

A welder wearing a grey protective suit and a dark helmet is shown in a close-up, working on a metal piece. The welder is holding a TIG torch in their right hand and a tungsten electrode in their left hand. The background is blurred, suggesting an industrial setting. The text "TIG Welding" is overlaid in large white letters, and the names "Kyle Westmoreland" and "Brad Watson" are listed below it in smaller white text.

# TIG Welding

Kyle Westmoreland

Brad Watson

# Overview

## TIG=Tungsten Inert Gas Welding

Uses a tungsten electrode to produce an electric arc. The weld is shielded by a gas typically argon and a welding rod is added to produce the weld

## Uses

- TIG welding can be used to weld Magnesium, Aluminum, Steel, Stainless Steel, Brass alloys, Silver, Cast Iron and Copper
- Can weld very thin sections and metals that can not be easily welded with other types of welding.



# Safety Concerns

- Always be sure to wear flame resistant clothing like cotton when welding. Synthetic materials burn easily and can melt to your skin.
- Before Welding be sure area is properly ventilated. Use adjustable exhaust fan when welding in shop.
- Always wear welding gloves and a welding helmet with a lens shade of 10 or 11.
- Caution: Welding produces high temperatures even after welding is completed
- Ensure the piece you are welding is safe to weld (ie: a container containing flammable liquid).



# Welding Area

Helmets

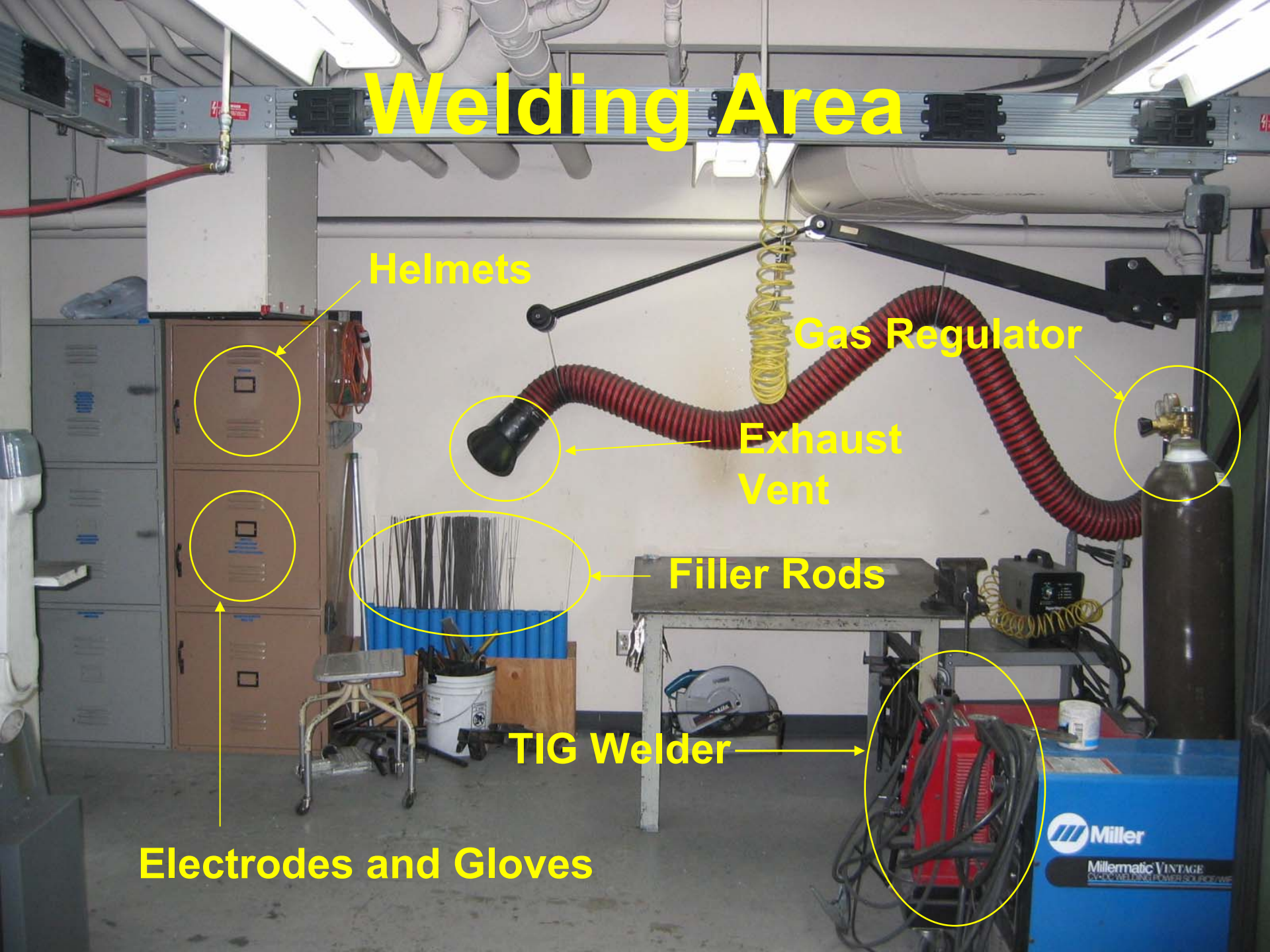
Gas Regulator

Exhaust Vent

Filler Rods

TIG Welder

Electrodes and Gloves



# Getting Started

- Choose the correct electrode and filler rod based on the type of material and thickness of weld (see Aluminum TIG Specifications)
- Prep surface by removing any corrosion or oil with a wire brush to ensure a clean strong weld.
- Ensure others around you know you are welding and there is no potentially flammable materials.

# Setting up the Machine

- **Steel:** Use DC straight polarity and an electrode with a red end (2% Thoriated). When welding steel with DC straight polarity make sure the tip is ground to a conical point (see Preparing Steel Electrode).
- **Aluminum:** Use AC current and an electrode with a green end (100% Tungsten) Ensure that the tip is round properly (see Preparing Aluminum Electrode).
- **Other Material:** Consult welding reference or experienced welder.

\*Amperage varies depending on material thickness and type of weld.



# Aluminum TIG Specifications

Stock Thickness	Joint Type	Amperes AC Current			Electrode (in.)	Argon Flow(20psi)		Filler Rod(in)
		Flat	Horizontal & Vertical	Overhead		lpm	cfh	
1/16"	Butt	60-80	60-80	60-80	1/16	7	15	1/16
	Lap	70-90	55-75	60-80	1/16	7	15	1/16
	Corner	60-80	60-80	60-80	1/16	7	15	1/16
	Fillet	70-90	70-90	70-90	1/16	7	15	1/16
1/8"	Butt	125-145	115-135	120-140	3/32	8	17	1/8
	Lap	140-160	125-145	130-160	3/32	8	17	1/8
	Corner	125-145	115-135	130-150	3/32	8	17	1/8
	Fillet	140-160	115-135	140-160	3/32	8	17	1/8
3/16"	Butt	190-220	190-220	180-210	1/8	10	21	5/32
	Lap	210-240	190-220	180-210	1/8	10	21	5/32
	Corner	190-220	180-240	180-210	1/8	10	21	5/32
	Fillet	210-240	190-220	180-210	1/8	10	21	5/32
1/4"	Butt	260-300	220-260	210-250	3/16	12	25	3/16
	Lap	290-340	220-260	210-250	3/16	12	25	3/16
	Corner	280-320	220-260	210-250	3/16	12	25	3/16
	Fillet	280-320	220-260	210-250	3/16	12	25	3/16

\*Miller,R.T. Welding Skills 2<sup>nd</sup> Edition. 1997 American Technical Publishers Inc. Homewood, Illinois 60430

**Note:** When welding thicker aluminum with shop welder(>.25 in) try to preheat material with oxy-acetylene torch.

# Adjusting Torch

- Insert electrode by unscrewing the end of the torch and then sliding electrode into the collet.
- For general use the electrode should extend  $\frac{1}{8}$  to  $\frac{3}{16}$  of an inch beyond the cup to ensure the shielding gas shields the weld.



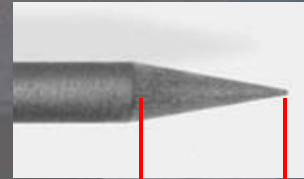
$\frac{1}{8}$ - $\frac{3}{16}$  in



# Preparing Steel Electrode

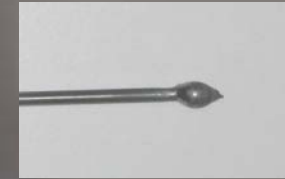
- Make sure tip is free for build up and ground to fine point
- Using machine sharpening grinder to grind to a point

Correct Tip



≈ 2.5 x Diameter

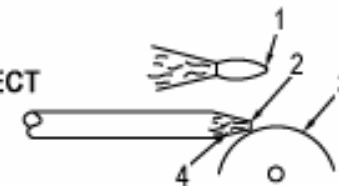
Incorrect Tip



## Tungsten Grinding

Diagram 5

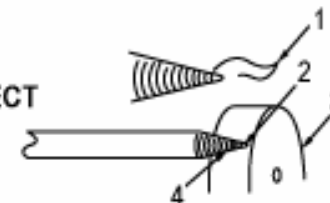
CORRECT



1. Stable Arc
2. Flat
3. Grinding Wheel
4. Straight Ground

Ideal Tungsten Preparation - Stable Arc

INCORRECT



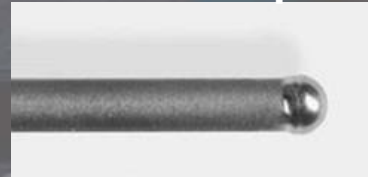
1. Arc Wander
2. Point
3. Grinding Wheel
4. Radial Ground

Wrong Tungsten Preparation - Welding Arc

# Preparing Aluminum Electrode

- Aluminum tip created using a piece of copper to generate an arc.
- Set amperage to max setting.
- Hold Electrode 1/8 in from copper and press peddle.
- Heat generated causes tip to melt in to smooth ball.

Correct Tip



Incorrect Tip



# Welding Technique



Hold torch approximately 75-80 degrees from horizontal and the filler rod 15-20 degrees from horizontal.

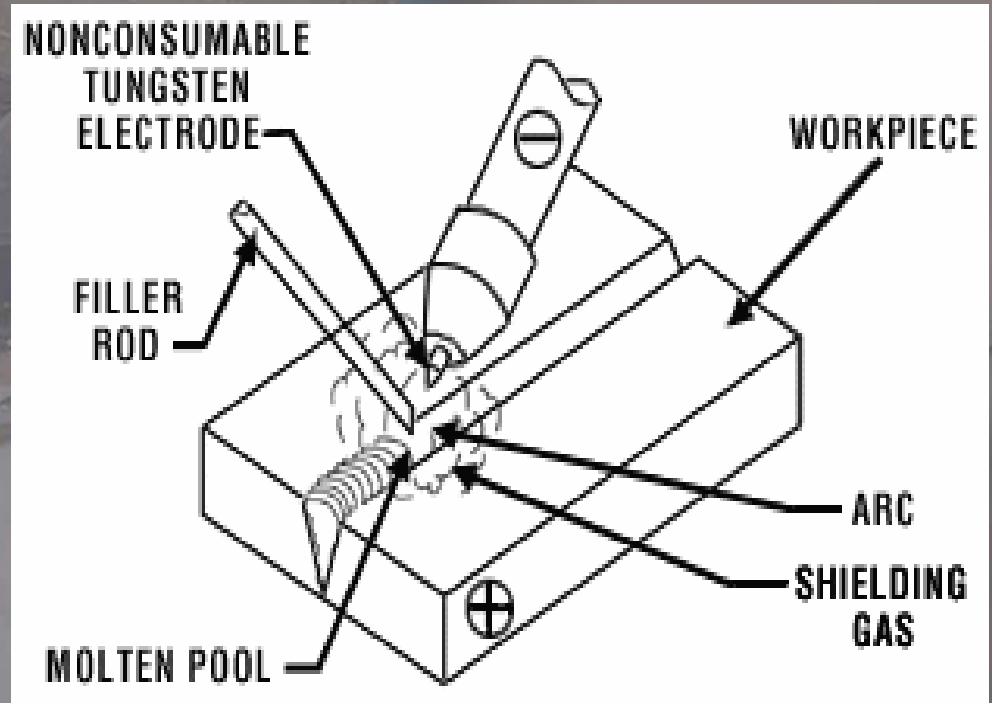
# Welding Technique

- Hold the tip of the electrode about 1/8" away from piece and press the pedal down until an arc is created between the electrode and work piece. Keep peddle depressed until puddle is created.
- Ensure the tip of the electrode does not touch the molten weld puddle. This cause electrodes to become contaminated with weld material.



# Welding Technique

- After puddle is created use a circular motion or repeated crescent motion to move puddle while adding filler rod.



- When welding thinner materials a heat sink, consisting of a metal block, can be used to dissipate excess heat. Place this heat sink underneath material when welding.

# Welding Demonstration

TIG Welding Demonstration



# Additional References

- Mentors for 2005-2006:

- Phil Arpke
- Mike Harper

- Books

Miller, R.T. Welding Skills 2nd Edition. 1997  
American Technical Publishers Inc. Homewood,  
Illinois 60430

- Welding Skills 2<sup>nd</sup> Edition

Author: R.T. Miller

Publisher: American Technical Publishers Inc.

- U of I Course

- Agricultural Systems Management 107 (ASM 107)

A welder wearing a brown protective helmet and a dark face mask is working on a metal component. The welder is wearing a light-colored long-sleeved shirt. The background is a blurred industrial setting. The text "Thanks to:" is overlaid in white on the image.

Thanks to:

Phil Arpke

Adrian Gomez

Mike Harper

Russ Porter