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Recommended Practices for Gas Tungsten Arc Welding



American Welding Society



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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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Table of Contents

	Page No.
<i>Personnel</i>	iii
<i>Foreword</i>	v
<i>List of Tables</i>	x
<i>List of Figures</i>	xi
1. Scope and Introduction	1
1.1 Scope	1
1.2 Introduction to the Gas Tungsten Arc Welding (GTAW) Process.....	1
1.3 History	1
2. Normative References	4
2.1 American Conference of Governmental Industrial Hygienists Standards	5
2.2 AWS Standards.....	5
2.3 ISO Standards.....	6
2.4 OSHA Standards	6
3. Definitions	6
4. GTAW Principles	9
4.1 Process Description	9
4.2 Process Advantages	9
4.3 Process Limitations	11
4.4 Process Variables.....	12
4.5 Related Variables.....	17
5. Equipment and Supplies.....	18
5.1 Welding Power Sources (Used for GTAW)—Introduction	18
5.2 Controllers.....	20
5.3 Pulse Controllers	22
5.4 Weld Sequence Controllers	22
5.5 Arc Welding Torches	23
5.6 Wire Feeders.....	30
5.7 Arc and Torch Oscillators.....	31
5.8 Arc Initiation Equipment.....	32
6. Tungsten Electrodes	33
6.1 General	33
6.2 Classifications of Electrodes	34
6.3 Surface Finishes	37
6.4 Electrode Sizes and Current Capacities	37
6.5 Electrode Tip Configurations	38
6.6 Electrode Cutting.....	41
6.7 Factors Affecting Electrode Life.....	41
6.8 Removing Contamination	42
6.9 Grinding Dust.....	42
6.10 Storage.....	43
7. Gas Shielding, Purging, and Backing	43
7.1 Torch Shielding Gas	43

	Page No.
7.2 Purging	50
7.3 Shielding and Purging Gas Purity	62
7.4 Shielding and Purging Gas Economics	65
7.5 Purifiers	65
7.6 Purging Gas Safety	67
8. Fixturing and Tooling.....	68
8.1 Material Selection	68
8.2 Tooling/Fixturing Considerations.....	68
8.3 Temporary (Soft)/Permanent (Hard) Tooling.....	69
9. Welding Techniques	71
9.1 General	71
9.2 Manual and Semiautomatic Welding	71
9.3 Mechanized Welding.....	80
9.4 Automated Welding.....	83
10. Joint Design, Preparation, and Welding Positions	85
10.1 Introduction	85
10.2 Basic Joint Configurations and Welding Positions	85
10.3 Edge Preparation and Surface Cleaning.....	85
11. Welding Characteristics of Selected Alloys	85
11.1 Introduction	85
11.2 Carbon and Alloy Steels.....	89
11.3 Stainless Steels and Iron-Based Superalloys.....	89
11.4 Aluminum Alloys	90
11.5 Magnesium Alloys	91
11.6 Beryllium.....	91
11.7 Copper Alloys	91
11.8 Nickel Alloys.....	92
11.9 Cobalt Alloys.....	92
11.10 Refractory and Reactive Metals	92
11.11 Cast Irons.....	92
11.12 Welding Dissimilar Materials.....	92
11.13 Filler Metals	92
12. Qualification of Procedures, Welders, and Welding Operators.....	94
12.1 Introduction	94
12.2 Welding Program.....	95
12.3 Establishing Welding Requirements	95
12.4 Welding Procedure Specifications (WPS).....	95
12.5 Procedure Qualification Records (PQR)	95
12.6 Welder and Welding Operator Qualification Tests.....	95
13. Quality Control	96
13.1 Introduction	96
13.2 Weldment Quality.....	96
13.3 Specifications	96
14. Troubleshooting	97
14.1 General	97
14.2 Electrical.....	97
14.3 Inert Shielding Gas Troubleshooting	102
14.4 Water Cooling Systems	105
14.5 Tools and Fixtures	106

	Page No.
14.6 Filler Material.....	106
14.7 Design of Welded Assemblies.....	106
14.8 Weld Joint Fit-up.....	108
15. Safety	108
15.1 Hazards.....	108
15.2 Electrical Shock.....	108
15.3 Arc Radiation and Burns	108
15.4 Welding Environment.....	109
15.5 Oxygen Deficiency.....	110
15.6 Noise.....	110
15.7 Safe Handling of Cylinders	110
15.8 Fires And Explosions	110
15.9 Common Sense.....	110
15.10 Grinding Dust.....	110
<i>Nonmandatory Annexes</i>	<i>113</i>
<i>Annex A—Guidelines for Preparation of Technical Inquiries for AWS Technical Committees.....</i>	<i>113</i>
<i>Annex B—Suggested Reading List and Other References</i>	<i>115</i>
<i>List of AWS Documents on Arc Welding and Arc Cutting</i>	<i>117</i>

List of Tables

Table		Page No.
1	Welding Process Comparison Based on Quality and Economics	11
2	Comparison of Typical Current Ratings for Gas-Cooled and Water-Cooled GTAW Torches	25
3	Typical Welding Cable Capacities	29
4	Guide for Selecting the Size of Cable Based on the Welding Current.....	30
5	Chemical Composition Requirements for Tungsten Electrodes	34
6	Typical Current Ranges for Tungsten Electrodes and Recommended Gas Cup Sizes	35
7	Comparison of Surface Finish Designations.....	37
8	Recommended Types of Current, Tungsten Electrodes, and Shielding Gases for Welding of Various Metals and Alloys	39
9	Tungsten Electrode Tip Shapes and Examples of Current Ranges	39
10	General Properties of Gases	44
11	Thermodynamic Properties of Gases	44
12	Dew Point Conversions	45
13	Advantages of Shielding Gases.....	46
14	Typical Argon Flow Rates.....	50
15	Gas Purity Specification by Industrial Grade.....	62
16	Purity Requirements for Gaseous Argon	62
17	Purity Requirements for Gaseous Helium	63
18	Purity Requirements for Gaseous Hydrogen	63
19	Welding Equipment or Components	72
20	AWS Specifications Related to Gas Tungsten Arc Welding	88
21	Troubleshooting	98
22	Guide for Shade Numbers.....	109

List of Figures

Figure	Page No.
1 Early Gas Tungsten Arc Welding Torches and Accessories, Circa 1943, with a Torch Body and an Early Flowmeter	2
2 Early Gas Tungsten Arc Welding Torches	2
3 SMAW Power Source Used for Early Gas Tungsten Arc Welding	3
4 Motor-Generator SMAW Power Source Used for Early Gas Tungsten Arc Welding	3
5 Gas Tungsten Arc Welding Power Source—Pulsed	4
6 Gas Tungsten Arc Welding Power Source	4
7 Stylized Representation of the Gas Tungsten Arc Welding Process	9
8 Gas-Cooled GTAW Torch and Stylized Representation of Typical Gas Tungsten Arc Welding Equipment	10
9 Clean Weld Beads Typical of Properly Shielded GTAW Welds	11
10 Characteristics of Current Types Used for Gas Tungsten Arc Welding	13
11 Relationship Between Arc Pressure and Pulse Frequency	14
12 Programmed (Modulated) Current without Polarity Reversal	15
13 Characteristics of Variable Polarity (Programmed) Weld Current	16
14 Arc Shape and Fusion Zone Profiles as a Function of Electrode Tip Geometry in Pure Argon Shielding Gas	17
15 Typical Volt-Amp Characteristic Curves for GTAW Power Sources	18
16 Typical Inverter Power Source Components	20
17 Typical Wire Feeder	22
18 Typical GTAW Sequence for Non-Pulsed DC Welding	23
19 Typical GTAW Sequence for Pulsed DC Current and Pulsed Wire Feed	24
20 Typical Water-Cooled GTAW Torch (Cross-Sectional View)	25
21 Examples of GTAW Torches	26
22 Orbital Weld Head with Wire Feeder	27
23 Components of a Typical GTAW Torch, Including Gas Nozzle/Cup, Gas Lens, Collet Body, Torch Body, Collet, and Electrode	27
24 GTAW Torch Without a Gas Lens (Left) and with a Gas Lens (Right)	28
25 GTAW Torch with Cold Wire Feed	31
26 Schematic of GTAW with Hot Wire Feed	31
27 Magnetically Deflected Arc Laying a Stringer Bead in a Deep Groove Weld	32
28 Cross Sections of Welds Made in 1/2 in. [13 mm] Thick Stainless Steel; (A) with Magnetic Arc Oscillation, and (B) without Magnetic Arc Oscillation	32
29 High-Frequency Arc Starting	33
30 Balled Tip on the End of a Pure Tungsten Electrode Used for AC Welding	36
31 Ground Tapered Tip on End of Doped Tungsten Electrodes	38
32 Ground Electrode Tip Geometry	39
33 Typical Preparation Method of Tungsten Electrodes Used for GTA Welding, Including Tip Truncation, Grinding, and Cutting	40
34 The Desired Surface Finish of a Ground Electrode	41
35 Proper Cutting of Tungsten Electrodes with a Diamond Cut-Off Blade	42
36 GTA Weld Bead Shape as a Function of Shielding Gas Composition and Electrode Tip Geometry (on 304 Stainless Steel)	47
37 GTA Voltage—Current Relationships with Argon and Helium Shielding Gases for Different Arc Lengths	48

Figure	Page No.
38 Improved Surface Cleanliness on Monel ^{®1} Welds Produced with the 5% Hydrogen Mixture in Argon Shielding Gas with GTAW	49
39 The Effects of Shielding Gas Contamination on Titanium Weldments (Color Chart for Titanium Welding Acceptance).....	51
40 GTAW Weld Underbead Contamination with Various Levels of Oxygen Contents in the Purging Gas.....	52
41 Purging Times for Various Pipe Sizes.....	54
42 Purging a Piping System with Open Ends Blanked	55
43 Purging of a Piping System with Appropriate Venting to Eliminate Dead Air Pockets	55
44 Purging with Removable Plugs	56
45 Purging with Removable Chamber	56
46 Purge Distributor Ring	56
47 Purging with Water Soluble Paper Dams	57
48 Purging with a Backing Channel.....	57
49 Purging with a Gas Distributor (Diffuser).....	58
50 Typical Inert Gas Glove Box Chamber	58
51 Flexible Plastic Purge Bag	59
52 Trailing Shields—Bottom View of Inert Gas Trailing Shield Fabricated Using Stainless Porous (100 micron) Tubing (Shown with High Temperature Tape).....	60
53 Trailing Shields—Inert Gas Trailing Shield Fabricated Using Stainless Porous (100 micron) Tubing (Shown with High Temperature Tape)	60
54 Trailing Shields—Inert Gas Trailing Shield Fabricated Using Stainless Porous (40–100 micron) Sheet Metal	61
55 Shielding with the Use of a Backing Tape	61
56 Point-of-Use (POU) Purifiers (Waferpure ^{®2} Reactive Resin Type) Below a Welding Fixture.....	66
57 Point-of-Use Gas Purifier (Heated Metal Getter Type)	67
58 Cylinder Status Tag (The Use of a Simple Tagging System Can Be Very Helpful)	68
59 Weld Distortion in Ti-6Al-V Bead-on-Plate (Sheet) Weld	69
60 Tooling for GTAW of Fuel Cell Components to Control Distortion of Weldment	70
61 Run-On/Run-Off Tabs Used for Welding Ends of Strip Material.....	70
62 Walking-the-Cup Technique	74
63 Dragging-the-Finger Technique	74
64 Folding Fingerstall Technique.....	75
65 Brace Technique Showing Wrist in Contact with Workpiece to Stabilize the Torch.....	75
66 Small Rotary Positioner Used for Workpiece Manipulation.....	76
67 Mechanical Manipulation in a Mechanized Welder.....	76
68 Gas Tungsten Arc Welding Torch with Wire Feeders [(A) and (B)] for Spooled Wire	78
69 Cross Sections of Typical Consumable Inserts	79
70 Lathe-Type Welding Setup.....	81
71 Orbital GTAW Weld Head	84
72 Basic Joint Types.....	86
73 Weld Joint Edge Preparation (U-Groove, J-Groove, and V-Groove).....	87
74 Effects of Sulfur Content on Bead-on-Plate Weld Bead Shape in 304L Made with the Same Parameters	90
75 GTAW in 6061-0 Aluminum Showing the Surface Contours with Pulsed Direct Current Straight Polarity (DCEN).....	91
76 High Quality Welds in Inconel ^{®1} 718, Original Scale 5X	93
77 High Quality Welds in Cobalt Alloy HS188, Original Scale 5X.....	93
78 Manual GTAW of Titanium in an Inert Gas Chamber (Glove Box)	94
79 Criteria for Acceptable GTAW in Titanium via Tack Welds Only	104

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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. Exam-

ples 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 patents² 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.