

LINCOLN® GUARDIAN® HB

The First Engineered Tool Joint Hardband

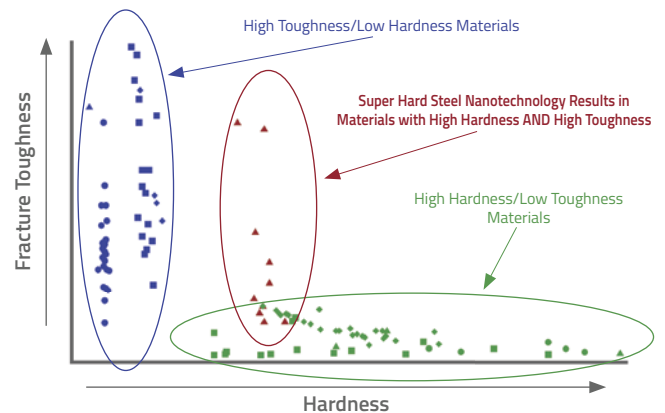


- Industry leading casing wear protection
 - High tool joint protection in casing
 - Very easily reapplied over itself
 - Proven performance for more than 9 years
 - Superior spalling resistance
-
- **Industry Leading Material Achieves Industry First**
Guardian HB is the first tool joint hardband to provide minimum casing wear while maintaining excellent tool joint protection.
 - **Proven in Severe Wear Drilling Environments**
Guardian HB easily handles severe wear environments encountered in reach, horizontal, deepwater and abrasive hard rock drilling, making it the ideal choice of oil companies and drill pipe owners for a complete range of original and after market applications.
 - **Nanotechnology Results in Superior Performance**
Other hardband materials are conventional alloys or steels with microstructures containing grains that vary in size from hundreds of microns to several millimeters.

Nanocrystalline materials are measured on nanoscale, or a length scale of 1-100 nanometers (1 nm = 10⁻⁹ m).

Guardian HB is a nanocrystalline material which features a microstructure containing near-nanoscale grains that yield combined levels of high hardness and high toughness resulting in wear performance never before achieved in a hardband material.

Guardian HB is based on patented and proprietary Super Hard Steel® Nanotechnology



▪ **Superior Cracking Resistance**

Guardian HB has been engineered to contract and expand at the same rate as the tool joint steel to resist cracking during shop and field applications.

Matching the coefficient of thermal expansion (CTE) of the hardband material and base tool joint steel enables higher strength and hardness without detrimental cracking tendencies.

Conventional hardbands have traditionally lowered their strength and hardness to reduce cracking, which consequently sacrifices tool joint protection performance.

▪ **Industry Leading Casing Wear Protection**

The near-nanoscale grains in the microstructure of **Guardian HB** deliver the industry's absolute best casing protection.

In DEA 42 tests, **Guardian HB** shows a **37% reduction in casing wear** over the nearest "casing friendly" competitor.

▪ **High Tool Joint Protection in Casing**

Guardian HB not only minimizes casing wear, it provides significantly better tool joint protection in casing than any other "casing friendly" hardband product.

In DEA 42 tests, **Guardian HB** shows a **55% improvement in radial tool joint wear resistance in casing** compared to the second best performer.

▪ **Easy Reapplication Over Itself**

When considering the long-term cost of drill pipe ownership, reapplication of the hardband is important.

Many of the unique properties that result in **Guardian HB's** superior field performance also contribute to its ease of reapplication.

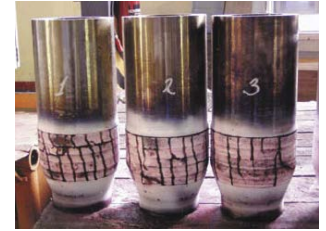
The "matched" CTE, virtual elimination of cracking and the combined high hardness/high toughness properties of **Guardian HB** allow it to be economically applied over itself.

Guardian HB



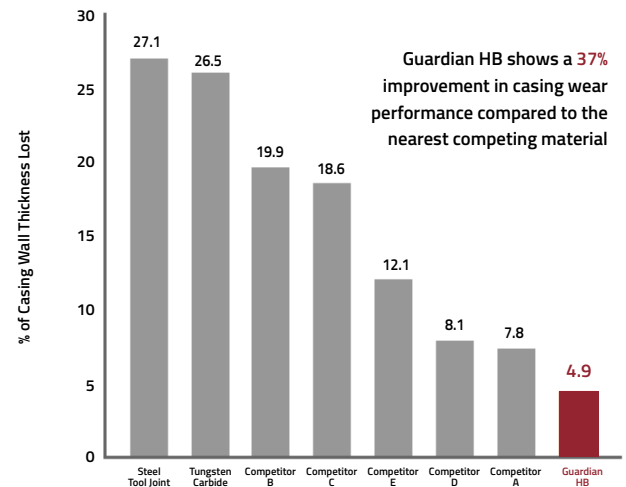
Dye penetrant testing proves **Guardian HB's** superior cracking resistance

3 Competing Materials

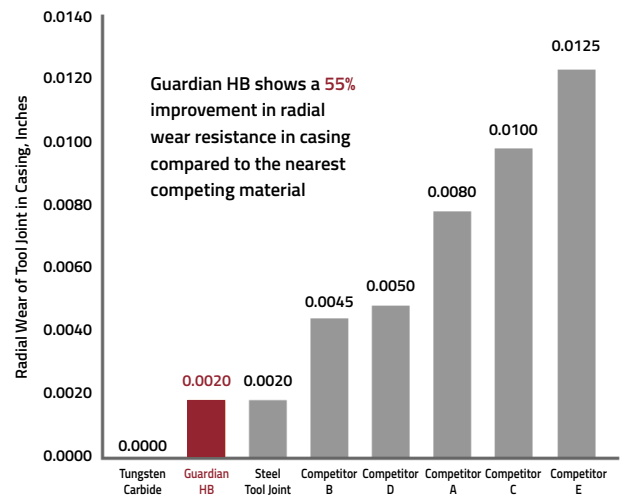


Dye penetrant testing of competing "casing friendly" hardbands reveals cracking

Industry Leading Casing Wear Protection



High Tool Joint Wear Protection



CUSTOMER ASSISTANCE POLICY

The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.