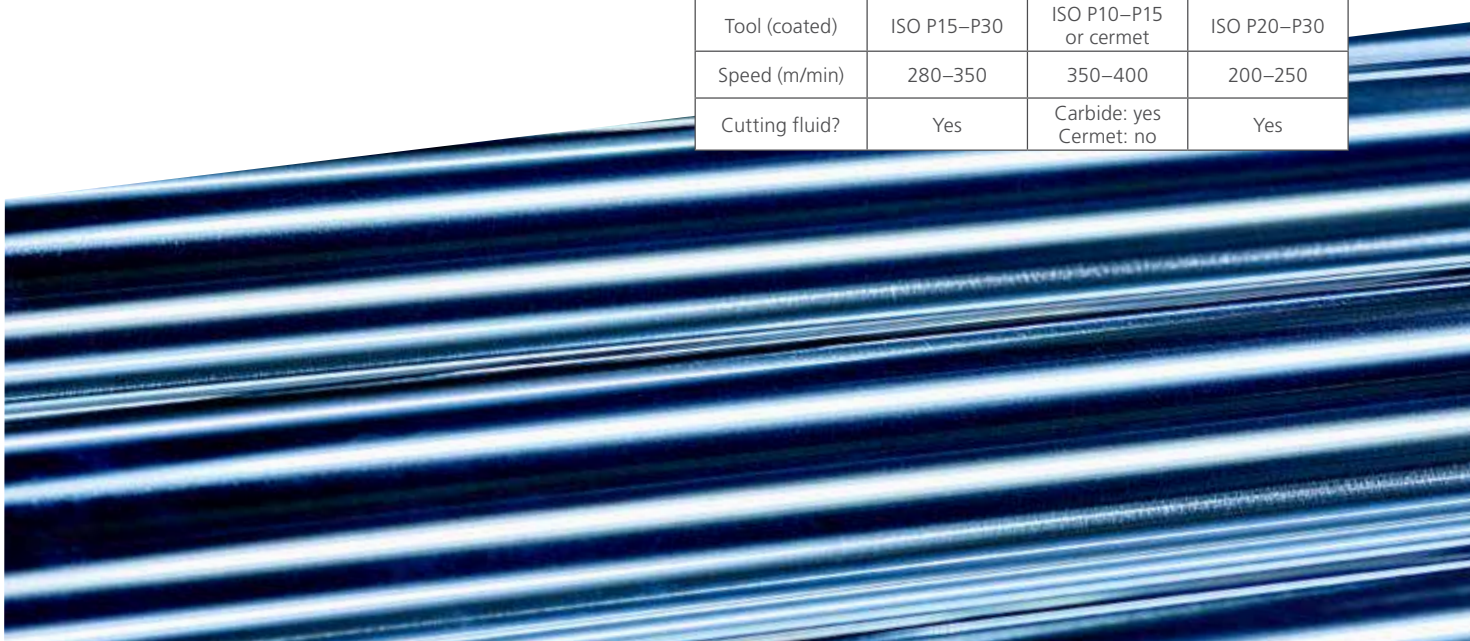
Cromax 180X is relatively easy to weld but pre-heating to 150–200 °C is recommended for dimensions exceeding 60 mm. Examples of suitable consumables are OK 74.78 for MMA welding and Autorod 12.64 or Aristorod 12.50 for MAG welding (shielding gas 80 % Ar, 20 % CO₂).

The chemical composition and processing of the base steel in Cromax 180X are devised so as to make the material amenable to friction welding. In particular, this involves limiting segregation and non-metallic inclusions which can give rise to brittleness in the weld zone.

Machinability

Specific machining recommendations for turning and threading of Cromax 180X are tabulated below.

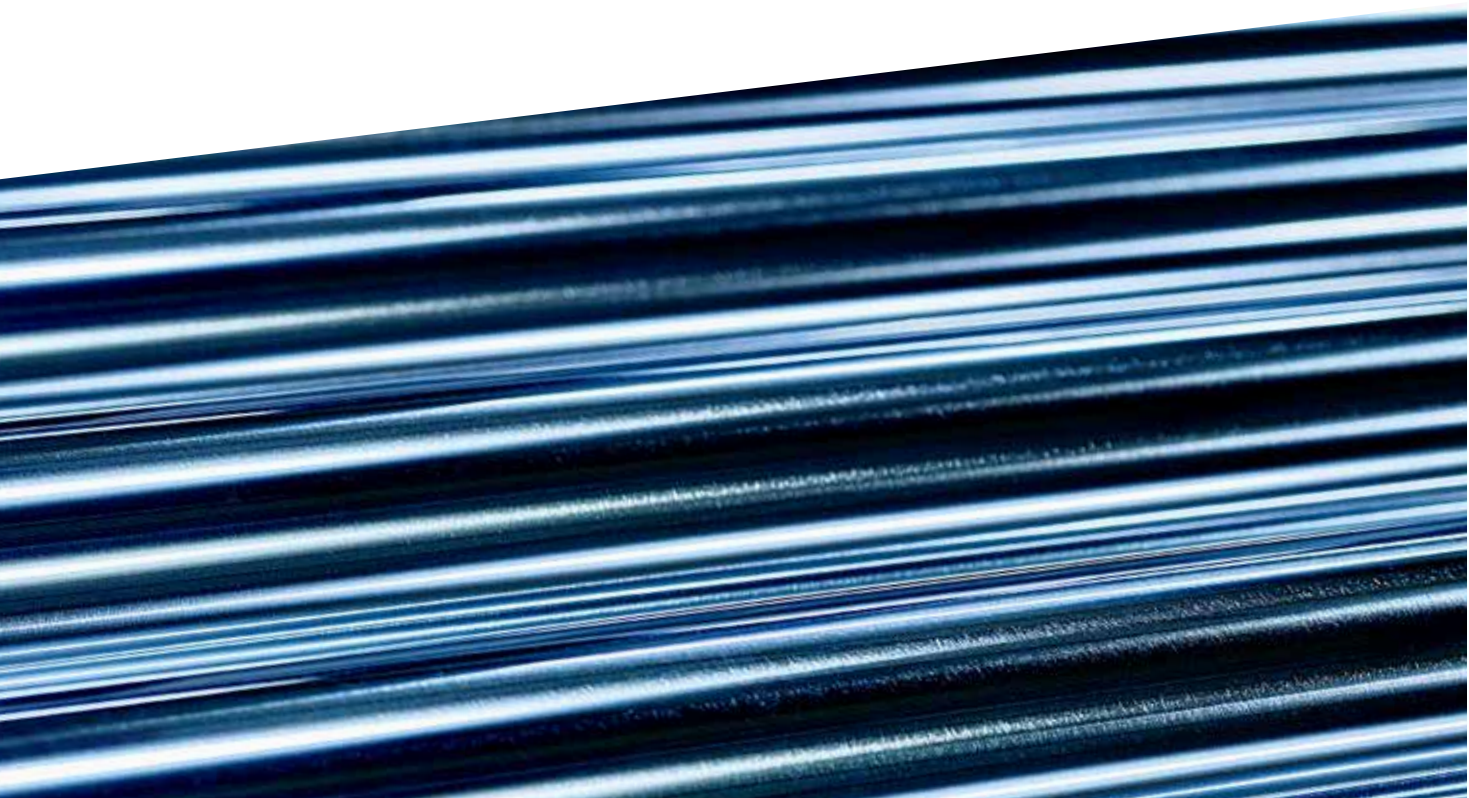
	Rough turning	Fine turning	Threading
Feed (mm/r)	0.3–0.6	0.05–0.3	–
Cut depth (mm)	2–5	0.2–2	6–8 passes for thread pitch 2 mm
Tool (coated)	ISO P15–P30	ISO P10–P15 or cermet	ISO P20–P30
Speed (m/min)	280–350	350–400	200–250
Cutting fluid?	Yes	Carbide: yes Cermet: no	Yes

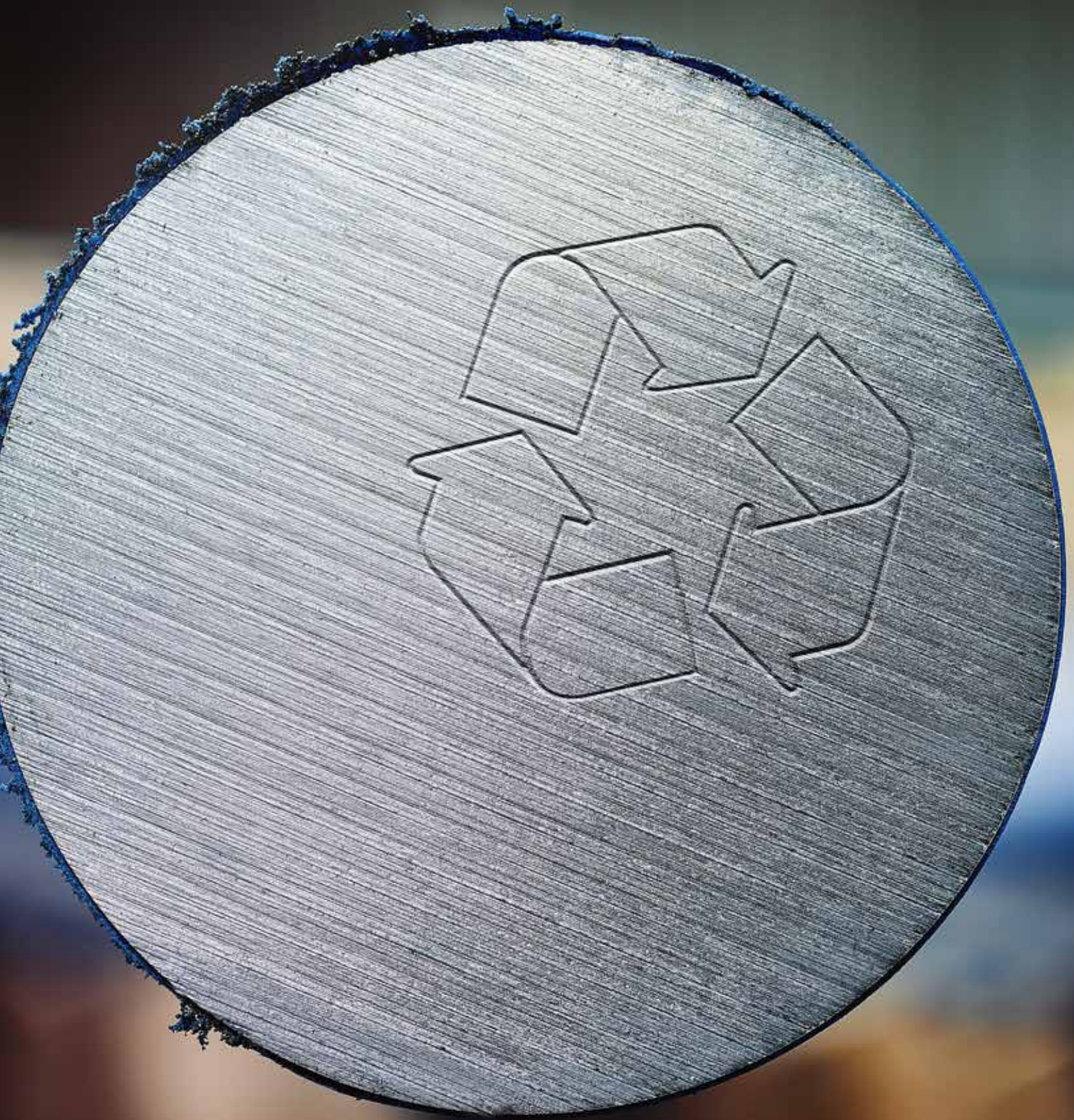


Standard dimensions for Cromax 180X*

Dimension Ø (mm)	Weight (kg/m)	Dimension Ø (mm)	Weight (kg/m)	Dimension Ø (inch)	Weight (kg/m)	Dimension Ø (inch)	Weight (kg/m)
20	2.47	60	22.19	¾	2.23	3	35.81
25	3.85	63	24.47			3 ¼	42.03
		65	26.05	1	3.97	3 ½	48.72
30	5.55			1 ¼	6.22		
35	7.55	70	30.21	1 ⅜	7.52		
		75	34.68	1 ½	8.92		
40	9.86			1 ¾	12.19		
45	12.48	80	39.46				
		85	44.54	2	15.91		
50	15.41	90	49.94	2 ¼	20.13		
55	18.65			2 ½	24.87		
56	19.33			2 ¾	30.09		

* Other dimensions can be supplied upon request but not outside the above range.





COMMON CROMAX FACTS

Chrome layer

The thickness of the chrome layer for all Cromax standard products is greater than 20 µm. For the smaller sizes in the range ($\varnothing \leq 20$ mm), the thickness is guaranteed to min. 15 µm. The hardness of the chrome layer is min. 850 HV0.1.

Surface characteristics

For all Cromax executions, the surface roughness (Ra) is less than 0.2 µm, normally in the range of 0.05–0.10 µm. Rt (ISO) is less than 2.0 µm, normally in the range of 0.5–1.0 µm.

Corrosion resistance

Since the risk for corrosive attack on piston rods varies depending on environment and the nature of the hydraulic application, Cromax can provide different levels of corrosion resistance to meet the challenge.

As standard, Cromax is plated with a single-layer of chrome. For increased corrosion resistance, multiple-layer coatings (Cromax C) can be offered. Furthermore, all Cromax base steels can be manufactured and supplied in a nickel-chrome-plated execution (NiKrom™) to meet the needs for aggressively corrosive environments, such as encountered in marine, off-shore, mining and similar applications.

Products from Cromax are characterized by a controlled micro-crack distribution, which in combination with specially adapted finishing processes provides for a superior corrosion resistance. Most of the specifications for corrosion resistance are based on salt-spray testing according to ISO 9227, or corresponding standards, in combination with evaluation according to ISO 10289.

ISO 9227	ASTM	DIN 50021	Salt-spray type
NSS	B 117	SS	Neutral
AASS	B 287	ESS	Acetic acid
CASS	B 368	CASS	Copper-accelerated acetic acid

Cromax corrosion resistance

Execution	Guarantee
Cromax*	AASS 40h rating 9
Cromax C*	AASS 100h rating 9
NiKrom 150	AASS 150h rating 10
NiKrom 500	AASS 500h rating 10

* Standard base guarantee, better corrosion resistance can be offered through separate agreement.

Geometrical characteristics

Straightness: For the smaller sizes ($\varnothing < 30$ mm), the maximum deviation is 0.1 mm/0.5 m. The maximum deviation for larger diameters is 0.1 mm/1.0 m.

Diameter tolerance: ISO f7 is standard for all Cromax products. Other tolerances can be supplied to meet customer-specific requests (narrowest range is ISO level 7). The out of roundness is maximized at 50 % of the diameter tolerance interval.

Delivery lengths

All Cromax products can be manufactured in lengths between 3000 mm – 7800 mm (7300 mm for nickel-chrome products); the standard length is 6100 mm (+100 mm/-0 mm)*.

The “unchromed length” of each bar, i.e. the distance at each end over which the chrome-layer properties and tolerances cannot be guaranteed, is at most 150 mm per end, i.e. 300 mm in total.

As a value-added service, every Cromax unit has substantial capacity for fix-length cutting, which can be supplied for all Cromax products and dimensions with a standard length tolerance of +2 mm/-0 mm.

* For some specific executions and sizes, production limitations dictate other standard lengths. Customer-specific tailored lengths can be supplied by special agreement.

Packaging

As standard, Cromax products are supplied with plastic sleeves as a protective packaging. However, upon request our products can be delivered protected by cardboard tubes. Additional packaging is determined by the mode of transport and the final destination for the products.

We reserve the right to make changes to dimensions, tolerances and other data.

Liability disclaimer – All statements and implications regarding the properties or fitness for purpose of the products described in this publication are for information only. Guarantees in relation to specific properties or fitness for purpose are valid only if agreed upon in writing.

Ovako develops high-tech steel solutions for, and in cooperation with, its customers in the bearing, transport and manufacturing industries. Our steel makes our customers' end products more resilient and extends their useful life, ultimately resulting in smarter, more energy-efficient and more environmentally-friendly products.

Our production is based on recycled scrap and includes steel in the form of bar, tube, rings and pre-components. Ovako has around 2,700 employees in more than 30 countries and sales of approximately EUR 900 million. Ovako is a subsidiary of Sanyo Special Steel and a member of Nippon Steel Corporation group, the third-largest steel producer in the world with more than 100,000 employees globally and a revenue of approximately EUR 50 billion. For more information, please visit us at www.ovako.com, www.sanyo-steel.co.jp and www.nipponsteel.com.

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