# Welding of Pipelines and Related Facilities

API STANDARD 1104
NINETEENTH EDITION, SEPTEMBER 199[illegible]
ERRATA 1, OCTOBER 31, 2001

American Petroleum Institute

Helping You
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**Pipeline Segment**

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## FOREWORD

This standard was prepared by a formulating committee that included representatives of the American Petroleum Institute, the American Gas Association, the Pipe Line Contractors Association, the American Welding Society, and the American Society for Nondestructive Testing, as well as representatives of pipe manufacturers and individuals associated with related industries.

The purpose of this standard is to present methods for the production of high-quality welds through the use of qualified welders using approved welding procedures, materials, and equipment. Its purpose is also to present inspection methods to ensure the proper analysis of welding quality through the use of qualified technicians and approved methods and equipment. It applies to both new construction and in-service welding.

The use of this standard is entirely voluntary and is intended to apply to welding of piping used in the compression, pumping, and transmission of crude petroleum, petroleum products, fuel gases, carbon dioxide, and nitrogen and, where applicable, to distribution systems.

This standard represents the combined efforts of many engineers who are responsible for the design, construction, and operation of oil and gas pipelines, and the committee appreciatively acknowledges their wholehearted and valuable assistance.

From time to time, revisions of this standard will be necessary to keep current with technological developments. The committee is always anxious to improve this standard and will give full consideration to all comments received.

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Suggested revisions are invited and should be submitted to the general manager of the Pipeline Segment, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

*ATTENTION USERS:* Portions of this standard have been changed from the previous edition. The locations of changes have been marked with a bar in the margin, as shown to the left of this paragraph. In some cases, the changes are significant, while in other cases the changes reflect minor editorial adjustments. The bar notations are provided as an aid to users as to those parts of the standard that have been changed from the previous edition, but API makes no warranty as to the accuracy of such bar notations.

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## 1 General

### 1.1 SCOPE

This standard covers the gas and arc welding of butt, fillet, and socket welds in carbon and low-alloy steel piping used in the compression, pumping, and transmission of crude petroleum, petroleum products, fuel gases, carbon dioxide, and nitrogen and, where applicable, covers welding on distribution systems. It applies to both new construction and in-service welding.The welding may be done by a shielded metal-arc welding, submerged arc welding, gas tungsten-arc welding, gas metal-arc welding, flux-cored arc welding, plasma arc welding, oxyacetylene welding, or flash butt welding process or by a combination of these processes using a manual, semiautomatic, or automatic welding technique or a combination of these techniques. The welds may be produced by position or roll welding or by a combination of position and roll welding.

This standard also covers the procedures for radiographic, magnetic particle, liquid penetrant, and ultrasonic testing as well as the acceptance standards to be applied to production welds tested to destruction or inspected by radiographic, magnetic particle, liquid penetrant, ultrasonic, and visual testing methods.

The values stated in either inch-pound units or SI units are to be regarded separately as standard. Each system is to be used independently of the other, without combining values in any way.

Processes other than those described above will be considered for inclusion in this standard. Persons who wish to have other processes included shall submit, as a minimum, the following information for the committee's consideration:

a. A description of the welding process.

b. A proposal on the essential variables.

c. A welding procedure specification.

d. Weld inspection methods.

e. Types of weld imperfections and their proposed acceptance limits.

f. Repair procedures.

It is intended that all work performed in accordance with this standard shall meet or exceed the requirements of this standard.

## 2 Referenced Publications

The following standards, codes, and specifications are cited in this standard:

API

| | |
|---|---|
| Spec 5L | *Specification for Line Pipe* |

ASNT[1]

| | |
|---|---|
| RP SNT-TC-1A | *Personnel Qualification and Certification in Nondestructive Testing* |
| ACCP | *ASNT Central Certification Program* |

ASTM[2]

| | |
|---|---|
| E 164 | *Standard Practice for Ultrasonic Contact Examination of Weldments* |
| E 165 | *Standard Test for Liquid Penetrant Examination* |
| E 709 | *Standard Guide for Magnetic Particle Examination* |
| E 747 | *Standard Practice for Design, Manufactue and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology* |
| E 1025 | *Standard Practice for Design, Manufacture, and Material Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiology* |

AWS[3]

| | |
|---|---|
| A3.0 | *Welding, Terms and Definitions* |
| A5.1 | *Covered Carbon Steel Arc Welding Electrodes* |
| A5.2 | *Iron and Steel Oxyfuel Gas Welding Rods* |
| A5.5 | *Low Alloy Steel Covered Arc Welding Electrodes* |
| A5.17 | *Carbon Steel Electrodes and Fluxes for Submerged Arc Welding* |
| A5.18 | *Carbon Steel Filler Metals for Gas Shielded Arc Welding* |
| A5.20 | *Carbon Steel Electrodes for Flux Cored Arc Welding* |
| A5.28 | *Low Alloy Steel Filler Metals for Gas Shielded Arc Welding* |
| A5.29 | *Low Alloy Steel Electrodes for Flux Cored Arc Welding* |

BSI[4]

| | |
|---|---|
| BS 7448: Part 2 | *Fracture Mechanics Toughness Tests Part 2, Method for Determination of $K_{Ic}$ Critical CTOD and Critical J Values of Welds in Metallic Materials* |

[1]American Society for Nondestructive Testing, Inc., 1711 Arlingate Lane, P.O. Box 28518, Columbus, Ohio 43228-0518.

[2]American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959.

[3]American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126.

[4]British Standards Institution, British Standards House, 389 Chiswick High Road, London, W4 4AL, United Kingdom.