PRESTRESSED STEEL WIRE

Your reliable partner
PRESTRESSED STEEL WIRE

APPLICATIONS

- Railway sleepers
- Prestressed panels
- Prestressed concrete beams
- High pressure pipes

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BS 5896 Certificate No. CL12020163
ASTM A Certificate No. CL12020162
COMPAGNY PROFILE

Maklada is part of a Stunas Group, leader in steel industries in Mediterranean area. Stunas Group includes a total of 13 companies, manufacturing 200,000 Mt of steel from sandwich panels, structures, modular buildings, wires, ropes, strands... up to consulting services and real estate. Maklada produces more than 100,000 Mt of drawn steel wires and has a worldwide customer portfolio among 35 countries.

Since its creation in 1984, with the Cooperation and Technical Assistance of Suzuki Metal Industry Japan, Maklada has reinforced its technical skills through benchmarkings with leading steel companies Arcelor Mittal, Lucchinni, Tatasteel,... and equipped our plants with the highest end technology and first class supplies for our Production Lines and Laboratories.

Our philosophy is to develop products according to our customers expectations and facilities, and to look after Excellence in Product Performance through our collaborations with Universities, Quality Organizations, Specialists,...

Backed by 30 years of experience and his know-how, Maklada is specialized in the manufacturing of High Carbon Steel Wires and Strands according to international standards and / or client’s specifications. Today, we continue investing in Technology, in I+D for new products, in Environment Protection and in Customer Service.

MODERN TECHNOLOGIES

Our plants are equipped with modern machinery and we are still heavily investing in new equipments and technologies in collaboration with worldwide leading companies and consultants. Our aim is to maintain high quality standard at all levels.

MAKLADA GOES GREEN

Maklada engages in environmental protection and energy management. Our new production site generates its own energy, with a full tri-generation plant, and is reducing also chemicals emissions by adding a mechanical shot blasting system for raw material cleaning.
Application:
High Carbon steel wires are used for the production of high pressure pipes, beams and poles.

Standards:
These steel wires are produced in conformity with more reputed standards:
- BS 5896 certified by Dubai Central Laboratory (DCL).
- ASTMA421
- EN 10138
- UNE 36094
- Clients’s specifications.

Relaxation:
- Normal relaxation,
- Low relaxation,
- Very low relaxation with maximum relaxations losses of 2.5% after 1000 hours under initial load 70% of actual breaking load at 20%.
MANUFACTURING PROCESS

1. Wire Rod Cleaning & Pre-coating:
All wire rod (raw material) must be de-scaled to remove the mill scale (iron oxides) present on the steel surface. This descaling process can be done chemically or mechanically using shotblasting line.

After the mill scale has been removed, the wire rod is then coated with a textured carrier coating that promotes lubricant adherence during the subsequent wire drawing process. The most commonly used carrier coating is Zinc Phosphate (ZnPO4) but other coatings are sometimes used (borax, lime, etc.).

2- Drawing:
The wire rod is drawn through a series of normally 7 dies but might be up to 9 dies for smaller sizes, to achieve the desired mechanical properties.

This is a cold-working process; therefore the wire drawing practices are tightly controlled to prevent premature die wear or damage to the steel wire.

In PCWire drawing, the wire rod cross-sectional area is reduced up to 85% when comparing the finished wire area to the area of the original wire rod.

The tensile strength of the wire rod is normally ~1,250 - 1,300 MPa. After the wire drawing process, the wire tensile strength is >1,600-2,000 MPa; therefore the tensile gain is >50% due to work hardening.

3- Stabilization:
Once wire is produced, it is loaded into pay-off of the treatment line.

The wire is subjected to a thermo-mechanical process in which the wire is continuously heated to ~380°C +/- 25°C while under tension at ~40-50% of the minimum ultimate tensile strength of the wire. This process acts to relieve the residual wire drawing stresses, permanently elongate the wire, increase the yield strength and reduce relaxation losses. This combination of factors gives the wire a very consistent modulus of elasticity up to and exceeding 80% of the wire’s ultimate strength.

Before the wire is wound back into a coil, it is quenched in a water bath to freeze the steel in the permanently elongated condition and to rinse residual drawing lubricants from the wire surface.

PRODUCTION RANGE AND TECHNICAL DATA

The dimensions and properties of the wires are put across in the tables 1 and 2.

Chemical composition (%):

<table>
<thead>
<tr>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>P</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.70 - 0.50</td>
<td>0.30</td>
<td>0.035</td>
<td>0.035</td>
<td></td>
</tr>
<tr>
<td>0.85</td>
<td>0.90</td>
<td>Max.</td>
<td>Max.</td>
<td>Max.</td>
</tr>
</tbody>
</table>

Surface State:
Smooth or intended

Specification of indentation:
in 3 faces in conformity with EN10138 - 2 & BS5896

<table>
<thead>
<tr>
<th>Ø</th>
<th>min</th>
<th>max</th>
<th>tol.</th>
<th>l</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5</td>
<td>0.06</td>
<td>0.13</td>
<td>±0.03</td>
<td>3.5 ± 0.5</td>
<td>5.5 ± 0.5</td>
</tr>
<tr>
<td>5.5 - 8</td>
<td>0.09</td>
<td>0.16</td>
<td>±0.04</td>
<td>5.0 ± 0.5</td>
<td>8.0 ± 0.5</td>
</tr>
</tbody>
</table>

Table 1: ASTM A421

<table>
<thead>
<tr>
<th>Type</th>
<th>Nominal Diameter</th>
<th>Diameter Tolerance</th>
<th>Out of Round</th>
<th>Steel area of strand</th>
<th>Nominal Weight</th>
<th>Tensile Strength</th>
<th>Grade</th>
<th>Minimum stress at 1% extension</th>
<th>Max. Elong.</th>
<th>Corrosive Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>4.98</td>
<td>0.196</td>
<td>+/- 0.05</td>
<td>38.80</td>
<td>0.06</td>
<td>146</td>
<td>97.8</td>
<td>1860</td>
<td>235</td>
<td>199.75</td>
</tr>
<tr>
<td>WA</td>
<td>4.98</td>
<td>0.196</td>
<td>+/- 0.05</td>
<td>38.80</td>
<td>0.06</td>
<td>146</td>
<td>97.8</td>
<td>1860</td>
<td>235</td>
<td>199.75</td>
</tr>
<tr>
<td>WA</td>
<td>6.35</td>
<td>0.250</td>
<td>+/- 0.05</td>
<td>31.70</td>
<td>0.049</td>
<td>247</td>
<td>165.5</td>
<td>1725</td>
<td>240</td>
<td>204.00</td>
</tr>
<tr>
<td>WA</td>
<td>7.01</td>
<td>0.276</td>
<td>+/- 0.05</td>
<td>38.60</td>
<td>0.06</td>
<td>146</td>
<td>97.8</td>
<td>1725</td>
<td>240</td>
<td>204.00</td>
</tr>
</tbody>
</table>

Max. relaxation loss after 1000 Hrs ≤ 2.5% when initial load at 70% of specified breaking Load
Table 2: EN 10138-2 & BS 5896

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Tensile strength (N/mm²)</th>
<th>Mass per meter (g/m)</th>
<th>Cross sectional area (mm²)</th>
<th>Tolerance on mass per meter</th>
<th>Min. Breaking Load (KN)</th>
<th>Max. Breaking Load (KN)</th>
<th>Yield strength of 0.1% Elongation (KN)</th>
<th>Min. Elong. (%)</th>
<th>Curvature of wire (max. 25 mm / meter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1860</td>
<td>98.4</td>
<td>12.60</td>
<td>± 2</td>
<td>23.40</td>
<td>26.90</td>
<td>20.80</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1860</td>
<td>153.1</td>
<td>19.60</td>
<td>± 2</td>
<td>38.50</td>
<td>42.00</td>
<td>32.50</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1770</td>
<td>221</td>
<td>28.30</td>
<td>± 2</td>
<td>50.10</td>
<td>57.60</td>
<td>44.10</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1770</td>
<td>300.7</td>
<td>38.50</td>
<td>± 2</td>
<td>68.10</td>
<td>78.30</td>
<td>59.90</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1670</td>
<td>392.8</td>
<td>50.30</td>
<td>± 2</td>
<td>84.00</td>
<td>96.60</td>
<td>73.10</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

Max. relaxation loss after 1000 Hrs ≤ 2.5% when initial load at 70% of specified breaking Load.

Conditioning and protection:

- **Coils**: There are 3 types

<table>
<thead>
<tr>
<th>Type</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner diameter (mm)</td>
<td>~1000</td>
<td>~1500</td>
<td>~1800</td>
</tr>
<tr>
<td>Outer diameter (mm)</td>
<td>~1450</td>
<td>~1900</td>
<td>~2200</td>
</tr>
<tr>
<td>Coir weight (Kg)</td>
<td>200 to 500</td>
<td>500 to 1500</td>
<td>1000 to 2500</td>
</tr>
</tbody>
</table>

- **Bars**: Straightened & cut to length for railway sleepers

<table>
<thead>
<tr>
<th>Nominal Diameter</th>
<th>Maximum length (mm)</th>
<th>Tolerance on length (± mm)</th>
<th>Maximum curvature in 8 mm./2 m</th>
<th>Conditioning in bundle of 1000 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.00 or 8.00</td>
<td>6000</td>
<td>± 1</td>
<td>8 mm./2 m</td>
<td></td>
</tr>
</tbody>
</table>

Protection:

Wrapping by PE plastic film or crepe paper (on request).

INTERNATIONAL EXHIBITIONS AND EVENTS

- **Presidentiel award of quality - 2010**
- **Interwire - Atlanta 2013**
- **Big Five – Dubai 2012**
- **World of concrete - Las Vegas 2014**
- **Batimat - Casablanca 2012**
- **Wire - Dusseldorf 2014**