

THE Art OF Sculpture WELDING

From Concept to Creation



Kristi Richardson McCoy



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WELDING
From *Concept* to *Creation*

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Introduction

Too many times, students are put into a classroom situation where all they do is practice welding joint after joint and run bead after bead. Being the artistic person that I am, teaching welding in this fashion is not for me. In my experience, if students WANT to be in the classroom, they will work harder. In turn, my job becomes easier and more enjoyable. The projects in this book are designed to teach every facet of welding in a more interesting way so that students stay on task and are excited every day to walk into my classroom.

Whether you are a student or a home hobbyist looking for something to build, the projects in this book provide learning experiences that not only are fun and challenging but also will help to develop your welding skills.

This book includes 13 projects for the novice welder; they are designed with specific welding applications in mind including GMAW, GTAW, SMAW and oxyacetylene welding. While constructing these projects, beginners do more than practice welding. They also:

- Develop better measuring skills.
- Identify types of steel.
- Align joints properly.
- Use the tools of the trade including scribes, squares, plasma and cutting torches.
- Work with grinders and polishers during and after fabrication.
- Learn the importance of final clean-up.
- Experiment with different types of metal finishes.

The chapters in this book include projects that were designed with each specific welding discipline in mind so that the reader gets hands-on practical experience. Each project includes a detailed list of parts that are needed for that project, a set of plans showing the layout and dimensions for the part, and detailed instructions on how to build the project accompanied by numerous full-color photographs taken especially for this text. The chapters include Helpful Hints, which provide advice on how to properly construct the project so that optimal learning takes place through-



out the fabrication process. Additional Notes provide interesting background information. Safety Tips also appear throughout the book.

The book is organized into the following units:

- Part 1:** Beginning Gas Metal Arc Welding Projects
- Part 2:** Beginning Shielded Metal Arc Welding Projects
- Part 3:** Beginning Gas Welding Projects
- Part 4:** Beginning Gas Tungsten Arc Welding Projects
- Part 5:** Heating, Bending, Rolling and Wrought Iron Projects

Gas Metal Arc Welding tends to be less intimidating to beginners than the other slightly more complicated welding processes. Therefore, it provides a great way to begin learning metal fusion. Both projects in Part 1 introduce a large variety of tools in the welding shop and initiate novice welders to the basics of part layout, which is a vital step in the metal working process.

The Shielded Metal Arc Welding projects in Part 2 concentrate on learning and practicing the proper use of the oxyacetylene cutting torch along with mastering the more complicated bead laying process that comes with stick welding. Three projects, all with similar difficulty levels, are included in this part to provide beginners with choices as they learn to become proficient with this process.

The Oxyacetylene Welding projects in Part 3 and Gas Tungsten Arc Welding projects in Part 4 will develop hand-eye coordination skills. Each of the two parts begins with a very simple project that concentrates more on mastering the welding skill itself. In each case, the second more complicated projects are designed to concentrate on welding skills along with construction techniques.

The final projects in Part 5 are designed to teach skills related to shaping parts with heat and with the use of specialty tools. The target and decorative vase projects introduce beginners to heating and bending techniques with oxyacetylene and hydraulics. The dinner bell and tricycle plant stand incorporate the use of wrought iron benders and ring rollers to complete the projects.

This book teaches all aspects of the welding environment and will help shape beginning welders into well-rounded individuals. When beginners are focused on a goal at hand and are interested in achieving the end result, they focus on their work. The learning that takes place within a welding technology classroom or home shop is evident every hour of every day.



Acknowledgements

I have been surprised many times in my life with crazy opportunities that are thrown my way out of the blue that I just can't believe are happening. The most memorable was being told three years into my teaching career that I would be teaching welding. I can honestly say, at the time, I was anything but "qualified," even though my teaching certificate said otherwise. But, I have never been afraid to learn, and 17 years later, welding has become my passion.

I want to thank Mr. Golz, my high school shop teacher, who has always been encouraging and who has helped me along the way, as well as all the administrators over the years at Spearfish High School who have shown nothing but faith in my abilities. For that I am grateful.

I am thankful for the opportunity my publisher Industrial Press has enabled me to share with others what I do in my classroom to make each day an enjoyable experience for myself and my students. Who would have thought that a 15-minute conversation at a teaching conference would turn into a year's full of work? Thank you, Christine Ott, for introducing me to the publishing team in New York and Connecticut. Thank you, Jim Dodd, for having faith in a shop teacher who hadn't written even an essay since college some 20 years ago. Thank you, Janet Romano, for the helpful encouragement and for doing such a great job putting my words and images onto paper. And thank you, Robert Weinstein, for having the patience to be my editor.

Thanks to all my friends for their encouragement and for sharing in the excitement of my new adventure. Most important — thank you to my husband and my two wonderful children for allowing me the time to write. I love you guys!

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PART I

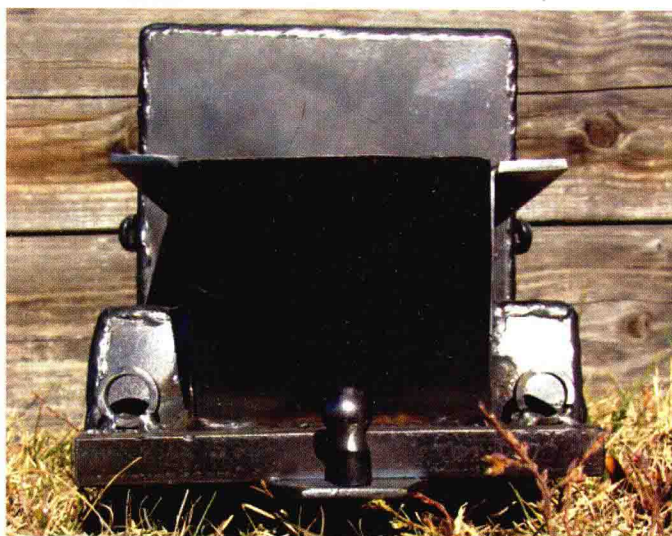
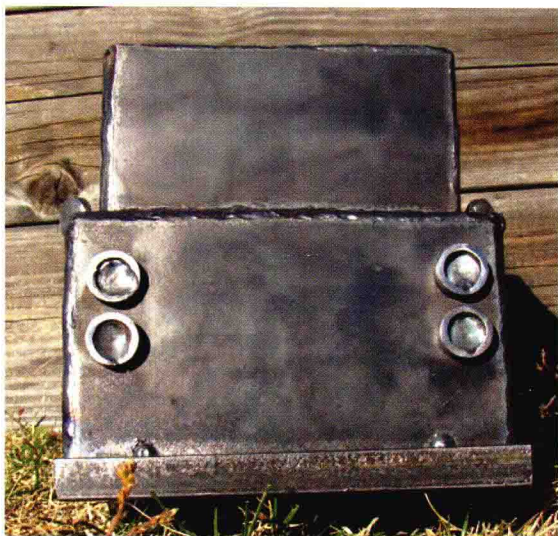
Beginning Gas Metal Arc Welding Projects

Gas Metal Arc Welding (GMAW), sometimes referred to as MIG (Metal Inert Gas) welding, was invented over a century ago, but it took until the late 1950s and early 1960s before the process was affordable and versatile enough to be extensively used. Today, MIG welding is the most common method of welding, especially in industry.

Many people think that MIG welding is as simple as picking up the gun and pushing the trigger. This is a huge misconception. As with other welding processes, a person needs to know how to set the welder for proper penetration, which way to aim the gun, how to move and advance down the weld joint, and how to identify and maintain the proper arc distance, as well as how to care for and clean the machine and its many parts.

This section provides the beginner welder an opportunity to build something fun and learn the MIG welding process. Both projects provide the same learning experiences and can be very beneficial in understanding the basic fabrication processes.





Truck

While assembling the truck, you will learn and develop a variety of proficiencies in the welding shop environment. These include a working knowledge of welding equipment, power tools, hand tools, layout tools, and machinery. You will become familiar with identifying steel, using a plasma cutter and its accessories, and how to properly assemble a basic welding project. The project will supply plenty of practice using a MIG welder to tack parts and weld the basic joints.

Specifically, this project focuses on proper layout of parts, proper cleanup after cutting, and the importance of tacking parts together prior to welding joints solid. At times, the truck may seem tedious to build due to the large amount of parts, but is rewarding when complete.



STEP 1. Identify the steel needed for truck fabrication.

Before building any project, a person must be able to identify different types of pre-fabricated steel shapes. Without properly knowing how to identify steel, costly and time consuming mistakes can be made.

There are a variety of shapes, most of which can be identified by thickness, width, height, or diameter. Some of the more common and familiar shapes include; square tube, flat bar (strap), round bar (rod), angle iron, rectangular tube, pipe, square bar, and expanded metal (Figure 1-1). Other commonly used products are sheet metals, channel iron, and W-beams.

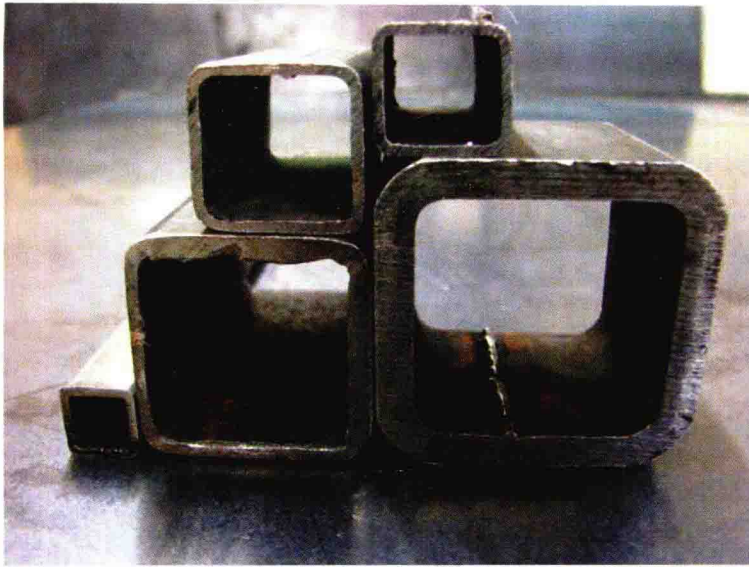
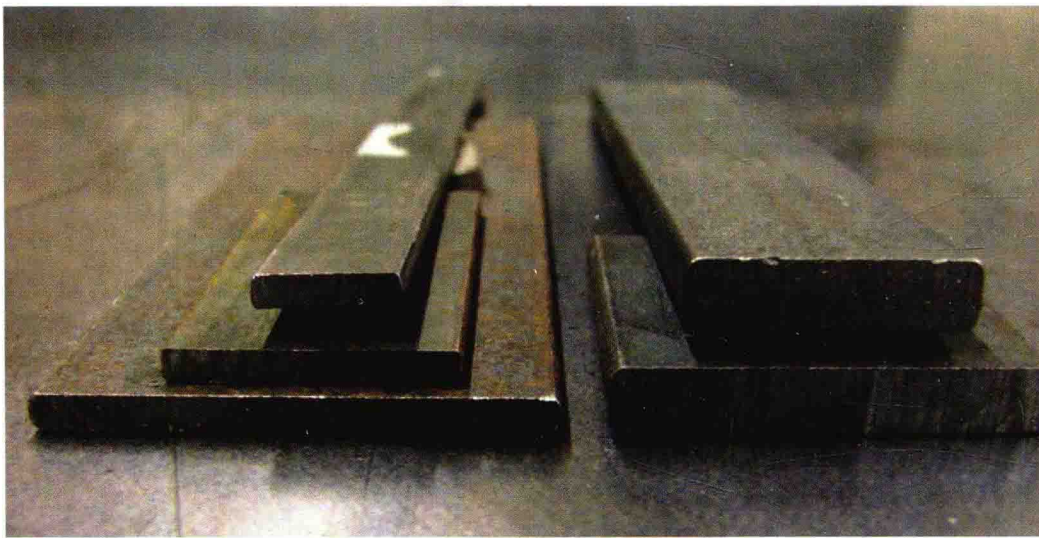


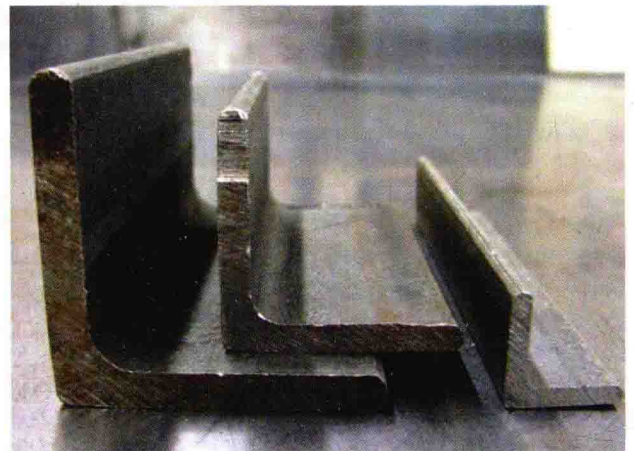
Figure 1-1. a. Square tube is identified by height, width, and thickness.
Example: 1" x 1" x 10ga sq tube.



b. Flat bar, also known as strap, is identified by thickness and width.
Example: 1/4" x 1" strap.



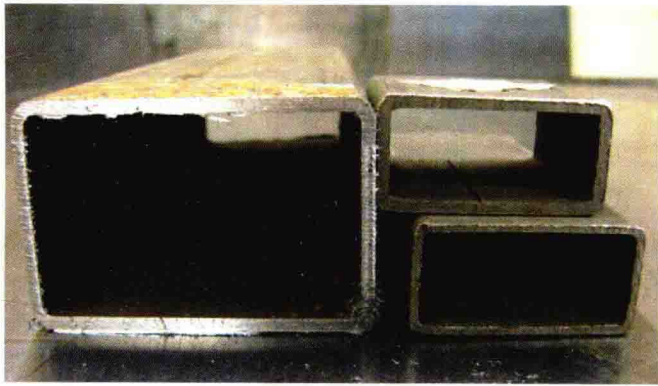
c. Round bar, also referred to as rod, is identified by its diameter.
Example: 1/4" rod.



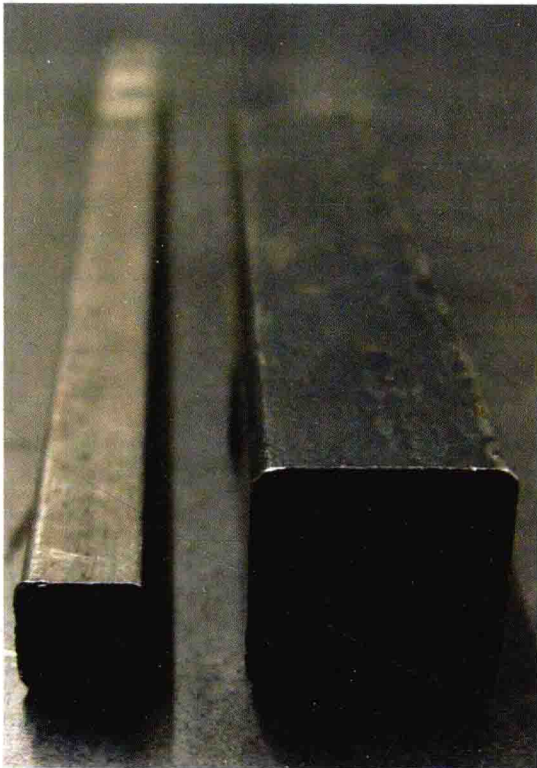
d. Angle iron is identified by height, width, and thickness.
Example: 1" x 1" x 3/16" angle.

e. Rectangular tube is identified by height, width, and thickness.

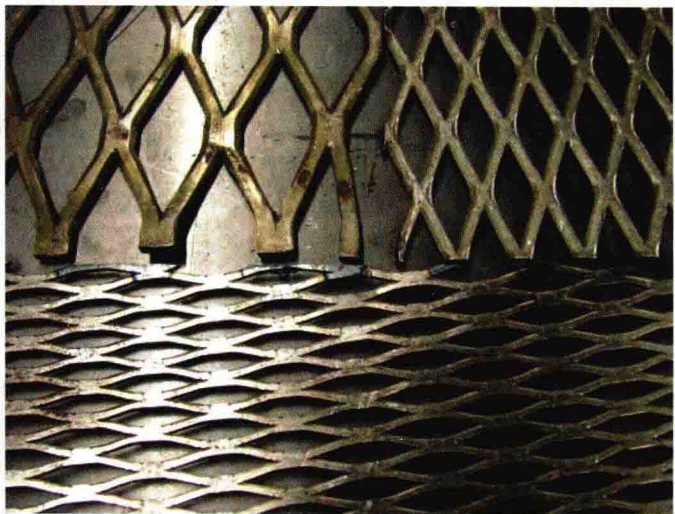
Example 1"x 2" x 14ga rectangular tube.



f. Pipe is identified by inside and outside diameters as well as wall thickness.



g. Square bar is identified by its height and width.
Example: 1/4" x 1/4" square bar.



h. Expanded metal is a sheet product that comes in a variety of sizes. It is identified by its web distance, metal thickness, and the sheet size. Example: 4' x 8'- 3/4" x 9ga Expanded or Expanded Flush. Expanded metal has raised webs whereas expanded flush has a smooth surface.



When building a project it is helpful to refer to a parts list (Figure 1-2a). It can help you determine your total steel requirements, including types of steel you will need. It will also allow you to easily find individual lengths and widths of different parts.

Before beginning a project, it is also helpful to review the plan views. These views help to identify how parts fit together as a whole (Figure 1-2b).

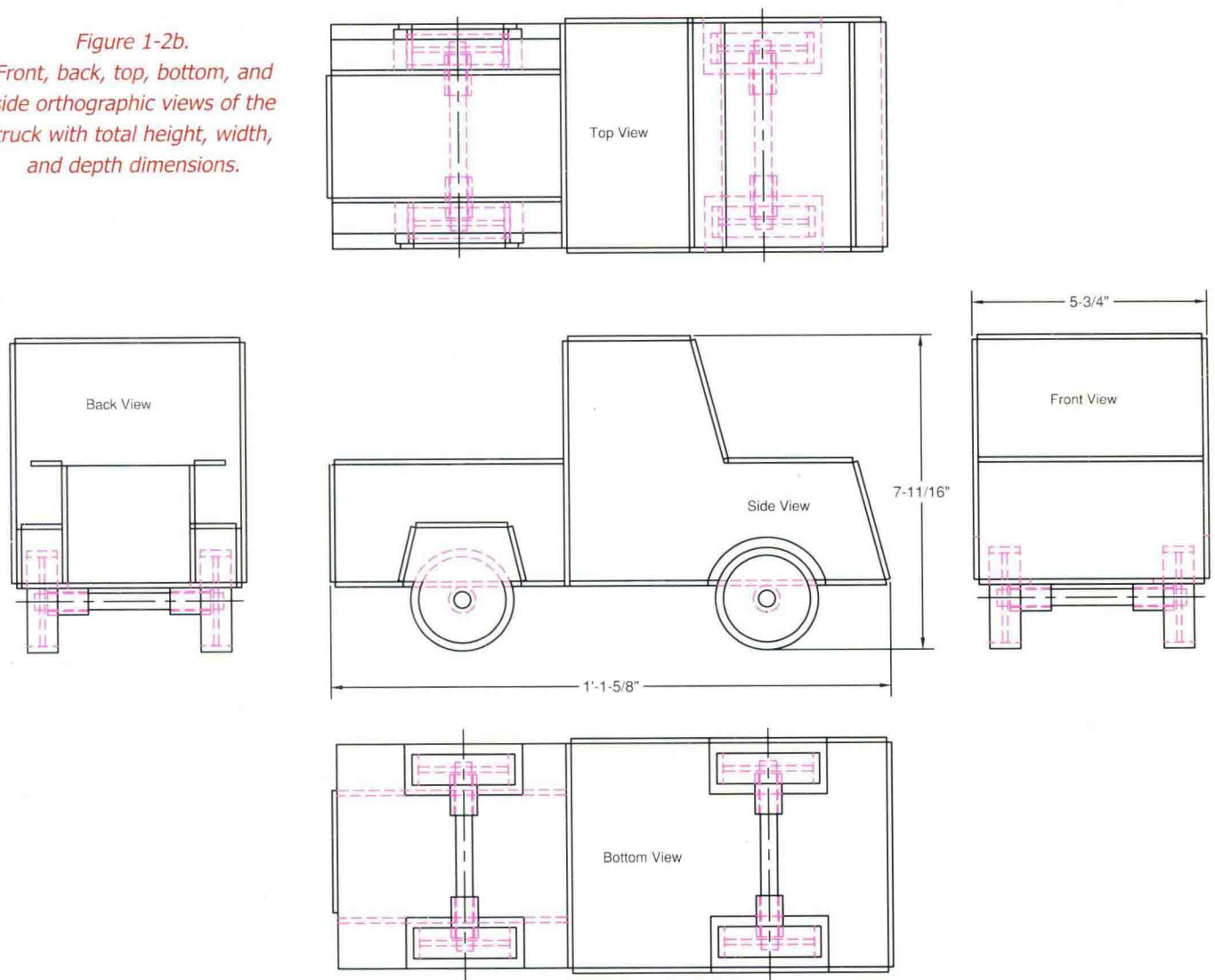
Truck Parts List					
No of Parts	Part Description	Material	Thickness	Width	Length
2	Cab Sides	Sheet Metal	10ga	0'-5 7/8"	0'-7 11/16"
1	Cab Bottom	Sheet Metal	10ga	0'-5 1/2"	0'-7 11/16"
1	Cab Back	Sheet Metal	10ga	0'-5 1/2"	0'-5 7/8"
1	Cab Top	Sheet Metal	10ga	0'-5 1/2"	0'-3"
1	Cab Windsheild	Sheet Metal	10ga	0'-5 1/2"	0'-3"
1	Cab Hood	Sheet Metal	10ga	0'-5 1/2"	0'-3"
1	Cab Front	Sheet Metal	10ga	0'-5 1/2"	0'-3"
1	Box Bottom	Sheet Metal	10ga	0'-5 1/2"	0'-5 9/16"
2	Box Sides	Sheet Metal	10ga	0'-2 7/8"	0'-5 9/16"
2	Box Rails	Flat Bar	1/8	0'-0 3/4"	0'-5 9/16"
1	Box Tailgate	Sheet Metal	10ga	0'-3"	0'-2 7/8"
2	Hub Sides	Sheet Metal	10ga	0'-1 7/16"	0'-2 7/8"
2	Hub Front	Flat Bar	1/8	0'-1"	0'-1 3/8"
2	Hub Back	Flat Bar	1/8	0'-1"	0'-1 3/8"
2	Hub Top	Flat Bar	1/8	0'-1"	0'-2 1/4"
4	Outside Wheel	2" Sch40 Pipe	0.154000	2.375 OD / 2.067 ID	0'-3/4"
4	Wheel center	Sheet Metal	10ga	0'-2 1/16" Ø	-
2	Axle	Round Bar	7/16Ø	-	0'-4 5/8"
4	Axle Support	3/8" Sch40 Pipe	0.091000	.675 OD / .493 ID	0'-1"

Figure 1-2a. Parts List.

CHAPTER 1 TRUCK

Figure 1-2b.

Front, back, top, bottom, and side orthographic views of the truck with total height, width, and depth dimensions.



Note: Some hidden lines were left out of views for clarity.

When ordering pipe, you should refer to a pipe reference chart to be sure of what you are getting. For example, 2" schedule 40 pipe has a 2.375 outside diameter and 2.06 inside diameter with a wall thickness of .154. 3/8 schedule 40 pipe has a .675 outside diameter and .091 inside diameter with a wall thickness of .091. The size of pipe doesn't match the diameter of pipe until it reaches 6" or larger.

HELPFUL HINT

