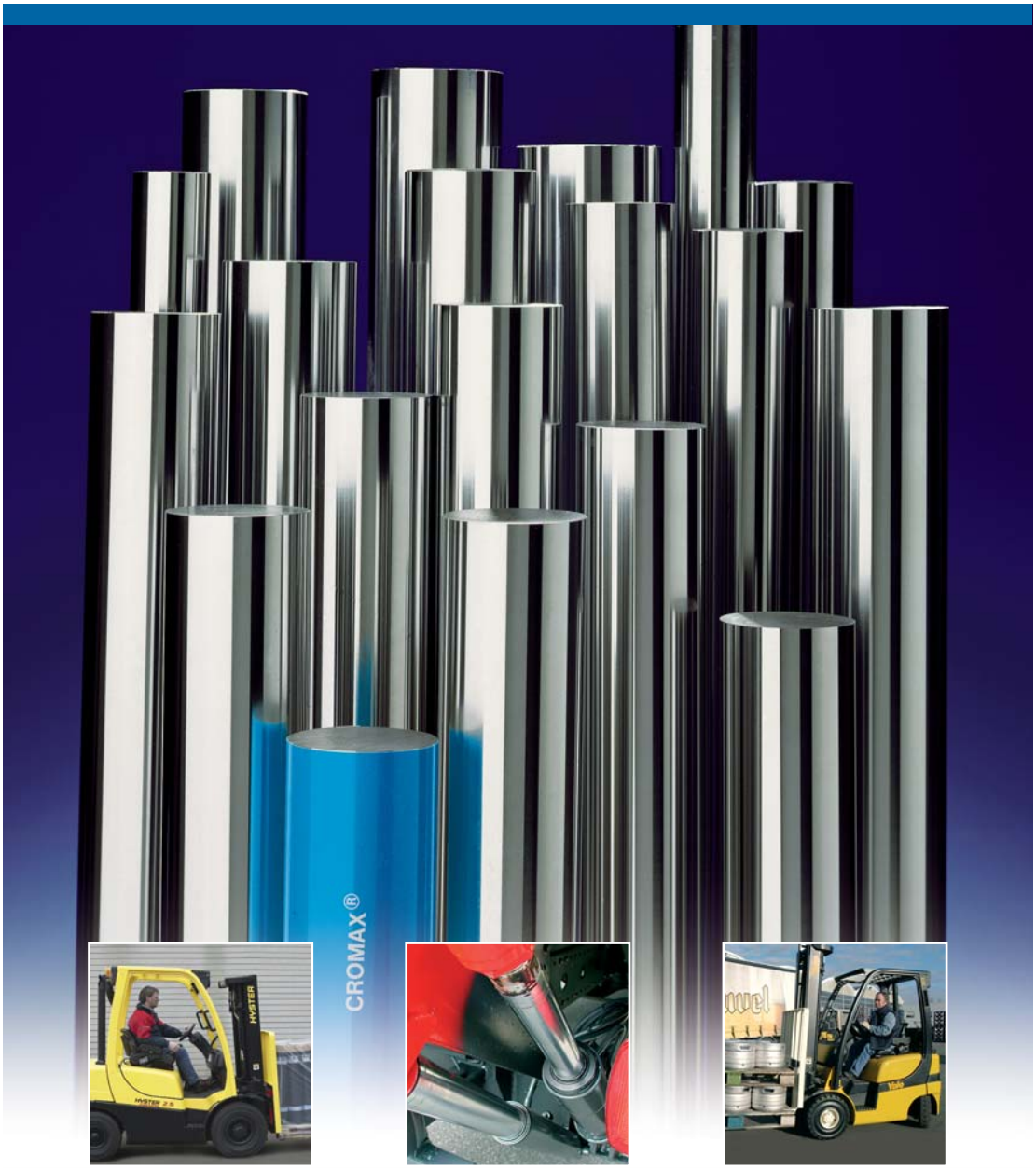
CROMAX® 280X

Hard chrome bar



OVAKO

Cromax® 280X is based on a low carbon, microalloyed steel combining high strength with excellent machinability and weldability. For $\phi \leq 90$ mm, yield and tensile strength are 20% higher than is normal for hard-chrome bars based on low-carbon weldable steel. This improvement is achieved without detriment to machinability or weldability.

In comparison with standard products based on grade 20MnV6, the superior properties profile of Cromax 280X offers a number of potential advantages in the design and manufacture of fluid-power cylinders, not the least of which is the possibility to downsize piston rods without loss of load-bearing capacity, thereby reducing not only weight but also cost.

Average chemical analysis Cromax® 280X

C %	Si %	Mn %	S %	V %	C.E. %(*)
0.18	0.35	1.55	0.025	0.11	0.55 max

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

Corresponding standards

The table shows the closest equivalent standard for the steel in Cromax 280X.

Cromax	EN	DIN	BS	AFNOR	ASTM
280X	20MnV6	20MnV6	55M	E420	A572

Mechanical properties

Size (ϕ), mm	Yield stress, R_{eH}, N/mm², min.	Ultimate tensile stress, R_m, N/mm²	Elongation, A_5, %, min.	Hardness, HB	Toughness, KV, Joule, min.
< 20	520	650 - 800	12	200 - 240	No guarantee
20 - 90	520	650 - 800	19	200 - 240	27 at -20 °C
> 90	440	550 - 700	19	180 - 230	No guarantee (*)

*Base steel meeting KV≥27J at -20°C can be supplied by special arrangement.

Chrome layer

For $\phi \geq 20$ mm, the chrome layer thickness is 20 µm min. For smaller sizes, the minimum thickness is 15 µm.

Surface roughness

The surface roughness (Ra) is always less than 0.2 µm and normally in the range 0.05-0.15 µm. Rt (ISO) is always less than 2.0 µm and normally in the range 0.5-1.5 µm.

Surface hardness

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

Straightness

For $\phi < 30$ mm, the maximum deviation is 0.1 mm/0.5 m. The maximum deviation for larger diameters is 0.1 mm/1.0 m.

Roundness

The out of roundness is maximised at 50% of the diameter tolerance interval.

Diameter tolerance

ISO f7 is standard. Other tolerances can be supplied upon request (narrowest range is ISO level 7).

Tolerance ranges

Size, mm	ISO f7, µm upper	lower
10 - 18	- 16	- 34
> 18 - 30	- 20	- 41
> 30 - 50	- 25	- 50
> 50 - 80	- 30	- 60
> 80 - 120	- 36	- 71
> 120 - 150	- 43	- 83

Standard sizes

Dia., mm	kg/m	Dia., mm	kg/m	Dia., inch	kg/m
10	0.62	60	22.19	1/2	1.00
12	0.89	63	24.47	5/8	1.55
14	1.21	65	26.05	3/4	2.23
16	1.58	70	30.21	7/8	3.05
18	2.00	75	34.68	1	3.97
20	2.47	80	39.46	1 1/4	6.22
22	2.98	85	44.54	1 3/8	7.52
25	3.85	90	49.94	1 1/2	8.94
28	4.83	100	61.65	1 3/4	12.19
30	5.55	110	74.60	2	15.91
32	6.31	115	81.53	2 1/4	20.13
35	7.55	120	88.78	2 1/2	24.87
36	7.99	125	96.33	2 3/4	30.09
38	8.90	130	104.19	3	35.81
40	9.86	140	120.83	3 1/4	42.03
42	10.88	150	138.72	3 1/2	48.72
45	12.48			4	63.65
50	15.41			4 1/2	80.55
55	18.65			5	99.44
56	19.33			5 1/2	120.32

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

Delivery lengths

Production lengths are between 3.6-7.6 m. Standard is 6.1+0.1/-0 m with the following exceptions. For Ø≤20 mm, the production length is 3.6+0.1/-0 m. For diameters 20 and 22 mm, the standard production lengths are 5.0+0.1/-0 m and 5.5+0.1/-0 m respectively. Bars with length 7.6+0.1/-0 m can only be supplied for diameters between 40-80 mm.

The "unchromed length" of each bar, i.e. the distance at each end over which the chrome-layer properties and tolerances can not be guaranteed, is at most 0.15 m per end, i.e. 0.3 m in total per bar.

Fixed, cut lengths can be supplied if required, but at a price premium.

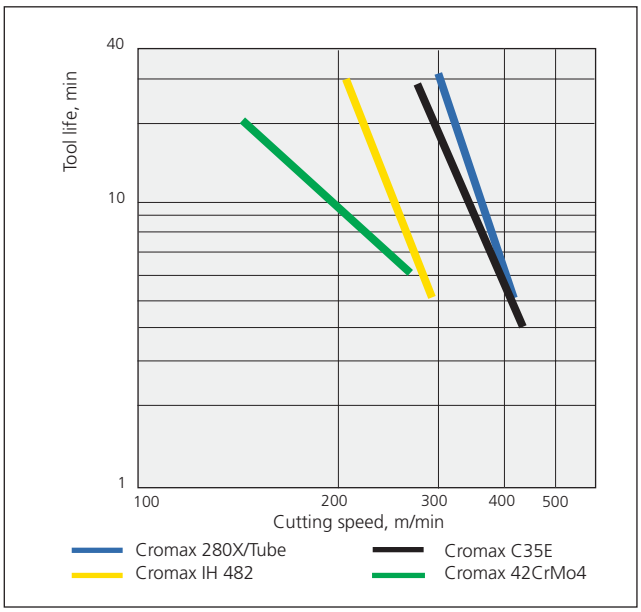
Weldability

Cromax 280X has excellent weldability. However, for Ø>90 mm, preheating to 150-200°C is recommended. Suitable consumables are OK 48.00/38.84 for MMA welding and OK 12.64 for MAG welding (shielding gas 80% Ar, 20% CO2).

Cromax 280X can normally be friction welded without difficulty.

Machinability

The machinability of Cromax products in turning is compared in the diagram below. Coated carbide tool Sandvik SNMG 120408-PM-4015. Feed 0.4 mm/r. Cutting depth 2 mm. Wear criterion 0.4 mm. Cutting fluid: Peralube 0125 5%.



Specific machining recommendations for turning and threading of Cromax 280X are tabulated below.

Operation/ parameters	Rough turning	Fine turning	Threading
Feed, mm/r	0.3 – 0.6	0.05 – 0.3	–
Cut depth, mm	2 – 5	0.2 – 2.0	–
Tool (coated)	ISO P15 – P30	ISO P10 – P15	ISO P20 – P30
Speed, m/min	280 – 350	350 – 400	200 – 230

Corrosion resistance

The chromium layer generated in hard-chrome plating contains micro-cracks and its corrosion resistance is thereby limited. Ovako's Cromax products are characterised by a controlled micro-crack distribution with high crack density, which in combination with specially adapted finishing procedures, provides for superior corrosion resistance.

Most corrosion resistance specifications for hard-chrome products are based on salt-spray testing following the ISO 9227 standard or its equivalents (see below), combined 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

While the correlation between these methods is not always clear, our experience is that a given degree of corrosion is reached 2-3 times as fast in the AASS test as in NSS-testing.

Cromax in standard execution is guaranteed to attain rating 9 or better after 40 h in AASS test. The same rating will be achieved in NSS test after about 100 h.

Packaging

Cromax 280X can be supplied with three different packaging options:

- Paper tubes with the characteristic blue and yellow spiral stripes.
- Blue plastic sleeve, which can be left on as protection during piston-rod manufacture.
- Plastic spacer rings.

For the two latter alternatives, the bars are normally packed in a wooden box for additional protection during transport.

Irrespective of mode of packaging, every Cromax bar is marked with product and batch information so as to facilitate full traceability.

Other Cromax products

Ovako's hard-chrome product programme also comprises:

- Cromax C35E based on medium-carbon steel,
- induction-hardened bar, Cromax IH 482,
- quenched and tempered bar, Cromax 42CrMo4, and
- Cromax in the form of tube (Cromax Tube).

CROMAX® C, Ni-CROMAX®

When the application demands a higher corrosion resistance than afforded by standard Cromax, then Cromax C or Ni-Cromax execution is recommended.

Cromax C is guaranteed for min. rating 9 after 100h in ISO 9227, AASS. Ni-Cromax is guaranteed not to corrode at all (rating 10) after 350h in AASS or 1 000h in NSS.

In order to distinguish from standard execution, Cromax C is supplied in a red plastic sleeve. Ni-Cromax is characterised by white plastic or a white paper tube.

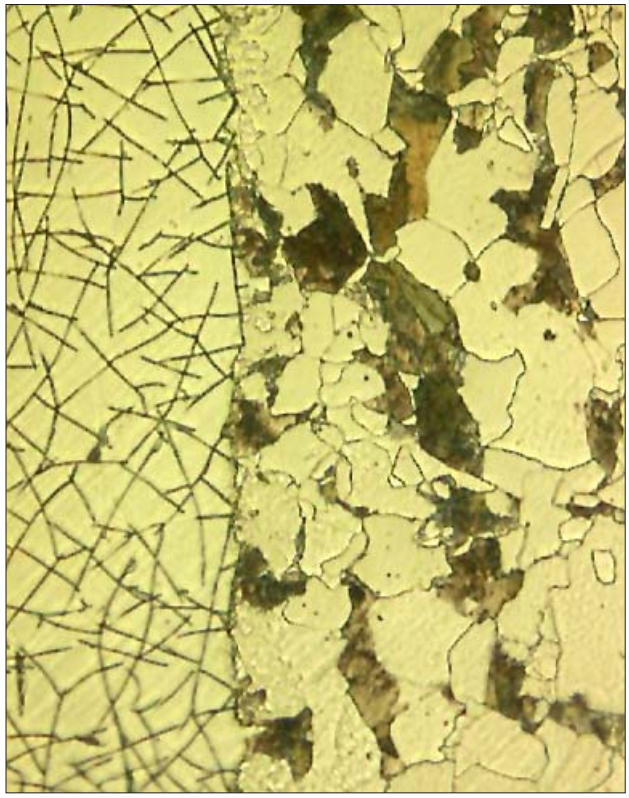
Ni-Cromax execution is described in more detail in a separate data sheet.

Ovako is a leading European producer of special steel long products for the automotive and engineering industries. Deliveries in 2005 exceeded 1.6 million tons and comprised low-alloy and carbon steels in the form of bars, wire rod, tubes, rings and pre-components. The company has 16 manufacturing sites and several sales companies in Europe and the USA. Ovako has 4,600 employees.

Ovako Cromax is the major manufacturer in Europe of hard-chrome plated products in the form of bar and tube. The Cromax Group comprises five modern production units, two in Sweden and one in each of Holland, France and Italy.

The majority of the base-material requirements for Cromax manufacture are supplied by Ovako's own steel production units. The high and reproducible quality and superior mechanical characteristics of Cromax products are to a large extent attributable to a complete control over the entire manufacturing chain from steel melting to finished bar.

Ovako Cromax has about 200 employees and a turnover of EUR 60 million.



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