

Uddeholm Vanadis[®] 8 SuperClean

Welding recommendations

GENERAL

Uddeholm Vanadis 8 SuperClean is a chromium-molybdenum-vanadium alloyed Powder metallurgical cold work tool steel, especially suitable for very long run tooling where abrasive wear is the dominating problem. Its very good combination of extremely high wear resistance and good toughness also make Uddeholm Vanadis 8 SuperClean an interesting alternative in applications where tooling made of such materials as cemented carbide or high speed steels tends to chip or crack.

Welding of PM-steels is normally not recommended, due to the chance of failure, but 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 A696 Caldie TIG Weld | Not Recommended | Not recommended | Tyrax Laser Weld | |
| | Type AWS ER 312 | | | | Use soft filler material for buffering layer |
| Hardness as welded | 60 - 64 HRC A696 58 - 62 HRC Caldie | | | 55 – 60 HRC | |

DIMENSIONS FILLER MATERIAL

| Type | TIG | | | Laser |
|------------------|-------|------|------|---------------|
| Dia. Ø mm | 1.0 | 1.6 | 2.4 | 0.2 – 0.6 |
| Dia. Ø Inch | 0.040 | 1/16 | 3/32 | 0.008 – 0.024 |
| UTP A 696 | | X | | |
| Caldie TIG Weld | X | X | X | |
| Tyrax Laser Weld | | | | X |

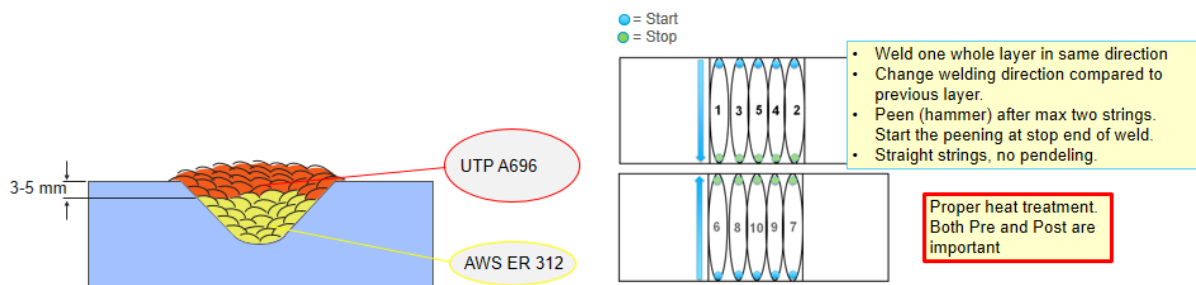
PARAMETERS

| Condition | Soft Annealed 215 HB | Hardened 58 - 60 HRC | Comment |
|------------------------|--|---|---|
| Preheating Temperature | 375°C ± 25°C 710°F ± 50°F | 300°C ± 25°C 570°F ± 50°F | The temperature should be kept constant during the welding operation. Start with buffering layers if not all cracks are removed. Minor repairs up to 3 strings can be made without buffering layer. |
| 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 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 Vanadis 8 SuperClean 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 375°C ± 25°C / 710°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 25°C / 50°F below previous tempering temperature for two hours.
- 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.
- Shield Metal Arc Welding SMAW (MMA) and MIG Welding is not recommended.



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