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SHEET METAL WELDING GUIDE

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.
www.smacna.org

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THIRD EDITION – JANUARY, 2007

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4201 Lafayette Center Drive
Chantilly, VA 20151–1209
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SHEET METAL WELDING GUIDE

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**SHEET METAL AND AIR CONDITIONING CONTRACTORS'
NATIONAL ASSOCIATION, INC.**

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FOREWORD

Sheet metal contractors know that joining metal is a very labor-intense part of their business. Many hours are spent welding the various parts together that make up the total sheet metal system. Managing the welding operation of the contractors business is a vital part of the total operation.

In the early 80's, The Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) seeing the need for more information and guidance published the first edition of this manual. It was an out growth of concern that the sheet metal contractor was in need of more specific guidance on the welding operation. The first edition attempted to collect information about the various facets of welding as it applied to the sheet metal business, but written from a non-expert perspective. It was recognized that the manager had to be able to make informed business decisions and needed the tools to help in the process. Things such as weld productivity, quality, equipment selection, training, hiring, estimating, safety, welding processes and standards were examined from the managers prospective. The purpose of subsequent editions has been to continue providing the sheet metal manager with the tools to manage the welding operation, including the latest technological advances that affect welding operations in many respects.

This edition includes:

- Updated coverage of most welding processes in common use today. Updated figures and drawings of typical welded joint designs.
- New guidelines for developing welding procedures are provided in the chapter on standards, codes and specifications.
- Estimating is expanded and provides both a short and long method of estimating welding costs with examples.
- Welder training is updated and covers the International Training Fund (ITI) welding program and welder qualification.
- Integration of metric units is incorporated into the text and tables using "soft" conversion methods.

The Welding Committee of SMACNA developed this third edition after reviewing the needs of the contractor and revised the guide to reflect the latest technology and methods. It is hoped that the revised guide will help Contractors manage their welding operation more profitably.

Welding is a significant part of the sheet metal business. SMACNA through its welding committee working with members, chapters, and the welding industry is committed to providing sheet metal contractors with guide-lines for managing their welding operations.

SMACNA sincerely appreciates the contributions of the welding industry and the input of concerned and interested individuals.

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CHAPTER 1

INTRODUCTION

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1.1 BACKGROUND

The Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) has found that joining metal by welding is one of the most labor-intense operations in the sheet metal industry. Predicting and controlling the costs and quality of welding is absolutely essential if contractors are to manage work effectively. This Third Edition was undertaken to refine and clarify several areas and to upgrade this manual and to promote its use as an effective guide for contractors.

Codes, specifications, and classifications are voluntary consensus standards developed by committees whose membership is balanced among interested parties such as producers, consumers, general interest and others. Others, such as government, may have their own category if substantial interest is shown. No single group may dominate a standards committee. Well known examples of this type of organization are American Welding Society (AWS), American Society for Testing and Materials (ASTM) and American Society of Mechanical Engineers (ASME). For a standard such as AWS D1.1, *Structural Welding Code – Steel* the producer group would be made up of contractors, manufacturers, and distributors. Consumers would be developers, inspection agencies, and owners. General interest would represent the general public interest, and they may from academia, government, or the general public. Any individuals, whether committee members or not, have the right to comment on a proposed standard. The committee is required to consider all comments and to advise the individual of the disposition of the comment.

Contractors can expect the requirements of national codes and standards to be reasonable and equitable as they apply the same requirements to all practitioners, therefore contractors can fairly compete for such work. The additional requirements imposed by these national codes and standards are more record keeping such as mill test reports (MTRs), welding procedure specifications (WPSs), performance qualification test records (PQTRs), and inspection records.

Rules for development of the WPSs and PQTRs, are provided in the application codes such as AWS D1.1, *Structural Welding Code – Steel,* AWS D1.3, *Structural Welding Code – Sheet Steel*, and D9.1, *Sheet Metal Welding Code*. Alternatively qualification rules may be found in AWS B2.1, *Specification for Welding Procedure and Performance Qualification.* Most AWS codes and specifications accept welding qualifications that are performed under B2.1.

Welding is a special process because, except for hardness, we cannot evaluate the mechanical properties without destroying the weld. Therefore, we control the properties of the weldment by using written qualified procedures (WPSs). The soundness of the weld is maintained by using trained and qualified welders and welding operators.

Welding Procedure Specifications (WPSs) provide several benefits such as:

a. QUALITY AND REPEATABILITY - Welding performed in strict adherence to welding procedures can assure consistent quality and repeatability in welding production.

b. INCREASE IN PRODUCTIVITY - Consistent use of welding procedures can give the contractor much better control of the welding operations by providing written instructions for the welder to use, including the welding process, machine setting, type of electrodes, etc.

c. MEASURE PERFORMANCE - Welding procedures provide the basis for comparison of welder performance to previously established production methods.

d. MATERIAL REQUIREMENTS - Use of written welding procedures not only establishes the type and size of electrodes, shielding gases and materials that are required for the job, they can also be used in determining the quantities of electrodes and gases and the arc time needed for the size of weld to be made in accordance with the joint design.

e. TRAINING - Training programs can be established to train welders in particular welding processes using the procedure as the base line document.

There has been a mystique in the past about welding. Too often the sheet metal contractor's management has been totally reliant upon the welder for guidance in such matters as the correct welding procedure, achievable productivity, welding costs and, in many instances, the type of equipment to be purchased.

This publication is intended to provide the contractors' managers and supervisory employees sufficient information to predict welding costs, audit welding productivity and source information to recognize weld quality even though they may not have extensive experience in "laying down a weld."

This publication is not intended for welder training nor does it purport to provide all of the information