Hot rolled Steel Plates, Sheets and Coils
Structural steels
Optim 700 MC Plus

Steel grade Optim 700 MC Plus combines top material properties and the best workshop properties on the market. It has the tightest permitted bending radius in its strength class, which means excellent formability. In addition to good flangeability, the new steel grade can be cut, pierced and welded easily. Products made of Optim 700 MC Plus have good impact strength so they are capable of withstanding heavy loads under difficult, cold conditions. Optim 700 MC Plus gives new freedom to designers and can be used for manufacturing machines, equipment and structures for the most demanding uses. Cut lengths are delivered with Ruukki’s Dead Flat guarantee, which ensures that residual stresses are low and pieces cut from the sheet maintain their flatness.

Applications
- Lifting equipment and crane arms
- Frame structures and superstructures of mobile vehicles
- Timber harvesters, earthmoving and mining machines
- Load handling equipment

Ruuikki is a metal expert you can rely on all the way, whenever you need metal based materials, components, systems or total solutions. We constantly develop our product range and operating models to match your needs.
**Description of the steel grade**
Optim 700 MC Plus offers many important properties to its users:
- high strength
- excellent flangeability
- excellent shearability and pierceability
- excellent impact strength in all directions

The surface quality, dimensional and geometrical accuracy and uniformity of properties of this steel grade are all top class. The number of designation means yield strength category (700 MPa). The letter "M", in turn, means that the delivery condition for the steel grade is thermomechanically rolled. The letter "C" means that the steel is suitable for cold forming, and "Plus" the properties that offer additional technical and economic value to the customer.

**Product shapes**
Cut lengths.

**Delivery condition**
Thermomechanically rolled.

**Corresponding standards**
Optim 700 MC Plus meets the requirements of EN 10149-2 and even exceeds them in terms of its key properties.

**Dimensions**
Dimensional ranges are shown in Table 1.

**Dimension and shape tolerances**
The dimension and shape tolerances conform with, and in part exceed, EN 10051 requirements. The Dead Flat guarantee for flatness of cut lengths and pieces cut from them is 3 mm/m.

**Mechanical properties**
Mechanical properties are shown in Table 2.

**Forming**
Excellent flangeability in all directions.
Smallest permitted flanging radius is 1 x plate thickness with thicknesses ≤10 mm (Table 3).

Successful utilization of the excellent formability requires the use of good workshop techniques. Worn tools, scratches on the surface of the steel as well as edge burrs can reduce the quality of the forming. Plates taken from cold storage must be allowed to warm up to room temperature (+20 °C) before being formed.

**Cutting and piercing**
Optim 700 MC Plus is ideal for mechanical cutting and piercing. It can be cut easily with plasma, laser and other cutting methods. A plate taken from cold storage must be allowed to warm up to room temperature (+20 °C) before being cut.

**Carbon equivalent**
Carbon equivalent values are shown in Table 4.

**Welding**
The weldability is excellent with all methods. Preheating is not necessary under normal conditions. Groove surfaces must be dry and clean during welding. Matching welding materials are recommended for welding. A welded joint matching the strength of the base material can be achieved e.g. using a consumable complying with AWS A/SFA 5.28: ER 100S-G and a cooling time of $t_{8/5} = 10$ s. Undermatching consumables may also be used if the weld is located in a less stressed part of the structure. The welding materials and methods must be of sufficiently low hydrogen in order to ensure that there is ≤ 5 ml of hydrogen per 100 g of weld material. The weld materials must be stored and dried, if necessary, in accordance with the manufacturer’s instructions.

A narrow zone softer than the base material is formed in the welded joints of Optim 700 MC Plus. The softer zone is similar to that in quenched and tempered steel and does not usually affect the strength of the structure. The width of this zone can be limited by avoiding the use of unnecessarily high welding energy.

**Heat treatment**
To reduce residual stress, Optim 700 MC Plus may be stress-relieved at a temperature of 530 – 580 °C, which can, however, affect its impact strength. Heating the steel to temperatures higher than 600 °C can reduce its strength, and for this reason hot working or normalizing are prohibited.

**Chemical composition**
Chemical composition is shown in Table 5.

**Inspection**
Inspections documents are in accordance with EN 10204 -3.1.
Structural steels. Optim 700 MC Plus

### Dimensions

<table>
<thead>
<tr>
<th>Thickness mm</th>
<th>Width mm</th>
<th>Length m</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 12</td>
<td>1000 – 1550</td>
<td>2 – 13</td>
</tr>
</tbody>
</table>

### Mechanical properties

<table>
<thead>
<tr>
<th>Thickness mm</th>
<th>Yield strength $R_p$ or $R_{p0.2}$ MPa minimum</th>
<th>Tensile strength $R_m$ MPa</th>
<th>Elongation A % minimum</th>
<th>Impact strength temperature °C</th>
<th>Charpy V, J minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 12</td>
<td>700$^1)$</td>
<td>750 – 930</td>
<td>15</td>
<td>-60</td>
<td>40</td>
</tr>
</tbody>
</table>

$^1)$ For thickness (8) – 12 mm the yield strength can be 20 MPa lower. Yield and tensile strength and elongation are tested longitudinally to the rolling direction. Impact strength is also tested longitudinally to the rolling direction but guaranteed in the longitudinal and transverse directions.

### Minimum permitted bending radius, bending angle ≤ 90°

<table>
<thead>
<tr>
<th>Thickness (t) mm</th>
<th>Minimum permitted inside bending radius R</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 10</td>
<td>1 x t</td>
</tr>
<tr>
<td>(10) – 12</td>
<td>1.5 x t</td>
</tr>
</tbody>
</table>

No limitations on bending direction

### Carbon equivalent (CEV)

<table>
<thead>
<tr>
<th>Thickness mm</th>
<th>CEV average</th>
<th>CEV maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 10</td>
<td>0.37</td>
<td>0.40</td>
</tr>
<tr>
<td>(10) – 12</td>
<td>0.40</td>
<td>0.44</td>
</tr>
</tbody>
</table>

$CEV = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$

### Chemical composition

<table>
<thead>
<tr>
<th>Content % (ladle analysis)</th>
<th>C maximum</th>
<th>Si maximum</th>
<th>Mn maximum</th>
<th>P maximum</th>
<th>S maximum</th>
<th>Al minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>0.50</td>
<td>2.10</td>
<td>0.020</td>
<td>0.010</td>
<td>0.015</td>
<td></td>
</tr>
</tbody>
</table>

In addition, Nb, V, T or B can be used as alloying elements either singly or in combination

---

Our Customer Service is happy to give you further information
Sales, Technical Customer Support
info.metals@ruukki.com
Rautaruukki Corporation, P.O. Box 138, FI-00811 Helsinki, Finland. tel. +358 20 5911

This data sheet is accurate to the best of our knowledge and understanding. Although every effort has been made to ensure accuracy, the company cannot accept responsibility for any loss, damage or other consequence resulting from the use of this publication. We reserve the right to make changes. Copyright © 2010 Rautaruukki Corporation. All rights reserved. Ruukki, Rautaruukki, More With Metals and Ruukki’s trade names are trademarks or registered trademarks of Rautaruukki Corporation.