AWS C4.4/C4.4M:2022
An American National Standard

Recommended Practices for Heat Shaping and Straightening with Oxyfuel Gas Heating Torches

American Welding Society®

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Approved by the
American National Standards Institute
December 17, 2021

Recommended Practices for Heat Shaping and Straightening with Oxyfuel Gas Heating Torches

3rd Edition

Prepared by the
American Welding Society (AWS) C4 Committee on Oxyfuel Gas Welding and Cutting

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This third edition of Recommended Practices for Heat Shaping and Straightening covers the shaping of metal products by prudent use of heat to obtain a desired configuration. The text reviews the theory and analytical calculations that explain how heat shaping and straightening occurs. Sample calculations and tables are presented for typical materials. General heating patterns and heat shaping and straightening techniques are discussed. Specific heating applications are illustrated for various sections.

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ISBN Print: 978-1-64322-229-5
ISBN PDF: 978-1-64322-230-1
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This standard is subject to revision at any time by the AWS C4 Committee on Oxyfuel Gas Welding and Cutting. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS C4 Committee on Oxyfuel Gas Welding and Cutting and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS C4 Committee on Oxyfuel Gas Welding and Cutting to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

Personnel

AWS C4 Committee on Oxyfuel Gas Welding and Cutting

L. L. Liston, Chair	*Consultant*
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J. M. Rosario	*American Welding Society*
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N. J. Matson	*The Harris Products Group*
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C. C. Wheeler	*John Deere Davenport Works*

Advisors to the AWS C4 Committee on Oxyfuel Gas Welding and Cutting

J. F. Henderson	*Victor Technologies, Incorporated*
R. K. Langford	*Victor Technologies Incorporated*

Foreword

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

The shaping of metals by the use of heat has a long history of successful applications. This shaping has been used to curve, camber, or otherwise shape a product as well as to correct members that have become distorted or damaged by accident or fire.

This third edition of *Recommended Practices for Heat Shaping and Straightening with Oxyfuel Gas Heating Torches* presents methods and techniques used by engineers and technicians to shape and straighten metal parts by careful application of heat.

Revisions to the 2007 edition are identified by either underlined text or a vertical line in the margin next to the text.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS C4 Committee on Oxyfuel Gas Welding and Cutting, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Recommended Practices for Heat Shaping and Straightening with Oxyfuel Gas Heating Torches

1. General Requirements

1.1 Scope. This publication describes some causes of distortion and corrective actions through the use of heat. It also describes some heat shaping techniques and the direction of movement expected in the heated metal. Equations are provided to aid in estimating the amount of movement for a given heating technique. The methods discussed are specifically applicable to ferrous metals (e.g., ASTM A36, A571, and Type 304). For a more comprehensive description of specific applications, see Annex A, Informative References.

Although this recommended practice 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 Measure. This standard makes use of both U.S. Customary Units and the International System of Units (SI). 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.

1.3 Safety. Safety issues and concerns are addressed in this standard although health issues and concerns are beyond the scope of this standard. 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 and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.

2. Normative References

The documents listed below are referenced within this publication and are mandatory to the extent specified herein. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments or revisions of the publications may not apply since the relevant requirements may have changed.