

ASME B31.5-2016
(Revision of ASME B31.5-2013)

Refrigeration Piping and Heat Transfer Components

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

ASME B31.5-2016
(Revision of ASME B31.5-2013)

Refrigeration Piping and Heat Transfer Components

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: June 29, 2016

The next edition of this Code is scheduled for publication in 2019. This Code will become effective 6 months after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. Interpretations are published under <http://go.asme.org/Interpretations>. Periodically certain actions of the ASME B31 Committees may be published as Cases. Cases are published on the ASME Web site under the Committee Pages at <http://go.asme.org/B31committee> as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages of the associated codes and standards to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The B31 Committee Pages can be found at <http://go.asme.org/B31committee>. The associated B31 Committee Pages for each code and standard can be accessed from this main page. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not “approve,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assumes any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

Copyright © 2016 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

CONTENTS

| | |
|---|-----------|
| Foreword | v |
| Committee Roster | vi |
| Introduction | viii |
| Summary of Changes | x |
| Chapter I Scope and Definitions | 1 |
| 500 General Statements | 1 |
| Chapter II Design | 8 |
| Part 1 Conditions and Criteria | 8 |
| 501 Design Conditions | 8 |
| 502 Design Criteria | 9 |
| Part 2 Design of Piping Components | 24 |
| 503 Criteria for Design of Piping Components | 24 |
| 504 Pressure Design of Piping Components | 24 |
| Part 3 Design Application of Piping Components Selection and Limitations | 33 |
| 505 Pipe | 33 |
| 506 Fittings, Bends, and Intersections | 34 |
| 507 Valves | 34 |
| 508 Flanges, Blanks, Flange Facings, Gaskets, and Bolting | 35 |
| Part 4 Selection and Limitations of Piping Joints | 35 |
| 510 Piping Joints | 35 |
| 511 Welded Joints | 35 |
| 512 Flanged Joints | 36 |
| 513 Expanded Joints | 36 |
| 514 Threaded Joints | 36 |
| 515 Flared, Flareless, and Compression Joints | 36 |
| 517 Brazed and Soldered Joints | 37 |
| 518 Sleeve Coupled and Other Novel or Patented Joints | 37 |
| Part 5 Expansion, Flexibility, Structural Attachments, Supports, and Restraints | 37 |
| 519 Expansion and Flexibility | 37 |
| 520 Design of Pipe Supporting Elements | 46 |
| 521 Design Loads for Pipe Supporting Elements | 47 |
| Chapter III Materials | 49 |
| 523 Materials — General Requirements | 49 |
| 524 Materials Applied to Miscellaneous Parts | 55 |
| Chapter IV Dimensional Requirements | 56 |
| 526 Dimensional Requirements for Standard and Nonstandard Piping Components | 56 |
| Chapter V Fabrication and Assembly | 58 |
| 527 Welding | 58 |
| 528 Brazing and Soldering | 67 |
| 529 Bending — Hot and Cold | 68 |
| 530 Forming | 68 |
| 531 Heat Treatment | 68 |
| 535 Assembly | 69 |

| | | |
|--------------------------------|---|----|
| Chapter VI | Examination, Inspection, and Testing | 73 |
| 536 | Examination | 73 |
| 537 | Inspection | 75 |
| 538 | Testing | 75 |
| 539 | Records | 76 |
| | | |
| Figures | | |
| 502.3.2 | Stress Range Reduction Factors | 23 |
| 504.3.1-1 | Reinforcement of Branch Connections | 27 |
| 504.3.1-2 | Extruded Outlet Header Notation | 29 |
| 504.3.1-3 | Mechanically Formed Tee Connections in Copper Materials | 31 |
| 504.5.3 | Blanks | 34 |
| 519.4.5-1 | Bends | 44 |
| 519.4.5-2 | Branch Connections | 45 |
| 523.2.2 | Reduction in Minimum Design Metal Temperature Without Impact Testing | 53 |
| 527.1.2 | Typical Joints With Backing Ring | 59 |
| 527.2.1-1 | Butt Welding End Preparation | 59 |
| 527.2.1-2 | Internal Trimming for Butt Welding of Piping Components With Internal Misalignment | 59 |
| 527.3.3-1 | Fillet Weld Size | 60 |
| 527.3.3-2 | Welding Details for Slip-On and Socket Welding Flanges, and Some Acceptable Types of Flange Attachment Welds | 61 |
| 527.3.3-3 | Minimum Welding Dimensions Required for Socket Welding Components Other Than Flanges | 61 |
| 527.3.5-1 | Typical Welded Branch Connection Without Additional Reinforcement | 62 |
| 527.3.5-2 | Typical Welded Branch Connection With Additional Reinforcement | 62 |
| 527.3.5-3 | Typical Welded Angular Branch Connection Without Additional Reinforcement | 62 |
| 527.3.5-4 | Some Acceptable Types of Welded Branch Attachment Details Showing Minimum Acceptable Welds | 63 |
| 527.3.5-5 | Some Acceptable Details for Integrally Reinforced Outlet Fittings | 64 |
| 527.3.6-1 | Acceptable Welds for Flat Plate Closures | 66 |
| 527.3.6-2 | Unacceptable Welds for Flat Plate Closures | 67 |
| | | |
| Tables | | |
| 500.2-1 | Refrigerant Safety Classifications | 4 |
| 500.2-2 | Safety Classifications for Refrigerant Blends | 6 |
| 502.3.1 | Maximum Allowable Stress Values, ksi | 10 |
| 514 | Minimum Thickness of External Threaded Components | 36 |
| 519.3.1 | Thermal Expansion Data, <i>e</i> (IP and SI) | 39 |
| 519.3.2 | Moduli of Elasticity, <i>E</i> (IP and SI) | 40 |
| 519.3.6 | Flexibility Factor, <i>k</i> , and Stress Intensification Factor, <i>i</i> | 41 |
| 521.3.1 | Minimum Sizes of Straps, Rods, and Chains for Hangers | 48 |
| 523.1 | Acceptable Materials — Specifications | 50 |
| 523.2.2 | Impact Exemption Temperatures | 54 |
| 526.1 | Dimensional Standards | 57 |
| 531.2.1 | Heat Treatment of Welds | 70 |
| | | |
| Nonmandatory Appendices | | |
| A | Referenced Standards | 77 |
| B | Preparation of Technical Inquiries | 80 |
| C | Selecting Applicable Piping Codes | 81 |
| D | Nomenclature | 83 |