

Uddeholm Nimax[®] ESR

Welding recommendations

GENERAL

Uddeholm Nimax ESR is a low carbon plastic mould steel delivered at a hardness of ~40 HRC. Uddeholm Nimax ESR is an ESR remelted version of Uddeholm Nimax, keeping the features of Uddeholm Nimax, but with improved cleanliness and homogeneity as a result of the ESR process.

Good results when welding can be achieved if proper precautions are taken (joint preparation, choice of consumables and welding procedure). Uddeholm Nimax TIG-Weld is a TIG filler rod specially composed as to be compatible with the mould steel Uddeholm Nimax. Uddeholm Nimax TIG-Weld gives a weld metal identical in composition to Uddeholm Nimax ESR and is characterized by:

- very good melting properties
- high impact and fracture toughness
- good polishing and texturing properties

RECOMMENDED FILLER MATERIAL

| Welding Method | Gas Tungsten Arc Welding GTAW (TIG) | Gas Metal Arc Welding GMAW (MIG/MAG) | Shielded Metal Arc Welding SMAW (MMA) | Laser | Comments |
|--------------------|-------------------------------------|--------------------------------------|---------------------------------------|------------------|---|
| Filler material | Nimax TIG | Nimax MIG | Impax Weld | Nimax Laser Weld | If the surface is going to be photo-etched Nimax TIG or Nimax Laser Weld is recommended |
| | Type AWS ER 312 | | | | Use soft filler material for buffering layer |
| Hardness as welded | 40 HRC | 40 HRC | | 40 HRC | |

DIMENSIONS FILLER MATERIAL

| Type | TIG | | MIG | MMA | | | Laser |
|------------------|-------|------|------|------|------|------|---------------|
| Dia. Ø mm | 1.0 | 1.6 | 1.2 | 2.5 | 3.25 | 4.0 | 0.2 – 0.6 |
| Dia. Ø Inch | 0.040 | 1/16 | 3/64 | 3/32 | 1/8 | 5/32 | 0.008 – 0.024 |
| Nimax TIG Weld | X | X | | | | | |
| Nimax MIG Weld | | | X | | | | |
| Impax Weld | | | | X | X | X | |
| Nimax Laser Weld | | | | | | | X |

PARAMETERS

| Condition | Prehardened 40 HRC | Comment |
|------------------------|---|--|
| Preheating Temperature | 175°C ± 25°C 345°F ± 50°F | Preheating is not necessary, but if it is desired, a temperature at 175°C ± 25°C 345F ± 50°F is recommended Start with buffering layers if not all cracks are removed |
| Interpass temperature | Max 150°C, 270°F above preheating temperature | The temperature of the tool in the vicinity of the weld should not exceed 300°C, 570° F. When passed, the tool will have a risk for distortion increases. |
| Cooling rate | 20 - 40°, 35 - 70°F C/h The first 2 hours then freely in air <70°C, 160°F | |
| Post treatment | 450°C (840°F) for 2 hours | Post treatment is normally not required. However, in cases when high strain could be expected (for example deep groove preparations, large welded areas and fillet welds) a stress relieving at 450°C (840°F) for 2 hours is recommended. Heat treatment above 500°C (930°F) should be avoided because it will reduce the hardness as well as the toughness of Uddeholm Nimax ESR. |

PROCEDURES

- Clean weld area.
- Preheating is not necessary, but if it is desired, a temperature at $175^{\circ}\text{C} \pm 25^{\circ}\text{C}$ $345\text{F} \pm 50^{\circ}\text{F}$ is recommended
- Do not let the temperature in the vicinity of the weld (the HAZ) increase to more than $300^{\circ}\text{C} / 570^{\circ}\text{F}$. There is a risk of lowering (softening) the hardness of the base material or/and cracking in the HAZ. Use temple sticks or other temperature-measuring devices.
- For finishing layers use consumables which give suitable hardness.
- Wait a few minutes between each layer of strings, both for soft and hard filler, in order to let the layer equalize and minimize stresses. Peen to minimize stresses.
- If possible, change welding direction 180° between each layer.
- Cool slowly after welding, $20 - 40^{\circ}\text{C}/\text{h}$, $35 - 70^{\circ}\text{F}/\text{h}$ for the first two hours and then freely in air $< 70^{\circ}\text{C} / 160^{\circ}\text{F}$.
- Post treatment is normally not required. However, in cases when high strain could be expected (for example deep groove preparations, large welded areas and fillet welds) a stress relieving at 450°C (840°F) for 2 hours is recommended. Heat treatment above 500°C (930°F) should be avoided because it will reduce the hardness as well as the toughness of Uddeholm Nimax.

Use these guideline recommendations along with
“Welding of Uddeholm Tool Steel” for complete instructions.