

Uddeholm RoyAlloy®

Welding recommendations

GENERAL

Uddeholm RoyAlloy is a patented free machining stainless holder steel, which is supplied in the prehardened condition. Uddeholm RoyAlloy is characterized by:

- Excellent machinability and weldability
- Good dimensional stability and uniform hardness in all dimensions
- Good corrosion resistance, ductility, and indentation resistance.

Good results when welding can be achieved if proper precautions are taken (joint preparation, choice of consumables and welding procedure).

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	RoyAlloy TIG	Nimax MIG Weld	400 series Stainless Steel E 29 9 R	Nimax laser Weld	Use soft filler material for buffering layer
	Type AWS ER 312 AWS ER NiCrMo-3				
Hardness as welded	36 - 39 HRC	375 HB		40 HRC	

DIMENSIONS FILLER MATERIAL

Type	TIG		MIG	MMA			Laser
Dia. Ø mm	0.9	1.8	1.2	2.5	3.25	4.0	0.2 – 0.6
Dia. Ø Inch	0.035	0.070	3/64	3/32	1/8	5/32	0.0 – 0.0
RoyAlloy TIG	X	X					
Nimax MIG			X				
Nimax Laser							X

PARAMETERS

Condition	Pre-hardened ~310 HB	Comment
Preheating Temperature	125°C ± 25°C 250°F ± 50°F	The temperature should be kept constant during the welding operation. Start with buffering layers if not all cracks are removed
Interpass temperature	Max 485°C, 900°F	RoyAlloy can safely be heated to 485°C, 900°F without altering the prehardened properties of the material, however heating in an unprotected atmosphere will result in slight discoloration of the surfaces.
Cooling rate	20 - 40°, 35 - 70°F C/h The first 2 hours then freely in air <70°C, 160°F	
Post treatment	Stress relieving	Stress relieving is recommended for large weld repairs to reduce residual stresses. Max. stress relieving temperature 485°C. See heat treatment specification in Uddeholm RoyAlloy product brochure.

PROCEDURES

- Clean weld area.
- Neither pre-heating nor post-heating is necessary. Uddeholm RoyAlloy does not develop an overhardened heat-affected zone (HAZ) around the weld deposit. This eliminates the concern of weld-induced cracking during repair or, subsequently, during service.
- A pre-heating of the material to $125^{\circ}\text{C} \pm 25^{\circ}\text{C}$ / $250^{\circ}\text{F} \pm 50^{\circ}\text{F}$ and maintaining the temperature during welding will result in better dimensional stability.
- For best results, use Uddeholm RoyAlloy welding electrodes, which provide an optimal match with the base metal in terms of chemical composition and mechanical properties. The Uddeholm RoyAlloy consumables will give 34–38 HRC.
- 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, if possible use pre-heating furnace. 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°F .
- Stress relieving is recommended for large weld repairs to reduce residual stresses. Max. stress relieving temperature 485°C / 900°F .

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