Automotive product catalogue
Dear All,

Thank you for your interest in the automotive products of ArcelorMittal.

ArcelorMittal is the world’s number one steel and mining company, with over 245,000 employees in more than 60 countries. ArcelorMittal is a leader in all major global steel markets, including automotive, construction, household appliances and packaging, with leading R&D and technology capabilities, as well as mining interests and outstanding distribution networks.

Worldwide, ArcelorMittal is the market and portfolio leader for automotive flat carbon steel and a major player in the European Long Automotive products. The offer also includes products such as tailor welded blanks and tubes.

Our commercial activity is supported by an extensive industrial presence in 22 countries and a strong and committed R&D network. Our Research has a long-term experience in steel innovation and is proud to be able to offer OEMs Advanced High Strength steels to help them build lighter, safer and more fuel-efficient vehicles. Our showcase S-in-motion is one example of how ArcelorMittal offers solutions to reduce the weight of a C-segment Body-in-white and chassis by 19%, as well as to allow for a 13.5% reduction in CO2 equivalent during the use phase.

Within this scope, ArcelorMittal Long Carbon Europe has a major presence in the European Automotive segments of Cold Heading, Free-Cutting, Forging and Spring Steels. Our three plants of Duisburg, Gandrange and Warsaw are dedicated to the Automotive & Truck industry offering products covering all main markets of Special Bar Quality and Wire Rod.

In the past 5 years, major investments have been implemented at these 3 sites: a new Bar mill in Warsaw, a new Wire Rod mill (set to become the reference in automotive Wire Rod in Europe) in Duisburg and a new conditioning line in Gandrange.

Finally, further capability enhancements within these facilities are ongoing in order to extend the product offer. We are committed to meet current and developing needs of our customers and to implement “a new dynamic in Long Steel solutions” through service and innovation.

Regards,

Michel Wurth
Member of the Group Management Board Responsible for Long Carbon Worldwide
Automotive products process flow

ArcelorMittal Duisburg

- Pig Iron
- Hot Metal Desulphurization
- Oxygen Converter 1500 Kt
  - Ladle furnace
  - Vaccum Degassing
  - RH Degassing
  - Continuous casting billets 700 Kt
    - Billets 155²
  - Continuous casting blooms 1200 Kt
    - Blooms 265x385
    - Bar & Billet mill 800 Kt
      - Wire Rod Mill 450 Kt
      - Wire Rod Ø 5.5-25
      - Wire Processing (annealing, pickling, phosphating) by local subcontractor
      - Heat Treatment (soft annealing, stress relieving, normalising) 12 Kt
      - Bars Billets Ø 100-170 Ø 65-200
- Continuous casting billets 1200 Kt
  - Billets for rolling 160²
  - Bar Mill 370 Kt
  - Finishing EC & US test 360 Kt
  - Wire Rod Ø 15-52
  - Wire Rod 450 Kt
  - Bars Ø 20-65
  - Bars Ø 18-100
  - Wire Rod Ø 15-52
- Peeling 12 Kt
- Heat Treatment (soft annealing, stress relieving, normalising, spheroidising; Q+T) 65 Kt

ArcelorMittal Warsaw

- Scrap
- Electric Arc Furnace 530 Kt
  - Ladle furnace
  - Vaccum Degassing
  - Continuous casting billets 530 Kt
  - Billets for rolling 160²
  - Bar Mill 370 Kt
  - Finishing EC & US test 140 Kt
  - Bars Ø 20-65
  - Wire Rod Ø 15-52
  - Wire Rod 450 Kt
  - Bars Ø 20-65
  - Bars Ø 18-100
  - Wire Rod Ø 15-52
- Peeling 12 Kt
- Heat Treatment (soft annealing, stress relieving, normalising, spheroidising; Q+T) 65 Kt

ArcelorMittal Gandrange

- Scrap
  - Electric Arc Furnace 530 Kt
    - Ladle furnace
    - Vaccum Degassing
    - Continuous casting billets 530 Kt
    - Billets for rolling 160²
    - Bar Mill 370 Kt
    - Finishing EC & US test 140 Kt
    - Bars Ø 20-65
    - Wire Rod Ø 15-52
    - Wire Rod 450 Kt
    - Bars Ø 20-65
    - Bars Ø 18-100
    - Wire Rod Ø 15-52
- Peeling 12 Kt
- Heat Treatment (soft annealing, stress relieving, normalising, spheroidising; Q+T) 65 Kt
Today the wire rod mill offers products on a high-end quality spectrum, and the billet mill produces advanced bainitic steels for hot forging.

The new rod mill is set to become European benchmark for high value added wire-rod in mechanical properties, tolerances, surface quality.

**Final applications**
- Cold heading qualities:
  - steel for cold extrusion; fasteners
- Heat treatable steel grades:
  - components of common rail systems
- Carbon grade: offshore; pre-stressed steel
- Alloyed spring steel: Valve springs; clutch springs
  - tension/ compression and axle springs
- Free-cutting steel
  - special shape turned parts
  - shafts and hydraulic systems
- Bainitic steel
  - front axle beam, steering lever & knuckle parts

**Facilities**
- Desulphurisation station
- 2 BOF converters (TBM process); ladle furnace
- Ladle and circulation (RH) degasser
- Steel conditioning (stirring with Ar; N2)
- Two 6-strand casters for blooms and billets
- Billet rolling mill with pusher type furnace; reversing breakdown and finishing stand; hot cutting machine
- Bar & Billet conditioning with US and surface testing (TOM)
- Special Bar & Billet annealing devices available (up to 9m length):
  - soft annealing, normalising, and stress relieving treatments
- Dimension control; robot grinding
- High speed single-strand wire rod mill w/ walking beam furnace,
  28 stands incl. pre–block, NT block
- Thermo–mechanical rolling incl. loop
- 104 meters long stelmor line
- Wire rod processing (annealing, pickling, phosphating) upon request

**Strengths**
- Production of crude steel with lowest C content (< 100 ppm) and a defined alloy concentration.
- Refining of metal charges in 150 t converters due to a specific model calculation incl. management of lance status, oxygen flow rate and alloys.
- Ladle metallurgical centre for precise alloying, reduction of solute gases, desulphurisation and adjustment of melting temperature.
- Bloom and billet casters with re-oxidation prevention and mould stirring.
- Most modern layout and equipment on a new single-strand wire rod mill like thermo–mechanical rolling and special cooling devices for a fine–grained structure.
- Special customer requirements upon request.

**Product range**
- Wire rods
  - in 5.5 to 25 mm (steps of 0.5 mm)
  - Maximum coil weight: 3.0 tons
  - Tolerances: according to DIN EN 10108: 2005
  - Coil dimensions (mm):
    - inner diameter 800
    - outer diameter 1,250
    - coil length 2,300
- Round Bars / Square Billets for forging
  - in 100 to 170 mm (Round) / 65 to 200 mm (Square)
  - Maximum bundle weight: 10.0 tons
  - Strapping: 6 steel bands
  - Labelling: content upon request
ArcelorMittal Warsaw

Mini-mill with a strong position in mechanical engineering and automotive markets.

Facilities

- Electric arc furnace with EBT, ladle furnace, vacuum degassing device—4 strand billet caster
- New rolling mill: reheating walking beam furnace, 18 stands in continuous system roll line
- Finishing line: straightening machines, milling and chamfering devices, surface control (Circograph, Circoflux), ultrasonic control device, antimixing control—spectrotest devices, packaging, marking
- Heat treatment: soft annealing, normalising, isothermal, spheroidising and stress relieving treatments, quenching and tempering

Final applications

- Case hardening steels
  Parts such as camshafts, gearbox shafts, engine parts
- Heat treatable steel grades
  Components of steering system, braking system, axle hubs, front axles
- Cold heading qualities
  Steel for cold extrusion, fasteners, screws, ball pins
- Carbon and micro-alloyed steel grades
  Hot forging / stamping—flanges, conrods, Cold forming
- Carbon and alloyed spring steel
  Tension/compression and axle springs
- Bearing steel
  Bearing rings

Strengths

- Production of wide range of steel grades
- Flexibility of mini-mill
- Steel with controlled/regulated sulphur content
- Micro alloys steel with Nb, V, B
- Steel with 'restricted hardenability' (Jominy, 2/3 of band)
- Full downstream capability: heat treatment and peeling on bars

Product range

- Bars:
  Rounds 20 to 65 mm
  - Length 3.5–12m, tolerance acc. to EN 10060 (P)
  - Tolerance acc. to EN 10060 (P) < heat treatment, tighter tolerances upon request
  - Maximum bundle weight: 10 tons
  - Strapping: minimum 3 steel bands or more possible upon request
  - Labelling: content upon request
  - Heat treatment up to 12m except for quenching and tempering up to 6m.
  - Peeling upon request by local subcontractor
- Also produces rebars, merchant bars, angles, flat bars and ingots for forging & rolling.

Final applications

- Case hardening steels
- Parts such as camshafts, gearbox shafts, engine parts
- Heat treatable steel grades
- Components of steering system, braking system, axle hubs, front axles
- Cold heading qualities
- Steel for cold extrusion, fasteners, screws, ball pins
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- Also produces rebars, merchant bars, angles, flat bars and ingots for forging & rolling.
ArcelorMittal Gandrange

Products for Automotive and Mechanical Engineering markets with a large range of bars and wire rods.

**Final applications**
- Carbon and micro-alloyed steel grades
  - Hot forging / stamping
  - Cold forming
- Cold heading qualities
  - Steel for cold extrusion; fasteners
- Free-cutting steel grades
  - Special shape turned parts
  - Shafts and hydraulic systems
- Heat treatable steel grades
  - Components of Common Rail systems
- Carbon and alloyed spring steel
  - Tension/ compression and axle springs, torsion bars

**Strengths**
- Possibility to source steel from both BOF and EAF routes
- A wide range of grades and dimensions on Bars and Wire Rods
- State of the art Sizing Block and Bar Conditioning
- Mini-mill flexibility in order to meet customer needs

**Facilities**
- Bar & Wire rolling mill:
  Furnace with tight temperature control, Kocks finishing block, dimensional and surface controls during rolling.
- Finishing line:
  Multi-roll straightener, sawing and chamfering devices (45° or 60° from 0.2 up to 4mm), Anti-mixing, Surface control (Circoflux), Ultrasonic control device, bundling, strapping and stamping

**Product range**
- Wire rod
  - Rounds: 15 to 52 mm (steps of 0.1 mm)
  - Hexagons: 14.3 to 42.5 mm
  - Coil weight standard: 2.5 tons, other coil weights available upon request
- Coil dimensions (mm):
  - Inner diameter 900
  - Outer diameter 1,400
  - Coil length 1,500 max
- Bars:
  - Rounds: 18 to 100 mm (steps of 0.1 mm)
  - Hexagons: 14.3 to 70.4 mm
  - Maximum bundle weight: 8.0 tons,
  - Length: 5 to 12 meters
  - Strapping: 4 to 8 steel bands
  - Labelling: 2 per bundle
  - Tolerances acc. EN10060 A to P, tighter tolerances upon request
Cold drawn bars for Automotive and Mechanical Engineering markets with a large range of grades and sections

**Final applications**
- Steels for general engineering
  - Head rest support – stabiliser bar – green good applications
- Free-cutting steels
  - Components for camshaft – injector pieces – temperature sensors
  - ABS parts – hydraulic couplings
- Case hardening steels
  - Air conditioning parts
- Steels for quenching and tempering
  - Components for shock absorber
  - Struts – gearbox fork

**Strengths**
- Production of wide range of diameters
- Tight quality control
- Various upstream supply routes – wide range of product choice
- High supply flexibility due to tight relation with the rolling mills of ArcelorMittal Duisburg & Gandrange
- 3 Service Centres in Italy, France & Germany

**Product range**
- **Bright Bars**
  - Rounds: 5 to 80 mm
  - Hexagons: 5.5 to 75 mm
  - Special shape on request
  - Length: 3 to 7 meters
  - Tolerances acc. EN10278
  - Bundle weight: 1 to 3 t
  - Labelling and packaging
- **Grinding**
  - Rounds: 6 to 50 mm
- **Control**
  - Eddy current control (Circograph – Defectomat)
  - Ultra-sonic testing available
## Improved Machinability Steels

Improved Machinability Steel grades have small amounts of additional alloying elements to improve machinability. Alloying elements are added during secondary steelmaking specifically to modify the steel inclusion population. Some elements form controlled inclusions to promote chip formation and break-up during subsequent machining, while others melt locally at the tool / work piece interface acting as a lubricant and reducing tool wear. Possible additions include Sulphur, Lead, Tellurium, Bismuth and Selenium.

### Specifications

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<th>Warsaw</th>
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## Quenched and Tempered Steels

Quenched and Tempered Steel grades have greater hardenability than structural carbon steels. The grades contain specific amounts of alloying elements to favour transformation of austenite into martensite during the quenching process. After forging, the work piece is quenched in water, polymer or oil to increase the hardness even in thick sections (through-hardening). The tempering process allows to obtain the best compromise between strength, ductility and toughness.

### Specifications

<table>
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<tr>
<th>Grade designation</th>
<th>Duisburg</th>
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</tbody>
</table>

- **Usimax®**:
  - High Speed Free Cutting Steel (without pd) - UTS 400–700 MPa drawn
  - Free Cutting Steel for Heat Treatment - UTS 700–850 MPa drawn
  - High Resistance Free Cutting Steel - UTS 950–1100 MPa drawn
- **38Cr2**:
  - (Q+T): (Quenched and Tempered)
- **41Cr4**:
  - (Q+T): (Quenched and Tempered)
- **18CrMo4**:
  - (Q+T): (Quenched and Tempered)
- **25CrMo4**:
  - (Q+T): (Quenched and Tempered)
- **34CrMo4**:
  - (Q+T): (Quenched and Tempered)
- **42CrMo4**:
  - (Q+T): (Quenched and Tempered)
- **36MnCr5**:
  - (Q+T): (Quenched and Tempered)
- **34CrNiMo4-6**:
  - (Q+T): (Quenched and Tempered)
- **36CrNiMo4**:
  - (Q+T): (Quenched and Tempered)
- **30CrNiMo8**:
  - (Q+T): (Quenched and Tempered)
- **42CrMo4 NV**:
  - (Q+T): (Quenched and Tempered)
- **51CrV4**:
  - (Q+T): (Quenched and Tempered)
- **15Mo3**:
  - (Q+T): (Quenched and Tempered)
- **40NiCrMo4**:
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- **115Mn30**:
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- **445Mn28**:
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  - (Q+T): (Quenched and Tempered)
- **C35Pb**:
  - (Q+T): (Quenched and Tempered)
- **C45Pb**:
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- **38Cr2**:
  - Common Rail
- **37Cr4**:
  - Common Rail
- **34Cr4**:
  - Common Rail
- **41Cr4**:
  - Common Rail
- **18CrMo4**:
  - Rocker Arms, Pistons, Crankshaft; UTS > 1100 MPa
- **25CrMo4**:
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- **30CrMo4**:
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- **34CrMo4**:
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- **42CrMo4**:
  - Rocker Arms, Pistons, Crankshaft; UTS > 1100 MPa
- **36MnCr5**:
  - Rocker Arms, Pistons, Crankshaft; UTS > 1100 MPa
- **34CrNiMo4-6**:
  - Rocker Arms, Crankshaft
- **36CrNiMo4**:
  - Rocker Arms, Crankshaft
- **30CrNiMo8**:
  - Rocker Arms, Crankshaft
- **42CrMo4 NV**:
  - Rocker Arms, Crankshaft
- **51CrV4**:
  - Rocker Arms, Crankshaft
- **15Mo3**:
  - Rocker Arms, Crankshaft
- **40NiCrMo4**:
  - Rocker Arms, Crankshaft

- **51CrV4**:
  - Rocker Arms, Crankshaft

- **15Mo3**:
  - Rocker Arms, Crankshaft

- **40NiCrMo4**:
  - Rocker Arms, Crankshaft
ArcelorMittal Long Carbon Europe capabilities

**Bainitic Steels for Forging**

Bainitic Steels are designed for applications requiring a good compromise between Tensile Strength and Ductility, and offer the added benefit of eliminating the final Quench and Tempering process usually performed to achieve high properties. Controlled cooling after forging steers the Austenite transformation into the Bainitic region. The fine tuning of alloying elements will enable to reach the desired level of strength, taking into account the customer process and the size of the part.

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| SOLAM ® B1100     | ●        | ○         |        | "Truck Front Axle Beam, Steering Knuckle, Steering Arm
UTS > 1100 MPa" |
| SOLAM ® B1150 IH  | ○        |           |        | "Crankshaft (Induction Hardened) - UTS > 1150 MPa" |
| SOLAM ® B1200     | ○        |           |        | "Common rail, Axle Baam, Steering Lever
(hot forged parts 30-100 mm) - UTS > 1200 MPa" |
| 20MnCr++          | ● ● ●    |           |        | "Injectors, Injection Nozzles - UTS > 1200 MPa" |

**Cold Heading Steels**

Cold heading steels are designed to fulfil the most demanding customer specifications. So, the formability, ductility and strength required for producing by cold deformation the most complex parts is offered by a wide range of low carbon, alloyed, micro-alloyed and boron grades produced according to international standards. Closely controlled rod manufacturing practices ensure their good internal soundness and their defect-free surface. For specific grades, a close control of the chemical composition and post-rolling cooling allow the achievement of requested mechanical properties of the parts even by cold heading without final heat treatment.

To produce cold headed fasteners, threaded rods, wheel bolts, rivets, studs, nuts, U-bolts & welded studs and other complex formed parts for automotive, engineering and construction industries.

<table>
<thead>
<tr>
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<th>Duisburg</th>
<th>Gandrange</th>
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<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35B4</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-Phi 8.8</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FREEFORM ® B 10.9 IT</td>
<td>○</td>
<td></td>
<td></td>
<td>Wheel Spindle, Ball Joint, Fastener - UTS 1000-1200 Mpa</td>
</tr>
<tr>
<td>FREEFORM ® B 10.9</td>
<td>○</td>
<td></td>
<td></td>
<td>Ball Joint, Fastener - UTS &gt; 1000 Mpa</td>
</tr>
</tbody>
</table>
| FREEFORM ® M 1500 H2 | ●     |           |        | Conrod Screw (High Characteristics) - Suspension Screw
UTS > 1500 MPa |
| 28MnCrB7-2        | ●        |           |        | Ball pin |
| 27MnCrB5-2        | ●        |           |        | Ball pin |
| 32CrB4            | ●        |           |        | Screw   |
| 36CrB4            | ●        |           |        | Screw   |
| 36CrNiB4          | ●        |           |        |         |

- Industrial in all dimensions
- In development (part trial or produced)
- In-house development

Additions of Se possible to globulise the sulphurs;
Additions of Pb, Bi and Te possible to improve machinability.
ArcelorMittal Long Carbon Europe capabilities

Spring Steels

Spring Steels are Medium or High Carbon Steels with very high Yield Strength. This property allows the part formed with these grades to return to their original shape after significant bending or twisting. The principal alloying elements to achieve the high yield strength are Silicon and Manganese. For the very demanding applications, the grades are processed with high cleanliness level; hence, a very good fatigue behaviour.

Specifications

<table>
<thead>
<tr>
<th>Grade designation</th>
<th>Duisburg</th>
<th>Gandrange</th>
<th>Warsaw</th>
<th>Comments</th>
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<tbody>
<tr>
<td>45SiCrV6</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45MnSiCrV6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46SiCrMo6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55Cr3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51CrV4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58CrV4</td>
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<td></td>
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</tr>
<tr>
<td>58CrMoV4</td>
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<tr>
<td>55SiMo8</td>
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<td></td>
</tr>
<tr>
<td>52SiCrNi5</td>
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<td></td>
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<td>51SiCr7</td>
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<td>54SiCr6</td>
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<tr>
<td>54SiCrV6</td>
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<tr>
<td>60SiCrV7</td>
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<tr>
<td>SOLAM® M2050 S-Cor</td>
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<td>SOLAM® M2000 S</td>
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<tr>
<td>54SiCr6 super clean</td>
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<tr>
<td>60SiCr8</td>
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<td></td>
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</tr>
<tr>
<td>60SiCr ++</td>
<td></td>
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</tbody>
</table>

Case Hardening Steels

Case Hardening Steels are used for parts requiring high surface wear resistance but retaining a soft core that absorbs stresses without cracking. After forging, the outer layer is carburised (diffusion of carbon) and/or carbo-nitrided and then locally hardened by quenching. The grades are Low-Carbon steels with addition of suitable alloying elements. These additions typically include Chrome and Manganese, but also Nickel and Molybdenum can be involved to increase the through-hardening for larger cross-sections. A special characteristic of this kind of grade is the Jominy curve, which needs to be well controlled.

Specifications

<table>
<thead>
<tr>
<th>Grade des.</th>
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<th>Comments</th>
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<tbody>
<tr>
<td>20MnS</td>
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<td>16MnCr5</td>
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<tr>
<td>16MnCr5S</td>
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</tr>
<tr>
<td>16MnCr5S5Pb</td>
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<td>20MnCr5</td>
<td></td>
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<td>20MnCr5S</td>
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<tr>
<td>25MoCr4</td>
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</tr>
<tr>
<td>12NiCr3</td>
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<tr>
<td>14NiCr14</td>
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<tr>
<td>18NiCrMo6</td>
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<tr>
<td>15CrNi6</td>
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<td>17CrNi6</td>
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<tr>
<td>18CrNi8</td>
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<tr>
<td>17Cr3</td>
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<tr>
<td>20NiCrMo2</td>
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<tr>
<td>14NiCrMo13</td>
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<tr>
<td>23MnCrMo4</td>
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<tr>
<td>17CrNiMo6</td>
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</tr>
</tbody>
</table>

Axles / Shafts

Pinions

Gears
### ArcelorMittal Long Carbon Europe capabilities

#### Micro-Alloyed Steels

Micro-Alloyed Steel grades allow to produce parts with higher strength obtained as forged. Typical additions include Niobium, Vanadium and Titanium. These additions increase yield strength by precipitation hardening, and also offer finer grain structures. These 2 effects increase the strength of the forged parts compared to conventional Carbon steels.

<table>
<thead>
<tr>
<th>Grade designation</th>
<th>Duisburg</th>
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<th>Warsaw</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>10MnV6</td>
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</tr>
<tr>
<td>17MnV5</td>
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<td>●</td>
<td></td>
</tr>
<tr>
<td>22MnV6</td>
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<td>●</td>
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<tr>
<td>27MnSiV6</td>
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</tr>
<tr>
<td>30MnSiV6</td>
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<td>●</td>
<td></td>
</tr>
<tr>
<td>49MnV3</td>
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<td>●</td>
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<tr>
<td>38MnSiV5-6</td>
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<td>44MnSiV5</td>
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<td>C70S6</td>
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</tr>
</tbody>
</table>

**Specifications**

**Bearing Steels**

Bearing Steels are High-Carbon grades with very high mechanical properties achieved by quench and tempering combined with a very high wear resistance. Depending on the type of applications, different levels of cleanliness will be required to avoid inclusions that initiate fatigue during rolling contact.

<table>
<thead>
<tr>
<th>Grade designation</th>
<th>Duisburg</th>
<th>Gandrange</th>
<th>Warsaw</th>
<th>Comments</th>
</tr>
</thead>
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<td>100Cr6</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Mechanical Application / Tooling</td>
</tr>
<tr>
<td>100Cr6</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Bearing Ring</td>
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<td>100CrMn6</td>
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<td>●</td>
<td>●</td>
<td>Bearing Ring</td>
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<tr>
<td>100CrMo7</td>
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<td>●</td>
<td>●</td>
<td>Bearing Ring</td>
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<td>C55</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Integrated Running Gear</td>
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<tr>
<td>C70</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Integrated Running Gear</td>
</tr>
</tbody>
</table>

**Carbon Steels**

Carbon Steel grades are the combination of 3 families: Low, Medium and High Carbon. Low Carbon steels: Carbon range between 0.1 to 0.25%. One of the most common type of steels used for general purposes and are inherently easier to cold-form and handle (draw, bend, etc.) due to their soft and ductile nature.

Medium Carbon steels: approximately 0.30 to 0.59% Carbon content. Can be heat treated to have a good balance of ductility and strength. These steels are typically used in large parts, forgings, machine and automotive.

High Carbon steels: above 0.60% of Carbon content. High Tensile and Yield strengths. Used for applications in which high strength, hardness and wear resistance are necessary, such as wear parts, gear wheels, chains, brackets.

<table>
<thead>
<tr>
<th>Grade designation</th>
<th>Duisburg</th>
<th>Gandrange</th>
<th>Warsaw</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>C10 to C25</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Camshaft, Common Rail, Injectors, Joint Casing</td>
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<td>C30 to C60</td>
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<td>●</td>
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<tr>
<td>C68 to C92</td>
<td>●</td>
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</tbody>
</table>

**Specifications**

- ● Industrial in all dimensions
- ○ In development (part trial or produced)
- ○ In-house development

Additions of Se possible to globalise the sulphurs; Additions of Pb, Bi and Te possible to improve machinability.
Main missions

- Contribute with ArcelorMittal Long Carbon to strategic development of Automotive, Energy & Construction markets for Bars & Wires products
- Support plants in process improvement & new process developments
- Innovate to supply new steel solutions generating high value creation

Main activities

- Develop new solutions & new products: Conception of new steel grades (SOLAM®, FreeForm®, Maflex®...)
- Design of thermal treatments to achieve desired microstructure
- Surface treatment and coatings development (galvanising, galfanising, paints, lacquers, powder...)
- Qualify manufacturing & service properties of products
- Expertise process/product, to provide technical support to the plants & customers
- Contribute to conception & optimisation of processes by using Finite Element and other specific models: liquid metallurgy, casting, hot rolling, hot and cold forming, heat treatment, ...
- Support for instrumentation of industrial processes (Thermal camera, pyrometers, force sensors...)

R&D Facilities

- Numerical modelling from liquid metallurgy, casting to hot rolling & cold forming
- Product characterisation at micro & macro scale (Field Emission Gun SEM, macro-probe, torsion & fatigue machines, dilatoplastometry, corrosion chambers...)
- Process pilots for machinability, drawing and heat treatment
- Support from the ArcelorMittal R&D network (Automotive Research centres of Montataire & Maizières-les-Metz)
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