

RESIDUAL STRESS IN WELDED PLATES

by

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Summary

The dissertation describes a study of longitudinal residual stresses due to welding and flame cutting in members fabricated from steel plates. It is necessary to know the level of compressive residual stress when calculating the buckling strength of compression members. The aim of the present study is therefore to provide methods of prediction which are simple enough to be used by designers and yet still give an understanding of the important factors.

An experimental programme, using a new method of strain measurement, was used in conjunction with a rigorous numerical method of analysis to gain an understanding of the basic nature of longitudinal weld shrinkage. The results are used to develop a new theory which is accurate and yet easy to apply.

Simple formulae are proposed for the basic shrinkage in many practical types of weld. A formula for flame cutting shrinkage is also proposed. The methods apply to single pass and multi-pass welds which are deposited consecutively or simultaneously in thin or thick plate. The effects of preheat, initial stress, eccentrically located welds and weld interaction are allowed for.

Residual stress distributions in the large (typically 9m) diameter orthogonally stiffened cylinders which are used as flotation legs in North Sea oil jackets are studied. Analytical methods for stress prediction are