

UDDEHOLM NIMAX

Reliable and efficient tool steel is essential for good results. The same goes for achieving high productivity and high availability. When choosing the right steel many parameters must be considered, however by using a superior steel your productivity can be greatly improved. With excellent machinability and very good polishability you will spend less time to finish your product. This makes it much easier to meet your deadline. Uddeholm Nimax is a new steel grade for plastic moulding which provides several unique benefits.

SUPERIOR MACHINABILITY

This will give you the advantage of shorter machining time. In turn this means that it will be easier for you to meet your customers demands on delivery time.

You will also benefit from lower cutting tool cost and increased availability of your machines.

INSTANT WELDING

– NO PREHEATING OR POST HEAT TREATMENT REQUIRED

Weld repairs, maintenance and design changes can be performed quicker, thus shortening the downtime during mould manufacturing and production. You will be very flexible and your production will run smoother and faster.

CONSISTENT TOOL PERFORMANCE

– LONGER TOOL LIFE

Uddeholm Nimax combines high hardness with a high toughness. This leads to a mould with good resistance to indentations and a minimum risk for unexpected failures, thereby leading to a more reliable tool and prolonged tool life.

REDUCE YOUR POLISHING COSTS

– ACHIEVE A BETTER SURFACE FINISH

With good structure and a low amount of inclusions you will spend considerably less time to achieve the desired surface finish.

Nimax® is a trade mark registered in the European Union and in the U.S.

This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as a warranty of specific properties of the products described or a warranty for fitness for a particular purpose.

Classified according to EU Directive 1999/45/EC

For further information see our "Material Safety Data Sheets".

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The latest revised edition of this brochure is the English version, which is always published on our web site www.uddeholm.com



SS-EN ISO 9001
SS-EN ISO 14001

General

Uddeholm Nimax is a low carbon plastic mould steel delivered at a hardness of ~ 40 HRC.

Uddeholm Nimax is characterized by the following:

- Excellent machinability
- Very good welding properties
- Good polishing and texturing properties
- Good resistance against indentations
- High impact and fracture toughness
- Consistent properties through large sections

The excellent machinability and easy weldability, no preheating or post treatment necessary, reduce the manufacturing time and make the maintenance much easier. The high hardness in combination with a high toughness results in a mould with good resistance to indentations and a minimum risk for unexpected failures, leading to a safer mould and a prolonged tool life.

| | | | | | | |
|----------------------------|----------------------|-----|-----|-----|-----|-----|
| Typical analysis weight- % | C | Si | Mn | Cr | Mo | Ni |
| | 0.1 | 0.3 | 2.5 | 3.0 | 0.3 | 1.0 |
| Delivery condition | 360–400 HB | | | | | |
| Colour code | Light blue/Dark blue | | | | | |

Applications

Uddeholm Nimax is suitable for many different types of applications within the plastic segment. Its excellent machinability and high toughness also makes it suitable as a holder material as well as for many engineering applications.

Examples of applications are:

- Moulds for plastic injection
 - Packaging industry
 - Containers of different types
 - Automotive industry
 - Larger interior parts
 - Reflectors
 - Appliances
 - Panels and handles
- Holder material for forging and die casting dies
- Holder material for cutting tools
- Hot runner manifolds
- Structural components

Properties

Physical data

| Temperature | 20°C (68°F) | 200°C (390°F) |
|--|-----------------------------------|---|
| Density kg/m ³ lbs/in ³ | 7 900 0.285 | – |
| Modulus of elasticity N/mm ² psi | 205 000 29.7 × 10 ⁶ | – |
| Coefficient of thermal expansion per °C from 20°C °F from 68°F | – | 12.4 × 10 ⁻⁶ 6.9 × 10 ⁻⁶ |
| Thermal conductivity W/m · °C Btu in/(ft ² h °F) | – | 28 194 |
| Specific heat J/kg °C Btu/lb °F | 460 0.11 | – |

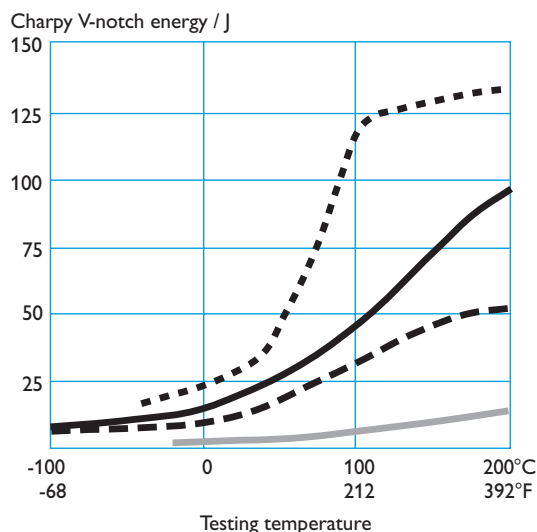
Mechanical properties

The properties are representative of samples taken from the centre of bars with dimension 596 × 296 mm unless otherwise is indicated. Values of different mechanical properties depend on dimension of original material, position and direction of samples as well as hardness and test temperature.

IMPACT TOUGHNESS

Specimens type: Charpy V, short transverse direction.

| | |
|-----------|---|
| — · — · — | Uddeholm Nimax Size: 400 × 100 mm, 373 HB |
| — — — — | Uddeholm Nimax Size: 596 × 296 mm, 375 HB |
| — — — — | W.-Nr. 1.2738 Size: 300 × 100 mm, 325 HB |
| — — — — | W.-Nr. 1.2738 Size: 355 × 90 mm, 356 HB |



The high impact toughness increases the safety against cracking failures.

TENSILE STRENGTH

Hardness ~370 HB.

| | |
|--------------------------------|------|
| Yield strength, $R_{p0.2}$ MPa | 785 |
| Tensile strength, R_m MPa | 1265 |
| Elongation, % | 11 |
| Area contraction, % | 47 |

COMPRESSIVE STRENGTH

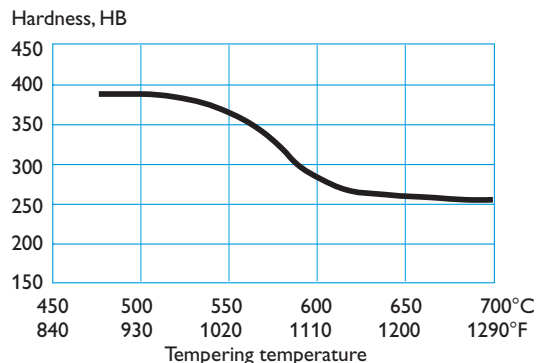
Hardness ~370 HB.

| | |
|--------------------------------------|------|
| Compressive strength, $R_{c0.2}$ MPa | 1000 |
|--------------------------------------|------|

Heat treatment

Uddeholm Nimax is intended to be used in the delivery condition. The hardness cannot be increased by heat treatment, but can be decreased by tempering. **However, tempering is not recommended because it significantly decreases toughness in spite of the fact that the hardness is reduced.**

The following hardness reduction can be expected after 2 h at full temperature:



If the steel has been exposed to high temperature thus reducing toughness and hardness, the following procedure can be performed in order to restore the original condition:

Heat to 850°C (1560°F), holding time 30 min.
Cool in circulating air.



Refrigerator handle.

Surface treatment

Flame and induction hardening

The surface hardness of Uddeholm Nimax cannot be increased either by induction hardening or flame hardening.

Nitriding

Nitriding increases the surface hardness and wear resistance. For best result the following steps should be followed:

1. Rough machining
2. Stress relieving at a temperature not higher than 525°C (977°F). Heat the mould up until it is heated through and let it cool down to room temperature
3. Grinding
4. Nitriding

The following approximate nitriding depths and surface hardnesses can be expected:

| | Surface hardness MHV (200g) | Depth after nitriding | | |
|--------------------------------------|-----------------------------------|--|--|--|
| | | 10h mm (inch) | 30h mm (inch) | 60h mm (inch) |
| Gas nitriding at 510°C (950°F) | 950 | 0.16 ¹⁾ (0.006 ¹⁾) | 0.28 ¹⁾ (0.011 ¹⁾) | 0.39 ¹⁾ (0.015 ¹⁾) |
| Plasma nitriding at 480°C (896°F) | 1000 | 0.13 ²⁾ (0.005 ²⁾) | 0.25 ¹⁾ (0.010 ¹⁾) | 0.33 ¹⁾ (0.013 ¹⁾) |

¹⁾ Not recommended

²⁾ Recommended

Nitriding at temperatures above 500°C (930°F) and times longer than 10 h is not recommended as it will reduce toughness and hardness significantly. For more detailed information contact your local Uddeholm office.

Case hardening

The surface hardness can be increased by case hardening. 2h at 850°C (1560°F) and a carbon activity of 0,65 followed by tempering 1 h at 170°C (340°F) gives a surface hardness of 650 MHV and a case hardening depth of 0.3 mm (0.012”).

Machining recommendations

The cutting data below are to be considered as guiding values which must be adapted to existing local conditions. More information can be found in the Uddeholm publication “Cutting data recommendations”.

Turning

| Cutting data parameters | Turning with carbide | | Turning with HSS Fine turning |
|---|---------------------------|-----------------------|-------------------------------|
| | Rough turning | Fine turning | |
| Cutting speed (v_c) m/min. f.p.m. | 110–150 360–492 | 150–200 492–656 | 10–15 33–49 |
| Feed (f) mm/rev. i.p.r. | 0.2–0.4 0.008–0.016 | –0.3 –0.012 | –0.3 –0.012 |
| Depth of cut (a_p) mm inch | 2–4 0.08–0.16 | –2 –0.08 | –2 –0.08 |
| Carbide designation ISO | P20–P30 Coated carbide | P10 Coated carbide | – |

Drilling

HIGH SPEED STEEL TWIST DRILL

| Drill diameter | | Cutting speed (v_c) | | Feed (f) | |
|----------------|----------|-------------------------|--------|-----------|-------------|
| mm | inch | m/min | f.p.m. | mm/rev | i.p.r. |
| –5 | –3/16 | 12–14* | 39–46* | 0.05–0.10 | 0.002–0.004 |
| 5–10 | 3/16–3/8 | 12–14* | 39–46* | 0.10–0.20 | 0.004–0.008 |
| 10–15 | 3/8 –5/8 | 12–14* | 39–46* | 0.20–0.25 | 0.008–0.010 |
| 15–20 | 5/8 –3/4 | 12–14* | 39–46* | 0.25–0.30 | 0.010–0.012 |

* For coated HSS drills $v_c = 18–20$ m/min. (59–66 f.p.m.)

CARBIDE DRILL

| Cutting data parameters | Type of drill | | |
|---|--|--|--|
| | Indexable insert | Solid carbide | Carbide tipped ¹⁾ |
| Cutting speed (v_c) m/min. f.p.m. | 150–170 492–558 | 100–130 328–426 | 90–110 296–360 |
| Feed (f) mm/rev. i.p.r. | 0.05–0.25 ²⁾ 0.002–0.010 ²⁾ | 0.10–0.25 ²⁾ 0.004–0.010 ²⁾ | 0.15–0.25 ²⁾ 0.006–0.010 ²⁾ |

¹⁾ Drills with replaceable or brased carbide tip

²⁾ Depending on drill diameter

Milling

FACE AND SQUARE SHOULDER MILLING

| Cutting data parameters | Milling with carbide | |
|---|------------------------|-------------------------------------|
| | Rough milling | Fine milling |
| Cutting speed (v_c) m/min. f.p.m. | 80–150 262–492 | 150–180 492–590 |
| Feed (f_z) mm/tooth in/tooth | 0.2–0.4 0.008–0.016 | 0.1–0.2 0.004–0.008 |
| Depth of cut (a_p) mm inch | 2–5 0.08–0.2 | – 2 – 0.08 |
| Carbide designation ISO | P20 Coated carbide | P10–P20 Coated carbide or cermet |

END MILLING

| Cutting data parameters | Type of milling | | |
|---|--|--|--|
| | Solid carbide | Carbide indexable insert | High speed steel |
| Cutting speed (v_c) m/min. f.p.m. | 70–110 230–361 | 80–120 262–394 | 10–15 ¹⁾ 33–49 ¹⁾ |
| Feed (f_z) mm/tooth in/tooth | 0.03–0.20 ²⁾ 0.001–0.008 ²⁾ | 0.08–0.20 ²⁾ 0.003–0.008 ²⁾ | 0.05–0.35 ²⁾ 0.002–0.014 ²⁾ |
| Carbide designation ISO | – | P20–P30 | – |

¹⁾ For coated HSS end mill $v_c = 25–30$ m/min. (82–98 f.p.m.)

²⁾ Depending on radial depth of cut and cutter diameter

Grinding

A general grinding wheel recommendation is given below. More information can be found in the Uddeholm publication “Grinding of Tool Steel”.

WHEEL RECOMMENDATION

| Type of grinding | Wheel recommendation |
|---------------------------------|----------------------|
| Surface grinding straight wheel | A 46 HV |
| Surface grinding segments | A 36 GV |
| Cylindrical grinding | A 60 KV |
| Internal grinding | A 60 IV |
| Profile grinding | A 120 JV |

Electrical discharge machining, EDM

Contrary to other steel grades, the heat affected surface layer achieved during EDM'ing will not be harder than the underlying steel. Consequently, the heat affected layer is more easily removed.

Welding

Preheating or post heat treatment is not necessary. However if severe strain conditions could be expected a stress relieving at 450°C (840°F) for 2h is recommended after welding.

| Welding method | TIG | MMA |
|---------------------------|--|-----------------|
| Preheating temperature | None | None |
| Filler material | Impax TIG Weld Nimax TIG-Weld | Impax Weld |
| Max interpass temperature | 300°C (570°F) | |
| Cooling rate | Freely in air | |
| Hardness as welded | Impax TIG-Weld 320–340 HB Nimax TIG-Weld 360–400 HB | 330–350 HB – |
| Post heat treatment | None / 450°C (840°F) 2h | |

Photo etching

Uddeholm Nimax is very suitable for texturing by photo etching. The very low sulphur content and homogenous structure ensures an accurate and consistent pattern reproduction.



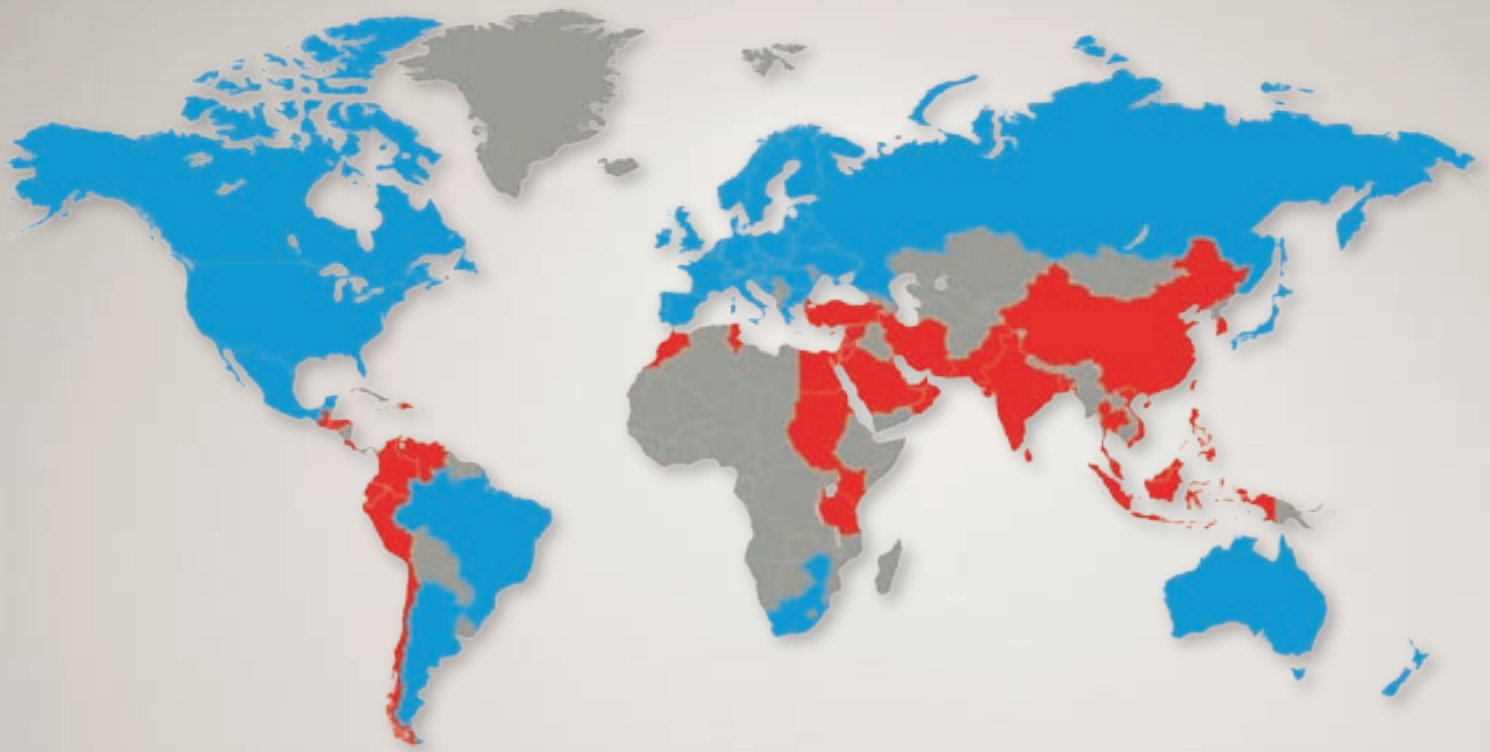
Chair support.

Polishing

Uddeholm Nimax has a very good polishability. The very low sulphur content and the homogenous structure ensures a good polishing result.

Further information

Please contact your local Uddeholm office for further information on the selection, heat treatment, application and availability of Uddeholm tool steels.



Network of excellence

UDDEHOLM is present on every continent. This ensures you high-quality Swedish tool steel and local support wherever you are. ASSAB is our wholly-owned subsidiary and exclusive sales channel, representing Uddeholm in various parts of the world. Together we secure our position as the world's leading supplier of tooling materials.

UDDEHOLM is the world's leading supplier of tooling materials. This is a position we have reached by improving our customers' everyday business. Long tradition combined with research and product development equips Uddeholm to solve any tooling problem that may arise. It is a challenging process, but the goal is clear – to be your number one partner and tool steel provider.

Our presence on every continent guarantees you the same high quality wherever you are. ASSAB is our wholly-owned subsidiary and exclusive sales channel, representing Uddeholm in various parts of the world. Together we secure our position as the world's leading supplier of tooling materials. We act worldwide, so there is always an Uddeholm or ASSAB representative close at hand to give local advice and support. For us it is all a matter of trust – in long-term partnerships as well as in developing new products. Trust is something you earn, every day.

For more information, please visit www.uddeholm.com, www.assab.com or your local website.

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