New Casting and Rolling Technology in MIDA Plant
What MIDA means?

MIDA is referring to MImini-mill DAinieli plant. It is a know-how developed by Danieli which means scrap charging, electric arc melting, continuous casting and finally rolling mill for rebars, wire rods and sections. All the integrated process is supported by levels 1, 2 and level 3 of automation systems.
MI.DA Concept and application

✧ The concept is based on the direct link between a billet caster and a highly-available rolling mill, without the conventional billet re-heating furnace.

✧ Super-compact productive unit for rebar steel

✧ Energy saving, 120 min from scrap to finished product

✧ Endless and uninterrupted smooth production

✧ Fast construction and commissioning path
Process flow chart

Scrap → Material Handling → Scrap Yard

Preheating and flue gas to FTP

EAF

Consteel

Bunkers

Additives and Dephosphorization

Ladle Furnace

CCM

Alloying elements and Desulphurization

Billet 130*130

Billet 165*165

HRM
CONSTEEL
• Charging Conveyor
• Preheating Conveyor
• Connecting Car

Advantages of CONSTEEL
• Decrease the consumption of electrical energy
• Decrease tap-to-tap time.
• Increase the productivity.
• Reduction of noise.
Continuous Casting Machine

M.I.D.A.® an uninterrupted Casting-Rolling Process

Longest billet ever rolled, over 8,280 m casting/rolling sequence in a single uninterrupted
CCM contains 3 strands; one of them is of Fast Continuous Casting (FCC) type 165 mm square, while the other 2 are similar ordinary strands 130mm square.
Such a high productivity can only be achieved thanks to the application of the latest FAST CAST Technology which is the new generation of continuous casting machines.

- Danieli FAST CAST Technology is characterized mainly by two innovative and high-tech systems:
  - Power Mould
  - Fast Cast Cube mould oscillation system (FCC)
The Power Mould: the name that was given to the newly developed product – is a copper mould specifically designed for these casting speeds and provides high thermomechanical strength and uniform heat transfer with optimized cooling conditions.

The Fast Cast Cube (FCC) technology has a compact design with a bearing-free suspension system, without any shaking of the meniscus, even at the highest oscillation frequencies.
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**Power Mould Benefits**
- Efficient cooling system
- Efficient and uniform heat transfer
- Very high rigidity
- No need water gap alignment

**Conventional mould**
- Size 130 x 130 mm
- Copper tube material – Cu-Ag 0.1
- Water gap – 3.5 mm
- Copper tube thickness – 13 mm
- Internal Radius – 4 mm
- Length – 1000 mm

**Power Mould**
- Size 165 x 165 mm
- Copper tube material – Cu-Cr-Zr
- Holes diameter – 10 mm
- Copper tube thickness – 30 mm
- Internal Radius – 4 mm
- Length – 1000 mm

**ECO Power Mould**
- Size 165 x 165 mm
- Copper tube material – Cu-Cr-Zr
- Holes diameter – 10 mm
- Copper tube thickness – 30 mm
- Internal Radius – 4 mm
- Length – 1000 mm
Mould Oscillator Type

Endless Strand

(FCC) Fast Cast Cube
- Oscillator type: hydraulically actuated
- Stroke regulation: PLC
- Oscillation stroke: 16 mm (±8 mm) - Max. acceleration, 4.5 m/s²
- Oscillation frequency: 25 OPM (min.) ÷ 420 OPM (max.)
- Servo cylinder: Quantity 2

Conventional Strand
- Oscillator type: hydraulically actuated
- Oscillation stroke: 20 mm (±10 mm)
- Oscillation frequency: 420 OPM (max.)
- Weight balancing: Pneumatic springs
Conventional Strand
- 6 rolls per strand (2 Apron rolls + 2 Apron rolls + 2 idle rolls)

Endless Strand
- 4 segments - 204 rolls (51 rows x 4 rolls)

Strand Containment rolls
<table>
<thead>
<tr>
<th>CCM Machine</th>
<th>Endless Strand</th>
<th>Conventional Strand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept</td>
<td>Strand linked directly with rolling mill to produce rebar</td>
<td>Billet produced and collected on the cooling bed</td>
</tr>
<tr>
<td>Shape &amp; Section Size</td>
<td>Square 165x165 mm</td>
<td>Square 130x130 mm</td>
</tr>
<tr>
<td>Casting type</td>
<td>submerged casting</td>
<td>open stream casting</td>
</tr>
<tr>
<td>linear weight (cold)</td>
<td>213 Kg/m</td>
<td>132 Kg/m</td>
</tr>
<tr>
<td>Max Casting Speed</td>
<td>6.2 m/min</td>
<td>4.5 m/min</td>
</tr>
<tr>
<td>Max Productivity per strand</td>
<td>78 t/hr.</td>
<td>35 t/hr.</td>
</tr>
<tr>
<td>Mould Cu Tube Type</td>
<td>Power Mould – Eco Power Mould</td>
<td>Conventional mould</td>
</tr>
<tr>
<td>Mould Lubrication</td>
<td>Powder</td>
<td>Oil</td>
</tr>
<tr>
<td>Mould level control</td>
<td></td>
<td>Radioactive Co60</td>
</tr>
<tr>
<td>CCM Machine</td>
<td>Endless Strand</td>
<td>Conventional Strand</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Oscillator type</td>
<td>Hydraulic (Fast Cast Cube) - FCC</td>
<td>Hydraulic</td>
</tr>
<tr>
<td>Secondary cooling system</td>
<td>8 Zones (water)</td>
<td>4 Zones (water)</td>
</tr>
<tr>
<td>Secondary cooling Length</td>
<td>13.5 m</td>
<td>Max. 10 m</td>
</tr>
<tr>
<td>Strand Containment rolls</td>
<td>4 segments - 204 rolls (51 rows x 4 rolls)</td>
<td>6 rolls (2 Apron rolls (4 rolls) + 2 idle rolls)</td>
</tr>
<tr>
<td>Max metallurgical length</td>
<td>50 m</td>
<td>24 m</td>
</tr>
<tr>
<td>Billet Cutting</td>
<td>Hydraulic Shear</td>
<td>Oxy-cutting torch - Hydraulic Shear</td>
</tr>
<tr>
<td>Final product</td>
<td>Rebar - Billet</td>
<td>Billet</td>
</tr>
<tr>
<td>CCM Yield</td>
<td>99%</td>
<td>98.50%</td>
</tr>
<tr>
<td>Rolling Mill yield</td>
<td>99.50%</td>
<td>90 : 97 %</td>
</tr>
<tr>
<td>No. of heats per sequence</td>
<td>Depends on Submerged Entry Shroud life</td>
<td>Depends on tundish refractories life</td>
</tr>
<tr>
<td>Strand Re-open in same</td>
<td>Not possible</td>
<td>Possible many times</td>
</tr>
<tr>
<td>sequence</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hot Rolling Mill (HRM)
Induction furnace temperature control

- The induction furnace is designed to reheat the billet coming from CCM and before Roughing mill (minimum surface temperature must be 820 °C up to 1050 °C).
- It can work in endless or semi endless mode (billet 12m).
- The system is composed by 6 inductors (nominal power is 1MW for each inductor), the length of induction furnace is 10m. Nominal production 76 ton/h).

The induction furnace works in 3 modes:

- 1. Automatic mode (endless or semi endless)
- 2. Manual mode
- 3. Heating mode
Induction furnace
The Mill

- The mill consists of 20 stands.
- Roughing mill: 8 stands (cantilever mono-groove type) 3 families 685-585-450mm.
- Crank shear
- Flying shear
- Finishing mill: 15:20 (330:285mm)
Cut to length Shears
THE DIRECT ROLLING AND BUNDLING (DRB®) SYSTEM

- (DRB®) system that enables the cut to final commercial length of high-tensile rebar product directly off the last finishing stand.
- The result is a very compact arrangement of the whole cooling bed/bundle forming and tying station,
- After bundling, the bars run through two wire-tying machines and then collected onto a chain transfer for final removal by cranes
Finishing area

- The products discharge to 27mt cooling bed by twin channel (revolver), Controlling the bar speed and position of discharge by 4 tail brakes.
- 2 tying machines.
## Comparison

<table>
<thead>
<tr>
<th></th>
<th>MIDA Plant</th>
<th>Traditional plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heating billet</strong></td>
<td>Induction furnace (850 to 1070)</td>
<td>Traditional furnaces (ambient temp to 1150)</td>
</tr>
<tr>
<td><strong>Plant area</strong></td>
<td>compact</td>
<td>less compact</td>
</tr>
<tr>
<td><strong>Yield</strong></td>
<td>more than 99.0%</td>
<td>Max 97 %</td>
</tr>
<tr>
<td><strong>Natural Gas</strong></td>
<td>No need</td>
<td>Needed</td>
</tr>
<tr>
<td><strong>Bar counter</strong></td>
<td>No need</td>
<td>Needed</td>
</tr>
<tr>
<td><strong>Rolling process</strong></td>
<td>Continuous and endless</td>
<td>Billet mood</td>
</tr>
<tr>
<td><strong>Cold shear</strong></td>
<td>No need</td>
<td>Main equipment</td>
</tr>
<tr>
<td><strong>Bundle shape</strong></td>
<td>very nice shape</td>
<td>moderate or even bad.</td>
</tr>
<tr>
<td><strong>Manpower</strong></td>
<td>Less</td>
<td>More</td>
</tr>
</tbody>
</table>
**MI.DA advantages**

- Less head and tail
- Less scale 4 – 6 0.2% of rolled billet
- Less Short bar approximately 1 ton/day
- Less break down possibility
- Higher yield 99.5 %
- Only during semi-endless mode
- Induction furnace (power consumption 46 kwh/t, refractories cost, inductors changing time 4 – 6 hours)
- Best Bundle shape
- Low risk in HSL (closed doghouse)

**Traditional limitations**

- Head and tail cuts
- High Scale amount
- Short bar 4 - 6 ton/day
- High Breakdown possibility due to heads
- Yield 97 – 97.5 %
- Inter-billet time 15 – 20 min / day
- Reheating furnace (gas consumption 27 – 32 nm3/t, refractories cost, major shutdown 20 – 30 day)
- Less Bundle shape quality
- High risk in the cooling bed (open area)
MIDA Plant Advantages

1- Yield

Yield in MIDA technology not less than 99% for the following reasons:

- No head – tail cuts due to endless rolling.
- Less probabilities for cobbles and scrap.
- Billet scale less than 0.2%
- Less probabilities for short bars.
2- No need for reheating furnace.

Heating billet is done by induction furnace from temperature 850 to 1070. No need for natural gas, savings in billet scale, no reject billet affecting yield, saving in manpower and saving in plant area.
3- High accuracy in number of bars per bundle

The counting of bar numbers in MIDA technology is performed by tracking the system on cooling bed movement. This technology guarantees 100% accuracy in the number of bars in bundle and saves bar counter equipment.
4- Bundle shape

This technology presents very nice bundle shape compared to traditional plants.
5- No need for cold shear and Bar counter devices

The commercial length is obtained directly by dividing shears before bar discharge on cooling bed. Also, the bar length is controlled 100% through tracking of the system and can be varied according to customer request.
MIDA Plant Advantages

- Saving energy through scrap charging by CONSTEEL.
- Saving in graphite electrodes consumption
- Improving environmental aspects.
- High availability in all production units
- Compacted mill area
- Continuous rolling with low probability for repeated billet head.
- Saving Mill power, natural gas, and furnace refractories.
- High rolling availability (95%) and yield (99.4%).
- Less CAPEX cost compared to traditional plants
Environmental benefits

- Less land required
- Lower CO2 emissions (no fossil fuel furnace)
- Energy saving (utilization of sensible heat of cast billet)
- The complete absence of RHF in MIDA process avoids a huge waste of energy and gives net savings in terms of NG consumption of about 30 Nm3/ton, which corresponds to a reduction in CO2 emissions.
THANK YOU