Crane Construction
WITH HOT FORMED STEEL TUBES AND MSH HOLLOW SECTIONS

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Motivated by challenge

Cranes serve a wide range of purposes. Whether in the building trade, in plant construction, or in the transhipment and handling of goods—cranes move things about.

The demands placed on modern cranes are as many and varied as their applications and design. The material used to build cranes is steel in a variety of forms, including plate, open rolled sections and tubes.

This brochure points out the special benefits of seamless hot rolled tubes and hollow sections to crane designers, and presents new ideas and approaches to their work, in which they are frequently confronted with the need to harmonize the most varied demands and requirements in their design concept.

The use of seamless hot rolled steel tubes and hollow sections in crane construction offers advantages which can make the decisive difference, enabling design engineers to fulfill all the specified requirements without having to make compromises.

Cranes – strong, quick, mobile and safe

Cranes must be strong
The need for maximum lifting capacity, lifting height and reach pose ever new design challenges to engineers. Over the past decades, intelligent design solutions and new advanced steel grades have enabled them to continuously optimize the top brands and boost performance. And there is no end in sight to this trend. Tubes play an important role here.

Cranes must be mobile
Since the middle of last century, mobile cranes have been used to satisfy temporary demand, even at remote, difficult to access sites. Their outstanding versatility has made them indispensable in civil engineering and the transportation of heavy goods.

At the same time, mobile cranes have to cope with ever heavier payloads. Tubes play an important role here.

Cranes must be quick
Our globalized world demands speedy transhipment of goods. Cranes are required to provide high working speeds and short load cycles. Compact designs with a low deadweight coupled with high lifting capacities help to supply logistics centres around the globe with cranes that match this challenging requirement profile. Tubes play an important role here.

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Cranes must be safe
Cranes are frequently loaded to their maximum capacity, come rain come shine. Cranes move loads, for and with people. Careful design, meticulous craftsmanship and a non-compromising approach to the quality of the materials used guarantee safe operation of the modern multi-purpose machines. Tubes play an important role here.
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Hook loads for Lattice boom cranes

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<th>Year</th>
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<td>2000</td>
<td>2500</td>
</tr>
<tr>
<td>2010</td>
<td>3250</td>
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</tbody>
</table>
The benefits of hot rolled tubes and hot finished hollow sections

**Light weight**

By virtue of their very nature – low weight coupled with high static values – tubes usually represent the best solution for applications where saving weight is a criterion and multi-axial loads are involved. In fact, compared to cold formed welded square and rectangular hollow sections, the strength of seamless hot finished steel sections from V&M TUBES can be for example 12% higher under bending loads and up to 7% higher under tension. This is a lot, when every kilogram counts.

A V&M TUBES specialty are tubes in weldable high-strength fine-grain structural steels. By means of hot rolling in combination with a quench and temper treatment, yield strengths of 900 MPa and higher can be achieved. And rest assured: we know the ropes when it comes to tube rolling – and we have done so for well over 100 years. Without this specific Know-how, today’s high-performance cranes with lifting capacities of several thousand tonnes would be unthinkable.

But V&M TUBES also uses normalized fine-grain structural steels with yield strengths of up to 500 MPa to make tubes for crane construction, perfectly matching the requirement profile of the intended application.

**Total customization**

Especially in crane construction, V&M TUBES cooperates closely with the manufacturers, jointly developing a tailored concept of tube materials and dimensions for each individual unit. It goes without saying that the tubes are supplied with all the relevant inspection reports and certificates stipulated by the applicable technical regulations and specifications. Together with customers we have also provided design verifications for individual steel tube components or assemblies, for example, in order to obtain the building authorities’ approval. Moreover, V&M TUBES offers support in drawing up application-related welding recommendations as well as fatigue tests for components.

Lattice structures can be easily designed and realized with rectangular MSH sections from V&M TUBES.

Straightforward connection geometries facilitate the welding work enormously. In addition, closed sections give structures an aesthetic appearance. Hot rolling reduces the residual stresses in seamless tubes, ensuring that they retain their straightness even during welding.

**Low temperature applications**

At temperatures just below 0 °C, steels become more susceptible to brittle fracture. Compared to cold formed sections according ASTM A500, Grade B, MSH sections like S355J2H have significantly higher plastic deformation reserves. EN 1993 (EC 3) specifies conditions governing the weldability of hollow sections so as to avoid brittle fracture. Based on the production process, seamless hot rolled sections have high limit values in this respect.

Important norms for the supply of Hot Rolled Tubes and MSH sections are EN 10 210, Stahleisen-Werkstoffblatt (SEW) 088 or comparable national and international standards and specifications. This means customers receive a product of certified quality. All tests and inspections are done on the finished product so that compliance with the specified mechanical and technological properties of the material and the specified dimensional tolerances is assured.

**In your vicinity – wherever you are**

Cranes are at home around the globe. So are we. As an internationally leading manufacturer of seamless tubes for structural purposes and machinery and plant construction we are always there, wherever you may need our expertise, experience and products. Where tubes and tube materials are concerned, our experts will be delighted to contribute towards optimizing your design – application oriented, individual and in line with what you need and expect.

Further technical details about tubes and MSH sections can be found in our brochures:

- Seamless tubes in weldable high-strength fine-grain structural steels
- Hot rolled MSH sections – A step ahead in quality
- MSH sections
  - Technical Information 1-7
  - (TI 2-7 only in german language)

and at www.vmtubes.com/publications

**Dimensions typically used in crane construction**

- Outside diameters 26.9 to 518.0 mm with wall thicknesses of 2.6 to 60.0 mm
- Outside diameters 40 x 40 mm to 300 x 300 mm with wall thicknesses of 2.9 to 17.5 mm
- Outside diameters 50 x 30 mm to 500 x 300 mm with wall thicknesses of 2.9 to 17.5 mm

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**Materials typically used in crane construction**

- **Quenched & Tempered Fine Grain Steels**
- **Normalised Steels**
- ** enamelled**
- **Tubes & Seamless**
Seamless tubes and hollow sections in crane construction

Crawler crane

Tubes, particularly in high-strength steels, for the construction of main, luffing and derrick jibs. Hollow sections for the mounting frame and A-boom.

Benefits

Lattice jibs ensure high stiffness. The use of high-strength steels takes account of the trend towards increasingly greater lifting capacities and lifting heights. The comprehensive size range of V & M TUBES offers all the dimensions needed to give the design the strength to cope with these loads.

Tower crane

Corner posts and diagonal stays for the tower section and jibs.

Benefits

Lattice design provides for high stiffness of the tower elements, which is additionally supported by the small corner radii of hot rolled hollow sections. Outlook: the development of extra small corner radii is in progress. The use of lattice structures reduces wind loads and provides for a low service weight.

Harbour and container crane

Tubes are used for jibs and lifting beams. Mobile harbour cranes are steadily gaining in importance, as they can be easily moved between job sites. Lattice jibs give these cranes a low service weight.

Benefits

Thanks to the savings in weight, high operating speeds are achieved. Lattice structures increase the lifting capacity and the number of load cycles per unit of time.

Mobile crane

In order to save weight, the telescopic jibs are combined with lattice extensions. In this way, acceptable lifting capacities are achieved in combination with a large horizontal reach. Also, the hook height can be raised above the fully extended height of the telescopic jib.

Benefits

The use of high-strength steel grades up to FGS100WV achieves substantial savings in weight at the jib head, which has a positive effect on the lifting capacity at maximum reach. A low service weight improves the crane’s mobility.

Truck loading crane

A compact, lightweight design is absolutely essential for truck loading cranes, given that there are restrictions on the maximum weight of the truck. Accordingly, they are usually built from box elements, which are frequently telescopic. The wide range of dimensions available makes MSH sections an interesting alternative to welded box-type sections.

Benefits

The use of hollow sections cuts out the need for bevelling and welding the sections, as well as the residual stresses which would arise from cold working. A wide reach can be achieved even for very compact designs. The smaller corner radius in the case of greater wall thicknesses increases the structure’s stiffness while at the same contributing to overall weight optimization.

Application area for seamless tubes and hollow sections
Seamless tubes and hollow sections in crane construction

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