

HARDBANDING TECHNOLOGY ADVANCES

Duraband® NC Certified for Re-applications

by Bob Miller , Materials Engineer, Postle Industries Inc.¹



As the drilling industry evolves to accommodate the challenges of deep well and horizontal drilling techniques, more demand is being placed on the maintenance of drill strings, and in particular the tool joints. Perhaps as little as 15 years ago, tool joints were protected quite adequately by tungsten

carbide hardbanding. These hardbandings provided the maximum wear resistance for the tool joints, and because of the limited use of casing while drilling, casing wear was not an issue. As well bores became deeper and deviated, more casing was used and thus became a serious target for wear by

the tungsten carbide hardbanding. For the most part tungsten hardbanding has been banned from drill string hardbanding except on drill collars and heavyweight. This resulted in relying upon more traditional type hardfacing alloys, but at the sacrifice of tool joint wear. Many of these alloys were considered "casing friendly", and did not wear out the casing prematurely. Many of the more effective alloys produced cracks due to the metallurgical structure of the hardbanding. These cracks often led to premature failures, spalling, and numerous re-application problems.

For over 40 years, Postle Industries Inc. has been designing alloys and procedures for many industries including mining, farming, agriculture, recycling, to name just a few. With a successful history in

Fearnley Procter Group⁷, headquartered in Aberdeen, Scotland, with offices in Houston, TX is a third party inspection and specification group dedicated to oilfield products and issues. Their NS-1™ New Application Certification involves the application of a hardbanding product onto three tool joints, which are then sectioned and

examined extensively via a crush test, micro hardness studies, etc. In addition to the physical welding and examinations, the product's procedure manual is scrutinized by an expert committee and a casing wear test conducted. Only after all the criteria have been met is the Certification awarded.

hardfacing, it was only natural for Postle Industries to become involved in the complex wear of drill pipe, heavyweight, drill collars, and casings/risers.

Three years ago, Duraband® NC, (*referred to as simply Duraband® in this article*), hardbanding wire was introduced to the drilling industry and carried Fearnley Procter's² NS-1™ "New Application" Certification. Duraband® is uniquely qualified to deposit a high quality hardbanding to minimize tool joint and casing wear. While this certification covers the "New Applications", it does not cover the "Re-applications" of Duraband® over itself, or Duraband® over other worn competitive hardbanding products. Critical to the longevity and the overall maintenance costs of drill strings is the choice of hardbanding products used and their ability to be re-applied easily and cost-effectively. Therefore re-application procedures and specifications are critically important, and perhaps even more so than new applications. Postle Industries immediately recognized the need for pursuing Fearnley Procter's new NS-1™ Re-application Certification for Duraband®

over previous worn Duraband®. In addition, in-depth conversations with applicators, drilling contractors, and operators quickly revealed the need for procedures to also re-apply Duraband® over popular competitive products. Postle Industries therefore added those products to the list for Fearnley Procter's NS-1™ Re-application Certification. In January of this year (2010), Fearnley Procter awarded the NS-1™ Re-application Certification for Duraband® over Duraband®, and over 3 other popular competitive hardbanding products. This product certification places Duraband® in a very unique pioneering position. At last the industry has a highly credible third party approval and procedures for the re-application of hardbanding.

As with many pioneering efforts, questions abound. The foregoing are the most frequently asked questions regarding Duraband® applications and re-applications hardbanding.

What is Duraband®?

Duraband® is a premium, NS-1™ certified, metal cored, gas shielded welding wire that is

capable of depositing a casing friendly, non-cracking, 100% rebuildable hardbanding in the shop or field. It is designed to maximize the wear resistance of tool joints while at the same time minimize the casing wear. Duraband® does not require removal prior to re-application and is compatible for re-application over previous worn selective competitive hardbandings.

Duraband® can also be used with tungsten carbide additions to enhance the wear resistance of heavyweight and drill collars. The addition of tungsten carbide however, renders this deposit non-casing friendly.

What are Casing Friendly hardbandings?

During a period of time when wells were shallow and straight, it was common practice to drop tungsten carbide chips into mild steel weld puddles. This combination resulted in excellent tool joint protection. However, as wells became deeper and multidirectional, casings became the target for catastrophic wear by the tungsten carbide hardbanding. Tungsten carbide chips are recycled and crushed, machine tools and therefore act as cutting agents when

coming into contact with metal. The industry quickly realized that these tungsten carbide chips wore through the casing in relatively short time. These failures were costly and time-consuming to repair. Alternative alloys were considered for hardbanding that came into contact with the casing. In the early 1990's, the DEA³ (Drilling Engineering Association) conducted a study (# 42), with the intent to categorize competitive hardbandings and their relationship to casing wear. Tests were conducted on the Maurer Engineering⁴ test apparatus. The results of the DEA 42 study were published and a 2.0 casing wear number criteria was established as a benchmark. Anything below 2.0 was considered "casing friendly", and anything above 2.0 was considered not casing friendly. The Maurer test apparatus changed hands a couple of times and it is now performing tests in the Mohr Engineering⁵ laboratories, Houston, TX. The test and the standards have deviated greatly from the DEA 42 study, and the resulting data differ greatly from the DEA 42 results. No

longer is the casing wear number of 2.0 considered the benchmark for casing friendly hardbanding. The casing wear test standards, and procedures are being reviewed by API⁶ with the intent to ultimately publish a standard. The unfortunate result of the changes in the test has caused confusion and apprehension about what is considered to be a casing friendly hardbanding. And until the API concludes their review and publishes a specification, the industry is confined to their own interpretations of the Mohr Engineering Test data.

What makes Duraband[®] different?

Duraband[®] is unique in that the deposits are crack free, highly wear resistant, and 100% rebuildable. It is what is commonly known as "casing friendly", meaning that it will not wear out the casing as does the tungsten carbide. The casing friendly attribute of Duraband[®] comes from a detailed casing wear test conducted at Mohr Engineering, Houston Texas. During this test the Duraband[®] deposit is rotated against a standard casing material

while at the same time sand bearing mud is trickled down between the deposit and casing. The material rotates at 155 rpm and is also oscillated back-and-forth. A 3000 pound per foot load is applied during the test. The test runs for eight hours. At the end of this test, a final wear scar depth measurement is made and determined how much metal has been removed. From this value, and other parameters, a casing wear number is calculated. Low value wear factors are considered desirable.

Duraband[®] is NS-1[™] certified for Initial Application and Re-application. What are these certifications?

In 2000, Fearnley Procter Group⁷ purchased Shell SQAIR rights from Shell U.K.⁸ and published certifications under the NS-1[™] designation. To be qualified for NS-1[™] Certification, Initial Application, the Duraband[®] procedure manual had to be approved by a committee of experts. A number of tool joints were welded using this manual, and exhaustive testing was conducted on them to ensure integrity, bonding and consistent hardness. In addition to this testing,

Duraband® is required to be casing wear tested. In this case by Mohr Engineering, Houston, TX.

NS-1™ Re-application Certification, is handled a little bit differently. The Duraband® Re-application procedures are examined. Tool joints with worn hardbanding products on them, are then welded according to the re-application procedures, and appropriate sections are taken from the tool joint and tested for bonding, hardbanding integrity, hardness consistency, and heat affected zone integrity.

Why is NS-1™ important?

For the most part, hardbanding is a self regulated procedure, unless third party inspectors are employed during the process. In that respect, it is extremely important to have an outside party examine, evaluate, and regulate hardbanding products prior to use. Postle Industries goes one step beyond this and qualifies each and every Applicator. Periodically the Applicator is audited for compliance to Postle Industries' manual and procedures. Noncompliant applicators are reviewed and handled accordingly.

How many times can Duraband® be re-applied?

Duraband® can be applied over itself any number of times. The Duraband® procedural manual calls out exactly how worn hardbanding should be inspected and demonstrates the acceptable criteria. Serious defects such as large porosity, numerous porosity, cracking and spalling are addressed in the manual. The re-application of Duraband® over itself is similar to the initial application of Duraband® on the tool joint. Because the tool joint has experienced previous welding temperatures, it is very critical for exact re-application procedures to be followed, to avoid any unnecessary heat affected zone issues.

Does Duraband® need to be removed before re-application?

Duraband® does not require removal before re-application over itself, providing that the worn hardbanding is free from gross defects incurred during drilling. Re-applications of Duraband® over competitive brand previous worn hardbandings should be scrutinized carefully for

excessive cracking and gross porosity. Duraband® re-applications are only as good as the previously worn hardbanding's condition. If for any reason that the previously worn hardbanding requires removal, and build up, Postle Industries suggests using Tuffband® NC, another premiere Postle hardbanding product. Tuffband® NC is much more forgiving as a buildup than Duraband®. Since Tuffband® NC is similar in chemistry to Duraband®, it combines well with re-applications and contributes to increasing tool joint life.

Some worn hardbandings are cracked. How does this affect Duraband® re-applications?

Typically worn hardbanding products return for re-application displaying cracks, which may be due to the natural characteristics of some competitive brand hardbandings. Careful examination should reveal any wide or deep cracking, which should be rejected. Cracks, unfortunately, harbor a great deal of debris which can affect the re-application of Duraband®. Practically all cracks in the worn deposit will also be reproduced in the

Duraband[®] re-application. Depending on the amount of debris within the worn deposit crack, gas and porosity may also be noted in the final deposit of Duraband[®]. These may or may not be acceptable in accordance with the Duraband[®] Procedure Manual.

Does worn deposit thickness affect Duraband[®] re-applications?

Duraband[®] does not require a previously worn Duraband[®] hardbanding to be flush with the tool joint for re-application. However, this is not always the case with competitive worn hardbandings. Often grinding is necessary to prep the tool joint for re-application, or the drill string may be returned to service and hardbanded in the next inspection cycle.

How does Duraband[®] compare to other, competitive, hardbanding?

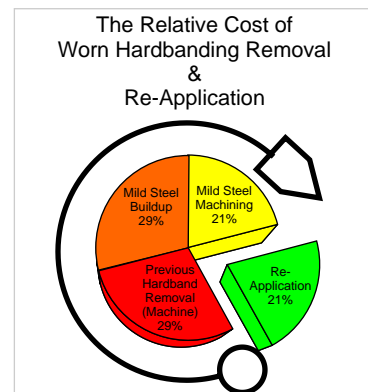
Duraband[®] is a premium hardbanding, and is very competitive with other premium, competitive, hardbanding products. Duraband[®]'s unique attributes, such as trouble free re-application, field application, and the

ability to accept WC products for use on heavyweight, is by far more cost-saving than the cost of the hardbanding wire. Keep in mind that Duraband[®] hardbanding does not require the drill string to be sent to the applicators shop for hardbanding. Hardbanding can be done in the field given proper equipment and procedures. This can relate to a vast savings in shipping costs and downtime.

How can Duraband[®] save me money?

Whether you are a drilling contractor or energy producer/operator, the use of Duraband[®] on drill strings and heavyweights can save you a great deal of money in terms of maintenance and downtime. Since Duraband[®] is crack free, re-applications are very easy. If you are currently employing a hardbanding product that requires removal before re-application, the use of Duraband[®] bypasses this removal process, because Duraband[®] can be applied over itself for any number of re-applications. The chart below illustrates the relative costs involved in previously worn hardbanding removal and the re-application.

Employing a hardbanding that requires removal before re-application costs nearly 5 times as the original application. All costs associated with removal, buildup, and machining are eliminated when Duraband[®] is chosen as the



hardbanding of choice.

As for heavyweight, WC chips or pellets can be dropped into the Duraband[®] puddle to create a highly abrasive resistant matrix with WC embedded. This is probably the pinnacle of abrasion resistance for drilling tools. Using Duraband[®] by itself on drill strings and Duraband[®] with tungsten carbide embedded requires the applicator to stock only one wire, Duraband[®]. These features in themselves have far-reaching impact on costs of hardbanding. They will benefit both the operator and contractor.

¹ Postle Industries Inc.
5500 West 164th Street
Cleveland, OH 44142

² Fearnley Procter Inc.
1001 South Dairy Ashford
Suite 120
Houston, Texas 77077

³ DEA
International Association of Drilling Contractors
10370 Richmond Ave,
Suite 760
Houston, Texas 77042

⁴ Maurer Engineering
13135 Dairy Ashford Rd.
Sugar Land, TX 77478

⁵ Mohr Engineering Division
13602 Westland East Blvd.
Houston, TX 77041-1205

⁶ American Petroleum Institute (API)
1220 L Street, NW
Washington, DC 20005-4070

⁷ Fearnley Procter Group
Aberdeen, Scotland

⁸ Shell U.K. Limited
Shell Centre
London
Se1 7NA

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