

# Uddeholm Alvar® 14

## Welding recommendations

### GENERAL

Uddeholm Alvar 14 is a chromium-molybdenum-vanadium alloyed hot work tool steel, which is characterized by good toughness, resistance to high thermal stresses, stability in hardening, and through-hardening properties.

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	UTP A 73 G4 Dievar TIG Weld QRO 90 TIG Weld	UTP A 73 G4 Dievar MIG Weld QRO 90 MIG Weld	UTP 73 G4	Dievar Laser Weld	
	Type AWS ER 312 AWS ER NiCrMo-3		E 29 9 R		Use soft filler material for buffering layer
Hardness as welded	38 – 48 HRC	48 – 52 HRC	38 – 42 HRC	48 – 52 HRC	

### DIMENSIONS FILLER MATERIAL

Type	TIG				MIG		MMA			Laser
Dia. Ø mm	1.0	1.6	2.4	3.2	1.0	1.2	2.5	3.25	4.0	0.3 – 0.7
Dia. Ø Inch	0.040	1/16	3/32	3/32	0.040	3/64	3/32	1/8	5/32	0.012 – 0.028
UTP A 73 G4 TIG		X	X	X						
Dievar TIG Weld	X	X	X	X						
QRO 90 TIG Weld	X	X	X							
UTP A 73 G4 MIG					X	X				
Dievar MIG						X				
QRO 90 MIG						X				
UTP 73 G4							X	X	X	
Dievar Laser										X

### PARAMETERS

Condition	Soft Annealed Max. 250 HB	Hardened 56 - 58 HRC	Comment
Preheating Temperature	250°C ± 25°C 485°F ± 50°F	250°C ± 25°C 485°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	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 Temper	Temper at 550°C / 1020°F, or 25°C / 50°F below previous tempering temperature	Holding time when tempering, 2h. The temperature depends on the last used tempering temperature. When soft annealing and hardening, see heat treatment specification in Uddeholm Alvar 14 product brochure.*

\* Note. We have seen that in many cases a high temperature tempering, 2h, of ~750°C (1380°F) functions instead of a complete soft annealing when welding in soft annealed material.

## PROCEDURES

- Clean weld area.
- Preheat material to 250°C ± 25°C / 485°F ± 50°F and maintain temperature during welding.
- Do not let the temperature in the vicinity of the weld (the HAZ) increase more than 150°C / 270°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° between each layer.
- Cool slowly after welding, 20 - 40°C/h, 35 - 70 °F/h for the first two hours and then freely in air < 70°C / 160°F.
- Temper at 550°C / 1020°F or 25°C / 50°F below previous tempering temperature, two hours at full temperature.
- Tools welded in the annealed condition must undergo a full soft annealing immediately after welding. Allow tool to cool to room temperature before soft annealing. If a complete soft annealing cannot be done, which we recommend, a high temperature tempering at 750°C / 1380°F could be used. Be aware of that the working properties of the material will be somewhat reduced, if the high temperature tempering is used instead of the soft annealing.

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