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Recommended Practices for Gas Tungsten Arc Welding

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Recommended Practices for Gas Tungsten Arc Welding

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Approved by
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Abstract

This document is designed to assist anyone who is associated with gas tungsten arc welding (GTAW). This includes welders, welding technicians, welding engineers, quality control personnel, welding supervisors, purchasing personnel, educators, and students.

This document discusses welding principles, equipment, gas shielding, and techniques for manual and automatic GTAW. Welding safety, troubleshooting, and related items are included for understanding by all types of personnel in establishing better production welding operations.

Educators will find this publication a handy reference for teaching all aspects of gas tungsten arc welding. It can become a quick reference for students after their graduation or during their employment.

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1. Monel and Inconel are registered trademarks of Special Metals Corporation.
2. Waferpure is a registered trademark of Mykrolis Corporation.

Recommended Practices for Gas Tungsten Arc Welding

1. Scope and Introduction

1.1 Scope. This document presents recommended practices for the gas tungsten arc welding (GTAW) process.[1] Its purpose is to provide a fundamental explanation of the process, describe basic practices and concepts, and outline some advanced methods and applications of GTAW. These should enable welding personnel to determine the best applications of this process and evaluate its use compared with other joining processes.

The section covering principles of operation will help the reader understand how the process works, the general types of equipment needed, and the advantages and limitations of the gas tungsten arc welding process. The basic concepts and practices include both general and specific recommendations and technical data for equipment, consumables, procedures, variables, applications, and safety considerations.

This standard makes use of U.S. Customary Units. Approximate mathematical equivalents in the International System of Units (SI) are provided for comparison in brackets [ ] or in appropriate columns in tables and figures.

1.2 Introduction to the Gas Tungsten Arc Welding (GTAW) Process. Welding as an occupation and a career is a very "special" and rewarding choice to pursue. It is one of the most interesting manufacturing disciplines as it involves both art and science. This is illustrated by manual gas tungsten arc welding (GTAW) because a person's manual dexterity, hand-eye coordination, and self-discipline in combination with the correct welding procedure(s) are paramount to its success. The "art" portion is most evident when an individual welder expresses their unique signature to the manually applied welds. Examples of this would be certain welded metal sculptures and/or a "perfectly" welded part or assembly. The "science" end of the spectrum would include recent developments such as fully automated robotic welding cells that could include through-the-torch vision that allows real-time viewing of the weld as well as real-time weld joint tracking. Also, weld parameter data acquisition and feedback control are routinely accomplished in real-time.

1.3 History. Although arc welding was first developed in the 1880s, its commercial use in the United States did not commence until the first decade of the 1900s. The years of the First World War brought the initial large-scale commercial use of arc welding, when shielded metal arc welding (SMAW) began to replace riveting as the means of joining in the manufacture of ships.

During the 1920s, H. M. Hobart and P. K. Devers performed preliminary work on using inert gases to shield the carbon or metallic electrode's welding arc and molten weld pool. In 1926 they applied for patents[2] on the use of an electric welding arc in which an inert gas was independently supplied around the arc, thus replacing flux as the shielding method. Other investigators experimented with both helium and argon as shielding gases, but because of the high costs associated with these inert gases, very little commercial use was made of them at that time.

By the onset of the Second World War, shielded metal arc welding had become the dominant welding process. However, there was a need within the aircraft industry for welds made with better shielding than that provided by SMAW when joining reactive metals such as aluminum and magnesium. Also, in the aircraft industry there was a need to develop an acceptable welding process to replace riveting for joining of thin gage materials. These needs led to the first commercial development of gas tungsten arc welding equipment.

1. Gas tungsten arc welding is defined as an arc welding process that uses an arc between a tungsten electrode (nonconsumable) and the weld pool. The process is used with shielding gas and without the application of pressure. (Ref. AWS A3.0, *Standard Welding Terms and Definitions*.)

2. H. M. Hobart, U.S. Patent 1,746,081, 2/4/1930 and P. K. Devers, U.S. Patent 1,746,191, 2/4/1930.