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Welding Research Council
bulletin

LARGE DIAMETER RATIO SHELL INTERSECTIONS

Part 1: Design of Large Diameter Ratio Shell Intersections Subjected to Pressure and External Loadings

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Part 2: Parametric Finite Element Analysis of Large Diameter Shell Intersections (Internal Pressure)

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Part 3: Parametric Finite Element Analysis of Large Diameter Shell Intersections (External Loadings)

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These Bulletins contain final Reports from projects sponsored by the Welding Research Council, important papers presented before engineering societies and other reports of current interest.

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FOREWORD

Cylindrical shell intersections are structural configurations commonly used in many industries, such as pipeline transportation, nuclear and power engineering, chemical and petrochemical engineering, aerospace, etc. Under internal pressure or external loadings, high local stresses occur at the Shell intersection region due to the geometric discontinuity. Therefore, the study of the influence of the geometric parameters for a specific design configuration on the maximum stress at shell intersections due to various loadings thus has great practical value.

In the past thirty years, considerable effort has been expended by stress analysts and designers all over the world in attempts to achieve a reasonable design procedure for shell intersections. WRC Bulletin 107[1], which is based on Prof. P. P. Bijlaard's work, and WRC Bulletin 297[2], which is based on Prof. Steele's work, provide guidance for the evaluation of shell and nozzle stresses due to external loadings. However, for large diameter ratio ($0.5<d/D<1.0$) shell intersections under internal pressure and external loadings, the design procedures are still in need of improvement.

A comprehensive parametric study of large diameter ratio cylindrical shell intersections subjected to internal pressure and external loadings was conducted by G. E. O. Widera and Z. Wei on behalf of the Pressure Vessel Research Council. The configuration employed in this parametric study is idealized and consists of two thin shell cylinders intersecting normally with no transitions, reinforcements, or fillets in the junction region. This parametric study was divided into two phases. Phase I is for internal pressure while phase II is for external loadings. The external loadings considered are in-plane moment on the nozzle, out-of-plane moment on the nozzle, and axial force on the nozzle.

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