DI-MC
Components

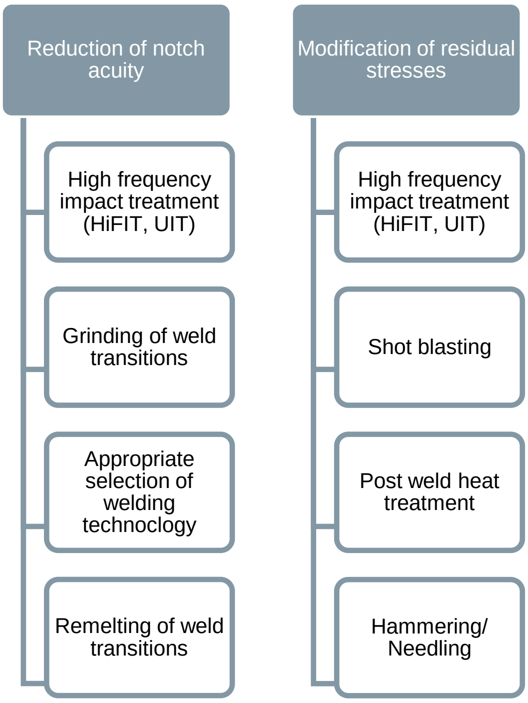
The component properties of DI-MC

Thermomechanically rolled structural steels (TM steels) from Dillinger, such as DI-MC, offer not only outstanding material, working and weldability properties – their performance also convinces under service conditions in the component itself. Of the large range of possible component properties, only a few that are of special interest for modern structural steel engineering are selected here for closer examination.

Fatigue strength

The fatigue performance of TM steels is identical to that of normalized steels of the same strength category. Tried and proven methods can therefore be used for the fatigue design of components.
Various series of tests have demonstrated that the base material of high strength steels in notch free state has a fatigue performance superior to that of lower strength steels.
However, in accordance with Eurocode 1993-1-9, for example, fatigue strength is determined for welded components irrespective of the material´s yield strength, and solely by the fatigue strength of the notch detail present, however. The cost effective use of high strength steels in welded structures, if the fatigue analysis is crucial, is therefore not possible, at least on the basis of current design rules. In such cases, the designer is unable to benefit to the full from the potentially higher static strength.

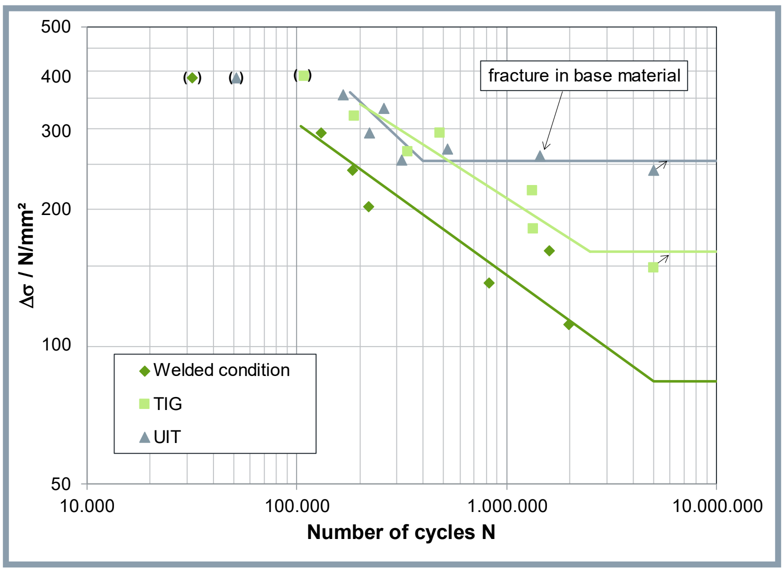
Fatigue adapted design is, above all, therefore of critical importance if high strength steels are to be used cost efficiently in components exposed to fatigue loads. The fatigue strength of high strength steels can, in addition, also be increased significantly by applying provisions to reduce the notch sharpness of the welded detail and/or modifying fatigue critical residual stresses.



Potentials for improvement of the fatigue strength of weld details

Higher frequency impact treatment (e.g. HiFIT or UIT) has, above all, proven suitable for application as a post weld treatment method for increasing fatigue strength. This can be explained by the fact that this procedure generates both an improved residual stress state (thanks to the impressing of compressive stresses) and also less fatigue critical weld transitions.

The effectiveness of such post weld treatment methods has been demonstrated in the most diverse range of research projects (e.g. REFRESH). Evidence in how these advantages can be used in structural design can be found e.g. in the new DASt-Richtlinie 026 or in the IIW Recommendations on High Frequency Mechanical Impact (HFMI) Treatment for Improving the Fatigue Strength of Welded Joints.



Wöhler (S-N) diagram (small test object, transverse stiffness, S460) from the „Effizienter Stahlbau aus höherfesten Stählen unter Ermüdungsbeanspruchung“ research project (AiF No. 13866 B)

Corrosion resistance

The corrosion performance of TM steels is no different to that of conventional structural engineering steels. They thus require protection by means of a coating system appropriate to the surrounding ambient media, normally in the form of a multi-film paint coating. For weather-resistant TM steels, please refer to the brand DIWETEN.

Fire performance

In addition to fire safety provisions, the current European standards (Eurocode) provide various structural engineering options for the quantification of stability in case of fire. The constitutive equations for structural steel under exposure to elevated temperatures to be assumed for calculation are described, for example, in the DIN EN 1993-1-2 standard. A uniform relative reduction of mechanical properties for temperatures up to 1,200 °C is specified here irrespective of delivery condition (thermomechanically rolled or normalized) for the S235 to S460 steel grades.
Analyses performed by the TU Darmstadt on the influence of delivery condition in S460 steel plates (steady state high temperature tensile tests and non steady state high temperature fatigue tests) have demonstrated that thermomechanically rolled structural steels, such as DI-MC 460/S460ML, for example, in fact possess a notably better high temperature behaviour (up to 800 °C) than their normalized rolled equivalents, however.

Thermomechanically rolled steel also proves to be advantageous in an examination of residual load bearing capacities after exposure to thermal loads. Residual load bearing capacity only falls more significantly from temperatures of T > 800 °C. No signifcant loss of mechanical properties occurs at temperatures below 700 °C.
Guiding figures for the reduction of the yield strength of S460N and S460M compared to initial state can be found in the relevant literature.

Disclaimer

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This processing information is updated at irregular intervals. The current version is relevant. The latest version is available from the mill or as download at www.dillinger.de.

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