



Epitaph of a Cracking Hardband[©]

"All cracked up.... & Buried in the Mud"



Say goodbye to spalling...delaminating hardbands and expensive repairs and casing damage...a thing of the past!!!

Say Goodbye to spending millions on the cost of spalled hardbands

- **Casing Damage**
- **Hardband repairs..removal and re-application**
- **Cost of fishing to retrieve fragments of spalled hardband with a magnet**
- **Hardband metal debris caught in screens**
- **Safety concerns – Pieces falling off standing drill pipe and hitting workers**

The term "Casing-Friendly Non-Cracking Hardbanding Wire" is used a lot with today's drill pipe jargon. No doubt this is due to the global success of Duraband[®] NC. Introduced to the drill pipe market over 10 years ago, it is the first truly 100% non-cracking casing-friendly hardband alloy. Spalling hardbands were no longer a concern. Duraband has caused other brands to come up with their own version of a crack-free hardbanding. However, the term non-cracking should not be thrown around so easily, nor should it be accepted so quickly. It has everything to do with a stable welding metallurgy and the ability to apply multiple layers of hardbanding without concerns for cracking to remain casing-friendly and non-cracking.

Duraband has proven that metallurgically it is possible to have a "Casing-Friendly Hardbanding Wire" that is non-cracking...first time, every time. It does not matter whether you are applying this hardband alloy onto a new tool joint for the first time or re-applying it for the third time, the hardband layer will be non-cracking providing that proper procedures are followed. This means it will remain casing-friendly during re-applications for the entire useful life of the drill string, and expensive repair costs and accelerated casing wear are avoided.

There are various products introduced to the market that claim they are non-cracking, but upon further examination it turns out these claims may not be accurate. Are they crack-free only on the first application? What about later re-applications? Will they begin to spall after 2 or 3 re-applications? Will they have to be removed after 2 or 3 applications? A spalling hardband can easily become a sharp milling tooth against the casing.

It is the second and third application when these hardbanding wires start to show their true tendencies as the welding dilution is minimized on each successive hardband layer. By the third pass, the hardband is normally 90-100% pure hardband wire and only about 10% parent steel. It is the later re-applications when problems of spalling and delamination begin. This is due to their unstable metallurgy and unpredictability during application. In other words, they are NOT 100% non-cracking... all the time!

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As shown in the above photos the “delamination” of the current hardband from the previous hardband verifies that the previous hardband is not a “true” non-cracking hardband wire. The most likely culprit is an unbalanced and/or unstable chemistry from the previous hardband that begins to show its true properties after a 2nd or 3rd application.

Upon further investigation of the above, it was noted that the under-bead delamination was not only limited to the current hardband application. The delamination was presenting itself all the way down to the parent material of the heavy weight tool joint and potentially into the tool joint itself.



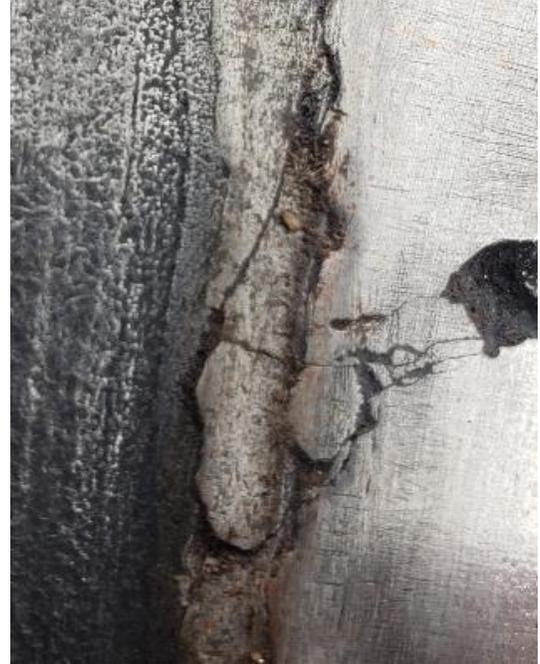
As the delaminated (or spalled) fragments of hardband have to go someplace, they are captured in the drilling mud and screens, and brought to the surface. The problem is that depending on the size of these pieces of hardband alloy, there are multiple issues that can arise as this debris works its way to the surface. These fragments have a hardness of ~60RC, if they get stuck in between the tube/TJ and the casing, they can put gouges into either and cause major damage. The spalled hardband can also cause major damage specific components to the BOP, etc. Even fishing for loose pieces is expensive rig time.

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The below pictures show that the cracking of the hardband goes all the way to below the first pass of the original hardband when it was applied to the heavyweight pipe.



The above pictures show that not only can the delamination (spalling) develop between the second and/or third layer, **BUT** the migration of the cracks can propagate into the initial layer of Hardbanding alloy.... and possibly even into the tool joint itself. When delamination (spalling) happens, the stated “casing friendly” hardband wire has just become a milling tool, due to the sharp edges of the delaminated fragments of hardbanding. In addition, the debris from the spalling hardband will most likely get caught in the screens or they will have to be fished out.

Some hardbanding wires make the claim that they are non-cracking, but field experience proves that this statement only applies to the first application on a new tool joint (dilutive effect). Subsequent re-applications and double layers will usually produce cracking and spalling issues and by the third application the hardband material must be removed, otherwise there could be significant delamination (spalling) issues, and costly equipment repairs.

Bottom-line.... When using an unstable, unpredictable metallurgy, two similar tool joints can be welded with the same hardbanding wire and one will crack while the other will not. The chemistry of the hardbanding material is paramount!

Today, some companies are being forced to spend significant amounts of time and capital on the resultant cost of cracked and spalled hardbands. Cracking can lead to casing damage, expensive tool joint repairs, and unnecessary fishing. Cracking and spalling is totally preventable and should be consigned to the past.

When using a stable chemistry like Duraband NC, multiple non-cracking hardband layers are easily achievable (following the proper WPS). Only then does hardbanding serve its purpose, by safely protecting the drill string and casing.

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