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
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 peripheral 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 peripheral 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.

FAASTEST 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 peripheral 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

![Diagram of TeroMatec® process](image)
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 Ø 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.

EFFICIENT WELD METAL RECOVERY (η %)
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.

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.
# TeroMatec® flux cored wires

## Technical Data

### For Joining, Buttering and Rebuilding

| 690  | Fe | Bucket blades, grabs, leveller blades, tooth-holders on mechanical shovels | Tensile strength: 600-670 N/mm²  
Elongation (l=d): 45-55 %  
Hardness: 170-210 HV |
|------|----|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 2010 | Fe | Foundry defects in cast steel, shrinkage cavities or blowholes in semihard or cast steel. | Tensile strength: 560-640 N/mm²  
Hardness: 260-310 HV |
| 4226 | Fe | Repair of foundry defects in nodular or spheroidal graphite grades of cast iron - porosity, blow holes or shrinkage cavities. | Tensile strength: ~475 N/mm²  
Hardness: ~50 HRC  
Annealed: ~24 HRC |
| EO 8340 | 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/mm²  
Elongation (l=d): 20%  
Yield stress: ~400 N/mm² |

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

| 3205 | Fe | Rolling mill slide rods, shovel buckets, mobile crane wheels, rails. | Tensile strength: 710-790 N/mm²  
Elongation (l=d): 20-30 %  
Hardness: 220-270 HV  
Hardness after workhardening: 400HV |
|------|----|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 3206 | Fe | Crusher hammers, rolls, cranies, jaws, power shovel or dredge buckets, pump parts. | Hardness: ~300 HV  
Work hardened: ~45 HRC |
| 3220 | Fe | Mechanical shovel teeth, crusher hammers and rolls, grab edges. | Hardness: 230-280 HV |
| 3302 | 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/mm²  
Elongation (l=d): 35-45 %  
Hardness: 180-220 HV |
| ES 4530 | 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/mm²  
Hardness: 290-340 HV  
Hardness after welding: 340-420 HV |

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

<table>
<thead>
<tr>
<th>4327</th>
<th>Fe</th>
<th>Crusher hammers, bars, anvils, casings, mechanical shovel bucket teeth &amp; lips, dragline grab teeth, scraper blades.</th>
<th>Hardness: ~59 HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4415</td>
<td>Fe</td>
<td>Ground augers, percussion grabs, dragline teeth and leading edges, gravel pumps, conveyor screws.</td>
<td>Hardness: 52-57 HV</td>
</tr>
<tr>
<td>4625</td>
<td>Fe</td>
<td>Crusher bars and cylinders, feed screws, clay crushers, conveyor belts, waste disposal crusher hammers.</td>
<td>Hardness: 49-54 HV</td>
</tr>
<tr>
<td>4923</td>
<td>Fe</td>
<td>Crusher hammers and bars, impact and casing screens, bucket teeth and lips, scraper blades.</td>
<td>Hardness: 54-59 HV</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>3952</th>
<th>Fe</th>
<th>Sinter crushers and fans, hot sieves, screens and bells.</th>
<th>Hardness: 61-66 HV</th>
</tr>
</thead>
<tbody>
<tr>
<td>4395N</td>
<td>Fe</td>
<td>Unique NanoAlloy for transport screws, furnace chutes, exhaust fans, cyclones, conveyer, mixers, scrapers, screws, screens.</td>
<td>Hardness: ~70 HRC</td>
</tr>
<tr>
<td>4601</td>
<td>Fe</td>
<td>Conveyor screws, rolls, crusher pinions and grinders, dragline and pump parts.</td>
<td>Hardness: 52-57 HV</td>
</tr>
<tr>
<td>4630</td>
<td>Fe</td>
<td>Press spindle segment heads, mixer segments, blades and scraper, wear plates, induction fans, drag chains.</td>
<td>Hardness: 65-70 HV</td>
</tr>
<tr>
<td>4660</td>
<td>Fe</td>
<td>Jaw crushers, mixer paddles, pump wheels, mould screws.</td>
<td>Hardness: 59-64 HV</td>
</tr>
</tbody>
</table>
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).

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>TeroMatec® Wire Feeder 600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>21-110 V DC</td>
</tr>
<tr>
<td>Input current for control circuits and motor</td>
<td>10A max (input fused at 10A)</td>
</tr>
<tr>
<td>Welding current range</td>
<td>50-600A (depending upon power source)</td>
</tr>
<tr>
<td>Welding wire diameters</td>
<td>1.2mm to 2.8mm</td>
</tr>
<tr>
<td>Duty cycle</td>
<td></td>
</tr>
<tr>
<td>. 60%</td>
<td>400A contactor - non live torch</td>
</tr>
<tr>
<td>. 60%</td>
<td>600A live torch</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Wear phenomena</th>
<th>Industry</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion + Pressure + Impact</td>
<td>Cement</td>
<td>Rollers of vertical roller mill</td>
</tr>
<tr>
<td>Abrasion + erosion</td>
<td>Sugar cane</td>
<td>Teeth of a sugar cane crusher</td>
</tr>
<tr>
<td>Abrasion</td>
<td>Open cast mining</td>
<td>Bucket teeth</td>
</tr>
<tr>
<td>Impact + abrasion</td>
<td>Glass works</td>
<td>Hammer</td>
</tr>
<tr>
<td>Impact + hot abrasion</td>
<td>Iron and steel works</td>
<td>Sinter Crush tooth</td>
</tr>
<tr>
<td>Friction + abrasion</td>
<td>Pulp and paper</td>
<td>Counter-knife</td>
</tr>
</tbody>
</table>
## TeroMatec® applications

For your critical applications

<table>
<thead>
<tr>
<th>Wear phenomena</th>
<th>Industry</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friction + abrasion + impact + erosion</td>
<td>Civil engineering</td>
<td>Drill sleeve cutter</td>
</tr>
<tr>
<td>Abrasion</td>
<td>Thermal power plants</td>
<td>Coal screw vanes</td>
</tr>
<tr>
<td>Impact + abrasion</td>
<td>Quarry</td>
<td>Limestone hammer</td>
</tr>
<tr>
<td>Impact + abrasion</td>
<td>Refuse recycling</td>
<td>Crushing claws</td>
</tr>
<tr>
<td>Friction</td>
<td>Forging</td>
<td>Hydraulic casing</td>
</tr>
<tr>
<td>Friction + abrasion + corrosion</td>
<td>Pulp and paper</td>
<td>Screw conveyor</td>
</tr>
</tbody>
</table>
**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.

**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.

**Cost saving**

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>With Castolin Eutectic procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtime cost per day</td>
<td>99 600 €</td>
<td>Cost of Castolin Eutectic procedure 62 300 €</td>
</tr>
<tr>
<td>Previous service life</td>
<td>21 days</td>
<td>Actual service life 300 days</td>
</tr>
</tbody>
</table>

* Life Prolonging Factor

Application part of the Polish TeroLink® database
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

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.
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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