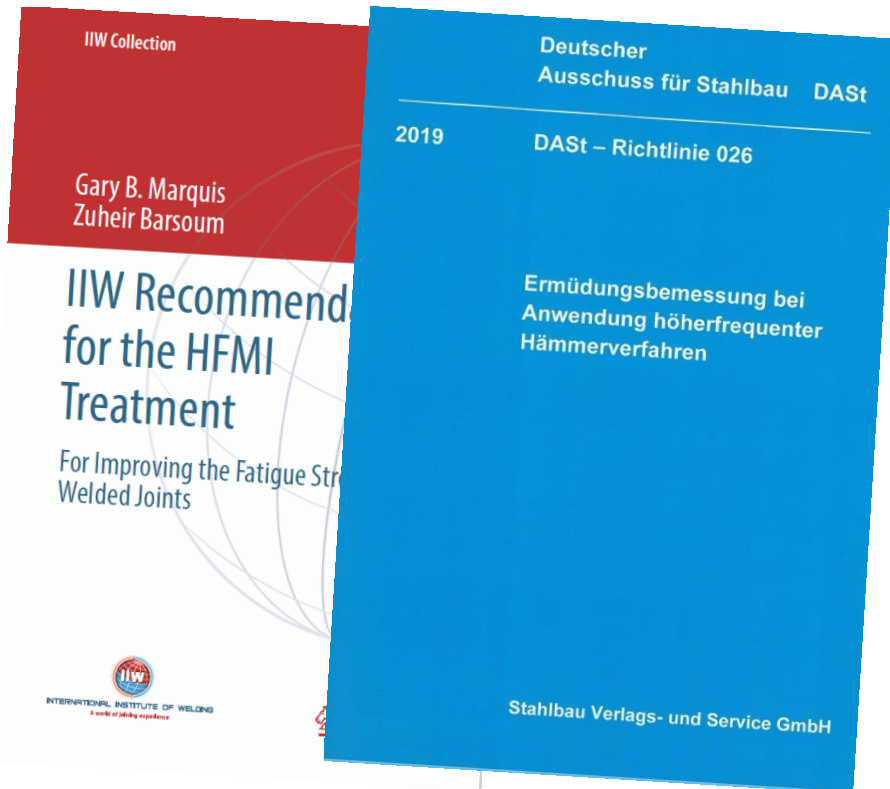


PIT News



PIT News Content:

- **After the IIW Recommendations, now finally the „DAST-Recommendations“ for HFMI are published**
 - in addition to the Eurocode
- **Stress relaxation because of variable amplitudes**
 - IIW-Factors are even valid with variable amplitudes
- **Quality-assurance**
 - just a 100 % visual control is completely enough to assure the quality of a HFMI treatment
- **Additional Quality- assurance at PITEC**
 - PITEC offers additional quality assurance with their PIT-Almentest
- **From current occasion**
 - The internal PIT Training from operator to operator carries high risks regarding the quality assurance



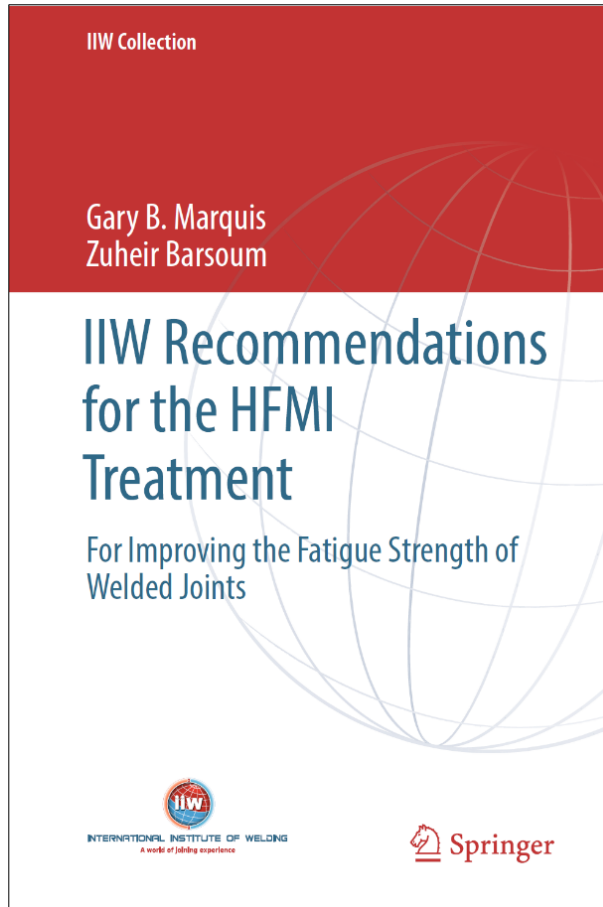


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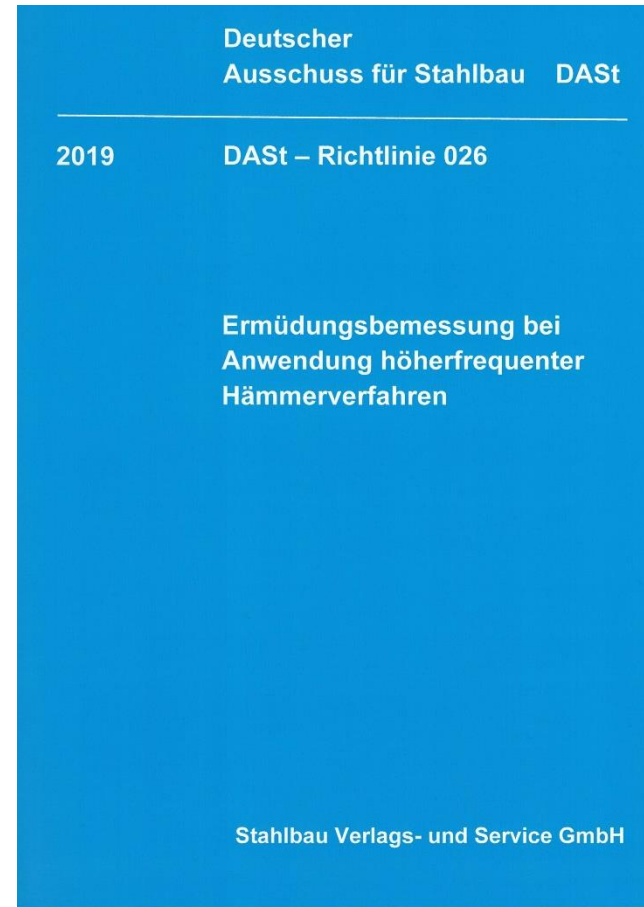
confirms the high effects of HFMI



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e.g. from FAT 80 to FAT 140 and more



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XIII-2818-19

Fatigue strength assessment of HFMI-treated steel joints under variable amplitude loading

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Abstract

A recommendation for the application and fatigue assessment of the HFMI post-treatment was published by the IIW in 2016. Recently, the therein recommended HFMI design curves in case of constant amplitude loading (CAL) were validated involving test data with different base material yield strengths, increased plate thicknesses as well as elevated load stress ratios. Continuitive to this previous work, this paper focuses on the fatigue assessment of HFMI-treated steel joints under variable amplitude loading (VAL). Four test data sets including randomly distributed VAL and a sufficient amount of tested specimens to ensure a statistically verified assessment are investigated. It is shown that an application of the recommended equivalent stress range approach and a further comparison of the test results to the design curves under CAL leads to a conservative fatigue assessment if the recommended value of the specified damage sum of $D=0.5$ is used. Furthermore, an increased value of $D=1.0$ still maintains a conservative design as presented in the study. Based on this work involving the analysed data sets it can be concluded that the recommended procedure is well applicable and a conservative fatigue design is facilitated.

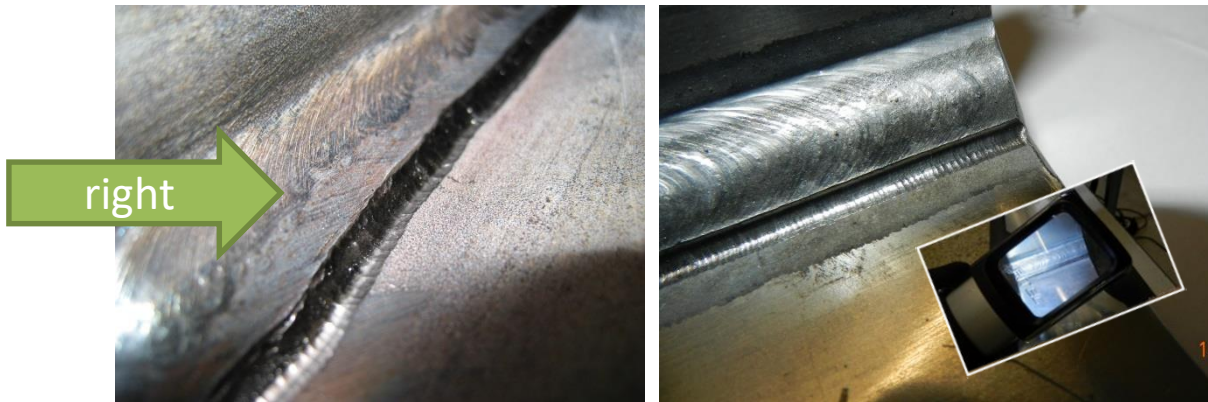
Keywords: Fatigue strength, HFMI-treatment, Variable amplitude loading, Equivalent stress range, Specified damage sum.

Often, the discussion of stress relaxation under variable amplitude loading or by individual loads close to the yield-point is leads to uncertainty. Extensive research has shown that although there is a certain reduction in the applied compressive residual stresses, but the recommended values in the IIW-HFMI guideline are such conservative **that the values of the recommendations ultimately lead to a safe interpretation.**

4 Conclusions

This paper aims to validate the applicability of the IIW recommendations for the HFMI-treatment in case of HFMI-treated steel joints under VAL. Focus is laid on test data, which includes randomly distributed VAL as well as a sufficient amount of tested specimens to ensure a statistically verified assessment, whereas a total number of four test data sets is analysed. Applying the recommended equivalent stress range approach and comparing the results to the design curves under CAL, it is shown that the use of the recommended value of the specified damage sum of $D=0.5$ leads to a conservative fatigue assessment in all cases. Furthermore, an increased value of $D=1.0$ still maintains a conservative design. Based on this work involving the analysed data sets it can be concluded that the recommended procedure is well applicable and a conservative fatigue design is facilitated.

Comprehensive investigations, even with hardening-profiles, X-Ray diffraction or laserscan has shown that a 100 % visuell inspection will be enough to assure the quality of a treatment if the real notch position is treated and the notch is completely removed.



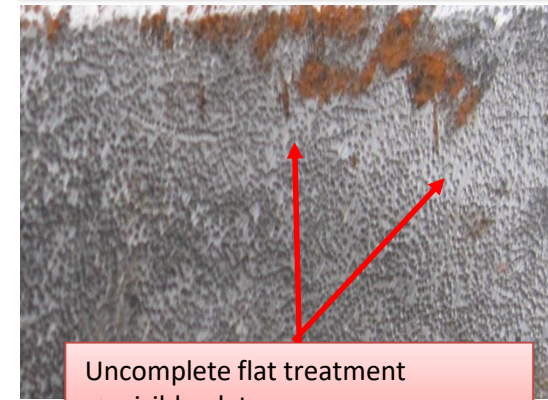
treated line



flat treated area

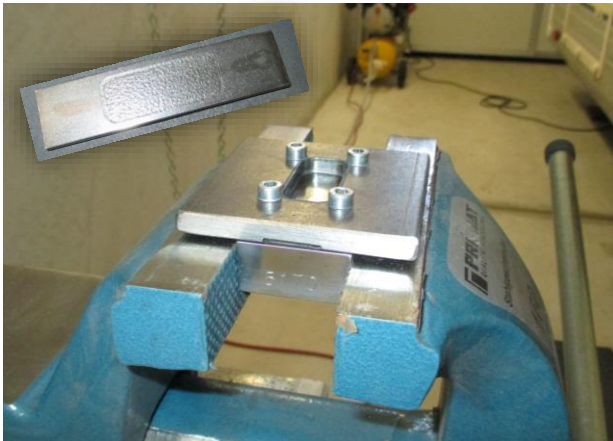
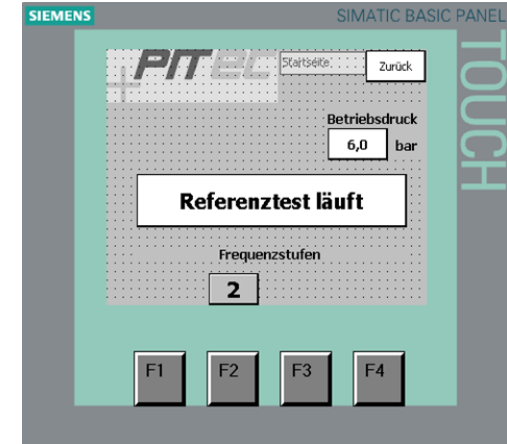
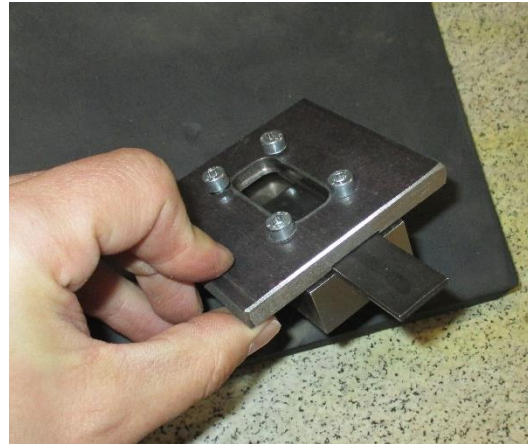
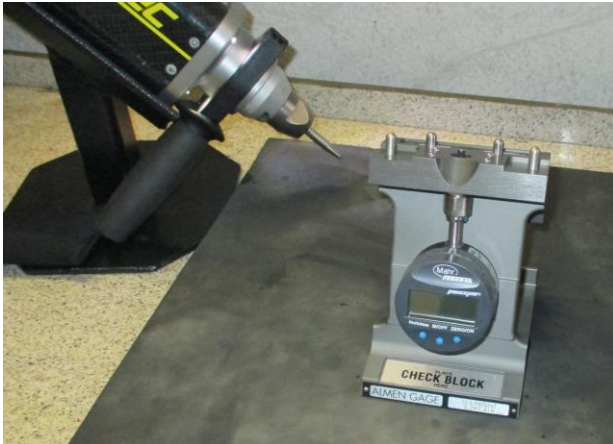


untreated notch => rest-notch is visible



Uncomplete flat treatment
=> visible plateaus

PIT has an especial effective disconnection of the operator-force to the impact into the surface. Therefore PITEC is able to offer an additional method to assure the high effect of PIT. Every mechanical System can become weaker because of wear or dust or similar. The Almentest which is modified for PIT allows to check the correct power any time by an easy way.



**Our long term experience has shown, how important a comprehensive operator training is.
A good knowledge of the effect is important for a sensibilisation of the operator.**

A comprehensive PIT-operator-training contains:

- theoretical knowledge of fatigue causes
- theoretical knowledge of the PIT effect
- Knowing the limitations of PIT
- practical training of intensity test
- practical training for different applications



The passing of knowledge from one colleague to another by virtually "word of mouth" is not enough to achieve the necessary sensitization of the operator.

Even though the application of HFMI is relatively simple, it is urgently necessary to have a basic understanding of the technical processes in the component so that the user ensures that the fatigue-critical areas are completely treated and the original seam transition score is fully recorded even in hard-to-reach areas.

PITEC therefore recommends a repetition of the user training after 5 years or the basic training of new users.

...we thank you for your attention.



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