



PROCESS  
INDUSTRY  
PRACTICES

*August 2022*

***Pipeline***

**PIP PLC00004**  
**Piping Stress Analysis Criteria**  
**for ASME B31.4 and B31.8 Metallic Piping**

---

## PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

© Process Industry Practices (PIP), Construction Industry Institute, The University of Texas at Austin, 3925 West Braker Lane (R4500), Austin, Texas 78759. PIP Member Companies and Subscribers may copy this Practice for their internal use. Changes or modifications of any kind are not permitted within any PIP Practice without the express written authorization of PIP. Authorized Users may attach addenda or overlays to clearly indicate modifications or exceptions to specific sections of PIP Practices. Authorized Users may provide their clients, suppliers and contractors with copies of the Practice solely for Authorized Users' purposes. These purposes include but are not limited to the procurement process (e.g., as attachments to requests for quotation/ purchase orders or requests for proposals/contracts) and preparation and issue of design engineering deliverables for use on a specific project by Authorized User's client. PIP's copyright notices must be clearly indicated and unequivocally incorporated in documents where an Authorized User desires to provide any third party with copies of the Practice.

### **PUBLISHING HISTORY**

*August 2022      Issued*

Not printed with State funds



# PIP PLC00004 Piping Stress Analysis Criteria for ASME B31.4 and B31.8 Metallic Piping

---

## Table of Contents

|   |          |
|---|----------|
| <b>1. Scope .....</b>                       | <b>2</b> |
| <b>2. References .....</b>                  | <b>2</b> |
| 2.1 Process Industry Practices .....        | 2        |
| 2.2 Industry Codes and Standards .....      | 2        |
| <b>3. Requirements.....</b>                 | <b>2</b> |
| 3.1 General.....                            | 2        |
| 3.2 Analysis Parameters .....               | 3        |
| 3.3 External Load Limits on Equipment ..... | 6        |
| 3.4 Analysis Applications .....             | 6        |
| 3.5 Documentation .....                     | 7        |

## 1. Scope

---

This Practice provides minimum requirements for analyzing the flexibility of metallic piping systems. This Practice describes piping flexibility analysis parameters and applications, and documentation requirements.

## 2. References

---

Applicable parts of the following Practice and industry codes and standards shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles will be used herein where appropriate.

### 2.1 Process Industry Practices (PIP)

- PLC00005 - *Design of ASME B31.8 Metallic Pipeline Systems within Facilities*

### 2.2 Industry Codes and Standards

- American Society of Civil Engineers (ASCE)
  - ASCE 7 - *Minimum Design Loads for Buildings and Other Structures*
- American Society of Mechanical Engineers (ASME)
  - ASME Boiler and Pressure Vessel Code  
Section VIII - *Pressure Vessels*
  - ASME B31.4 - *Pipeline Transportation Systems for Liquids and Slurries*
  - ASME B31.8 - *Gas Transmission and Distribution Piping Systems*
  - ASME B31J - *Stress Intensification Factors (i-Factors), Flexibility Factors (k-Factors), and Their Determination for Metallic Piping Components*
- Welding Research Council (WRC)
  - WRC 107 (see WRC 537)
  - WRC 537 - *Precision equations and enhanced diagrams for local stresses in spherical and cylindrical shells due to external loadings for implementation of WRC Bulletin 107*
  - WRC 297 - *Local Stresses in Cylindrical Shells Due to External Loadings on Nozzles - Supplement to WRC 107*
- Energy Institute (EI)
  - *Guidelines for the Avoidance of Vibration Induced Fatigue Failure in Process Pipework*

## 3. Requirements

---

### 3.1 General

- 3.1.1 All piping systems shall be evaluated and, if appropriate, analyzed for applicable conditions in accordance with ASME B31.4, ASME B31.8, and this Practice.
- 3.1.2 The most severe, anticipated, coincident pressure and temperature conditions shall be considered to evaluate the flexibility and sustained load analyses for each anticipated operating condition. Design conditions (pressure and temperature) shall be set in accordance with ASME B31.4-2016 subparas 401.2.2.2 and 401.2.3.7. For ASME B31.8-2018 see paras 805.2.1 and 805.2.2.