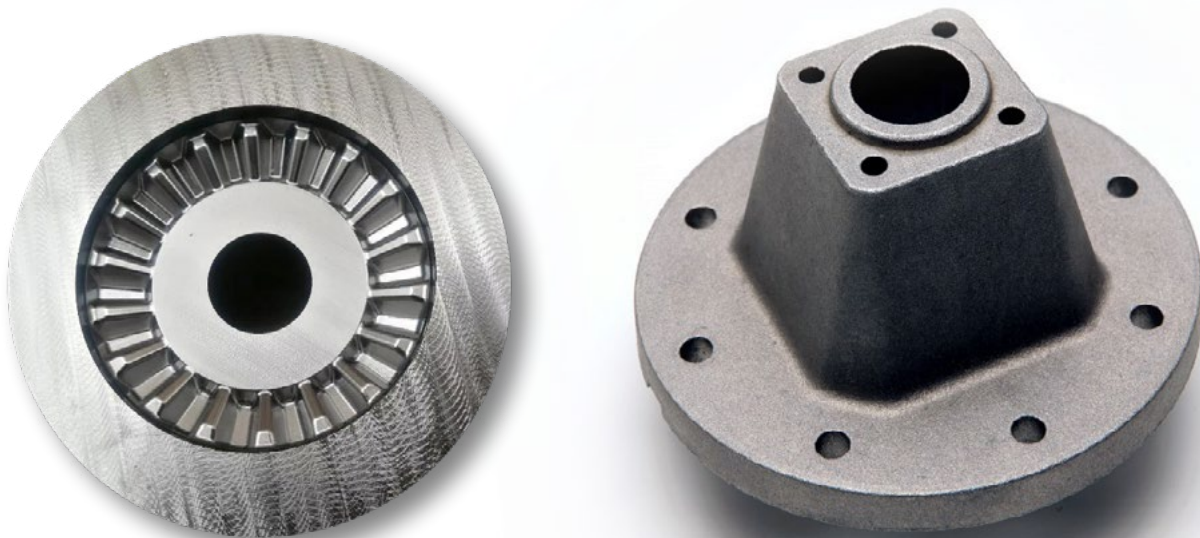


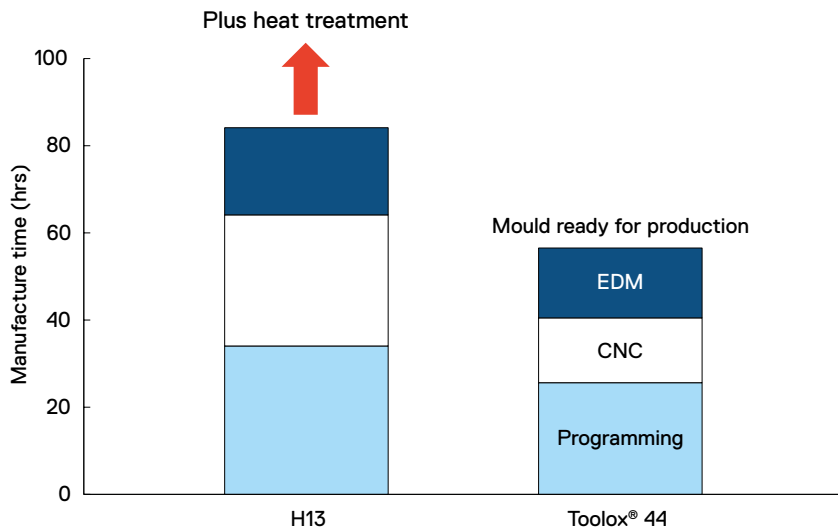
TOOLOX® FOR FORGING DIES

The Toolox® steels made by Swedish Special Steel producer SSAB have proven to be an excellent choice for Forging dies. Being delivered already heat treated large savings can be made in time and cost. The extensive quality control made on the Toolox® products takes away the risk always present when heat treatment is done. Having an elevated and guaranteed crack resistance limits gross cracking risk.

The Toolox® 44 steel grade has been available in the market for more than 10 years. Being used for a large number of forging dies, it has proven to perform in the level as standard hot work tool steels such as H13. Giving good results as it is the performance further improves with nitriding surface treatments. Being lower alloyed than traditional tool steels, the machining properties are excellent for the 45 HRC hardness level.

For more demanding conditions, such as longer cycle times, more complicated component shapes or less efficient cooling, SSAB has developed a new steel grade called Toolox® 46. Toolox® 46 has increased content of Mo which improves the heat resistance. In application testing, Toolox® 46 has performed similar or even better than ESR hot work tool steels. Keeping the benefits of Toolox® 44 being delivered already heat treated and being fully machinable with conventional tooling.





Saves time and lower risk

To the left an example on how using Toolox® will save time of die manufacture. The same mould was made both in H13 and Toolox® 44. Already without counting the heat treatment time, a very significant time was saved. Thanks to that the mould could be made in one setup with Toolox®. With the H13 tool steel all machining operations had to be repeated twice, before and after heat treatment

Standard tool steels can have very varying properties depending on where it was manufactured. The local heat treatment makes the situation even worse. To really know the properties the mould would have to be cut a part and the material analyzed in a laboratory.

With Toolox®, these risks disappear. SSAB does the material testing after heat treatment and before delivery. The actual values can be found on the material certificate. A very thorough ultrasonic testing is then also done on all material sold to make sure no internal defects can be found in the products.

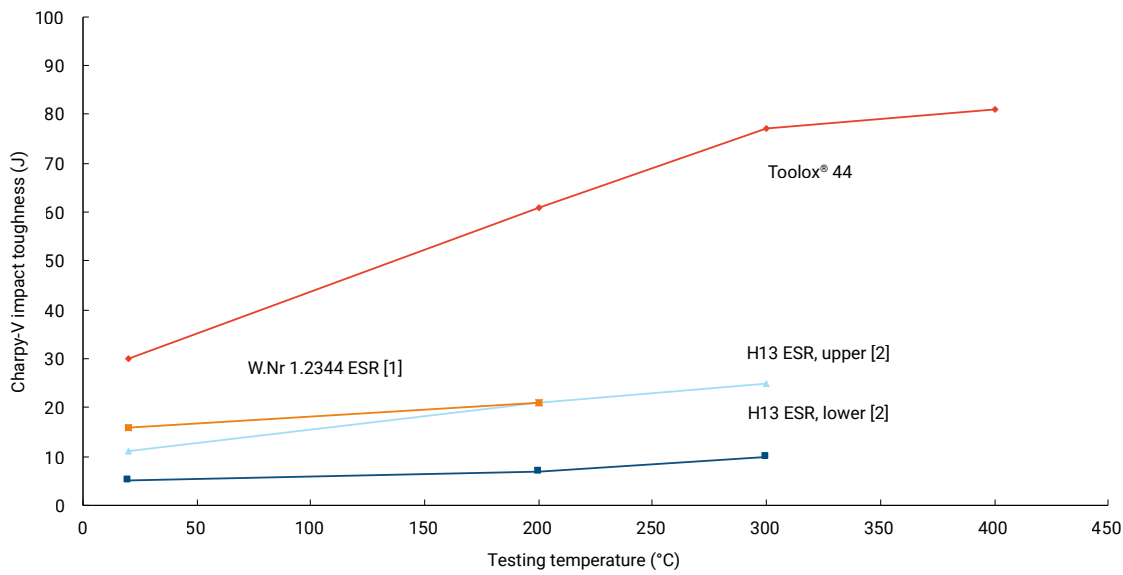
Toolox® being made only by SSAB has very consistent properties over time. Make the performance almost same over a long time period. Meaning that production can be planned in a much better way.

Better material concept

For best performance of a forging die, a homogenous martensitic microstructure is needed. To achieve that structure, the traditional way is to add a lot of alloying elements such as Cr.

Toolox® has much lower alloying content and instead martensite is reached but using water as quenching method. The fastest and most efficient way of obtained a high steel hardness. SSAB can use water in the processes since the steel raw material has very low level of impurities such as Phosphor. As result, a high hardness can be combined with a very high toughness and fatigue resistance. Furthermore, the Toolox® structure represents an excellent base for surface hardness such as nitriding, laser and PVD.

	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

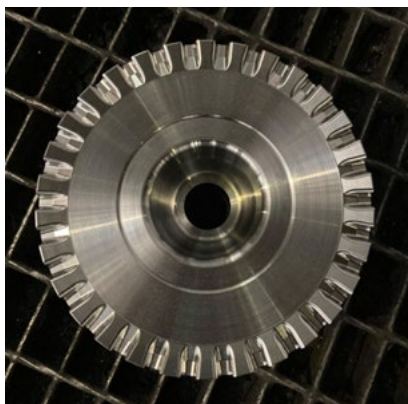


APPLICATIONS

Toolox® has been used extensively for different types of forging dies since more than 10 years. Consistently showing benefits not only in the manufacture of the dies but also in the usage. In the below case, a spare part for a personal car was produced. Toolox® performed better than 1.2714 but also better than H13 since the crack problems in H13 disappeared with Toolox®.

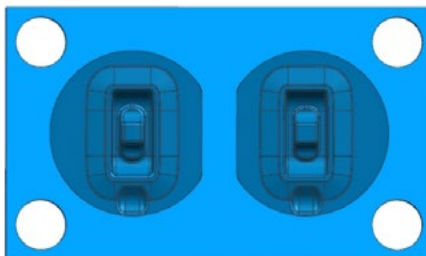
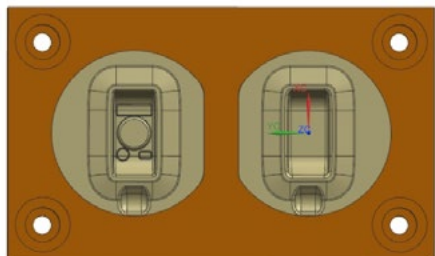


Material	Hardness	Die Life	Failure Mechanism
1.2714 – Prehardened	42 HRc	2 000 pcs	Hot wear
1.2344 – Heat Treated	46–47 HRc	4 500 pcs	Hot wear and crack
Toolox® 44 Round Bar, Dia 180 mm	44 HRc	6 000 pcs	Hot wear – no crack



For the die for the component to the left manufactured in different steel grades 35CrMo, 40Cr, C45, both Toolox® 44 and Toolox® 46 gave better life times than the previous tool steels. Thanks to that the higher Toolox® crack resistance early failures were avoided. Toolox® showed better performance despite being delivered with a lower hardness.

Tool steel	Hardness	Lifetime	Failure
H13 ESR	50–52	8 000–9 000	Thermal wear or crack
1.2367 ESR	50–52	9 000–9 500	Thermal wear or crack
Toolox® 44	45	10 500	Deformation and thermal wear
Toolox® 46	46–47	11 500	Deformation and thermal wear



Also against the highest quality hot work tool steels, Toolox® shows very competitive results. In this case life time became longer despite previous steel was nitrided. Toolox® gives excellent results when nitrided so even better life time can potentially be obtained doing that.

Material	Hardness	Service life	Failure
ESR quality patent hot work tool steel	44-46 HRc + Nitriding	7 000–8 000 pcs (per grinding-5mm-)	Hot Wear
Toolox® 46	46 HRc	13 000 pcs (per grinding-5mm-)	Hot Wear

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 or consult Tech Support at: help@ssab.com.