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Recent Revision of Detailed assessment of fatigue life in Clause 18 of EN 13445-3

INAIL

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Rev. 0

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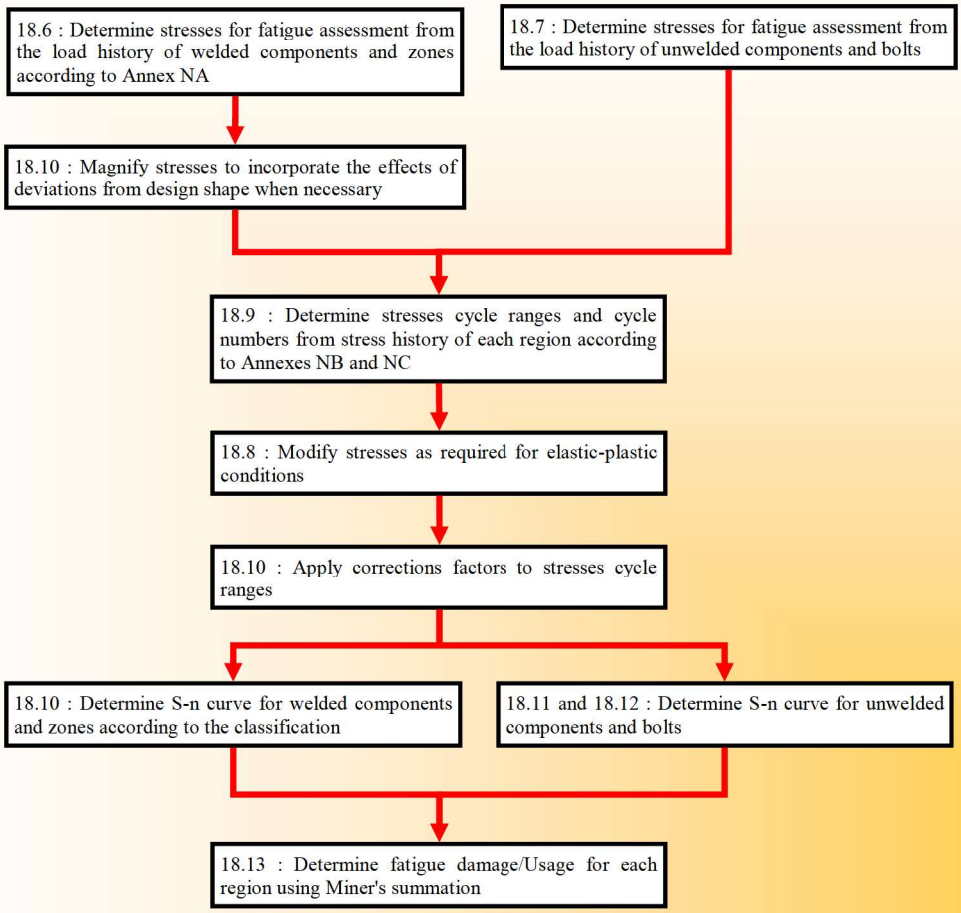
Introduction

- This document "DETAILED ASSESSMENT OF FATIGUE LIFE AND RELEVANT ANNEXES" is the presentation of the recent revision of Clause 18 of EN 13445-3
- This revision has been developed within the framework of CEN/TC 54/WG 59-DESIGN METHODS – SG DESIGN CRITERIA
- The purpose was to offer a modern and user-friendly clause 18 to develop the use of detailed fatigue life assessment
- Revised clause 18 is presently at the stage of Public Enquiry
- This work with the new revision of Clause 17, recently adopted, completes the work of revision of fatigue clauses of EN 13445-3

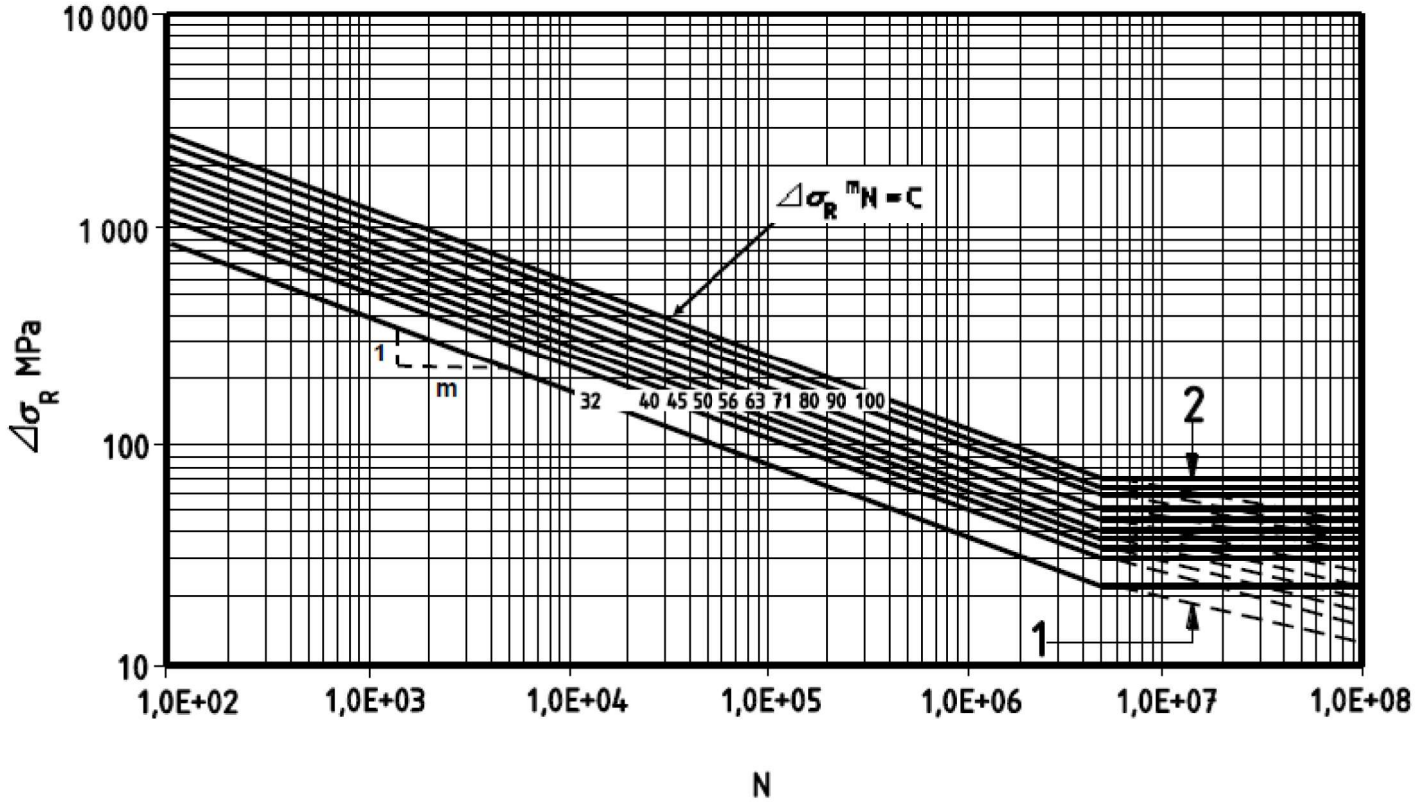
Process for detailed fatigue assessment of components



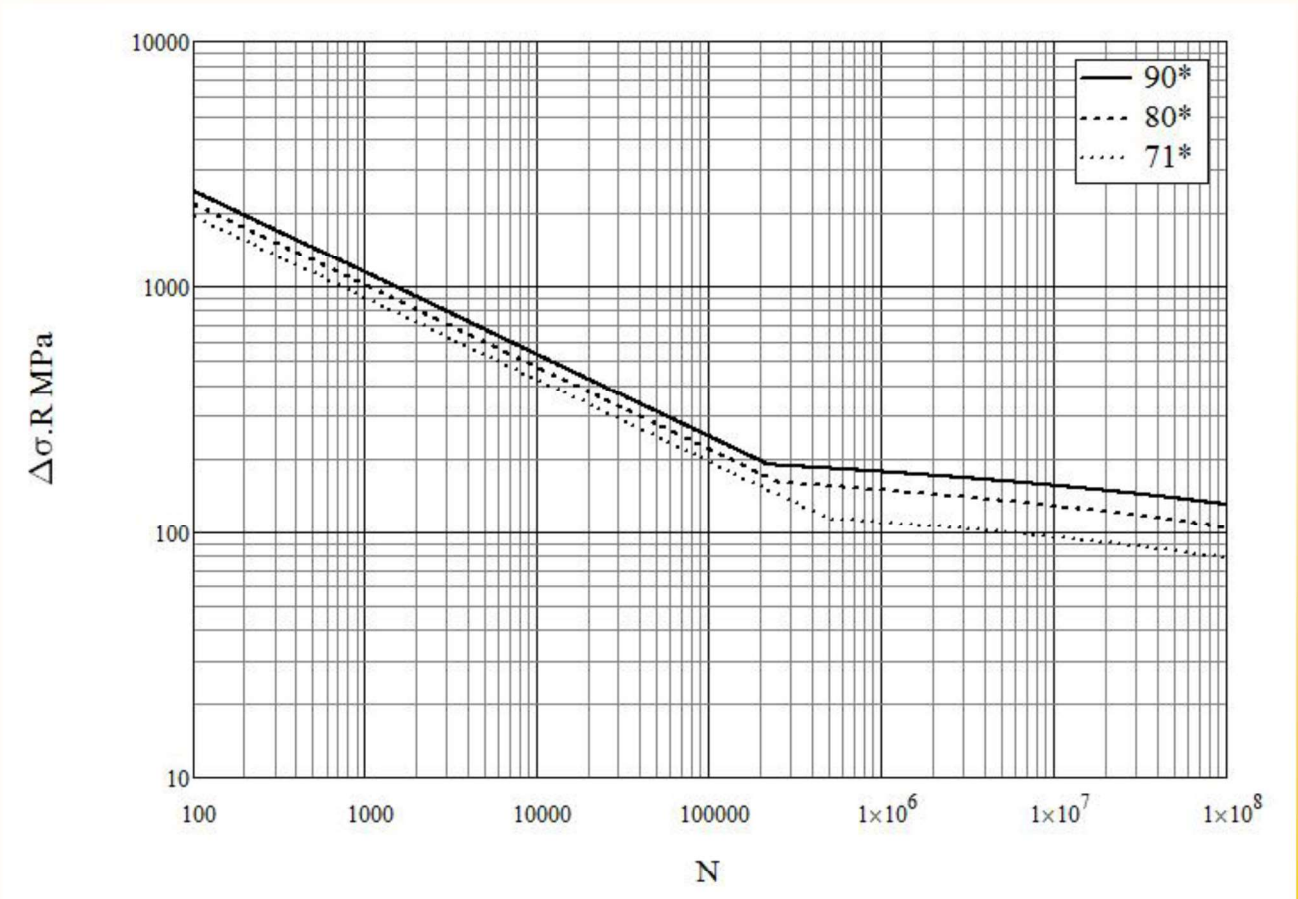
Fatigue assessment

The application of COMPONENT fatigue curves (for welded parts) and strain-controlled test data of STANDARD specimens (for unwelded parts) is the basic différentiation between the methodological approaches for welds and unwelded parts in EN 13445-3.

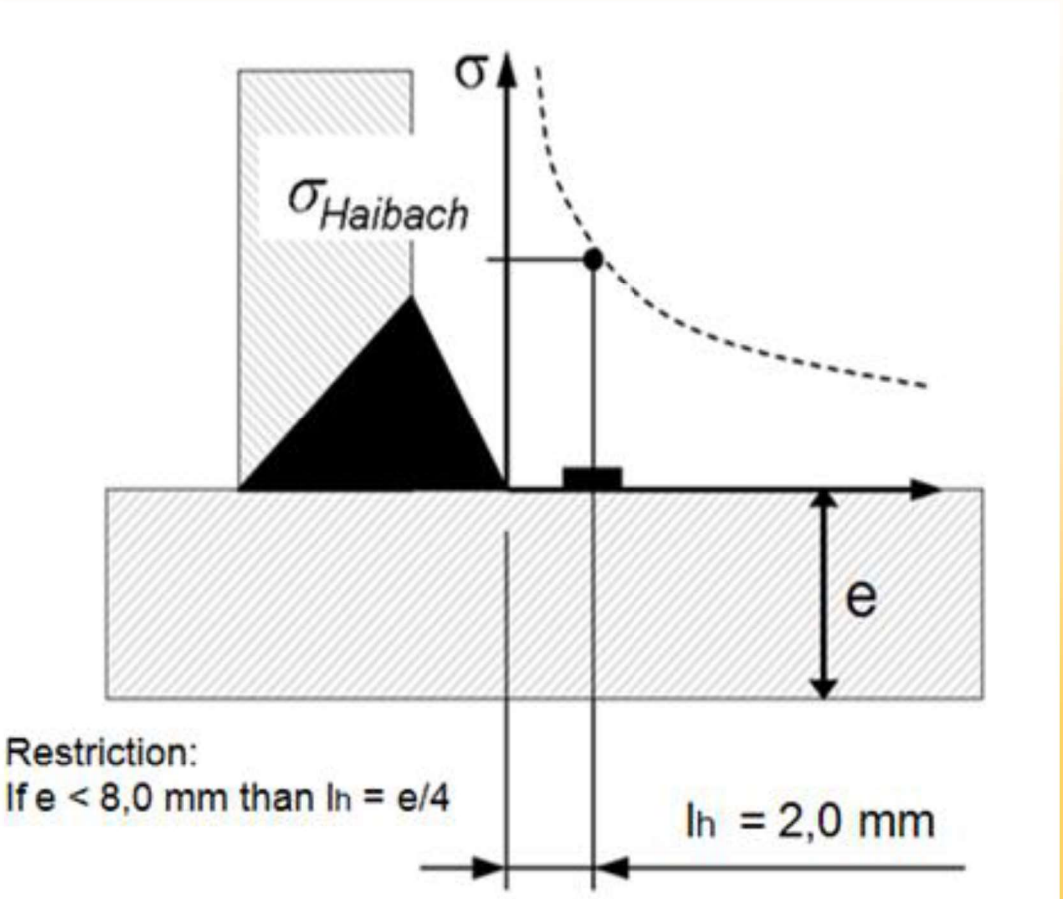
Fatigue design curves for welded components



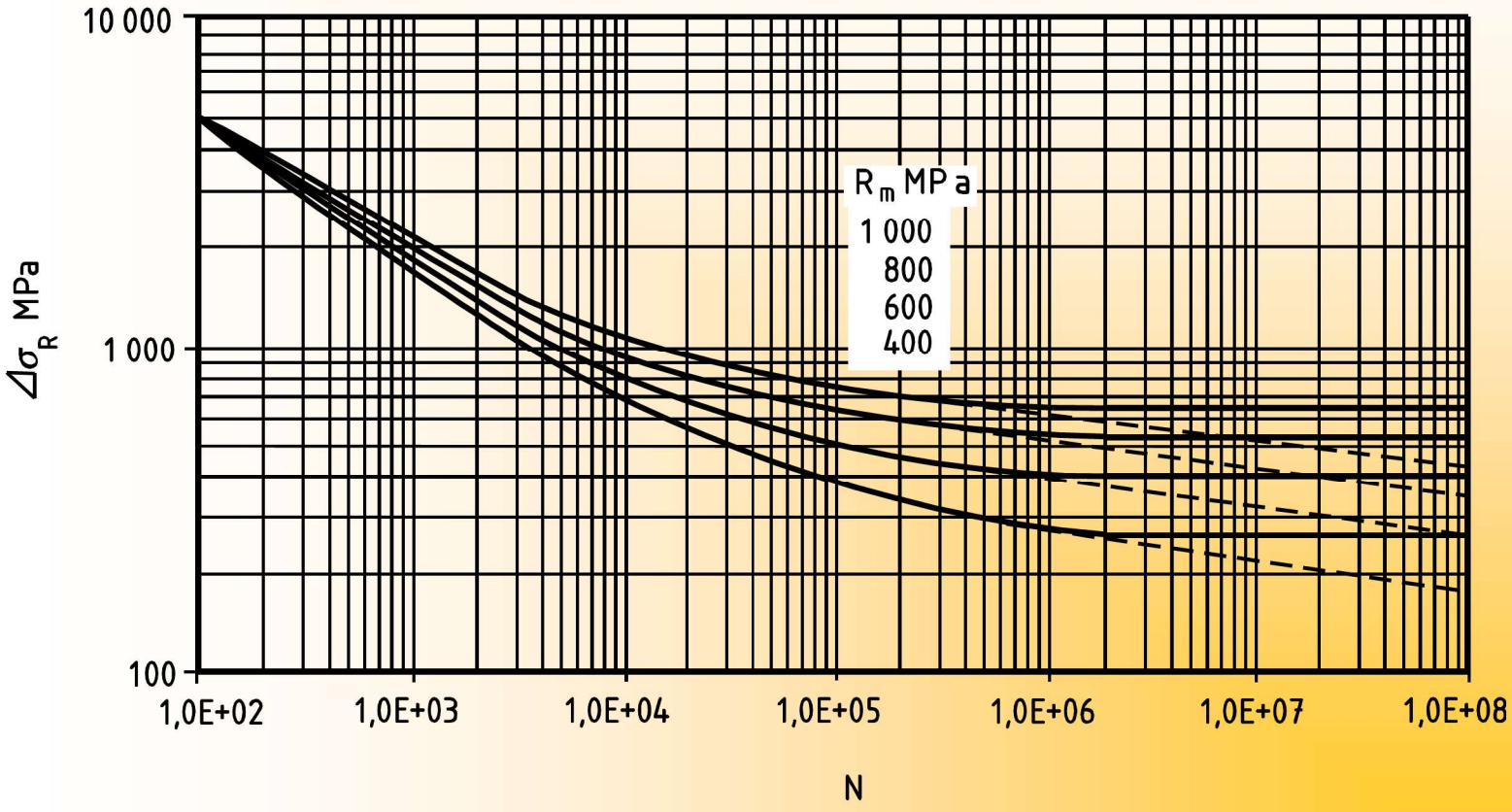
Alternative curves for class 90*, 80*, 71*



Annex NA Determination of the structural hot–spot stress (Haibach concept)



Fatigue design curves for unwelded ferritic and austenitic and rolled steels mean stress = 0



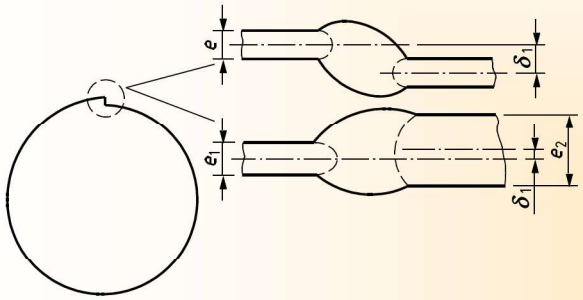
Total stress

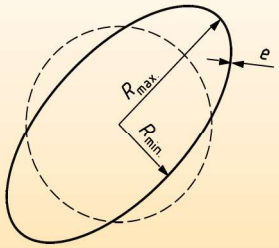
The assessment of unwelded components shall be based on the effective equivalent stress range of each cycle calculated using the components of the total stresses at the location under consideration. The total stress shall include the full effects of gross and local discontinuities.

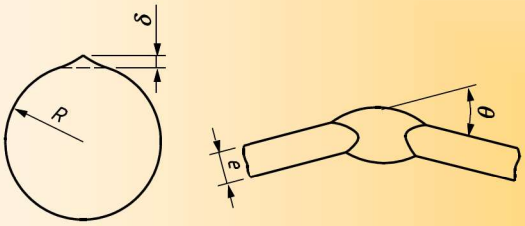
The total stresses can also be obtained from an analysis of the structural stresses amplified by a effective stress concentration factor for the effect of local discontinuities.

$$\Delta\sigma_f = K_f \cdot \Delta\sigma_{eq,struc}$$

Deviations from design shape at seam welds







NEW ANNEX NA

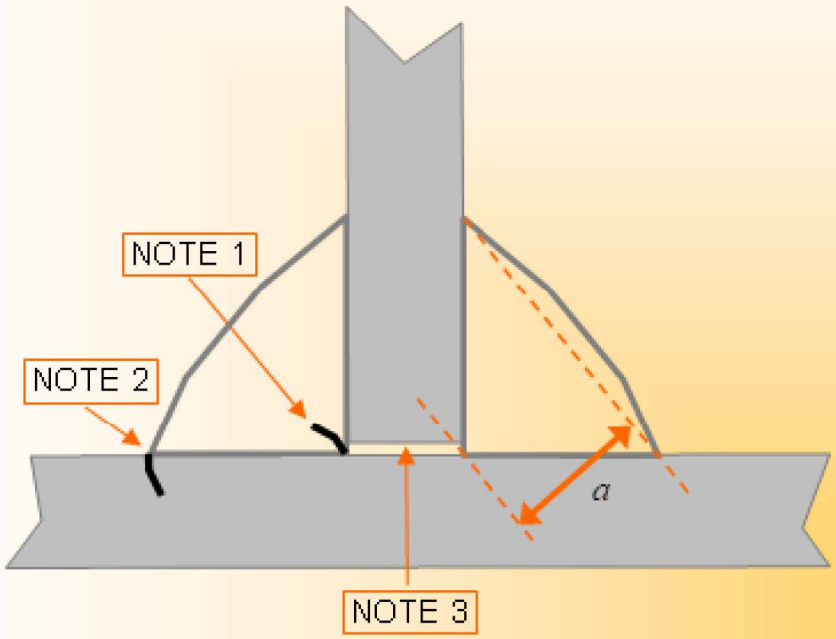
INTRUCTIONS FOR DETERMINING STRUCTURAL HOT-SPOT STRESS BY FINITE ELEMMENT ANALYSIS USING SHELL OR SOLID ELEMENTS

NEW ANNEX NB

CYCLE COUNTING AND DETERMINATION OF EQUIVALENT STRESS RANGE

Implementation of a critical plane approach (thermal stresses)

Annex ND Fatigue assessment of partial penetration welds



Dominant fatigue cracks in partial penetration welds

NEW ANNEX D

"

TABLE OF STRESS CONCENTRATION FACTORS"

- For spheres with a circular hole, spheres with a circular added thickness
- For cylinders with a circular hole and nozzles with a small curveting radius

Conclusion (Outstanding points)

- 26 definitions to guide the User
- Detailed guidelines for fatigue assessment of welded components based on Stuctural Hot Spot Stress
- Detailed guidelines for the determination of stresses and stress ranges using shell or brick finite element models
- Detailed guidelines for cycle counting
- Post weld techniques to raise fatigue resistance
- Alternative fatigue curves to extend fatigue life

Thank you for your attention