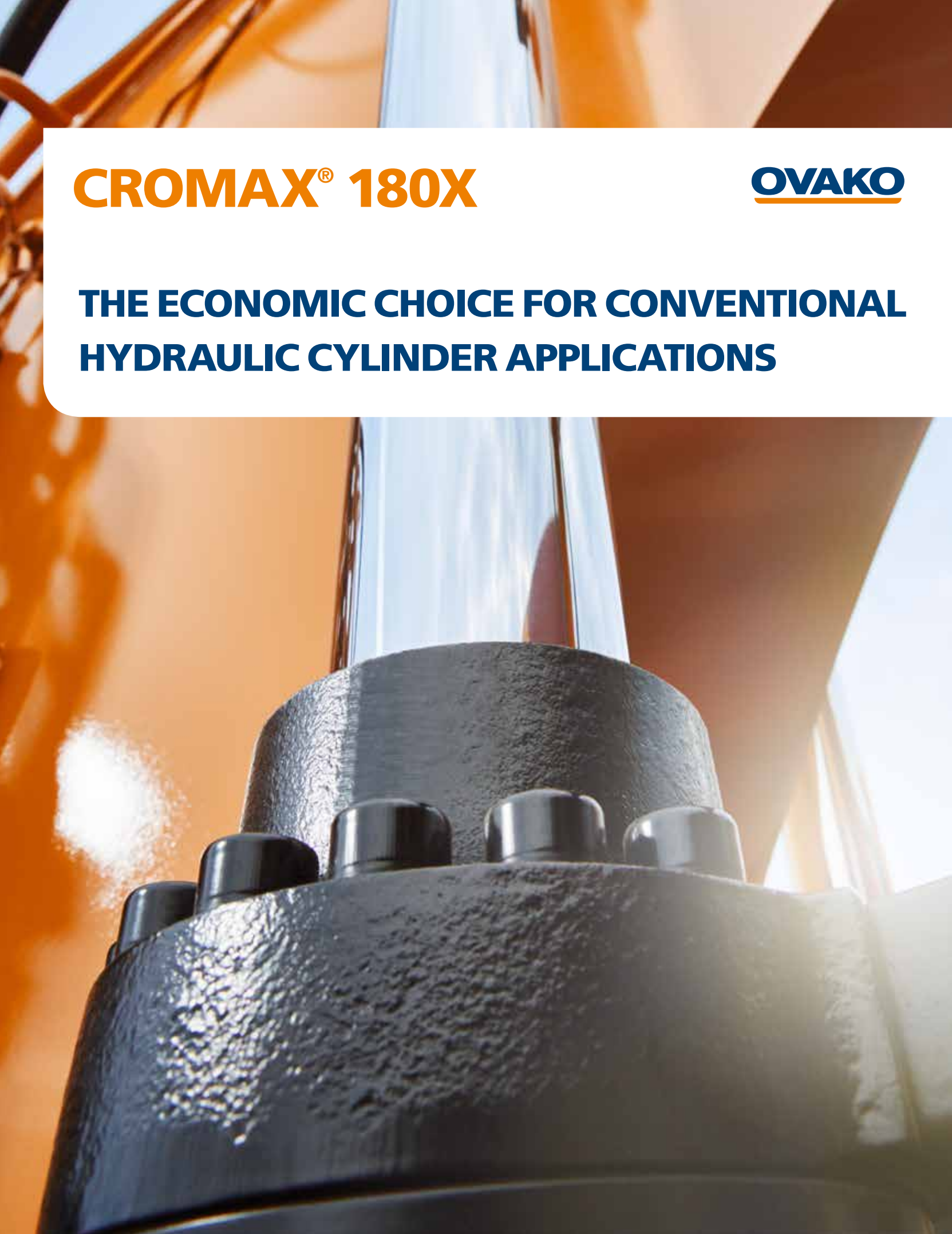
CROMAX® 180X

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 metallurgical know-how, along with research and development has resulted in hard-chrome-plated products with unsurpassed quality and consistency, in terms of both base materials and surfaces. For conventional usage, Cromax 180X is the optimal choice, combining economic benefits with entirely new design and manufacturing opportunities.

PERFORMANCE YOU CAN TRUST ON

Ovako Cromax is a qualified supplier of hard-chrome-plated bars and tubes, that controls the entire manufacturing process from raw materials to finished article,resulting in value-added products with consistent quality. Testing of each batch in the steel making process guarantees excellent reliability and traceability while safeguarding productivity at the customer. Research and development initiatives over many years within the Cromax operations has resulted in surface executions with perfect match to a broad range of hydraulic-cylinder applications. On top Cromax operates closely to its customers to understand the needs and create value with tailor made service concepts and product/process development support.

ECONOMIC BENEFITS IN CONVENTIONAL APPLICATIONS

Cromax 180X is developed to be the economic choice for conventional hydraulic-cylinder applications. The mechanical characteristics of 180X are significantly higher compared with traditional steels for conventional hydraulic-cylinder applications, such as C45E. All of these benefits have been achieved without compromise to processing characteristics, such as 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. For applications requiring extra high strength, the product is also available in a cold-drawn version. All mechanical properties are guaranteed in finished, hard-chrome-plated (or nickel-chrome-plated) condition.

COMPARISON OF PERFORMANCE DIMENSIONS FOR CROMAX 180X VS. C45E

Single-acting	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.)	0.65	0.77
Impact toughness min. (J at 20°C)	20*	20*

**Measured / indicative value, no guarantee*

CROMAX® 180X / 180X CD

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

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

Cromax 180X CD is a hard-chrome-plated product, which has been processed by cold drawing to achieve higher strength. The base material and 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	0.015	0.65

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

Mechanical properties

Cromax	Size (Ø)	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/mm^2

All mechanical properties are guaranteed in finished, hard-chrome-plated (or nickel-chrome-plated) condition.

Induction hardened

Cromax 180X can be supplied in an induction-hardened execution. In such a case, the hardness immediately beneath the chrome layer is min. 55 HRC.

Size (Ø) (mm)	Hardening depth (mm)
< 40	1.0–1,6
40–90	1.4–2.0

Weldability

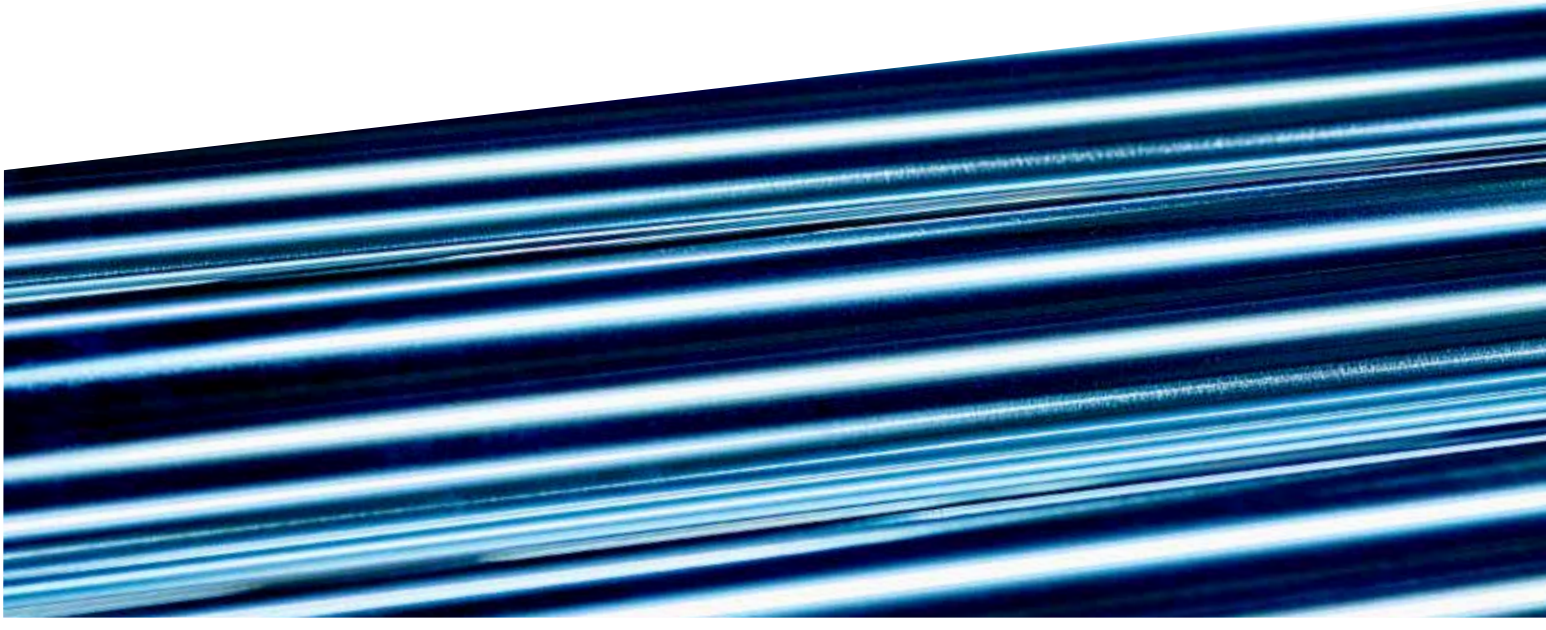
Cromax 180X is relatively easy to weld but pre-heating to 150– 200 °C is recommended, especially for sizes above 50 mm. Suitable consumables are OK 74.78 for MMA welding and OK 12.64 for MAG welding (shielding gas 80 % Ar, 20 % CO_2).

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

Machinability

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

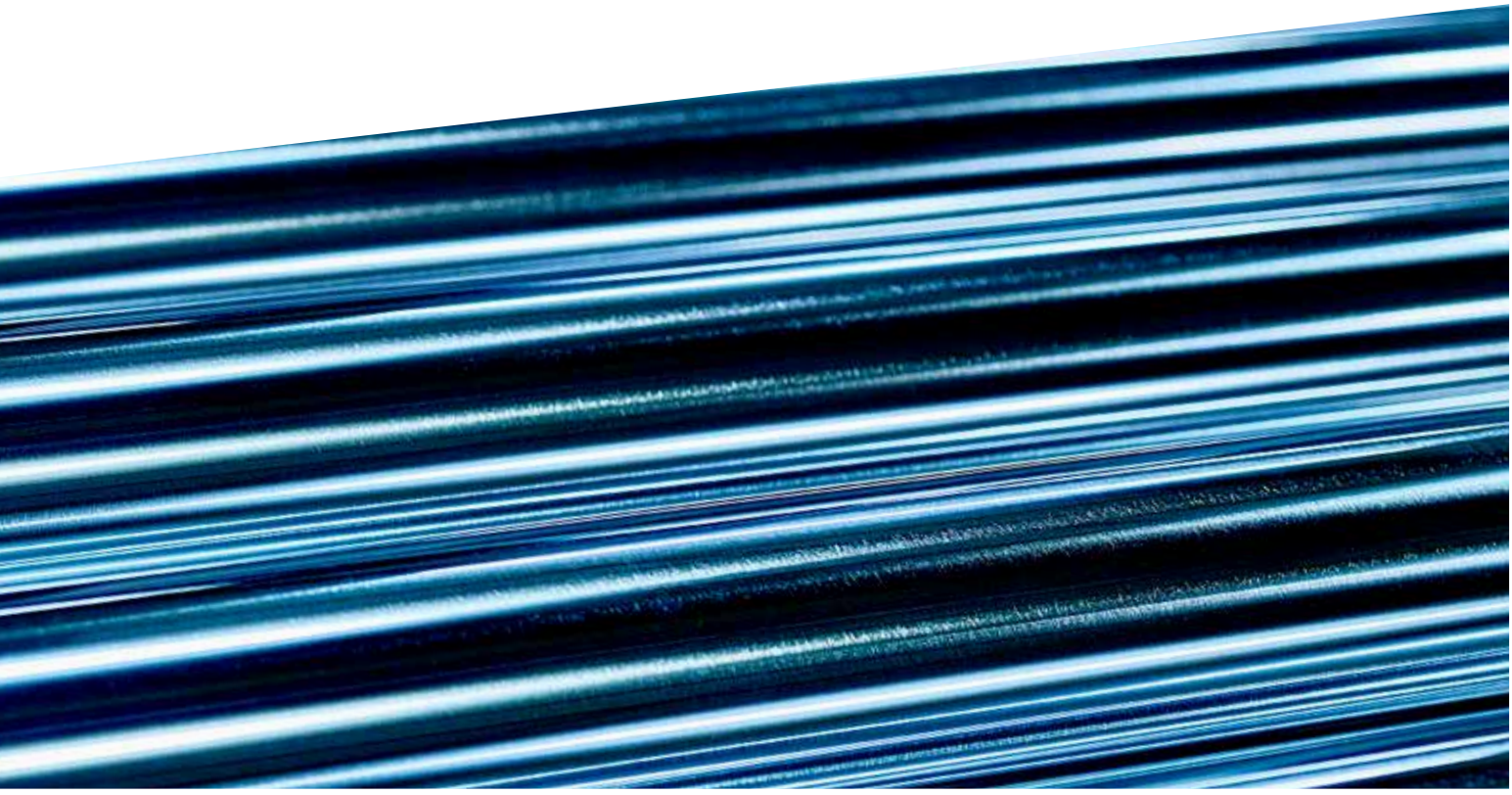
	Rough turning	Fine turning	Threading
Feed (mm/r)	0.3–0.6	0.05– 0.3	–
Cut depth (mm)	2–5	0.2–2	–
Tool (Coated)	ISO P15–P30	ISO P10–P15	ISO P20–P30
Speed (m/min)	280–350	350–400	200–230

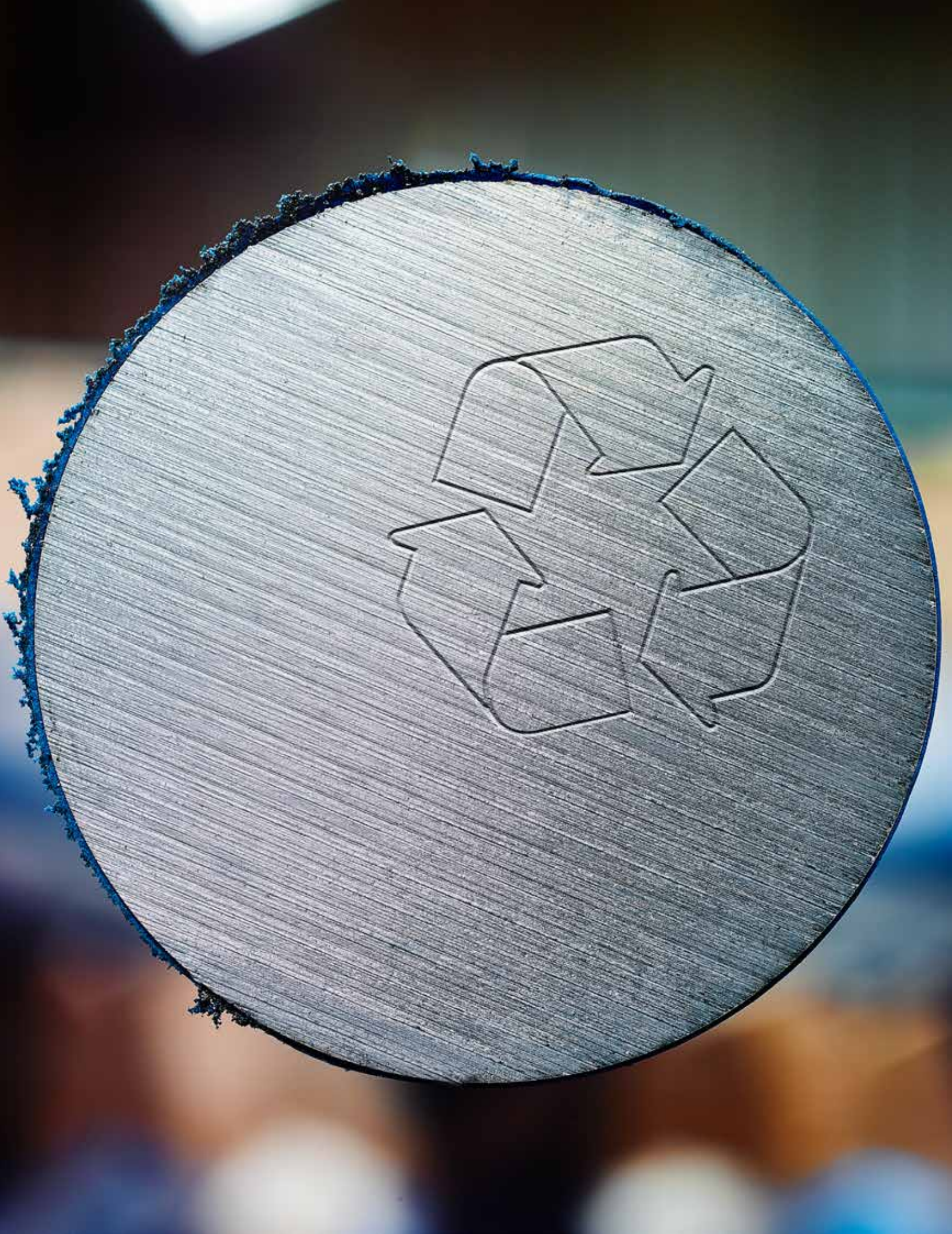


Standard sizes for Cromax 180X*

Size Ø (mm)	Weight (kg/m)	Size Ø (mm)	Weight (kg/m)	Size Ø (inch)	Weight (kg/m)	Size 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 3/8	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 sizes can be supplied upon request but within above size range.*





COMMON CROMAX FACTS

Chrome layer

The thickness of the chrome layer for all Cromax standard products is guaranteed to min. 20 µm. For the smaller size range (Ø ≤ 20 mm) the thickness is guaranteed to min. 15 µm.

The hardness of the chrome layer is min. 850 $HV_{0.1}$.

Surface characteristics

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

* *Lowest guarantee, increased corrosion resistance can be offered upon separate agreement*

Geometrical characteristics

For the smaller sizes (Ø < 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, productions limitations dictate other standards 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.

About Ovako

Ovako develops high-tech steel solutions for, and in co-operation 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, ring and pre-components. Ovako is represented in more than 30 countries, and has sales offices in Europe, North America and Asia. Ovako's sales in 2015 amounted to EUR 834 million, and the company had 2,905 employees at year-end. For more information, please visit us at **www.ovako.com**

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