TOOLOX®
ENGINEERING & TOOL STEEL

# TOOLOX® FOR ALUMINIUM EXTRUSION DIES

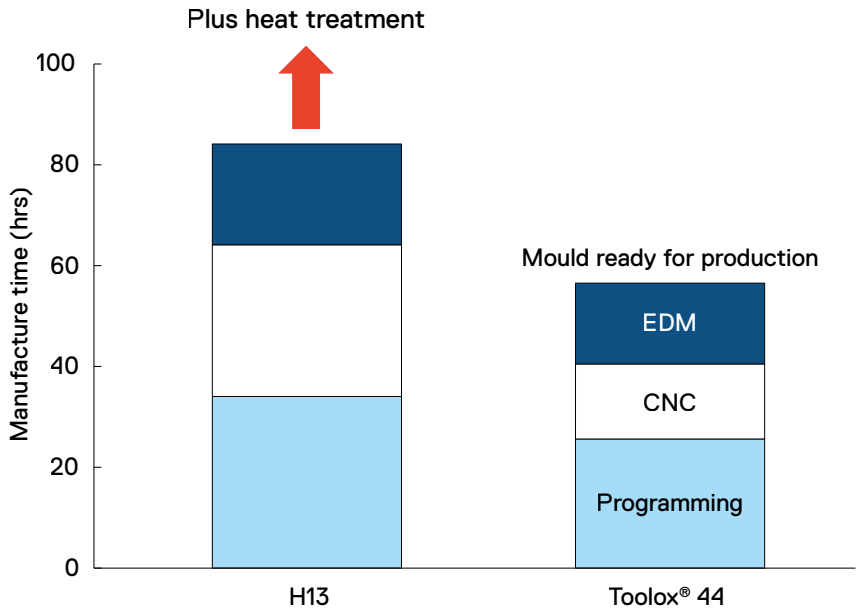
Standard tool steels can have very varying properties depending on where it was manufactured. The local heat treatment makes the situation even worse. To really know the properties the mould would have to be cut a part and the material analyzed in a laboratory.

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.

**Saves time and lower risk**

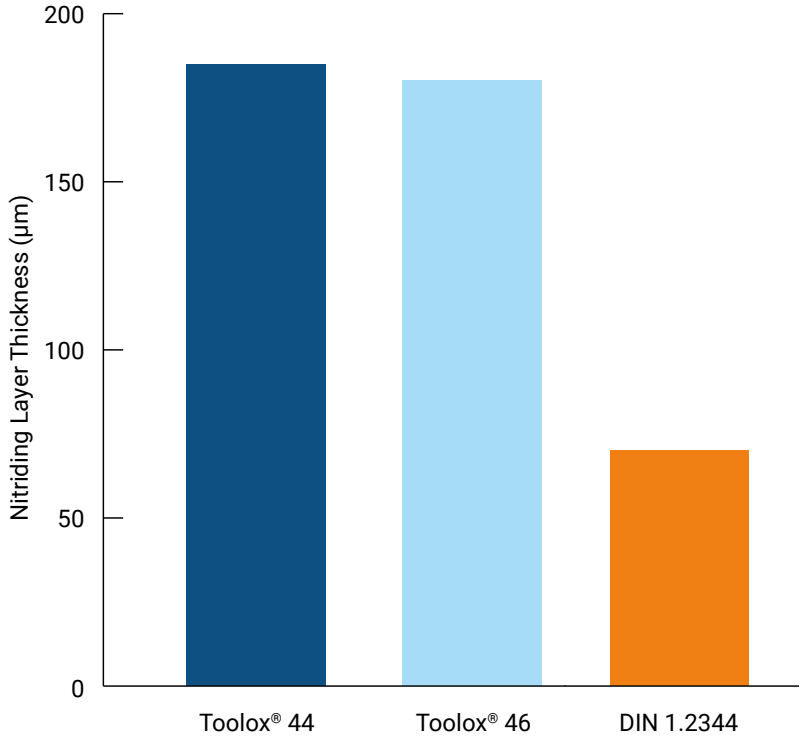
Below an example on how using Toolox® will save time of die manufacture. The same mould was made both in H13 and Toolox® 44. Already without counting the heat treatment time, a very significant time was saved. Thanks to that the mould could be made in one setup with Toolox®. With the H13 tool steel all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




**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**




**Process parameters**

**Nitriding Type:**
Nitrocarburization

**Process Temperature:**
565 ºC

**Process Time:**
4 hours (holding time)

**Process Gases:**
$NH_3$ and 5% $CO_2$

Pre Oxidation process applied as well.

**Toolox® 44**
Surface Hardness 950 HV
Core Hardness 435 HV

**Toolox® 46**
Surface Hardness 900 HV
Core Hardness 440 HV

**DIN 1.2344**
Surface Hardness 950 HV
Core Hardness 535 HV

**Better material concept**

For best performance of a extrusion 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 toughness and fatigue resistence. 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 |

**Hot work applications**

Toolox® 46 bars have been proven to perform consistently similar to ESR hot work tools 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 |
|---|---|---|
| 1st | 0 | 0 |
| 2nd | 1193 | 631 |
| 3rd | 2679 | 2610 |
| 4th | 8613 | 8790 |
| Total | 14420 | 14516 |

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642-en-Toolox for aluminium extrusion dies V1-2024

**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.


A die used for very demanding production of high strength AA6063 F31. Therefore, normally Patent ESR hot work tool steel is being used. Giving an average lifetime of 70–90 ton. Dies produced in Toolox® 44 performed similar with lifetimes of 40 and 129 tons. Both in Toolox® 44 and in previous steel, nitriding was carried out. Final failure was same in both cases. Customer reported large saving both in die manufacturing time and total costs.

In this die for aluminum bicycle wheels, lifetime with Toolox® 44 increased with almost double compared to the previous usage of H13 ESR. Nitriding was done in both cases.

| Steel grade | Hardness | Nitriding | Lifetime | Failure |
|---|---|---|---|---|
| H13 ESR | HRC 48-52 | Yes | 10–12 tons | Wear |
| Toolox® 44 | HRC 45-47 | Yes | 20 tons | 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.

SSAB