### **LESSON PLAN**

Date\_\_\_\_\_ Name Trade:- Welder Unit/Lesson:-Forty One

Subject:- Argon/helium gas properties and uses. GTAW defects ,causes and remedies.

Motivation:- In previous lesson we discuss GTAW process and other details like Tungsten

electrode, welding parameters and equipments, polarity, Torches etc.

#### PREPARATION

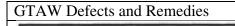
1) (Materials, Tools, Models, Charts and other aids)

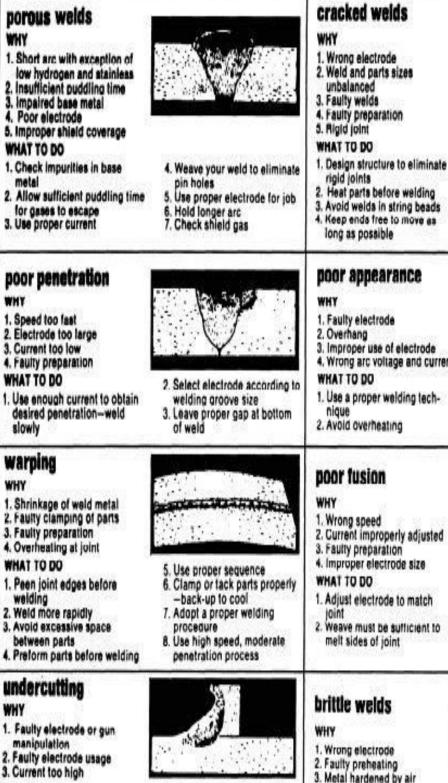
## INTRODUCTION:- Argon and helium gases are inert gases and use for shield the weld area. GTAW defects are causes due to wrong selection of electrode, positions and filler metals.

Торіс	Informatic	Information Point				
Argon gas	shielding t	Information PointSpot HintArgon and helium gases are inert gases and shielding the weld area during Welding from oxidations.				
Properties of Argon an	d Helium gases					
Chemical Formula		Ar				
Minimum Purity		99.997%				
Normal Boiling Point		-302 °F (-185 °C)				
Liquid Cylinder Outlet CGA		295 (Liquid)				
MSDS		P-4564				
CAS Number		7440-37-1 (R)				
UN Number		1951				
US DOT Name		Argon, Refrigerated Liquid				
US DOT Label		Nonflammable Gas				
US DOT Class		2.2 Nonflammable Gas				
Cylinder Style	Volume (ft <sup>s</sup> )	Pressure (psig)	Part Number			
160 Liter	4,460	230	AR LC160-230			
200 Liter	4,961	230	AR LC200-230			
230 Liter	5,290	230	AR LC230-230			
250 Liter	6,080	230	AR LC250-230			
450 Liter Microbulk	12,478	350	AR LC450-350			
1000 Liter Microbulk	28,225	350	AR LC1000-350			
1500 Liter Microbulk	42,950	350	AR LC1500-350			

Property	Helium	Neon	Argon	Krypton	Xenon	Radon
Density (g/dm³)	0.1786	0.9002	1.7818	3.708	5.851	9.97
Boiling point (K)	4.4	27.3	87.4	121.5	166.6	211.5
Melting point (K)	0.95	24.7	83.6	115.8	161.7	202.2
Enthalpy of vaporization (kJ/mol)	0.08	1.74	6.52	9.05	12.65	18.1
Solubility in water at 20 °C (cm <sup>3</sup> /kg)	8.61	10.5	33.6	59.4	108.1	230
Atomic number	2	10	18	36	54	86
Atomic radius (calculated) (pm)	31	38	71	88	108	120
lonization energy (kJ/mol)	2372	2080	1520	1351	1170	1037
Allen electronegativity	4.16	4.79	3.24	2.97	2.58	2.60

	Xe	Ar	Не	N <sub>2</sub>
Atomic number	54	18	2	7
Atomic mass, amu	131.29	39.948	4.003	14.01
Atomic radius, pm	131	88	49	75
Gas density, (liquid density),	5.54,	1.784,	0.1785,	1.251,
kg/m <sup>3</sup>	(3057)	(1394)	(122 <b>)</b>	(806.5)
Ratio of molar heat	1.667	1.667	1.667	1.4
capacities, (γ)				
T <sub>crit</sub> , °C @ atm	16.6, (8°C	(-122°C	-267.96	(-146.9°C
	@ 50bar)	@ 50bar)		@ 50bar)
T <sub>boll</sub> , °C	-108	-186	-268.785	-195.8
T <sub>melt</sub> , °C	-111.7	-189.3	-272.05	-210.1
Thermal conductivity, W/mK	0.00565	0.01772	0.14	0.02583





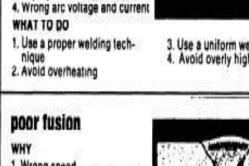
- WHAT TO DO
- 1. Use a uniform weave in butt
- welding 2. Avoid using an overly large alectrode
- 3. Avoid excessive weaving
- 4. Use moderate current, weld slowly
- 5. Hold electrode at sale distance from vertical plane in making horizontal fillet weld

# 7. Allow joints a proper and uniform gap 8. Work with amperage as low as possible 3. Use a uniform weave 4. Avoid overly high current

- 3. Select proper current and
- voltage
- 4. Keep weld metal from flowing away from plates



3. Stress relieving after welding 4. Use low hydrogen processes for increased weld ductility

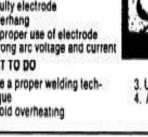


- 1. Adjust electrode to match
- 2. Weave must be sufficient to

3. Metal hardened by air

## WHAT TO DO

1. Preheat at 300° to 500° F. if welding on medium carbon steel or certain alloy steels 2. Make multiple layer welda



6. Adjust weld size to parts size

5. Make sound walds of good

fusion

Weld Jo	oint Discon	tinuities
Weld Jo Misalignment (hi-lo) Undercut Underfill Concavity or Convexity Excessive reinforcement Improper reinforcement Overlap Burn-through Incomplete or Insufficient Penetration Incomplete Fusion	<ul> <li>Inclusions</li> <li>Slag</li> <li>Wagon tracks</li> <li>Tungsten</li> <li>Spatter</li> <li>Arc Craters</li> <li>Cracks</li> <li>Longitudinal</li> <li>Transverse</li> <li>Crater</li> <li>Throat</li> <li>Toe</li> </ul>	<ul> <li>base Metal Discontinuities</li> <li>Lamellar tearing</li> <li>Laminations and Delaminations</li> <li>Laps and Seams</li> <li>Porosity</li> <li>Uniformly Scattered</li> <li>Cluster</li> <li>Linear</li> <li>Piping</li> <li>Heat-affected zone</li> </ul>
Surface irregularity – Overlap Arc Strikes	<ul> <li>Root</li> <li>Cold or delayed</li> <li>Underbead and Heat-affected zone</li> </ul>	microstructure alteration • Base Plate laminations • Size or dimensions

Questions:-

- 1. Write the boiling point of argon gas?
- 2. What is penetration and how it is important?
- 3. Write two GTAW defects and their causes?

Next Lesson:- Friction Welding process, equipments and application. Laser beam welding and electron beam welding.

Assignments:- Argon/helium gas properties and uses. GTAW defects ,causes and remedies.

Checked by.....

Instructor.....