

# Uddeholm Ramax<sup>®</sup> HH

## Welding recommendations

### GENERAL

Uddeholm Ramax HH is a chromium alloyed stainless holder steel, which is supplied in the hardened and tempered condition. Uddeholm Ramax HH is characterized by good corrosion resistance, uniform hardness even in large dimensions, good indentation resistance and good machinability. These properties combine to give a steel with outstanding production performance.

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	Impax TIG Weld	Nimax MIG Weld	Impax Weld	Nimax laser Weld	
	Type AWS ER 312 AWS ER NiCrMo-3		E 29 9 R		Use soft filler material for buffering layer
Hardness as welded	300 – 330 HB	375 HB	300 – 330 HB		

### 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	0.0 – 0.0
Impax TIG Weld	X	X					
Nimax MIG Weld			X				
Impax Weld				X	X	X	
Nimax Laser Weld							X

### PARAMETERS

Condition	Pre-hardened 290 – 330 HB	Comment
Preheating Temperature	225°C ± 25°C 440°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 150°C, 270°F above preheating temperature	The temperature of the tool in the vicinity of the weld. When passed, the tool will have a risk for distortion, soft zones or cracking in and around the weld (the HAZ).
Cooling rate	20 - 40°, 35 - 70°F C/h The first 2 hours then freely in air <70°C, 160°F	
Post treatment	Soft anneal Harden	Holding time when tempering, 2h. When soft annealing and hardening, see heat treatment specification in Uddeholm Ramax HH product brochure.*

## PROCEDURES

- Clean weld area.
- Preheat material to  $225^{\circ}\text{C} \pm 25^{\circ}\text{C}$  /  $440^{\circ}\text{F} \pm 50^{\circ}\text{F}$  and maintain temperature during welding.
- Do not let the temperature in the vicinity of the weld (the HAZ) increase more than  $150^{\circ}\text{C}$  /  $270^{\circ}\text{F}$  above the preheating temperature. 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, if possible use pre-heating furnace. Peen to minimize stresses.
- If possible, change welding direction  $180^{\circ}$  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  $< 70^{\circ}\text{C}$  /  $160^{\circ}\text{F}$ .
- Temper  $550^{\circ}\text{C}$  /  $1020^{\circ}\text{F}$  for two hours.

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