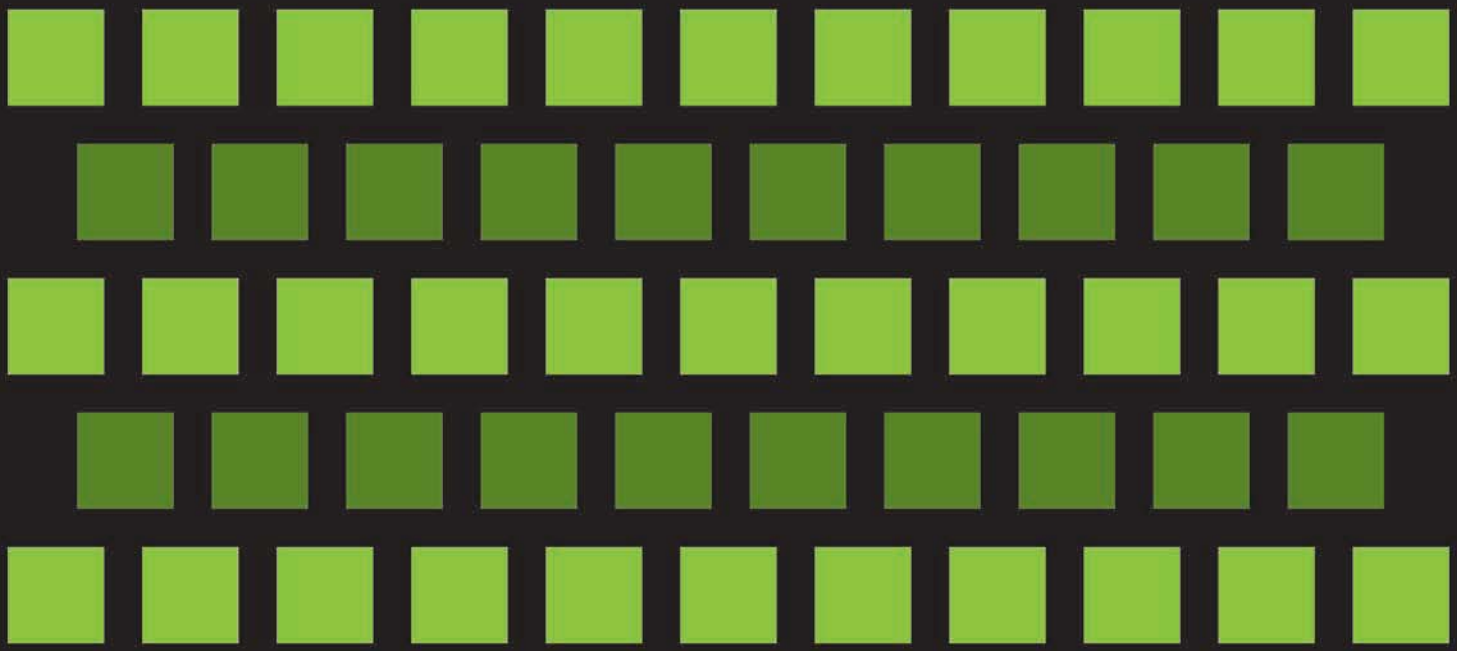
STP-PT-032

BUCKLING OF CYLINDRICAL, THIN WALL, TRAILER TRUCK TANKS AND ASME SECTION XII



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BUCKLING OF CYLINDRICAL, THIN WALL, TRAILER TRUCK TANKS AND ASME SECTION XII

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FOREWORD

This Standards Technology Publication is the result of a development project sponsored by ASME Pressure Technology Codes and Standards. The testing and analyses summarized in this report were performed to support the development of buckling design criteria and shell stiffening details for both hazmat and non-hazmat transport tanks.

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ABSTRACT

Buckling of cylindrical pressure vessels under axial compression and bending is normally evaluated using the axial compression stress evaluation design methods in ASME Section VIII, Division 1. In 1998 the ASME Boiler and Pressure Vessel Code Committee approved Code Case 2286, which introduced more comprehensive methods for determining allowable compressive stresses for cylinders, cones, spheres and formed heads due to external pressure, axial compression and bending. Section XII confirmed a need to develop similar such rules specific to the design of cylindrical, thin wall, trailer truck tanks. As first steps in the development of such rules, a full-scale tank buckling test was carried out, and the results of that were used to develop recommended design rules for consideration by Section XII. The results of this testing are summarized in this report. In addition, Section XII design rule proposals have been outlined and are also summarized in this report. These proposals are based on the test results, past experience with transport tanks and the design methods of Code Case 2286-2, and are presented for consideration by Standards Committee XII.

1 INTRODUCTION

New hazmat (hazardous material) and non-hazmat transport tanks will be constructed to the rules of the ASME Code Section XII [1]. Long, thin wall, trailer truck tanks are used extensively for over-the-road transport. These tanks typically operate with relatively low internal pressures from 25 to 45 psi (172 - 310 kPa) and are constructed with relatively stiff circumferential reinforcing rings at 60 in. (1500 mm) longitudinal spacing. These internal pressures cause positive circumferential stress in the tank wall. However, the longitudinal stresses addressed in this report are predominately bending and are not due to the internal pressures. Section XII confirmed a need to develop design rules similar to those in Code Case 2286-2 specific to the design for longitudinal bending in cylindrical, thin wall, trailer truck tanks. As first steps in the development of such rules, a full-scale tank buckling test was carried out, and the results of that were used to develop recommended design rules for consideration by Section XII. The results of that full-scale testing are summarized in this report. In addition, Section XII design rule proposals have been outlined and are also summarized in this report. These proposals are based on the test results, past experience with transport tanks and the design methods of Code Case 2286-2, and are presented for consideration by Standards Committee XII.