Formadur
(X5CrNiCuNb 15-5)

PH X Superclean

C 0.05 **Cr** 15.00 **Ni** 4.50 **Cu** 3.50 **Nb** +

Steel properties

Formadur PH X Superclean is a corrosion-resistant, precipitation-hardened steel with high strength. It shows excellent polishability due to the applied remelting process. Compared to Formadur 2316, hardness in as-delivered condition and corrosion resistance are improved.

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 150	20 – 200	20 – 250	20 – 300	20 – 350	20 – 400	20 – 450	20 – 500
10^{-6} m/(m • K)	10.4	10.6	10.9	11.1	11.4	11.5	11.7	11.9	12.0

Precipitation hardened

Thermal conductivity

at °C	23	150	300	350	400	500
W/(m • K)	16.8	20.1	22.1	22.8	23.3	24.1

Precipitation hardened

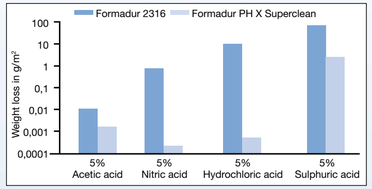
Applications

Formadur PH X Superclean is recommended for tools used in the processing of corrosive plastics. Further applications for components in aircraft and chemical industries.

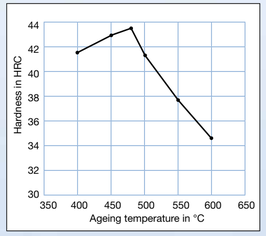
Heat treatment

Formadur PH X Superclean is usually supplied in precipitation-hardened condition with a hardness of 40 HRC.

Weight loss diagram



Ageing diagram



Reference numbers in brackets are not standardized in EN ISO4957.

Stock size Formadur PH X Superclean

20.1	x	4.1 inch, black condition	510.0 x 105.0 mm
20.1	x	6.1 inch, black condition	510.0 x 155.0 mm
20.1	x	8.1 inch, black condition	510.0 x 205.0 mm
20.1	x	9.1 inch, black condition	510.0 x 230.0 mm
28.2	x	22.1 inch, pre-machined	715.0 x 560.0 mm
35.4	x	9.8 inch, pre-machined	900.0 x 250.0 mm
35.4	x	11.8 inch, pre-machined	900.0 x 300.0 mm
35.4	x	13.8 inch, pre-machined	900.0 x 350.0 mm
35.4	x	15.8 inch, pre-machined	900.0 x 400.0 mm
35.4	x	17.7 inch, pre-machined	900.0 x 450.0 mm
35.4	x	19.7 inch, pre-machined	900.0 x 500.0 mm
43.3	x	3.9 inch, pre-machined	1,100.0 x 100.0 mm
43.3	x	5.9 inch, pre-machined	1,100.0 x 150.0 mm
43.3	x	7.8 inch, pre-machined	1,100.0 x 200.0 mm

General note (liability)

All statements regarding the properties or utilization of the materials or products mentioned are for the purposes of description only. Guarantees regarding the existence of certain properties or a certain utilization are only ever valid if agreed upon in writing. No responsibility is taken for the correctness of this information.

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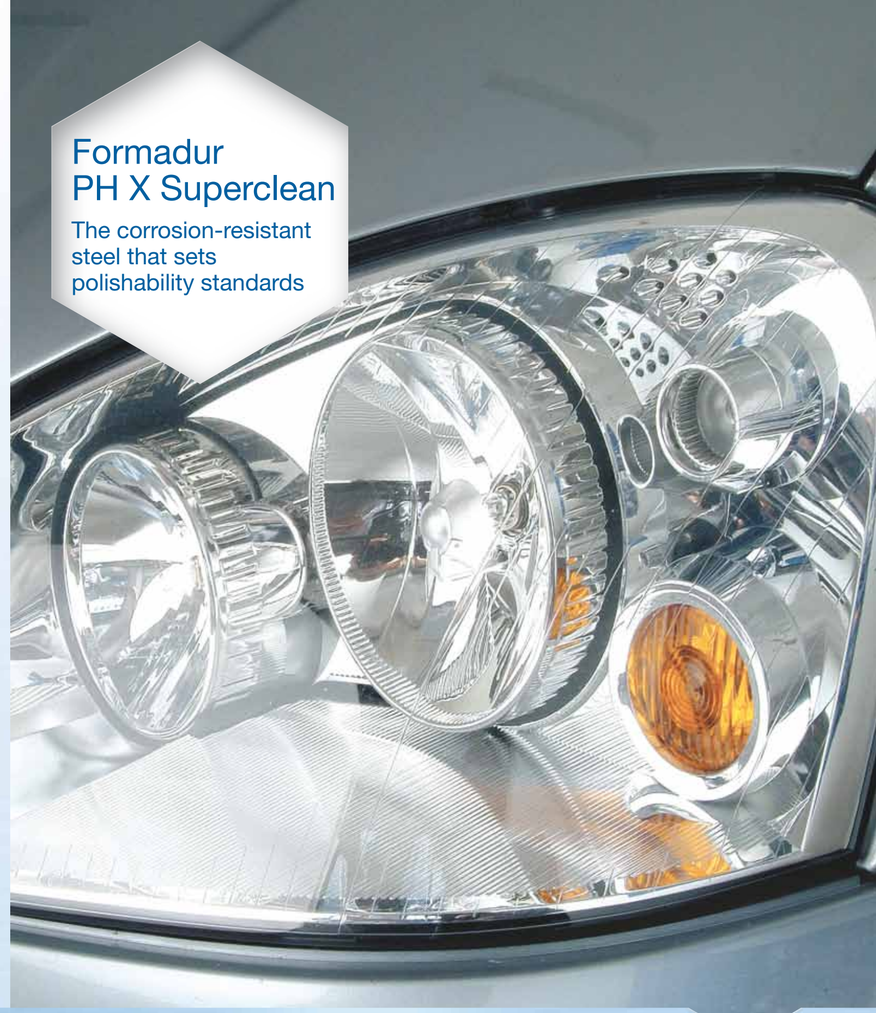

Formadur PH X Superclean

The corrosion-resistant steel that sets polishability standards

DEUTSCHE EDELSTAHLWERKE

Providing special steel solutions

Plastic mould manufacturing´s new gem

The current tendency in plastic mould manufacturing is to incorporate two mould features – corrosion resistance and the very best in polishability. The advantage of moulds of this nature is their ability to withstand condensation and cooling water. They are also resistant to plastics such as PVC or aminoplasts – materials which usually corrode tool steels through the separation of acids during processing. The other ever more significant key feature, especially when viewed from a standpoint of shortened production times, is exceptional polishability.

DEUTSCHE EDELSTAHLWERKE‘s tool specialists answer to this challenge was the development of the precipitation-hardenable high-performance steel, Formadur PH X Superclean. In contrast to the majority of corrosion-resistant steel grades commonly used in mould manufacturing, Formadur PH X Superclean contains a minimum of carbides. As a result of the material‘s homogeneous microstructure, stress-relief annealing after rough machining is unnecessary – a further advantage over conventional steels. Formadur PH X Superclean‘s outstanding polishability, corrosion resistance and dimensional stability have set a new standard in the world of plastic mould construction.

Formadur PH X Superclean – when you demand the very best polishability from a corrosion-resistant steel

Formadur PH X Superclean is a precipitation-hardenable remelted steel grade exhibiting exceptional corrosion resistance and outstanding polishability. This unusually pure premium steel is a development based on Formadur 2316.

- Formadur PH X Superclean is particularly suitable in fulfilling most demanding requirements when it comes to high-quality surfaces. Its microstructure and working hardness are the key to its excellent polishability.
- Specific technology is applied to Formadur PH X Superclean during manufacture, resulting in exceptionally low stress and outstanding shape retention at the machining stage.
- Formadur PH X Superclean requires no additional heat treatment as it is supplied at a standard hardness of 38 to 42 HRC.

In the world of plastics processing, profitability is highly dependent on the performance, reliability and quality of the steel grade used for the mould.

Thanks to Formadur PH X Superclean‘s superior advantages, the plastic manufacturer is able to achieve significant increases in profitability, productivity and quality when using this steel grade.

Comparison of properties

	Formadur PH X Superclean	Formadur 2316
Machinability	++	++
Corrosion resistance	++++	++
Thermal conductivity	+	+
Toughness	+++	+
Polishability	++++	++
Shape retention	++++	++

Benefits for the plastics-manufacturing industry

Moulds and mould inserts are typical operational applications for Formadur PH X Superclean in the automotive industry – for headlight reflectors for example – as in the optical industry (e.g. spectacle lenses and optical inserts). This especially pure steel is likewise favoured for components in the chemical and aeronautics industries.

When it comes to high-level polishability, shape retention and corrosion resistance, Formadur PH X Superclean is the perfect solution, offering manufacturers of plastic components very considerable advantages:

- necessary maintenance and cleaning activities are reduced to a minimum, particularly in demanding climatic conditions such as high humidity or sea air with a high salt content
- the very high resistance to corrosion results in long service lives
- water flow and heat dissipation are not impeded by substances resulting from corrosion in the cooling channels
- there is no risk of contact corrosion when using a combination of mould frames made from Corroplast® together with inserts made from Formadur PH X Superclean.

Standard machining Formadur PH X Superclean (hardness 38 to 42 HRC)

Tool	Hobbing / Kayway cutter	Surface milling	Round Plate	Drilling	Tapping
		∅ 120	∅ 66	∅ 17.7	M 20
Cutting material	P 20 - P 30	P 40 coated	P 40 coated	SCD	PM
Cutting speed VC [m/min.]	40 - 60	80 - 100	80 - 120	35v - 45	3 - 4
Feed per tooth fz [mm]	0.12 - 0.15	0.25 - 0.45	0.35 - 0.60	0.2 mm/rev	
Depth of cut ap [mm]	5.0 - 8.0	3.0 - 7.0	2.0	5.0 x D	15 x D
Width of cut ae [mm]	100v % D	75 % D	45	D	
Stability of the machine, clamping and workpiece	+++	+++	+++	+++	+++

Spectacle lenses. Photo: Rodenstock