

# TOOLOX® 46 BARS



The Toolox® steels made by Swedish Steel producer SSAB ([www.ssab.com](http://www.ssab.com)) have been proven to be an excellent solution when a high mechanical strength is needed combined with a superior resistance to cracks and fatigue.

Being delivered already heat treated to up to 47 HRc, mould and dies as well as the most demanding machine components can be produced directly without having to send to external heat treatment. Saving time and costs but even more important avoiding the risks always involved in heat treatments.

The Toolox® 44 steel is already used for hot work applications such as forging and extrusion dies. To further improve the performance at elevated temperature the Toolox® 46 grade has been developed.

## Material concept

The Toolox steels is based on a improved metallurgical concept compared to traditional hot work tool steels. Instead of heavily alloying with elements as Cr, SSAB has since decades developed a concept based on using water as quenching media in the heat treatment processes. Water being the most efficient cooling method makes it possible to achieve the optimum martensite microstructure at the same time as keeping carbon and alloying elements at a minimum. Resulting in a ductile and crack resistant structure but also giving other benefits as a for the hardness excellent machinability and weldability.

	Toolox® 44	Toolox® 46	W.Nr 1.2714	W.Nr 1.2344 (H13)
Hardness	410-475 HBW	430 – 490 HBW	36 – 40 HRc	(heat treated 45-55 HRc)
Toughness guarantee	Min 11 J @ RT	Min 11 J @ RT	None	None
C	0.31	0.34	0.55	0.40
Cr	1.35	1.50	1.10	5.20
Ni	0.70	1.20	1.65	-
Mo	0.80	2.00	0.50	1.40
V	0.145	0.14	0.10	0.90
P (max)	0.010	0.010	0.030	0.030
CE	0.97	1.28	1.12	1.96

## HOT WORK APPLICATIONS

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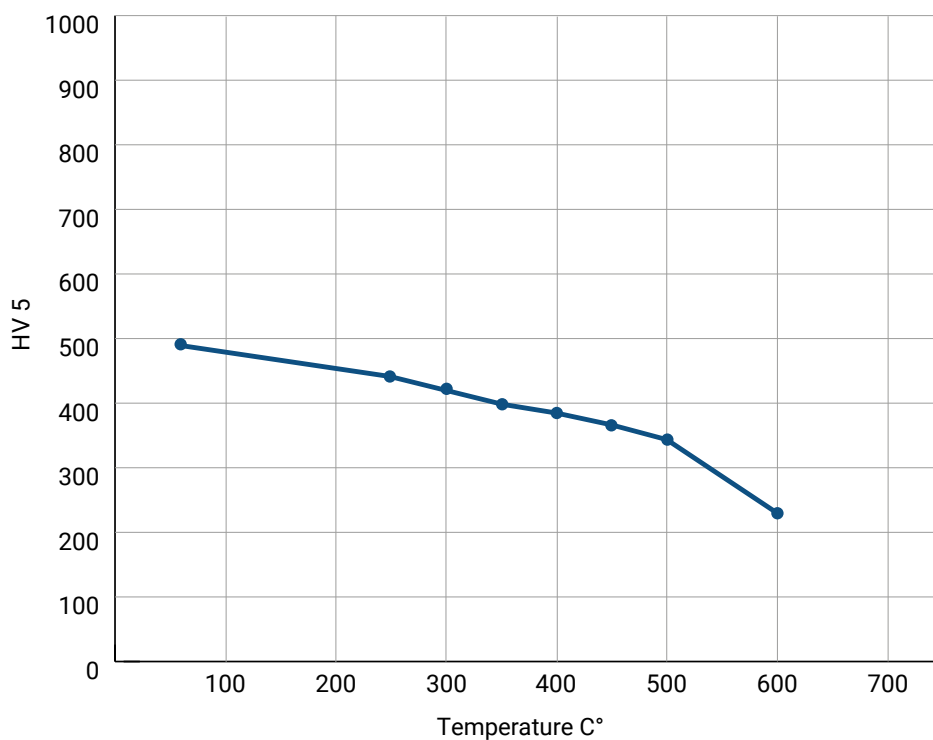
Toolox® 46 bars have been proven to perform consistently similar to ESR hot work tool steels in forging and extrusion dies. Below a parallel test in aluminium extrusion. The amount on aluminium produced between nitriding steps and the final result can be seen below.

Weight per nitriding (kg)	Premium branded ESR hot work tool steel	Toolox® 46
1 <sup>st</sup>	0	0
2 <sup>nd</sup>	1193	631
3 <sup>rd</sup>	2679	2610
4 <sup>th</sup>	8613	8790
Total	14420	14516

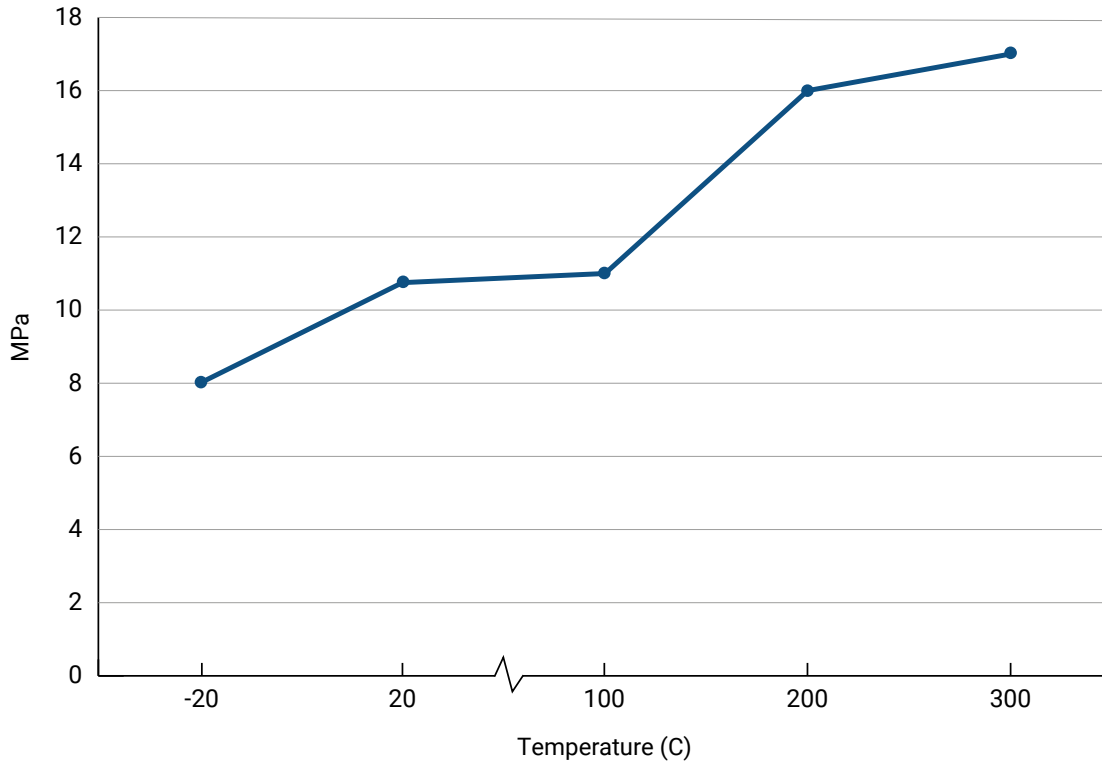
## PROPERTIES

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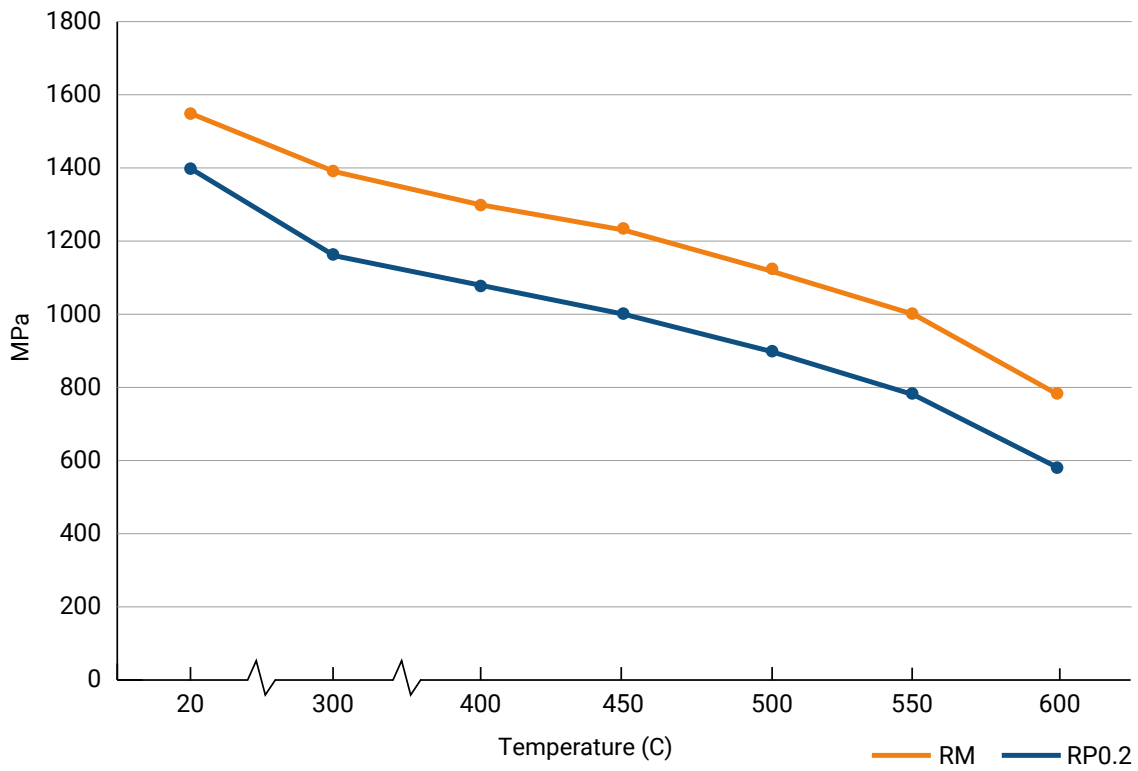
### Elevated temperature hardness



### Elevated temperature toughness



### Tensile properties



## WORKSHOP

### Machining

Toolox® 46 has for the hardness a very good machinability. Thanks to the low alloy content and the homogenous microstructure. The following parameters should be seen as proposed start values.

Further improvements can be obtained together with the tooling supplier.

### Turning

	Roughing ap 3 (mm)	Finishing ap 1 (mm)
Cutting speed Vc (m/min)	100	130
Feed per tooth fz mm/t	0.30	0.20
Insert grade	P15-25	P15-25

### Drilling

	Drill type					
	Solid		Exchangeable tip		Indexable tip	
Cutting speed Vc (m/min)	40-50		40-50		60-90	
Feed (mm/rev)	Diam 3-5 mm	0.07	Diam 7.5-12 mm	0.10	Diam 12-20 mm	0.06
	Diam 5.1-10 mm	0.10	Diam 12.1-20 mm	0.14	Diam 20.1-30 mm	0.08
	Diam 10.1-15 mm	0.15	Diam 20.1-25 mm	0.16	Diam 30.1-40 mm	0.12
	Diam 15.1-20 mm	0.18	Diam 25.1-30 mm	0.18	Diam 40.1-60 mm	0.14

### Milling

Face milling round inserts		End Milling – Solid cemented carbide tool		
Cutting speed Vc (m/min)	160	Slot milling		
Feed per tooth fz mm/t	0.15	Cutting speed Vc (m/min)		
Insert grade	P30	80		
		Feed (mm/rev)	Diam 3-6 mm	0.02
			Diam 8-12 mm	0.05
			Diam 14-20 mm	0.07

### Threading

For Toolox® 46, thread milling is highly recommended	
Cutting speed Vc (m/min)	60
Feed per tooth fz mm/t	0.03

As a result of testing, it was proven that both Toolox® 44 and Toolox® 46 can be perfectly gun drilled.  
On the following table start values can be found.

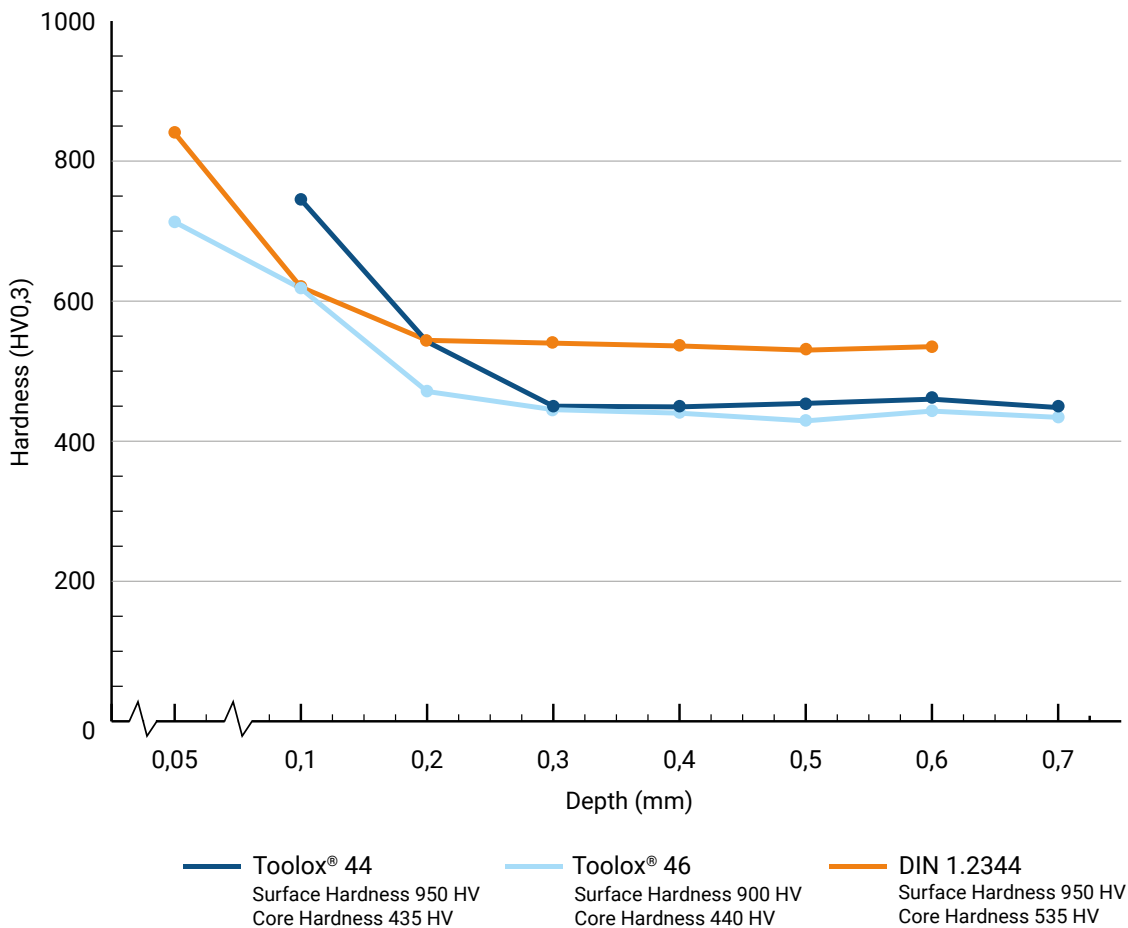
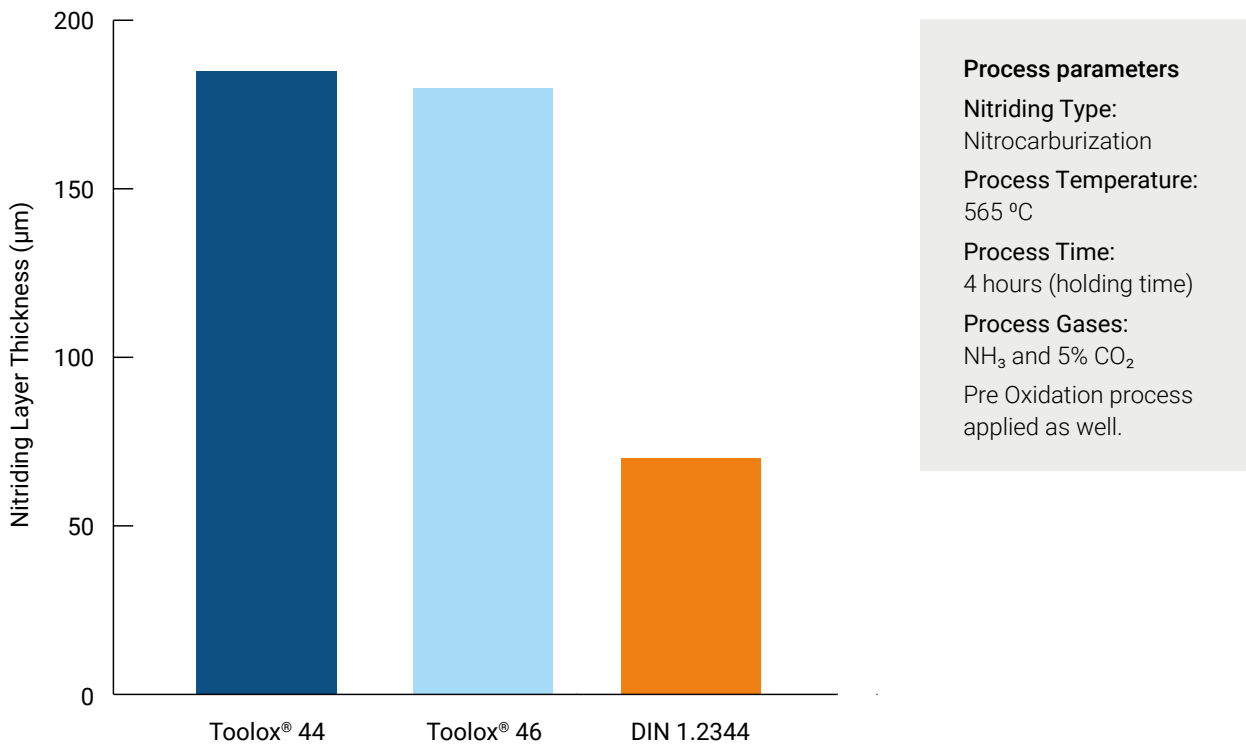
Diameter (mm)	Brazed Cemented Carbide Drill					Drills With Exchangeable Drill				
	RPM	Feed (mm/min)		Regrinding advice	Cooling pressure	RPM	Feed (mm/min)		Regrinding advice	Cooling pressure
		Min.	Max	mm	Mpa		Min.	Max.	mm	Mpa
φ 3	3715	18.6	37.2	800	100-120					
φ 4	2787	13.9	27.9	800	80-100					
φ 5	2229	17.8	22.3	800	60-80					
φ 6	1858	14.9	18.6	800	60-80					
φ 7	1592	15.9	23.9	800	50-70					
φ 8	1393	13.9	20.9	800	50-70					
φ 9	1238	18.6	24.8	800	40-60					
φ 10	1115	16.7	22.3	800	40-60					
φ 11	1013	20.3	30.4	800	30-50					
φ 12	929	18.6	27.9	800	30-50					
φ 13	857	25.7	34.3	800	20-40	1225	36.7	61.2	800-1200	20-40
φ 14	796	23.9	31.8	800	20-40	1137	34.1	56.9	800-1200	20-40
φ 15	743	29.7	37.2	800	20-30	1062	31.8	53.1	800-1200	20-30
φ 16	697	27.9	41.8	800	20-30	995	39.8	59.7	800-1200	20-30
φ 17	656	32.8	39.3	800	20-30	937	37.5	56.2	800-1200	20-30
φ 18	619	31.0	37.2	800	20-30	885	44.2	70.8	800-1200	20-30
φ 19	587	29.3	35.2	800	20-30	838	41.9	67.0	800-1200	20-30
φ 20	557	27.9	33.4	800	20-30	796	39.8	63.7	800-1200	20-30

The parameter data are depend on the drill of DGSLDJ company, [www.dgsl dj.com](http://www.dgsl dj.com)

## Surface hardening

Surface hardening such as nitriding, laser and PVD can be done with excellent results. Thanks to the ductile structure of Toolox® 46 the risk of the layer falling off disappears.

### Nitriding Performance of Toolox® 44, Toolox® 46 and 1.2344



## Repair welding

Thanks to the lower alloy content and high ductility, welding can be significantly improved compared to traditional hot work tool steels. Preheating can be done at lower temperatures and potentially less costly filler materials used.



## Availability

Plates and square blocks from 6–320 mm. Bars between 21 and 405 mm with lengths up to 5000 mm. Toolox® is available from the local SSAB stock. Cut pieces of Toolox® can be obtained through the well-established global network of Approved Toolox® Distributors. Both SSAB and the distributors can provide you with good application support as well as technical guidelines.

## Contact and more information

Contact your local sales representative to learn more, visit [www.toolox.com](http://www.toolox.com) or consult Tech Support at: [help@ssab.com](mailto:help@ssab.com).