CALMAX/CARMO WELD/TIG-WELD

Welding of plastic mould steel and cold work steel

Calmax/Carmo Weld is a basic coated electrode and Calmax/Carmo TIG-Weld is a TIG filler rod. These are suitable for welding of the tool steels Uddeholm Calmax and Uddeholm Carmo.

Calmax/Carmo Weld and Calmax/Carmo TIG-Weld gives a weld metal identical in composition to Uddeholm Calmax and Uddeholm Carmo and are characterized by:

- Good toughness
- Good wear resistance
- Good flame and induction hardenability
- Good polishability
- Good photo-etchability.

For polishing and photo-etching Calmax/Carmo TIG-Weld is recommended.

Dimensions

CALMAX/CARMO WELD

Diameter		Length		Current	Voltage
mm	inch	mm	inch	A (DC+)	V
2,5	0,10	350	14	65–110	~23
3,25	0,12	350	14	80–165	~23

Redrying temperature 250–300°C (480–570°F) 2–3 hours.

CALMAX/CARMO TIG-WELD

Diameter		Length	
mm	inch	mm	inch
1,6	0,06	1000	40

Storage of electrodes

Always keep the electrodes in a thermostatically controlled drying cabinet at 50–150°C (120–300°F) once the package has been opened. The electrodes can be stored unpacked as long as they are kept in the cabinet. Make it a rule that electrodes are clean and dry prior to welding.

Welding of the Uddeholm tool steels Calmax and Carmo

General

Good results when welding tool steel can be achieved if proper precautions are taken during welding (elevated working temperature, joint preparation, choice of consumables and welding procedure). If the tool is to be polished or photo-etched, it is necessary to use a filler material that has the same chemical composition as the base material.

Welding method	Gas Tungsten Arc Welding GTAW/TIG	Shielded Metal Arc Welding SMAW/MMA
Filler metal	CALMAX/CARMO TIG-WELD	CALMAX/CARMO WELD
Hardness as welded	58–61 HRC	58–61 HRC

Cleaning of tool

Clean the tool carefully with degreasing agent or by grinding before welding. The surfaces in the vicinity of the intended repairs/adjustment should be cleaned to base metal prior to doing anything. Make sure that the cavity surfaces are protected during welding, especially if these are polished.

Joint preparation

For a satisfactory result, it is imperative that the region to be welded is carefully prepared. Cracks should be ground out so that the joint bottom is well rounded and such that the sides make an angle of at least 30° to the vertical.

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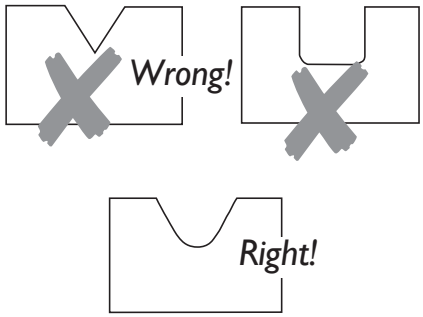
The breadth of the joint bottom should be at least 1 mm greater than the diameter of the electrode plus coating. Any damage occurring during welding should be ground down to "sound steel" before re-welding.



Preheating temperature

The temperature of the tool during the entire welding process should be maintained at an even level. This is best achieved using electrical heating elements.

If the tool is preheated in a furnace prior to welding, then it is important that the furnace temperature is below 200°C (390°F) when the tool is put in.

	Soft annealed	Hardened		Pre-hardened
Hardness	200 HB	58 HRC	56 HRC	240–270 HB
Preheating temperature	200–250°C (390–485°F)	180°C (355°F)	220°C (430°F)	200–250°C (390–485°F)
Max. interpass temperature	400°C (750°F)	250°C (485°F)	350°C (660°F)	400°C (750°F)

Small repairs can be made at room temperature with the TIG-method. For MMA-welding preheating is recommended.

Building up the weld

The root runs should be made with a small diameter electrode (Ø max. 3,25 mm). If TIG-welding, the current should be limited to 120 A. The first two runs should always be welded with the same low heat input, while a greater heat input can be used for the remaining layers.

Ensure that the heat from each run tempers the previous run. Hence even for very minor repairs, the minimum number of runs should be two.

Use a short arc and weld in separate runs. Do not oscillate the gun. Angle the electrode 90° to the joint sides in order to avoid undercut. In addition, the electrode should be held at an angle of 75–85° to the direc-tion of forward movement.

For small repairs and for the final runs along the fusion line, TIG-welding is to be preferred. The transition region between weld and base steel should be carefully inspected prior to stopping welding. Arcing sores or undercut should be repaired while the tool is still hot. After welding, the final layer of weld metal is ground away prior to any heat treatment.

If the tool is to be polished or photo-etched TIG welding is to be preferred so that pores, arcing sores or undercut can be avoided.

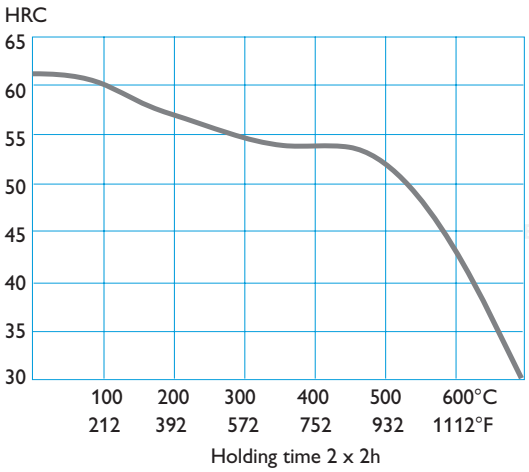
For more detailed information, see the Uddeholm brochure "Welding of Tool Steels".

Post treatment

	Soft annealed	Hardened		Pre-hardened
Hardness	200 HB	58 HRC	56 HRC	240–270 HB
Cooling rate	20–40°C/h (35–70°F/h) for the first 2 hours then freely in air			
Heat treatment	Soft anneal Harden Temper	Temper 200°C (390°F) 2 h	Temper 275°C (520°F) 2 h	Stress relieve 550°C (1020°F) 2 h

TEMPERING GRAPH FOR FILLER MATERIAL

Hardness as welded 58–61 HRC.



FURTHER INFORMATION

Please contact your local Uddeholm office for further information on the selection, heat treatment, application and availability of Uddeholm tool steels. For more information, please visit www.uddeholm.com or www.assab.com

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