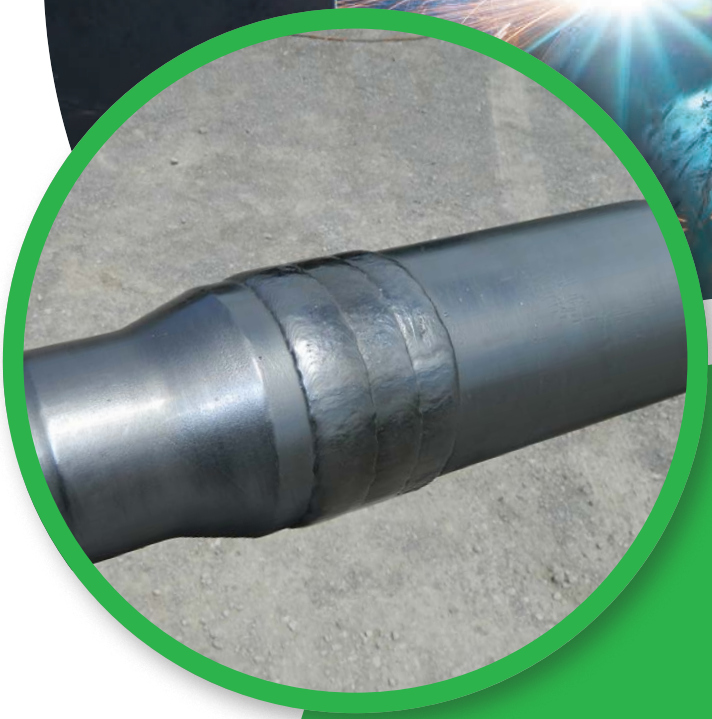
Wellbore Integrity
SOLUTIONS



DRILCO

DEFENDER

Premium
Hardbanding
Wires

Premium Abrasion and Wear Protection for Tubulars

Wellbore Integrity Solutions' (WIS) DRILCO product line has provided the **highest quality** hardbanding materials to **extend tubular life** on drilling operations around the world. Defender* premium hardbanding wires are designed for both openhole and casing-friendly applications, which **increases tubular durability** and **maximizes wear resistance** on drill collars, drillpipe, heavy wall drillpipe, casing, and other tools used in drilling applications.

Defender Premium Hardbanding

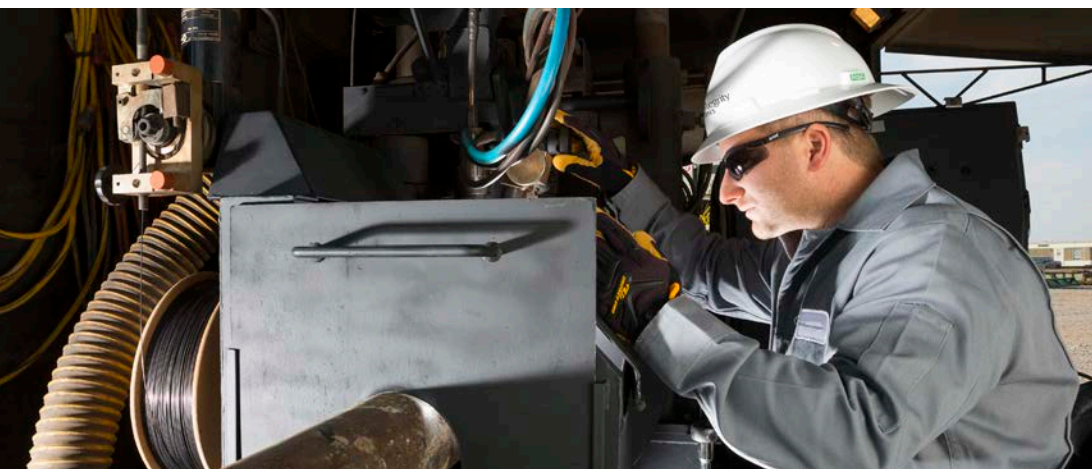
Hardbanding is the most effective way to reduce wear rates on tubulars and casing strings. When placed on the tool joints and center wear pads, hardbanding increases abrasion resistance and extends service life.

Defender premium hardbanding wires provide hardbanding solutions for both openhole and cased hole drilling. Defender premium hardbanding wires—designed and manufactured using the highest grade of raw materials—can be applied over previous DRILCO applications as well as other hardbands.

Proper inspection and evaluation of previous hardbands and surrounding base materials are inherent in all our hardbanding procedures.

Advantages

- Field hardbanding personnel undergo an extensive training and qualification program covering all aspects of oilfield hardband applications.
- Highly trained personnel use state-of-the-art calibrated equipment to ensure reliable performance for every application.
- Premium hardbanding materials are specifically formulated using high-grade raw materials for greater durability.



Defender MAX*

Metal-Cored Hardbanding Wire

Defender MAX metal-cored hardbanding wire is designed to operate in openhole or cased hole environments. In openhole applications, tungsten carbide is dropped into the molten hardband. The matrix is designed and formulated to hold the carbide throughout the life cycle of the handband.

Defender MAX hardbanding wire is designed with a low coefficient of friction for casing-friendly applications. It is a combination of crack-free, non-porous, deposited, work hardening hardband.

Advantages

- Non-cracking
- Non-spalling
- Reapplicability
- Tough hard matrix
- Hardness values between 53 and 56 on the Rockwell C scale (HRC)
- Single- or double-layer applications
- Openhole durability with tungsten drop
- Casing friendly without tungsten drop
- Cored wire formulation to optimize performance

Casing Friendly

Openhole Durability

DEFENDER MAX SPECIFICATIONS	
Wire diameter, in. [mm]	1/16 [1.6]
Polarity, current	Reverse, DC electrode positive
Shielding gas	98% Ar, 2% O2 @ 35 CFH [16 L/m]
Voltage	27–33 (typical 29)
Amperage	280–360 (typical 320)
Wire feed speed, in./min [mm/s]	260–330 [110–140] (typical 300 [125])
Electrode stickout, in [mm]	¾–1¼ [19–32] (typical ⅞ [22])
Preheat temperature for 5½- to 6¼-in. OD, degF [degC]†	450 [230]
Max. interpass temperature, degF [degC]	725 [385]
Cooling rate control, degF [degC]	Slow cool until below 150 [65]

†Dependent on drill collar tool joint, material, and diameter

Defender ULTRA*

Flux-Cored Hardbanding Wire

Defender ULTRA flux-cored hardbanding wire is designed and formulated to provide a combination of crack-free and non-porous deposited hardband. It provides optimal protection to the tool joint while minimizing wear to the casing.

In harsh, remote environments with strong winds, Defender ULTRA hardbanding wire operates with or without shielding gas to provide a premium hardband not otherwise available.

Advantages

- Non-cracking
- Non-spallling
- Reapplicability
- Casing friendly
- Openhole durability
- Hardness values between 53 and 56 HRC
- Single- and double-layer applications
- Self-shielded gasless or gas-shielded hardbanding
- Cored wire formulation to optimize performance

Casing Friendly

DEFENDER ULTRA SPECIFICATIONS	
Wire diameter, in [mm]	1/16 [1.6]
Polarity, current	Reverse, DC electrode positive
Shielding gas	None required if self-shielded (if used: 98% Ar, 2% O2 @ 35 CFH [16 L/m])
Voltage	27–33 (typical 28)
Amperage	280–320 (typical 290)
Wire feed speed, in/min [mm/s]	320–400 [135–170] (typical 350 [150])
Electrode stickout, in [mm]	¾–1¼ [19–32] (typical ¾ [19])
Preheat temperature for 5½- to 6¼-in OD, degF [degC]†	450 [230]
Max. interpass temperature, degF [degC]	725 [385]
Cooling rate control, degF [degC]	Slow cool until below 150 [65]

†Dependent on drill collar tool joint, material, and diameter

Defender NON-MAG ELITE*

Metal-Cored Hardbanding Wire

Designed to protect nonmagnetic drill collars and flex pipe, Defender NON-MAG ELITE metal-cored hardbanding wire is applied to standard austenitic stainless steels, chromiummanganese, and nitrogen-bearing austenitic stainless steels. This metal-cored hardband is a tough corrosion-resistant, highly alloyed austenitic deposit with a typical permeability value of 1.005, which is half the maximum API permeability value of 1.010. Permeability is the measurement of a material's susceptibility to become magnetic by external magnetic fields such as the Earth's magnetic field.

Defender NON-MAG ELITE hardbanding wire is enhanced with a tungsten drop that disperses evenly throughout. The formulation of the wire provides consistent and uniform arc transfer with low fumes to optimize performance.

Heat control is critical on non-magnetic tools during hardbanding applications. Our DRILCO team carefully controls application temperatures with typical heat signatures of approximately 275 degF [135 degC] after five 1-in bands on a 6½-in by 3¼-in drill collar.

Advantages

- Non-cracking
- Non-spallling
- Reapplicability
- Enhanced productivity
- Low fumes during hardbanding
- Highly alloyed austenitic deposit
- Tough and corrosion resistant
- Cored wire formulation to optimize performance
- Tungsten carbide to enhance wear resistance
- Low-heat signature during application

DEFENDER NON-MAG ELITE SPECIFICATIONS	
Wire diameter, in. [mm]	1/16 [1.6]
Polarity, current	Reverse, DC electrode positive
Shielding gas	98% Ar, 2% CO2 or 100% Ar @ 35 CFH [16 L/m]
Voltage	26–30 (typical 29)
Amperage	280–320 (typical 300)
Wire feed speed, in./min [mm/s]	260–330 [110–140] (typical 300 [125])
Electrode stickout, in. [mm]	¾–1¼ [19–32] (typical ¾ [19])
Preheat temperature, degF [degC]	100 [40]
Max. interpass temperature, degF [degC]	400 [205] (typical 275 [135])

DEFENDER

Premium Hardbanding Wires

For more information, contact your local WIS representative:

wellboreintegrity.com/drilco

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