Making Everything Easier!™

Welding

FOR DUMMIES®

Learn to:

- Work with various welding techniques
- Follow safety procedures
- Make each joint look professional
- Complete simple do-it-yourself projects

Steven Robert Farnsworth
Certified welding inspector and instructor

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Welding For Dummies®

by Steven Robert Farnsworth

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About the Author

Steven Robert Farnsworth hails from Iowa, close to the age of dirt being born in 1955. He attended Archer School until they closed it and went on to Sanborn Community High School, where he graduated in 1973. He was one of the lucky ones. While attending high school, he also attended a vocational school, graduating with a welding diploma.

Steve enlisted in the U.S. Navy in July of 1973. After boot camp, he attended HTA (Hull Maintenance Technician) in San Diego, California, and transferred to the USS ARD 30 (the floating dry dock for fast attack submarines), where he worked in the repair division. Steve was then sent to C1 Welding School in San Diego, where he qualified as a high pressure plate and high pressure pipe welder. After attending C1 Welding School, he was transferred to the USS Basilone DD824 until his honorable discharge in July of 1977. Steve began his civilian career at a construction company in Spencer, Iowa, working as the welder, semi driver, and heavy equipment operator. In August 1979, he acquired the position of Welding Instructor at Iowa Lakes Community College, teaching the following classes:

Oxyacetylene Theory and Lab

Electric Arc Theory and Lab

Structural Welding

Brazing and Soldering

Mig and Tig Theory

Mig and Tig Lab

Pipe Welding

Production Welding

Special Processes

In 1984 Steve left teaching and went back into the Navy, receiving orders to the USS White Plains AFS-4 (the Orient Express), home ported in Guam. After 36 months, he received orders to the USS Hunley AS-31, home ported out of Norfolk, Virginia. After four years in that naval tour, he returned to instructing at Iowa Lakes Community College and has been there ever since. Steve is a Certified Welding Educator and Certified Welding Inspector through the American Welding Society.

Dedication

I dedicate this book to all the welders and welding students who put everything together that makes this world go around. I cannot imagine a world without welded products. So thank you, welders who have breathed a little smoke and saw the flash of products being welded together. I would also like to thank Iowa Lakes Community College for allowing me to write this book and putting up with me for all these years.

Author's Acknowledgments

When I was young, my first job was moving chicken manure for 90 cents an hour. (Believe me, you never had a cold after you scooped that stuff.) Welding at the local factory paid 35 cents more an hour. (Wouldn't you change jobs?) At that time, who would have ever thought I would author a book on something that I enjoy doing? I would like to thank all the people who have helped me teach welding students how to weld over the last 25+ years. I hope this welding book helps you become the welder that you want to be.

Publisher's Acknowledgments

We're proud of this book; please send us your comments at http://dummies.custhelp.com. For other comments, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002.

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Introduction

Welding has become one of the most important trades in the world, and that isn't likely to change anytime in the near future. So many of the objects people have and need are created either directly or indirectly by welding. If everyone woke up one morning and no one could remember how to join metals, the world would be a very different place by the afternoon.

But welding isn't just important — it's also fun. The idea of welding as a hobby is catching on more and more. It's an extremely versatile skill that can be quite rewarding after you get the hang of it. Something is very empowering about knowing that you can harness some pretty powerful forces — electricity and intense heat — to melt metals and join them together. Even experienced welders get a kick out of the fact that they can take a machine and a few pieces of metal and create something new, functional, and even beautiful. That's an extremely fulfilling feeling, and I think it's a product of welding that people don't always mention when they talk about the trade.

One quality of welding that people *do* talk about a lot is its usefulness. You can use welding skills to accomplish a lot, whether you want to eventually make a career out of welding or just have the ability to make and fix metal objects for your personal pursuits. Over the years I've taught and worked with both kinds of welders, and I know that after they really figured out the ins and outs of welding, they were able to do things that made their personal and professional lives a lot easier.

About This Book

Welding For Dummies helps you understand the basics of how welding works and lets you begin practicing several of the most prominent and useful welding techniques. I walk you through the fundamentals that hold true for all types of welding, and I dig into the details of specific welding processes — stick, mig, tig, and more — to show you how to practice those skills in a safe, productive way. Don’t worry; I don’t have you welding the Statue of Liberty’s torch back onto her hand or anything, but I do hope this book puts you well on your way to achieving the welding goals you’ve set for yourself.

One of my favorite aspects of *Welding For Dummies* is that you can move around within it however you want and still end up with a huge amount of welding knowledge. You may initially be interested in one welding process but quickly discover you should be reading about a totally different process, and that’s okay — you can jump to that other discussion without worrying that you’ve missed something important. Just beware of paper cuts from flipping back and forth between chapters.

Conventions Used in This Book

Here are a few conventions I use to make reading this book even easier:

- The world of welding is full of jargon, so I present new terminology in *italics* and make sure to give a

definition nearby.

Bold text highlights the action parts of numbered steps and also designates keywords in bulleted lists.

I've tried to stick to welding standards supported by the American Welding Society (AWS), which is the largest and most prominent welding organization in the United States.

All Web addresses appear in `monofont`. When this book was printed, some Web addresses may have needed to break across two lines of text. If that happened, rest assured that the address doesn't contain any extra characters (such as hyphens) to indicate the break. So when using one of these Web addresses, just type in exactly what you see in this book, pretending as though the line break doesn't exist.

What You're Not To Read

Far be it from me to tell you what you should read, but allow me to make one quick point. In several spots throughout this book, I include *sidebars* (gray shaded boxes) that contain interesting (and possibly entertaining, depending on what kind of mood you're in) information that you don't absolutely have to read in order to understand and practice welding. If the how-to, functional information in the book is the entrée, the sidebars are like garnish. Not parsley, though — I like to think that the sidebars are at least a little more interesting and useful than an herb that tastes funny and doesn't do much more than crowd a plate. You can also skip anything with a

Technical Stuff icon; this information is more technically involved than the basics you need to weld.

Foolish Assumptions

I’m not really crazy about guesswork, but I did make a few assumptions about you as I wrote this book. (They’re all nice, I promise.) If any of the following statements applies to you, this book is for you.

- You’ve never welded but want to know more about metals and how to join them by using welding.
- You’ve welded a little but really want to figure out how to improve and start taking advantage of all welding has to offer.
- You’ve done a fair amount of one type of welding but want to expand your skill set so you can weld with a variety of different processes and techniques.
- You understand a few basic tools (such as hammers and screwdrivers) and what they do.
- You know how important taking necessary safety precautions is to keep yourself (and others) out of harm’s way.

How This Book Is Organized

This book is divided into six parts. Each part offers something different, but all of them are geared toward helping you figure out welding processes and put them to good use. Here's a quick look at what you can find in each part.

Part I: Understanding Welding Basics

This part provides the kind of welding information that crosses all types of welding. If you're really just starting out in welding, this part is a good first stop for you because it gives you the lowdown on metals (especially the ones that are commonly used in welding), the tools and equipment you use for welding, and the kind of environment you need in order to weld successfully. It also includes the chapter that's without a doubt the most important one in the book. That's Chapter 3, and it's all about welding safety.

If you read only one chapter in the book, let it be Chapter 3. Welding is a fantastic skill, but it's not worth getting hurt over.

Part II: Welding on a Budget: Stick and Tig Welding

Part II focuses on stick welding (the most commonly used welding process) and tig welding (also a great, useful technique). You can read all about the advantages and disadvantages of both stick and tig and understand how

they work and what makes them unique. I explain the different equipment you need if you want to get into stick or tig welding, and I also give you plenty of information on how you can try out the techniques.

Part III: Discovering Mig Welding

Mig welding is a fast, efficient welding process, and it’s great for new welders because it’s relatively easy to pick up and get started with. I devote Part III to the basics of understanding and executing mig welding.

Part IV: Getting Fancy: Plasma Cutting, Oxyfuel Cutting, and Other Processes

Arc welding isn’t the only way you can weld — welding includes lots of other processes, such as soldering, brazing, and gas welding, that are all useful in their own distinct ways. I cover those processes in Part IV.

I also cover a few cutting processes in this part, because cutting is an important task in any welding shop, and you’ll probably need to do some (or a lot) of it if you stick with welding for any extended period of time.

Part V: Putting Welding into Action with Projects and

Repairs

This part is probably the most fun because it gives you a chance to try out your welding skills and build some great, useful items. The chapters contain a welding project or two that is designed with the beginning welder in mind. You can read about how to build a portable welding table, a torch cart, a campfire grill, and more! This part also includes a chapter that helps you to figure out whether fixing something or buying (or building) it new makes more sense.

Part VI: The Part of Tens

If you've read a *For Dummies* book before, you already know all about this part. The Part of Tens is always a favorite; it features lists full of useful information in an extremely easy-to-read format. You can read about the advantages to becoming a certified welder, the tools that every welder wants, and more. There's also a glossary to help you with basic welding terminology.

Icons Used in This Book

Throughout the book, you'll occasionally notice little pictures in the margins. These icons help flag specific information I want to highlight; check out the following list for details on what those icons indicate.

When you see this icon, expect to find a helpful bit of information that will help save you time and money

and keep you from making mistakes when you're welding.

If I really want you to slow down and commit something to memory, I use this icon. It's important stuff, so take the time to read it!

The last thing I want is for you to get hurt, or for you to hurt others or damage property. With that in mind, please pay attention to these icons so you can keep from hurting someone (yourself included) or damaging your equipment or surroundings.

This icon denotes technical or historical information that's more involved than what you need for your basic welding practice.

Where to Go from Here

I know what you're thinking: With all of this terrific, useful welding information, where do I begin?

I certainly don't want to tell you what aspect of welding you should want to read about first — that's for you to decide — but I do make one request. If you're new to welding, or if you aren't completely familiar with the practices of welding safety, please go directly to Chapter 3 and read up on it. You really do need to know how to keep yourself safe as you start or continue your welding experience, and Chapter 3 goes a long way toward keeping you out of harm's way.