

BACKGROUND TO THE ELASTIC CREEP-FATIGUE RULES OF THE ASME B & PV CODE CASE 1592

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SUMMARY

Recent modifications have been made to the creep-fatigue rules of the ASME B & PV Code for use in design of elevated temperature nuclear components. The modifications are identified and guidance in detail application is presented.

The Code creep-fatigue rules, recently modified for use with elastic analysis involve the use of: (1) a modified equation for predicting the total strain range per cycle based on a more accurate approximation to the Neuber equation; (2) a modified equivalent strain range definition utilizing a variable Poisson's ratio and an approximate shakedown strain range; (3) a variable Poisson's ratio in calculating stresses and strain using elastic equations to account for local thermal strain concentrations and; (4) a procedure for evaluating creep damage due to primary and secondary stresses. The modified Neuber approach accounts for the beneficial effects of a residual stress related to the relaxation strength of the material and includes a strain concentration factor greater than the elastic stress concentration factor for geometrical notches for mechanical loads. Notch concentration factors are taken equal to the elastic stress concentration factors for peak thermal and creep strains.

The intent, background, and justification for these rules are discussed. Examples of applying these rules and correlations of the resulting life predictions to those obtained using more rigorous detailed inelastic analysis creep-fatigue rules are presented. Also, comparisons with test data confirm the adequacy of the new methods.