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An American National Standard

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

American Welding Society

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

2nd Edition

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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 second 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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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, but many of the methods can be applied to nonferrous metals as well. For a more comprehensive description of specific applications, see Annex A, Informative References.

Heat has been used to shape and straighten structural elements in bridges, buildings, and marine constructions for over a hundred years. Since the late 1930s, the use of oxyfuel gas torches to do this work has become more prevalent. This publication is a recommended practice for using the torch process for work on bridges and buildings, and to some extent, shipbuilding.

Mechanical forces in fabrication and erection, forces occurring in service, accidental impacts from external forces, fire, and explosion, all cause stress in a structural member or a part of a member. If that stress exceeds the elastic limit of the material, distortion will occur, and the member will not conform to its desired shape. Heat shaping and straightening is an economical method to produce the desired movement to bring the member into conformance.

The shipbuilding industry throughout the world has taken heat shaping to new heights in shaping technology. Particularly, the use of line heating to shape complex curves in hull structures has become an integral part of a group technology in shipbuilding which also includes product work packages and accuracy control.

Basically, straightening and shaping involves controlled thermal expansion and contraction of a structural element. The method, location, and shape of the heat application are covered briefly in this publication. This recommended practice is limited to fundamentals and simple applications (see Annex A for additional information).

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.

Safety and health issues may not be fully addressed by this standard. Users of this standard should consult ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, applicable federal, state, and local regulations and other relevant documents concerning safety and health issues not addressed herein.

2. Normative References

The following standard contains provisions, which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

AWS documents:[1]

AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*; and

AWS F4.1, *Recommended Safe Practices for Preparation for Welding and Cutting of Containers and Piping*.

Other documents:

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*;[2]

[1] AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.
[2] ANSI Z49.1 is published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.