AWS D10.4M/D10.4:2023
An American National Standard

Guide for Welding Austenitic Stainless Steel Piping and Tubing

American Welding Society®

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Guide for Welding Austenitic Stainless Steel Piping and Tubing

5th Edition

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Prepared by the
American Welding Society (AWS) D10 Committee on Piping and Tubing

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This document presents a detailed discussion of the metallurgical characteristics and weldability of many grades of austenitic stainless steel used in piping and tubing. The delta ferrite content as expressed by Ferrite Number (FN) is explained, and its importance in minimizing hot cracking is discussed.

Several figures and tables illustrate recommended joint designs and procedures. Annex A presents information on the welding of high-carbon stainless steel cast pipe and fittings.

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

This guide is intended to provide information that may be used to avoid, or at least minimize, difficulties in welding austenitic stainless steel piping and tubing. The term pipe used in the text also includes tube. Cast chromium-nickel stainless steel pipe with carbon content above 0.20 percent requires practices different from the austenitic stainless steels, therefore they are covered in Annex A.

The first document on this subject was approved by the AWS Board of Directors in August 1955 under the title, *The Welding of Austenitic Chromium-Nickel Steel Piping and Tubing, A Committee Report* and published as AWS D10.4-55T. This version was revised in 1966.

In 1979, a major updating of the document was completed and published as AWS D10.4-79, *Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing*. This version presented a detailed discussion of the role of delta ferrite in austenitic chromium-nickel steel welds.

In 1986, the document further expanded and refined this information. In addition, an annex was added that gives recommendations for welding high-carbon stainless steel castings.

This edition provides updated information based on current industry standards, material selections, and welding practices.

The evolution of AWS D10.4M/D10.4, *Guide for Welding Austenitic Stainless Steel Piping and Tubing*, is shown below:

D10.4-55T	*The Welding of Austenitic Chromium-Nickel Steel Piping and Tubing*
AWS D10.4-66	*Welding of Austenitic Chromium-Nickel Steel Piping and Tubing*
AWS D10.4-79	*Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing*
ANSI/AWS D10.4-86	*Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing*
ANSI/AWS D10.4-86R	*Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing*
AWS D10.4M/D10.4:2023	*Guide for Welding Austenitic Stainless Steel Piping and Tubing*

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D10 Committee on Piping and Tubing, American Welding Society, 8669 NW 36 St., # 130, Miami, FL 33166. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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Guide for Welding Austenitic Stainless Steel Piping and Tubing

1. General Requirements

1.1 Scope. This guide for welding austenitic stainless steel pipe is primarily for the welding of piping systems used for the distribution of fluids and gases, where smooth continuous flow of product is the desired result. It is written for welders, engineers, and management to provide the essential knowledge for successful welding of these materials using manual, semiautomatic, automated, mechanized, and orbital welding techniques and processes.

Austenitic, superaustenitic, and high carbon stainless steels are readily weldable when the proper procedures and techniques are followed. They can be joined by most of the fusion welding processes, and good pipe welders can adapt very quickly from carbon steel or low-alloy steel to stainless steel. Orbital pipe welding is also adaptable to these materials and is commonly used for high quality repeatable welds in critical applications.

This guide can be used by any competent pipe welder in any good shop or field site. Reasonable care is required, as in any pipe welding operation; however, careful adherence to the welding procedure requirements will usually produce excellent welds in stainless steel piping and tubing.

Although this guide is not written with mandatory requirements, mandatory language, such as the use of "shall," will be found in those portions of the document where failure to follow the instructions or procedures could produce inferior, misleading, or unsafe results.

1.2 Units of Measurement. This standard makes use of both the International System of Units and U.S. Customary Units. The latter are shown within brackets ([ ]) or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently.

To identify nominal pipe sizes in both SI and U.S. Customary Units, the following designations are used:

(1) DN (Diameter Nominal) is the SI designation, and

(2) NPS (Nominal Pipe Size) is the U.S. Customary designation.

1.3 Safety. Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided, but such issues are not fully addressed herein.

Safety and health information is available from the following sources:

American Welding Society:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

(1) Safety Data Sheets supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety