Hardbanding
For Oil and Gas drilling

Optimized Performance

• Crack Free Design
• Casing Friendly
• Optimized Tool Wear Resistance
• Flexible Rebuild Design
Today’s Drilling Challenges
General Performance Requirements

As average well depths have increased over the past decade, directional and extended-reach drilling have become more commonplace. These wellbore trajectories, with their highly deviated paths (ERD) and associated increases in torque and drag, have exerted unprecedented force on the drill pipe, surpassing all previous stress level limits. These trajectories in turn, create severe wear conditions on both the casing and drilling string, which is becoming increasingly detrimental for drilling operations.

Hardbanding has long been acknowledged as an effective means of preventing tool joint wear. During the 1990’s, tungsten carbide-based hardbanding was in widespread use and was determined to be the primary cause of casing wear. However the absence of hardbanding, while slowing casing wear to a small degree, allowed the tool joints to wear at an accelerated rate, lessening the torsional capacity of the drill pipe and putting drilling operations at a serious risk. The challenge was to discover a balanced, simultaneously effective solution between both casing wear defense and tool joint protection, which is caused by the worsening conditions associated with highly deviated ERD wells. Previous casing friendly alloys reduced casing wear, but produced unacceptable tool joint wear as a consequence. Crack-prone design flaws were also present, as widespread cracking of the alloy material often ensued. This caused catastrophic tool joint failure and in some cases, even the failure of the hardbanding itself, due to tool joint spalling.

Industry solutions include:

- Low casing wear determined by Mohr T-95 testing, which is well within industry limits.
- Highly durable and wear-resistant, protecting the tool joint.
- Crack-resistant, preventing cracking in the material and tool joint.
- Spalling-resistant metallurgical compatibility.
- Material is easy to reapply without special prep or pre-conditioning.

Meeting R&D Expectations

Spanning across 3 continents, our global Castolin Eutectic Research & Development Centers are fully equipped to resolve the most complex wear phenomena affecting the oil industry. Our R&D Centers are committed to
We Have the Right Product

We Have Established Experience

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optimizing metal chemistries, applied coatings, welding consumables and powder coating alloys. These optimized coating applications are carried out in Norway, Ireland, Austria, France, Mexico and the USA. OTW products are guaranteed to ensure the highest quality through our Production Quality Control Department and Total Quality Management Systems (TQMS). Castolin Eutectic production facilities are also ISO-9000, TUV and Lloyds Certified.

Our R&D centers include some of the most advanced welding technology and wear analysis laboratories in Europe. These modern facilities are well-equipped for in-depth study of all types of industrial scale welding & coating applications, geared towards solving high wear problems.

Our manufacturing plant in Dublin has an automated Micro Hardness Machine, a G65 Abrasion Wear-Test Machine and ICP/XRF Chemical Analysis Units, employing a well trained, customer-oriented technical team. Our global crew of highly qualified engineers tests OTW products on active field components, under the most extreme drilling conditions. These harsh environments provide the necessary criteria for understanding severe wear phenomena and set the standard by which we measure our product integrity.

Approved & Established Performance Preferred by Majors.

Castolin Eutectic has been performing hardbanding in the Norwegian market for more than 8 years. Due to excellent co-operation between Castolin Eutectic and Statoil, there has been very successful development, use and approval of new, innovative alloys. Today Statoil approves OTW 12Ti, OTW 16XS and the non-welded, patented MX5 coating for drilling.

During development of the OTW range, Castolin Eutectic constructed its very own, unique hardbanding C-Wear testing machine. The machine tests encompass:

- Casing material combined with full-size, hardbanding alloy-infused wear samples.
- Specific mud parameters, measuring tool-joint, open hole and casing wear rates.
- established hardbanding coating friction dynamics.

These thorough testing procedures provide a simple yet complete understanding of very complex wear phenomena and allow Castolin Eutectic to develop and ensure the best performing range of hardbanding alloys in the industry today.
The new standard for Sour Gas, casing friendly wire, that’s easy to weld

**OTW 10SS**

**OTW 10SS** is an exclusive gas shielded, metal cored alloy wire, specifically designed for use in severe sour (SS) environments and is fully compatible with all drill pipe sour service grades. Drill pipe sour service grades (VM 105 DP SS™, TSS 105™, CYX 105™) and HWDP differ greatly from normal API grades and use a modified form of steel on the pipe body and tool joints.

This alloy is formulated to be non-cracking, easy to apply and repair, with low dilution and minimal pre-heat temperatures. The reduced overall hardness is designed to optimize performance in even the most severe sour environments.

**OTW 10SS** is formulated to produce a unique, hard tool-steel microstructure with numerous ultra-fine/ultra-hard phases, dispersed in a tough tempered martensitic matrix.

**OTW 10SS** produces an excellent, non-spatter bead in both appearance & quality, ensuring greater flexibility & increased arc stability between 100 to 400 AMP operating ranges”. Reducing labor costs, **OTW 10SS** offers a high deposition rate with exceptional, all-position welding ability. The result is a cost-effective solution for multi-purpose hardbanding applications, including Drill Pipe Tool Joints, HWDP Tool Joints & Center Wear Pads.

The Casing Friendly Leader in “all-purpose” non-cracking design wires

**OTW 16XS** Extreme Service is a product ideally suited for drilling in the most demanding ERD and Ultra ERD wells. The unique nature of these wells puts severe stress on the drill string, prompting the industry to respond with High performance Tool Joint Connections (XT™, VX™, TT™). These connections produce higher torque values with lower drag and wall thickness. This requires increased reinforcement through optimized hardbanding solutions, resulting in heightened structural integrity and minimal dilution, while still providing effective overall durability.

**OTW 16XS** was specifically designed for use in Ultra Deepwater applications, where most wells are highly deviated and extremely deep. As these wells require the highest level of strength and prolonged performance, **OTW 16XS** not only contains superior casing friendly properties, but also demonstrates a unique ability to offer the best wear-resistant materials in both open hole and cased hole environments.

Providing the highest casing & open hole wear resistance, **OTW 16XS** contains a uniquely weighted mix of multi-carbides (Cr, Ti, Mo, and W), which is dispersed uniformly throughout a tempered martensitic micro-structure. This creates superior thickness and anti-wear properties, which maximize wear resistance, strength and longevity. **OTW 16XS** is also able to be cost-effectively reapplied over itself and most standard, non-cracking wires for drill pipe refurbishment and reinstatement.
**OTW 12Ti**

Best in its class with tough all-around hardness, where combined open & case hole wear performance counts

OTW 12Ti actively prolongs against wear in the most extreme drilling conditions, as demonstrated by its performance in highly deviated well & open hole applications. Maximum drill pipe life is achieved through superior wear-resistant properties, coupled with the ultra-smooth, casing friendly features preferred by most oil companies.

OTW 12Ti Titanium-Carbide chemical composition creates a martensitic matrix, which infuses ultra-smooth / ultra-fine compounds into an abrasion resistant, ultra-hard microstructure, ensuring optimal strength and metallurgical integrity.

OTW 12Ti hardness scale of 61.5 HRC, combined with our Non-Cracking (NCD) and Flexible Application Designs (FAD), enables high load, open hole performance while simultaneously meeting all casing friendly requirements. End-users yield a higher return on investment and long-term savings through OTW 12Ti’s life-extending drill pipe technology. OTW 12Ti can be reapplied over itself and most other hardbanding materials, ensuring quick and easy repair in even the most remote locations.

OTW 12Ti is a flux-cored wire alloy, designed & manufactured by Castolin Eutectic in our own state-of-the-art facilities, ensuring the highest degree in quality control. Furthermore, OTW is certified by NS-1 for application and reapplication of tool joints.

**OTW 13CF**

Outstanding casing wear resistance against current industry standards with exceptional tool performance

OTW 13CF has a smooth surface, crack-free design with low friction properties. Outfitted with a microstructure design which achieves optimal balance between casing friendly performance and tool wear minimization, OTW 13CF still remains the cost effective leader.

OTW 13CF has casing wear resistance superior to that of currently established, non-cracking wires and still retains a remarkable level of overall tool wear resistance. This is achieved with a slag-free deposit, precipitating a dense dispersion of hard, primary niobium and complex CrMo carbide phases, which are finely distributed in a martensitic / residual austenitic matrix. Strong resistance against high stress abrasion and erosion, even when combined with heavy impact or pressure, is typically expected in both open hole and cased hole environments. OTW 13CF is ideally suited for intermediate-to-advanced hardbanding applications.

OTW 13CF is an exclusive, gas shielded metal-cored alloy wire and can be reapplied over itself and any other OTW range. The Flexible Application Design (FAD) feature provides greater flexibility for the hardbander, as well as significant cost savings in old hardbanding removal and pipe preparation.
The Highest Level Of Development And Testing

Fearnley Proctor NS1 Approved Open Hole Casing Wear

Castolin Eutectic prefers the term “Wearfacing Coating” to “Hardfacing” as this better describes the importance of selecting the correct “coating structure”, in both function and ability to resist specific wear mechanisms, rather than just hardness alone. Understanding this crucial difference is absolutely critical to our success in the Hardbanding business and suggests that “3 coating properties” are required:

- High wear resistance of tool hardbanding coatings in cased and open hole environments
- Low casing wear with tool hardbanding coating
- Low friction levels with hardbanding coating

Our efforts have been recognized by Fearnley Procter’s NS1 testing with the early approval of OTW 12Ti.

Wear Testing Development

In addition to our specific hardbanding wear test machine, other wear and mechanical tests were performed in the development of our hardbanding coatings. These standard tests are quicker to run and allow more flexibility during development, while still providing important wear data relevant to the hardbanding coating.

Wear test methods, ASTM G65 abrasion test.

The ASTM G65 procedure simulates a three-body wear system designed to generate reproducible test data, in order to rank materials by their resistance-to-low stress abrasion. The testing equipment uses a rotating rubber wheel and dry sand to establish the abrasion resistance of different materials, through measuring the degree of wear caused by hard quartz sand particles, forced to move against and across the hardbanding “wearfacing coatings”.

Testing to simulate real life coating stresses

A special compression test is used to determine the integrity and compatibility of hardbanding and its relationship to the base material. In testing hardbanding bond-strength, a specific ring is made to precision and coated, followed by a destructive testing metallurgical exam, ensuring full bonding to base material, and metallurgical exam to ensure full bonding to the base material. This is also carried out as a compatibility test between layers of worn and re-applied hardbanding.

We Understand Quality
Assuring Quality And Reliability
From Production To Application

This Flexible Application Design (FAD) is a key feature of all OTW wires and implies the ability to weld over itself and any other previously deposited hardbanding alloy.

In-House Cored Wire Production with State-of-the-Art Machines

The OTW ranges of high performance cored wires are all formulated, developed and manufactured in Castolin Eutectic’s own modern plant in Ireland, using specially designed production equipment. The plant has 6 wire lines and continues to invest in the latest production machines, utilizing laser controls for dimensional & fill measurements. The wire lines are installed in a purpose-built, green field plant which opened in 2007 and employs around 100 people in manufacturing and quality control.

Quality and Consistency

All quality measurement data is stored in a new computer-based quality assurance system, which retains all manufacturing, wire property, chemistry and batch information. This system actually exceeds the ISO 9001 and EN 29001 Quality Assurance Standards, which have continuously been met and exceeded by our plant for over 15 years. Batches are weld-tested and their samples are stored for 5 years. Each OTW batch is also weld-tested for consistent quality control & operational integrity before final packaging. From production date until day of delivery, our products are ensured to the highest standard of package protection during shipping. All OTW wires are coiled & wound on rust-free plastic baskets, protecting against any corrosion or damage. Moreover, spools are protected by a layer of rust-inhibiting foil, prior to being vacuum-sealed for final packaging within heavy-weight, ergonomically designed and reinforced cardboard packaging.

On-Site Training, Qualification & Approval

Complete welding documentation has been written by our experts in multiple languages. To ensure that OTW hardbanding contractors are fully qualified, consistent in application and uniform globally, training is carried out by our hardbanding training staff, which is supported locally through our network of OTW-Certified Demographic Distributors, worldwide.
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Ask for a demonstration from our Application Specialists.