

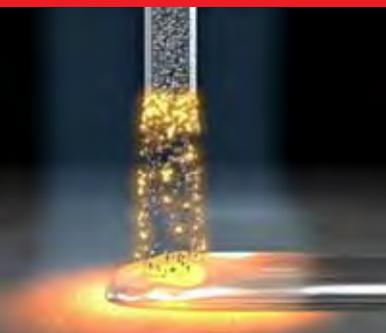
# **TeroMatec<sup>®</sup>**

Self shielding, welding cored wire technology for wear protection,  
rebuilding & repair

*Enduring Performance...*



*Stronger, with  
Castolin Eutectic*



Self shielding peripheric arc system ensures :

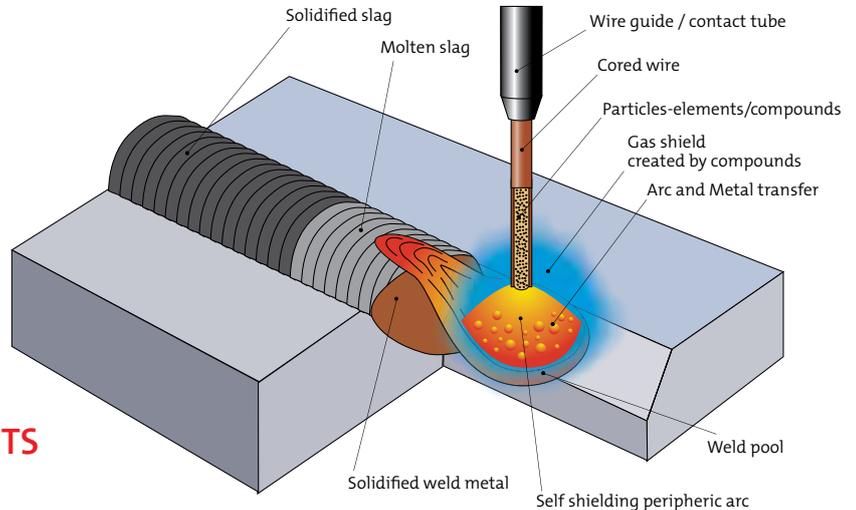
- Fastest weld deposition rates
- Higher welding duty cycles
- On site capability without shielding gas supplies
- Optimised alloy weld properties for longer service life
- Maximum cost savings & productivity

**Castolin Eutectic<sup>®</sup>**  
**Eutectic Castolin**

## TEROMATEC® CORED WELDING WIRES

TeroMatec® is a self shielded arc welding process (Open Arc/FCAW) using specially formulated flux cored wire electrodes. The self shielded peripheric arc conception includes a wide range of custom made alloys optimised for industrial wearfacing, rebuilding and repair solutions with many advantages :

- No shielding gas requirements
- Fastest weld deposition rates
- Higher welding duty cycles
- Efficient weld metal recovery
- Stock reduction opportunities
- Ease of use by semi skilled operators
- Maximum savings & productivity



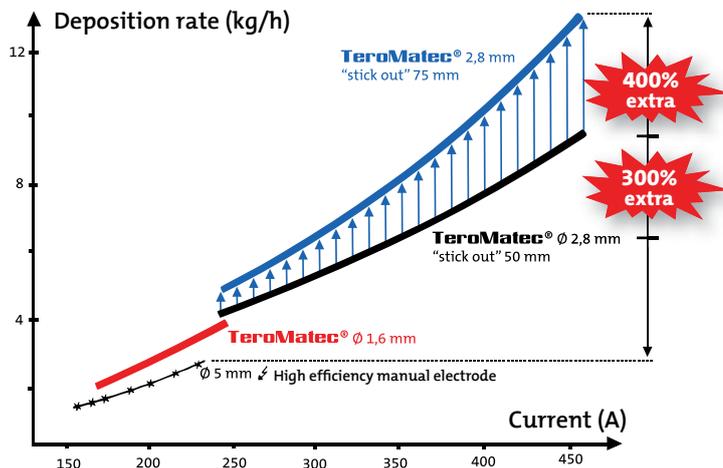
## NO SHIELDING GAS REQUIREMENTS



The TeroMatec® process requires no costly investments or complicated manipulation of heavy gas cylinders, regulators, flowmeters, mixers, hoses etc. TeroMatec®'s autonomous self shielding peripheric arc is designed for outdoor use where on-site wind or draught conditions would simply blow away any external protective gas (GMAW) causing porous, defective welds.

## FASTEST WELD DEPOSITION RATES

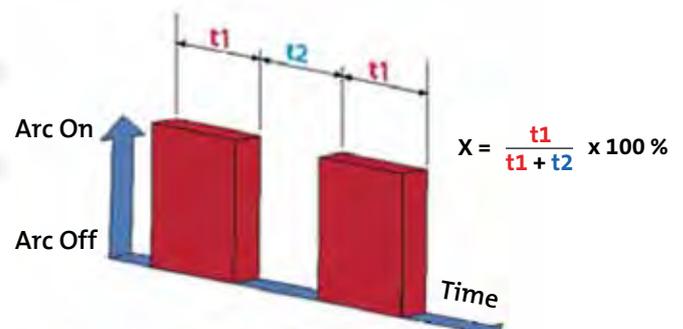
The deposition rate of TeroMatec® flux cored electrodes is remarkable reaching 4 kg/h with the Ø1.6 mm and almost 10 kg/h with the Ø2.8 mm due to peripheric arc current density effects. Furthermore, by increasing the electrode "stick out" (distance between the contact tube tip and the workpiece) from 50mm to 75mm, the deposition rate can be boosted over 12 kg/h due to electrical resistance heating effects whilst reducing heat input and dilution with the base metal.



## HIGHER WELDING DUTY CYCLES

The welding duty cycle (X) is simply the % relationship between the effective arc welding time (t1) and the total time involved (t1 + t2) where t2 is the non productive time between the arc welding cycles. Thus TeroMatec® duty cycles easily reach over 90% in automatic mode compared with MMA stick electrodes which peak around 40%. The higher duty cycle for TeroMatec® is due to :

- no need to keep stopping & changing electrodes
- repetitive striking & restriking eliminated
- less post weld slag cleaning required
- fewer stop-start weld crater defects to grind

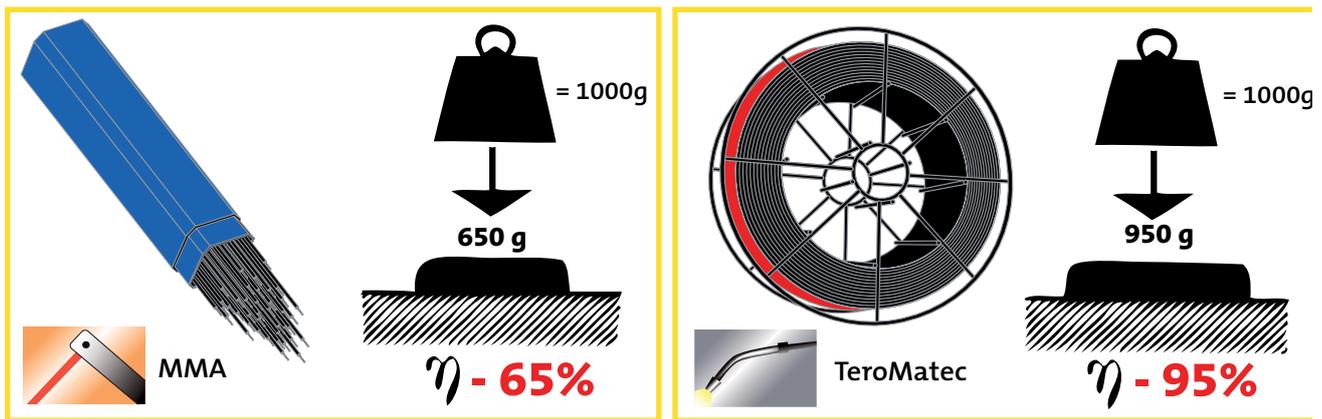


	<b>TeroMatec®</b>	<b>X ≈ 80-90%</b>
	<b>Manual electrode</b>	<b>X ≈ 40%</b>

## EFFICIENT WELD METAL RECOVERY ( $\eta$ %)

The weld metal recovery (sometimes called yield or efficiency) is simply the ratio of the mass of weld deposited to the total mass of the original welding electrode. Thus TeroMatec® cored wires have an excellent weld metal recovery ratio reaching 90% to 95% whilst MMA stick electrodes only reach around 65% due to higher slag volumes and repetitive stub end losses.

In other words, TeroMatec® ensures that virtually all the weight of purchased cored wire ends up as a useful weld deposit thus **reducing consumable costs**.



## STOCK REDUCTION OPPORTUNITIES

As a 15kg TeroMatec® spool represents around 22kg of MMA stick electrodes for the same quantity of required weld deposit, this represents a potential to cut welding consumable stocks by over 30%!

Additionally, when a single spool  $\varnothing$  1.2 or 1.6 mm TeroMatec® is considered, its all round application welding capabilities can eliminate the need to stock separate packs of stick electrodes in 2.4mm, 3.2mm, 4.0mm & 5.0mm sizes thus **further reducing inventory costs**.

## EASE OF USE BY SEMI SKILLED OPERATORS

Relatively little training is required for the TeroMatec® process (compared with MMA) which makes it easy to learn by semi-skilled operators due to the self regulating nature of the arc, variable stick out capability, better visibility and absence of external shielding gases. Furthermore, powerful flux deoxidisers in the TeroMatec® cored wire enable direct welding on rusty or oxidised steel surfaces without the meticulous precleaning needed for the GMAW process, especially when access is limited.

## MAXIMUM SAVINGS & PRODUCTIVITY

Numerous studies by industry show that labour costs are the biggest single expense in welding. As skilled labour rates continue to rise inexorably, **cut and control** your welding costs with TeroMatec®.

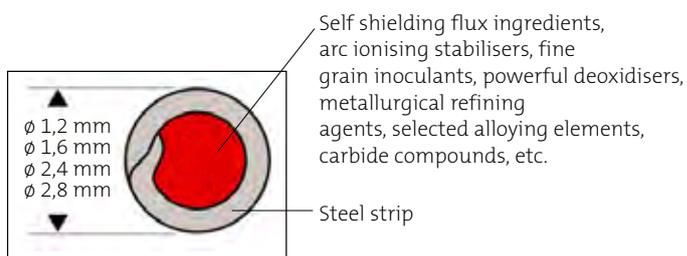
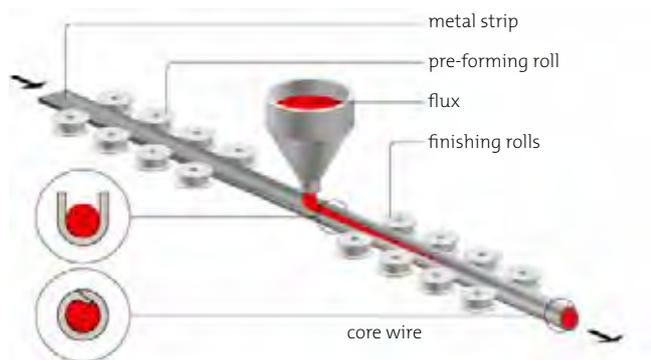
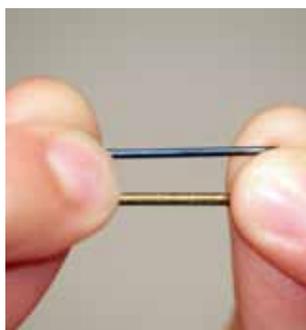


**TeroMatec® systems significantly increase cost savings and productivity over both Mig / Mag & MMA processes due to the ease of use by semi skilled operators, the incomparable weld deposition rates giving superior performance and service life.**

## TEROMATEC® MANUFACTURING FACILITIES

The TeroMatec® range of high performance cored electrodes are formulated, developed and manufactured in Castolin Eutectic's own modern plants using specially designed production equipment and procedures in accordance with ISO 9001 and EN 29001 quality assurance standards.

Each TeroMatec® batch after wire drawing and baking, is weld tested for consistent chemistry, properties & operability before precision spiral spooling and protective packaging for stock.



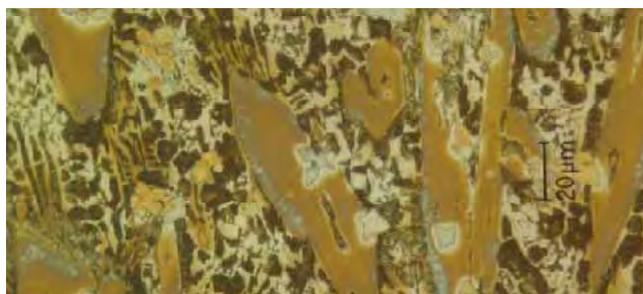
## SELF SHIELDED PERIPHERIC ARC



Thanks to TeroMatec®'s self shielding and high current density characteristics, it can be welded at lower welding currents than a solid wire whilst keeping a stable metal transfer across the arc due to ionising elements in the core. Additionally, the lower heat input and presence of powerful deoxidising fluxes means that TeroMatec® weld deposits have better bonding, lower dilution, superior microstructure properties and minimal heat affected zones for maximum service performance.

## UNIQUE ANTI-WEAR ALLOYS

Solid Mag wires can only be manufactured in metallurgical alloys which can be cast and easily drawn down to final diameters. The TeroMatec® cored electrode concept completely overcomes such limitations and unique metallurgical alloys have been formulated with high density, ultra-hard micro constituents in Fe matrices. Thus the wide TeroMatec® alloy range provides cost effective solutions for most wear problems found in industry.



Abrasion  
Erosion  
Impact  
Friction  
Heat  
Corrosion  
Cavitation  
Rebuilding  
Base Metal

## TeroMatec® flux cored wires

### Technical Data

#### For Joining, Buttering and Rebuilding

Welding Position	Abrasion	Erosion	Impact	Friction	Heat	Corrosion	Cavitation	Rebuilding	Base Metal	Material	Applications	Properties
										Fe	Bucket blades, grabs, leveller blades, tooth-holders on mechanical shovels	Tensile strength : 600-670 N/mm <sup>2</sup> Elongation (l=d) : 45-55 % Hardness : 170-210 HV
										Fe	Foundry defects in cast steel, shrinkage cavities or blowholes in semihard or cast steel.	Tensile strength : 560-640 N/mm <sup>2</sup> Hardness : 260-310 HV
										Fe	Repair of foundry defects in nodular or spheroidal graphite grades of cast iron - porosity, blow holes or shrinkage cavities.	Tensile strength ~475 N/mm <sup>2</sup> Hardness ~50 HRC Annealed ~24 HRC
										Fe	For joining, fabrication & repair of mild and low alloy steels, galvanised steels, used for containers, vessels, hoppers, truck bodies, piping systems, machinery cast steel parts.	Tensile strength : 480 N/mm <sup>2</sup> Elongation (l=d) : 20% Yield stress= 400 N/mm <sup>2</sup>

#### For anti-wear Coatings high resistant to Impact, metal/metal Friction, and slight Abrasion

										Fe	Rolling mill slide rods, shovel buckets, mobile crane wheels, rails.	Tensile strength : 710-790 N/mm <sup>2</sup> Elongation (l=d) : 20-30 % Hardness : 220-270 HV Hardness after workhardening : 400HV
										Fe	Crusher hammers, rolls, cranes, jaws, power shovel or dredge buckets, pump parts.	Hardness ~300 HV Work hardened ~45 HRC
										Fe	Mechanical shovel teeth, crusher hammers and rolls, grab edges.	Hardness : 230-280 HV
										Fe	For intermediate layers and multi-pass anti-wear coatings, joining of large parts of dissimilar composition, rail points, crusher bars and jaws, drive sprockets.	Tensile strength : 580-660 N/mm <sup>2</sup> Elongation (l=d) : 35-45 % Hardness : 180-220 HV
										Fe	Railway retarder beams and wagon brakes, outside parts in hydroelectric power stations, defects in chromium cast steel. For submerged arc welding.	Tensile strength : 800-1000 N/mm <sup>2</sup> Hardness : 290-340 HV Hardness after welding : 340-420 HV

#### For anti-wear Coatings resistant to moderate Abrasion combined with Impact and Pressure

										Fe	Crusher hammers, bars, anvils, casings, mechanical shovel bucket teeth & lips, dragline grab teeth, scraper blades.	Hardness ~59 HRC
										Fe	Ground augers, percussion grabs, dragline teeth and leading edges, gravel pumps, conveyor screws.	Hardness : 52-57 HV
										Fe	Crusher bars and cylinders, feed screws, clay crushers, conveyor belts, waste disposal crusher hammers.	Hardness : 49-54 HV
										Fe	Crusher hammers and bars, impact and casing screens, bucket teeth and lips, scraper blades.	Hardness : 54-59 HV

#### For anti-wear Coatings resistant to high Abrasion and Erosion

										Fe	Sinter crushers and fans, hot sieves, screens and bells.	Hardness : 61-66 HV
										Fe	Unique NanoAlloy for transport screws, furnace chutes, exhaust fans, cyclones, conveyor, mixers, scrapers, screws, screens.	Hardness ~70 HRC
										Fe	Conveyor screws, rolls, crusher pinions and grinders, dragline and pump parts.	Hardness : 52-57 HV
										Fe	Press spindle segment heads, mixer segments, blades and scraper, wear plates, induction fans, drag chains.	Hardness : 65-70 HV
										Fe	Jaw crushers, mixer paddles, pump wheels, mould screws.	Hardness : 59-64 HV

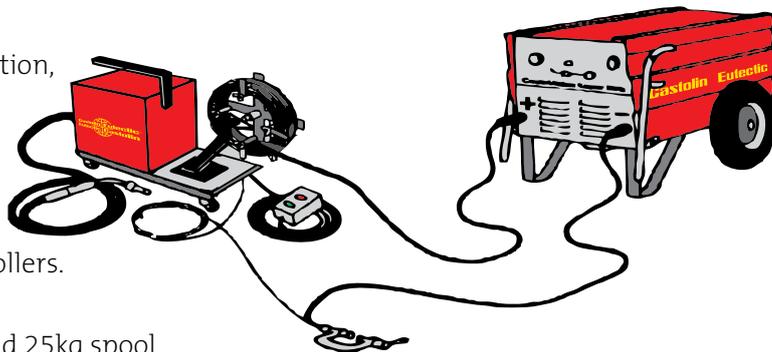
New Product

 Main application

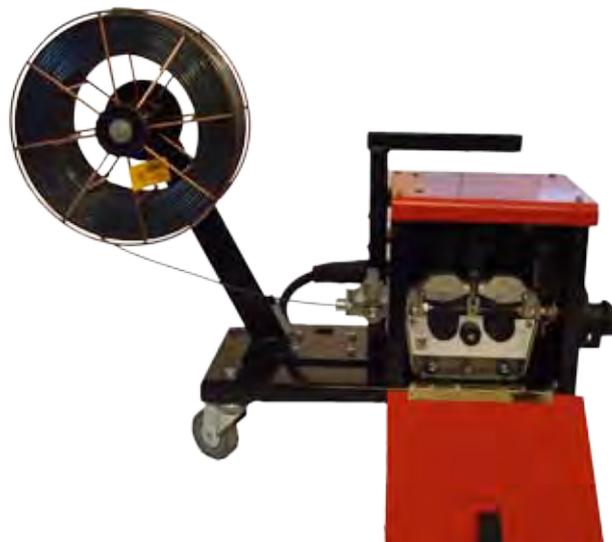
 Secondary application

## THE COMPLETELY MOBILE TEROMATEC® SYSTEM

- Wire Feeder developed specially for heavy duty wear protection applications.
- Unit powered by the open arc voltage.
- Fitted contactor (up to 400A) for safe operation, live torch >400A
- Fitted solenoid for gas shielding.
- Designed for wires from 1.2mm to 2.8mm with a simple combination of rollers.
- High feeding force: 4 wheel drive knurled rollers.
- Fully protected feeding system.
- Self regulating wire speed. Accepts 15kg and 25kg spool types.
- Easy to maintain.
- Euro connection to accept any torch (water cooling option).



Front panel of the TeroMatec® Wire feeder 600



Exclusive wire feeding system, ensures smooth push feeding speeds for TeroMatec® flux cored electrodes.

**TeroMatec® Wire Feeder 600** is designed for coating and joining with open-arc wires in the field. Connected directly to the arc voltage. No mains connection is needed. It operates with any welding power source (with any DC power source)\*. TeroMatec® Wire Feeder 600 is easier to use than a manual electrode as a constant arc length is assured by self regulation of the variable wire speed. Any arc length changes are automatically compensated via the arc voltage driving the wire speed. This feature is unique to TeroMatec®.

\* Suitable are CE marked welding power sources or those with OCV < 75V.

Technical Specifications	TeroMatec® Wire Feeder 600
Input voltage range	21-110 V DC
Input current for control circuits and motor	10A max ( input fused at 10A )
Welding current range	50-600A (depending upon power source)
Welding wire diameters	1.2mm to 2.8mm
Duty cycle	
· 60%	400A contactor - non live torch
· 60%	600A live torch

Consult your Castolin Eutectic Application Specialist about the range of CastoMatec welding power sources.

For your critical applications

Wear phenomena		Industry	Parts
Abrasion + Pressure + Impact		Cement	Rollers of vertical roller mill
Abrasion + erosion		Sugar cane	Teeth of a sugar cane crusher
Abrasion		Open cast mining	Bucket teeth
Impact + abrasion		Glass works	Hammer
Impact + hot abrasion		Iron and steel works	Sinter Crush tooth
Friction + abrasion		Pulp and paper	Counter-knife

# TeroMatec® applications

For your critical applications

Wear phenomena		Industry	Parts
Friction + abrasion + impact + erosion		Civil engineering	Drill sleeve cutter
Abrasion		Thermal power plants	Coal screw vanes
Impact + abrasion		Quarry	Limestone hammer
Impact + abrasion		Refuse recycling	Crushing claws
Friction		Forging	Hydraulic casing
Friction + abrasion + corrosion		Pulp and paper	Screw conveyor

## Application

### Cement Industry

A cement plant installed two new waste feeding lines into the kiln burner. Waste is pumped at 32 m/s speed through 60m and 90m long feeding lines. Previous OEM solutions consisted of standard mild steel straight tubes with internally basalt protected elbows which lasted only 3 weeks. When the installation was operating, the noise of multiple impacts could be heard due to scrap metal or stone particles in the waste feedstock. This caused high wear rate failures of the basalt lining.



First line installation (passing through platform floor).  
Second line awaiting installation.

Wear is usually localized at the elbow entry



## Solution

After a successful month's testing on one CastoTube® elbow coated on the inlet side with NanoAlloy® TM 4395N and on the remaining section with a TM 4666 coating, the customer decided to build the whole line with CastoTube®. Critical parts of the line such as the elbow inlets had NanoAlloy® protection, while the rest of the installation including the straight tubes, had the TM 4666 internal coating.



Sample of a NanoTube, yellow section wearfaced with NanoAlloy® TM 4395N and red one coated with standard CastoTube® alloy TM 4666



Elbows above the platform constructed from CastoTubes with NanoAlloy TM4395N coating have yellow inscriptions. Standard TM 4666 CastoTubes have red inscriptions.

## Cost saving

Before		With Castolin Eutectic procedure	
Downtime cost per day	99 600 €	Cost of Castolin Eutectic procedure	62 300 €
Previous service life	21 days	Actual service life	300 days

LPF\*  
+1329%

\* Life Prolonging Factor



Application part of the Polish TeroLink® database

## CASTOLIN EUTECTIC



Castolin Eutectic Locations



Training

To increase customer know-how in wear technology and repair techniques, we have developed a full line of seminars and training programs, teaching all relevant personnel from welders and engineers to sales teams and managing directors.



The unique Terolink database of Castolin Eutectic contains more than 8,000 fully documented approved applications from around the globe. The case studies include photographs, technical data, detailed descriptions and cost-saving analyses.



Manufacturing



Product Portfolio - Widest in the Industry

R&D-Wear Test Laboratory



Metallurgical Laboratory



Micrograph of Wear Phenomena

Together with our sister company, the Messer Group, we can offer our customers a very powerful range of products and services. Being «Part of the Messer World» means:

- Investment of over €420 million
- More than 6,000 motivated employees
- Over 100 factories to meet customer needs
- Technical sales support in over 120 countries
- 2,000 technical sales people in the field with our customers every day

## HISTORY OF CASTOLIN EUTECTIC



1906: Foundation of Castolin in Lausanne, Switzerland by Jean-Pierre Wasserman. His stroke of genius: to discover a way of welding cast iron at low temperature; in the following years, this innovation was further developed for all industrial metals including aluminium alloys.

1940: Foundation of Eutectic Welding Alloys Corporation in New York

1952: Foundation of Castolin France

1959: Foundation of Eutectic Japan Ltd

1962: Foundation of Eutectic India Ltd.

1960's: International consolidation under Castolin Eutectic

1970's: Creation of training centers for Maintenance & Repair technologies

1978: Establishment of World Head Quarters in St-Sulpice, Switzerland

2000: Merger with Messer Cutting & Welding and creation of the MEC Group - Messer Eutectic Castolin

2005: Part of the Messer World

2006: 100 years of innovation, service and quality.



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## Your resource for protection, repair and joining solutions

*Stronger with...*  
*Castolin Eutectic*

WEAR & FUSION TECHNOLOGY



*Ask for a demonstration  
from our Application  
Specialists.*

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