

General Hardband Welding Process

Scope of work:

Hardbanding of used drill pipe and heavy weight pipe using a hardbanding machine.

****note**** as there are many different types of hardbanding machines, this paper only looks at the general process.

Make sure that the tool joint to be hardbanded is free of all dirt/oils or other foreign items by buffing or grinding.

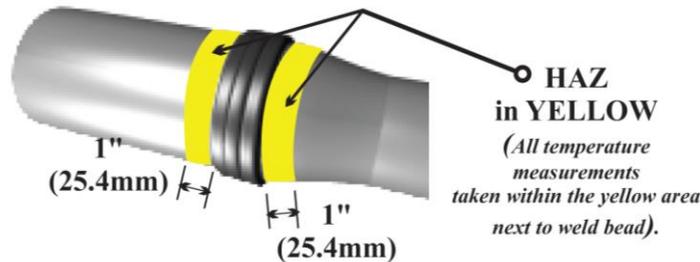
Step 1) Removal of Previous Hardband Material.

-Remove any previous hardband as per required specifications. Specifications are set by the wire manufacturer and should be in the possession of the individual doing the hardbanding. Removal is normally done by grinding, wire gouging or plasma gouging.

Step 2) Preheating of Tool Joint.

-Preheat the section to be hardbanded as per the below preheat table:

Tool Joint OD (inches)	Preheat Temperature	
	°F	°C
3-1/8 to 4-3/4	150 to 200	66 to 93
4-3/4 to 5-1/4	200 to 250	93 to 121
5-1/2 to 6-1/4	400 to 450	204 to 232
6-3/8 to 6-7/8	450 to 550	232 to 288
7 to 7-3/8	550 to 600	288 to 316
8 to 8-1/2	650 to 700	343 to 371
8 to 8-1/2 (W 5" ID)	550 to 600	288 to 316



-The reason for preheating is to allow the part to expand so that when the weld cools there is less chance of cracking (cross-checking) on the hardband.

-Preheating also minimizes the possibility of cracking beside the weld in the “heat affected zone” (HAZ) because the pipe is warmer and does not pull the heat away from the welded area as quickly.

Step 3) Hardbanding

-Hardband the part using the requested hardband wire, as per the Drilling Contractors requirements.

-Normal profile of the completed hardband is as shown below:



-Thickness of the hardband is normally between 3/32” and 1/8” thick and the width is ~3” for standard drill pipe or ~4” for heavy weight.

****NOTE****

Inter-pass temperature must not exceed 850°F, as a higher inter-pass temperatures will result in damage to the tool joints mechanical properties. This can then lead to tool joint failure in the field.

Step 4)

Tool joint is removed from the hardbanding unit and is put back onto the rack and immediately wrapped in an insulating material.

Step 5) Cooling of Tool Joint after Welding

The tool joint that is hardbanded **MUST** be cooled slowly down to 300 °F. Cooling time is based on the final temperature of the pipe in the HAZ zone (see Step 2), and should not be cooled faster than 75 °F per hour. Proper cooling prevents the HAZ zone of the tool joint from becoming too hard. It helps relieve stresses that are built up because of the welding process and allows hydrogen that has become entrapped in the hardband to escape or “bleed out”, thus helping to eliminate the possibility of “post weld cracking”.

Post weld cracking can occur hours after the tool joint has cooled.

Proper cooling can be achieved by using proper insulating materials such as insulated steel cans, insulated boxes, thermal blanket or glass wool insulation. The insulating material must also prevent the tool joints from being exposed to any wind, drafts or rain while cooling.

Examples of cooling materials are shown below.



note

If the insulating material can not control the cooling process adequately, it should be discarded and a proper insulating material used.

Temperature / Time Cooling Requirements for proper cooling of tool joint.

Below are examples of the time that the insulating material should stay on the tool joint.

If the tool joint temperature is at;

- 425 °F - 1 hour
- 500 °F - 2 hours
- 575 °F - 3 hours
- 650 °F - 4 hours
- 725 °F - 5 hours
- 800 °F - 6 hours