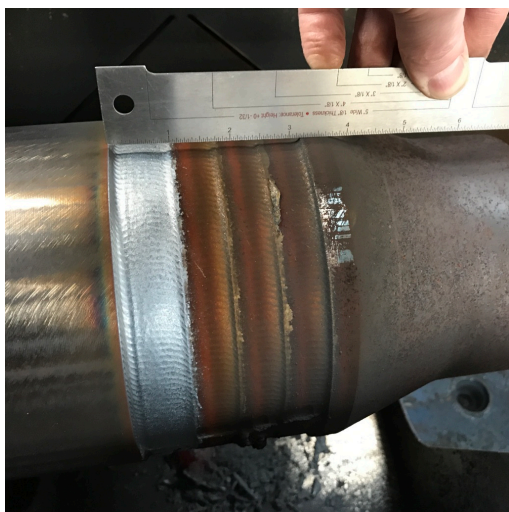




Remove, Repair, and Hardband in 35 Minutes with Skye – Laboratory Tested



1. Automatic removal of the old damaged hardband 2.5mm depth, with plasma system.



2. Automatic application of Postle Tool joint Build Up, 4 x 3/4" bands, 2.5mm height.



3. Automatic application of Duraband NC Hardbanding, 3 x 1" bands, 2.5mm height.



4. Finished product after 35 minutes (+ slow cool). Duraband NC has been applied, so no removal will be necessary in future.



Skye Hardbanding Equipment incorporates several unique features which allow us to achieve welding precision and simple control. Skye makes very high quality hardband repairs simple, and it has also given us the opportunity to develop new procedures, which would not be possible with standard hardbanding equipment.

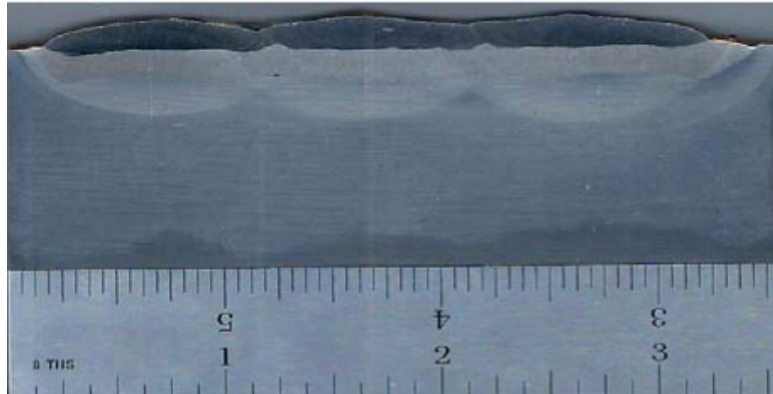
When drill pipe has cracked or damaged hardbanding, the hard material must be removed before the tool joint can be repaired, re-hardbanded and put back into service. There are several methods of removal available, we have listed the pros and cons:

- Industrial Grinder
 - Little dressing required
 - Pipe must be moved in and out of another piece of equipment
 - Equipment is expensive to buy
 - Equipment is expensive to transport for mobile repair
- Standard Plasma
 - Can be carried out with the pipe in 'weld' position in the hardband machine
 - Difficult to remove evenly and to the correct depth on the first pass
 - Untidy finish can leave a lot of dressing work
 - Switching between plasma and welding takes time, i.e. to arrange equipment and alter parameters
 - Delays result in additional pre-heat and slow cool requirement = even bigger delays
- Arc Air
 - No expensive equipment required
 - Slow, very untidy, imprecise, requires a lot of dressing
- 'SkyePlasma35' Removal System
 - All operations in one position
 - Precise automated removal, little dressing required
 - Switch from plasma to weld in 90 seconds
 - Switch from build-up to hardband in 90 seconds
 - Continuous heat-cycle of tool joint means no wrapping / slow cooling in-between processes

This procedure is designed for field removal, repair and hardband application, where Magnetic Particle Inspection (MPI) is not available, and visual inspection between processes is the only available option. Samples have been laboratory tested to ensure resulting hardness in HAZ, Tool joint, Build-up, and Hardband are acceptable. This test was conducted with one pass on plasma and one pass on build up as that was all that was required. More complicated jobs may need more than one pass of each process. For more information colin.duff@hardbandingsolutions.com

Hardness report #LR2715 Tool Joint TJBW and Duraband NC

Testing equipment: Tukon 2500 Certification expires: 1/19 Readings converted from Vickers HV0.5, reported in Rockwell C scale



Track 1	Track 2	Track 3
Readings Taken Through the Hardbanding		
Weld Bead 1 0.010 /62.6RC	Weld Bead 0.010 /60.9RC	Weld Bead 3 0.010 /61.0RC
Weld Bead 1 0.020 /61.6RC	Weld Bead 2 0.020 /62.8RC	Weld Bead 3 0.020 /62.9RC
Weld Bead 1 0.040 /60.2RC	Weld Bead 2 0.040 /62.8RC	Weld Bead 3 0.040 /62.3RC
Weld Bead 1 0.060 /59.9RC	Weld Bead 2 0.060 /61.2RC	Weld Bead 3 0.060 /62.8RC
Weld Bead 1 0.080 /61.5RC	Weld Bead 2 0.080 /62.5RC	Weld Bead 3 0.080 /61.7RC
Weld Bead 1 0.100 /61.9RC	Weld Bead 2 0.100 /62.2RC	Weld Bead 3 0.100 /62.1RC
Weld Bead 1 0.120 /61.8RC	Weld Bead 2 0.120 /61.2RC	Weld Bead 3 0.120 /63.7RC
Weld Bead 1 /RC	Weld Bead 2 0.140 /60.5RC	Weld Bead 3 /RC
Readings taken through the Build Up Wire		
TJBU 0.140/43.7RC	TJBU 0.160/40.4RC	TJBU 0.140/39.6RC
TJBU 0.160/43.0RC	TJBU 0.180/39.2RC	TJBU 0.160/40.0RC
TJBU 0.180/38.7RC	TJBU 0.200/41.7RC	TJBU 0.180/37.8RC
TJBU 0.200/42.6RC	TJBU 0.220/41.3RC	TJBU 0.200/40.2RC
TJBU 0.220/42.1RC	TJBU 0.240/41.3RC	TJBU 0.220/40.9RC
TJBU 0.240/40.9RC	TJBU 0.260/43.5RC	TJBU 0.240/38.3RC
TJBU 0.260/41.3RC	TJBU 0.280/41.3RC	TJBU 0.260/35.4RC
	TJBU 0.300/39.9RC	TJBU 0.280/40.0RC
Readings taken in the Weld HAZ		
TJBase0.280/35.6RC	TJBase0.320/34.0RC	TJBase0.300/33.9RC
TJBase0.300/34.9RC	TJBase0.340/36.7RC	TJBase0.320/34.3RC
TJBase0.320/34.1RC	TJBase0.360/36.1RC	TJBase0.340/32.9RC
TJBase0.340/31.1RC	TJBase0.380/35.1RC	TJBase0.360/35.4RC
TJBase0.360/34.9RC	TJBase0.400/33.8RC	TJBase0.380/33.6RC

Testing Performed by Postle Industries, Cleveland, Ohio.