

LESSON PLAN

Date _____

Trade:- Welder

Name _____

Week No:- Five

Subject :- Common gases use for welding and cutting. Flame temperature and uses. Chemistry of oxy-acetylene flame. Types of oxy-acetylene flame and uses. oxy-acetylene cutting equipments, parameters and applications.

Motivations:-

in previous week we learned about Basic electricity to applicable in Arc welding and related electric terms and definitions. Heat and temperature and its term related to welding. Principle of arc welding and characteristics of arc.

PREPARATION:- Teaching Aids:-Chalk ,Charts,

INTRODUCTION:- In gas welding and cutting there are two types gases used, first combustibles and second support of combustibles.

PRESENTATION:-

Topic	Information Point	Spot Hint																																																						
Common gases	Gases are three types. 1. Combustible. 2. Support of combustible. 3. Inert																																																							
Uses of gases in welding and cutting	<p>Coal gas-flame temperature 1800-2200⁰C Use- under water steel cutting and silver soldering of steel Hydrogen Gas- flame temperature 2400-2700⁰C Use-underwater cutting, steel brazing and soldering. Butane gas- Flame temperature 2700-2800⁰C. Use- steel gas cutting. Propane gas- flame temperature 2450-2775⁰C. Mostly in gas welding and cutting oxy-acetylene gas used.</p> <table border="1"> <thead> <tr> <th></th> <th>MAPP Gas</th> <th>Acetylene</th> <th>Natural Gas</th> <th>Propane</th> <th>Flamex</th> </tr> </thead> <tbody> <tr> <td>Shock sensitivity</td> <td>Stable</td> <td>Unstable</td> <td>Stable</td> <td>Stable</td> <td>Stable</td> </tr> <tr> <td>Explosive limits in oxygen, %</td> <td>2.5-60</td> <td>3.0-93</td> <td>5.0-59</td> <td>2.4-57</td> <td>*</td> </tr> <tr> <td>Explosive limits in air, %</td> <td>3.4-10.8</td> <td>2.5-80</td> <td>5.3-14</td> <td>2.3-9.5</td> <td>*</td> </tr> <tr> <td>Maximum allowable regulator pressure, psi</td> <td>Cylinder [225 psig (1.653 MPa) at 130 °F (54 °C)]</td> <td>15</td> <td>Line</td> <td>Cylinder</td> <td>Cylinder</td> </tr> <tr> <td>Burning velocity in oxygen, ft/sec</td> <td>7.9 (2.4 m/sec)</td> <td>17.7 (5.4 m/sec)</td> <td>8.2 (2.5 m/sec)</td> <td>5.9 (1.8 m/sec)</td> <td>14.5 (4.4 m/sec)</td> </tr> <tr> <td>Tendency to backfire</td> <td>Slight</td> <td>Considerable</td> <td>Slight</td> <td>Slight</td> <td>Slight</td> </tr> <tr> <td>Toxicity</td> <td>Low</td> <td>Low</td> <td>Low</td> <td>Low</td> <td>Low</td> </tr> <tr> <td>Reactions with common materials</td> <td>Avoid alloys with more than 67 % copper</td> <td>Avoid alloys with more than 67 % copper</td> <td>Few restrictions</td> <td>Few restrictions</td> <td>*</td> </tr> </tbody> </table> <p>* Information Not Available.</p>		MAPP Gas	Acetylene	Natural Gas	Propane	Flamex	Shock sensitivity	Stable	Unstable	Stable	Stable	Stable	Explosive limits in oxygen, %	2.5-60	3.0-93	5.0-59	2.4-57	*	Explosive limits in air, %	3.4-10.8	2.5-80	5.3-14	2.3-9.5	*	Maximum allowable regulator pressure, psi	Cylinder [225 psig (1.653 MPa) at 130 °F (54 °C)]	15	Line	Cylinder	Cylinder	Burning velocity in oxygen, ft/sec	7.9 (2.4 m/sec)	17.7 (5.4 m/sec)	8.2 (2.5 m/sec)	5.9 (1.8 m/sec)	14.5 (4.4 m/sec)	Tendency to backfire	Slight	Considerable	Slight	Slight	Slight	Toxicity	Low	Low	Low	Low	Low	Reactions with common materials	Avoid alloys with more than 67 % copper	Avoid alloys with more than 67 % copper	Few restrictions	Few restrictions	*	
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oxy-acetylene Flame

This flame is highest temperature flame in gas welding/cutting.

Chemistry of Flame :-

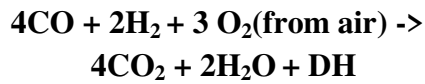
Complete combustion



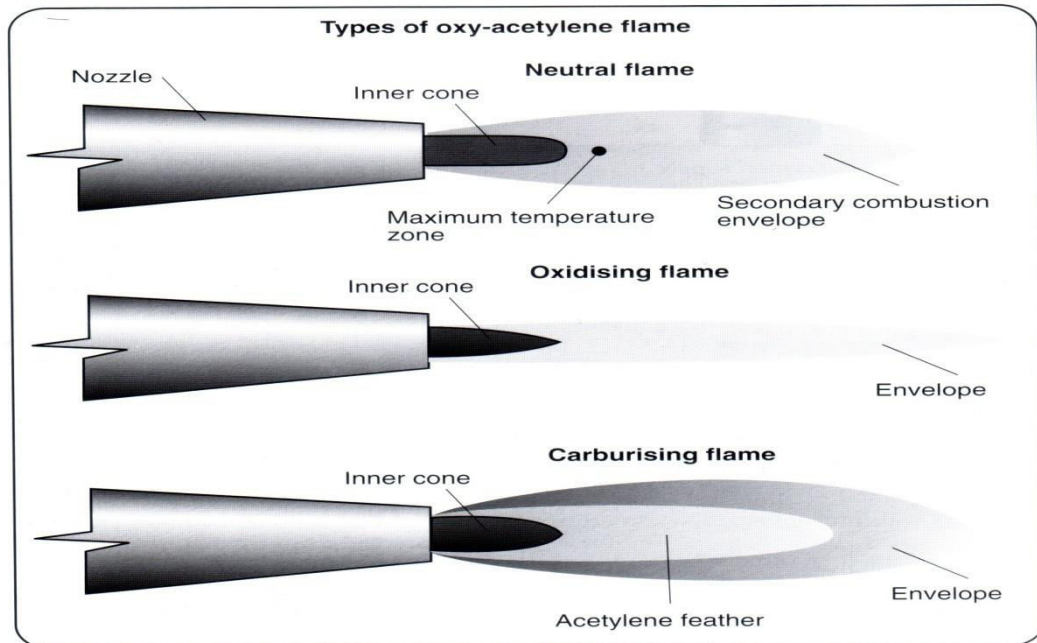
Primary combustion:



Secondary combustion:



Types of Flame:-



Base Metal	Filler Metal Type	Flame Type	Flux Type
Aluminums	Match base metal	Slightly reducing	Al. flux
Brasses	Navy brass	Slightly oxidizing	Borax flux
Bronzes	Copper tin	Slightly oxidizing	Borax flux
Copper	Copper	Neutral	None
Copper nickel	Copper nickel	Reducing	None
Inconel	Match base metal	Slightly reducing	Fluoride flux
Iron, cast	Cast iron	Neutral	Borax flux
Iron, wrought	Steel	Neutral	None
Lead	Lead	Slightly reducing	None
Monel	Match base metal	Slightly reducing	Monel flux
Nickel	Nickel	Slightly reducing	None
Nickel silver	Nickel silver	Reducing	None
Steel, low alloy	Steel	Slightly reducing	None
Steel, high carbon	Steel	Reducing	None
Steel, low carbon	Steel	Neutral	None
Steel, medium carbon	Steel	Slightly reducing	None
Steel, stainless	Match base metal	Slightly reducing	SS flux

oxy-acetylene cutting equipments:- The oxygen and acetylene hose pipes

Gases used

Gas pressure Regulators

Flashback arrestor

Welding torch/Welding nozzle

The oxygen and acetylene hose pipes Reinforced rubber hoses.

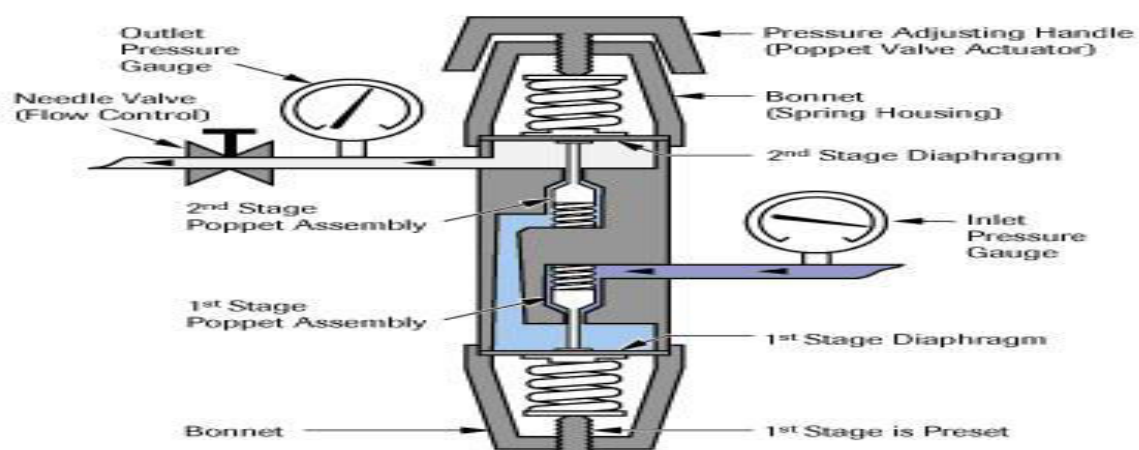
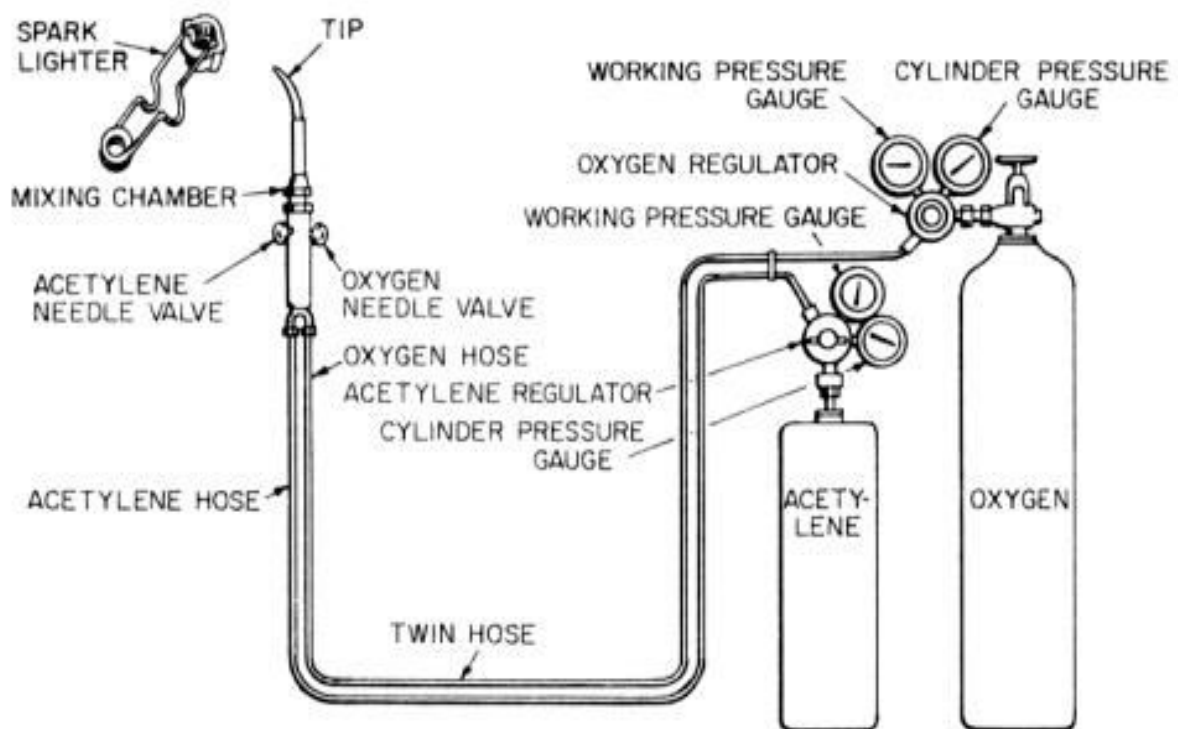
Acetylene hose has left hand thread couplings and colour coded red.

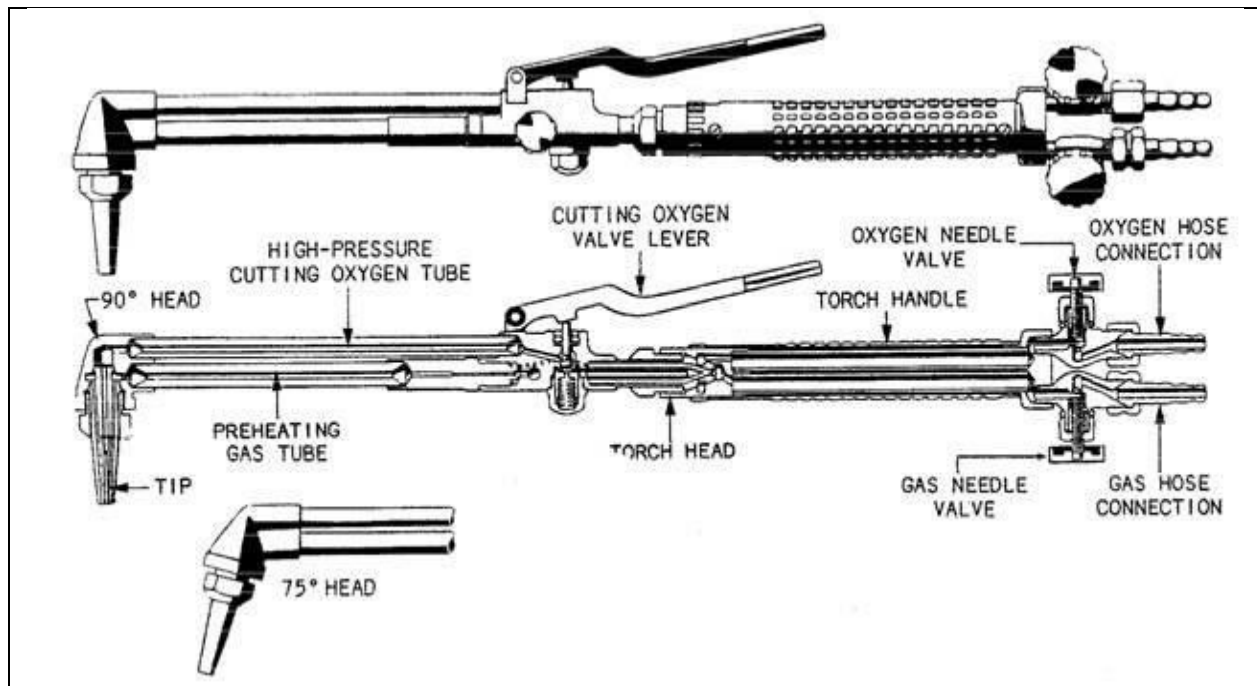
Oxygen hose has right handed thread couplings and colour coded blue.

Gas Pressure Regulators :- One gauge indicates the pressure of the cylinder and the other indicates the pressure in the supply pipe to the torch.

Welding torch :- Oxygen and acetylene are delivered to the torch by separate hoses. Each gas is controlled by a valve on the torch. The two gases mix in the torch and after they are ignited burn at the nozzle.

Flashback Arrestors :- These are positioned on both the fuel gas and oxygen supply between the hose and the regulator. Their purpose is to prevent the return of a flame through the hose into the regulator.





Cutting parameters:-

Tip Series: MTHM, N, P - Torch Series MT 300									
Metal Thickness	Tip Size	Cutting Oxygen (PSIG)***	Cutting Oxygen (SCFH)	Pre-Heat Oxygen (PSIG)*	Pre-Heat Oxygen (SCFH)	Fuel Gas (PSIG)	Fuel Gas (SCFH)****	Speed I.P.M.	Kerf Width
1/4"	00	85/95	68/75	30/35	23/140	8 oz +	12/65	23/30	.05
3/8"	00	85/95	68/75	30/35	23/140	8 oz +	12/65	22/29	.05
1/2"	0	85/95	110/120	30/35	23/140	8 oz +	12/65	20/28	.06
3/4"	0	85/95	110/120	30/35	23/140	8 oz +	12/65	18/26	.06
1"	1	85/95	145/160	30/35	23/140	8 oz +	12/65	17/24	.07
1-1/4"	1	85/95	145/160	30/35	23/140	8 oz +	12/65	16/20	.07
1-1/2"	1	85/95	145/160	30/35	23/148	8 oz +	12/65	12/16	.07
2"	2	85/95	230/250	30/35	23/140	8 oz +	12/65	11/15	.09
2-1/2"	2	85/95	230/250	30/35	23/140	8 oz +	12/65	10/13	.09
3"	2	85/95	230/250	30/35	23/140	8 oz +	12/65	9/11	.09
4"	3	85/95	285/320	30/35	23/140	8 oz +	12/65	7/10	.11
5"	3	85/95	285/320	30/35	23/140	8 oz +	12/65	6/8	.11
6"	3	85/95	285/320	30/35	23/140	8 oz +	12/65	5/7	.11
7"	4	85/95	390/450	30/35	23/140	8 oz +	12/65	5/6	.14
8"	4	85/95	390/450	30/35	23/140	8 oz +	12/65	4/6	.14
9"	5	85/95	670/720	30/35	23/140	8 oz +	12/65	4/5	.18
10"	5	85/95	670/720	30/35	23/140	8 oz +	12/65	3/5	.18

Tip Number	Metal Thickness		Pressure-PSIG		Kerf Width	Consumption-SCFH			Drill Size	
	Inches	mm	Oxygen	Acety.		Oxygen		Acetylene Preheat	Cutting Jet	Preheat
						Cutting	Preheat			
MC12-00	1/8"	3	20*	10	.050	30	7	6	68	75
MC12-00	3/16"	5	20*	10	.050	30	7	6	68	75
MC12-0	1/4"	6	35*	10	.055	40	7	6	62	75
MC12-0	3/8"	10	40*	10	.055	46	7	6	62	75
MC12-1	1/2"	13	45*	10	.080	75	9	7	55	74
MC12-1	5/8"	16	50*	10	.080	81	9	7	55	74
MC12-2	3/4"	19	50*	10	.095	107	11	9	54	71
MC12-2	1"	25.4	55*	10	.095	118	11	9	54	71
MC12-3	1-1/2"	38	55*	10	.100	170	12	10	51	70
MC12-3	2"	51	60*	10	.100	181	12	10	51	70
MC12-4	2-1/2"	64	65*	10	.125	249	14	12	45	70
MC12-4	3"	76	70*	10	.125	267	14	12	45	70
MC12-4	4"	102	65	10	.125	320	15	13	45	70
MC12-5	5"	127	80	10	.150	420	15	13	41	70
MC12-5	6"	152	90	10	.150	485	15	13	41	70

Bore Size for Oxyfuel Cutting

Plate Thickness inches (mm)	Bore Drill Size inches (mm)
1/4-1/2 (6.35-12.7)	68-53 DR 0.031-0.059 (0.794-1.51)
3/4 (19.05)	62-53 DR 0.038-0.059 (0.965-1.51)
1 (25.4)	56-53 DR 0.046-0.059 (1.18-1.51)
1 1/2-2 (38.1-50.8)	51-46 DR 0.067-0.081 (1.70-2.06)
3-5 (76.2-127.0)	46-44 DR 0.081-0.086 (2.06-2.18)
6-8 (152.4-203.2)	40-39 DR 0.098-0.010 (2.49-2.53)
10 (254)	39-35 DR 0.010-0.011 (2.53-2.94)

Tip Orifice Size for Welding

Welding Thickness inches (mm)	Drill Size inches (mm)
1/64 (0.38)	76 DR 0.020 (0.51)
1/32 (0.78)	72 DR 0.025 (0.64)
1/16 (1.59)	68 DR 0.031 (0.79)
3/32 (2.38)	62 DR 0.038 (0.96)
1/8 (3.18)	56 DR 0.047 (1.19)
3/16 (4.76)	54 DR 0.055 (1.40)
1/4 (6.35)	51 DR 0.067 (1.70)
5/16 (7.94)	48 DR 0.076 (1.93)
3/8 (9.53)	44 DR 0.086 (2.18)
1/2 (12.70)	40 DR 0.098 (2.49)
5/8 (15.88)	35 DR 0.110 (2.79)
3/4 (19.05)	30 DR 0.128 (3.25)

Table 5-3. Oxyacetylene Cutting Information

Plate thickness (in.)	Cutting tip ¹ (size number)	Oxygen (psi)	Acetylene (psi)	Hand-cutting speed (in. per minute)
1/4	0	30	3	16.0 to 18.0
3/8	1	30	3	14.5 to 16.5
1/2	1	40	3	12.0 to 14.5
3/4	2	40	3	12.0 to 14.5
1	2	50	3	8.5 to 11.5
1-1/2	3	45	3	6.0 to 7.5
2	4	50	3	5.5 to 7.0
3	5	45	4	5.0 to 6.5
4	5	60	4	4.0 to 5.0
5	6	50	5	3.5 to 4.5
6	6	55	5	3.0 to 4.0
8	7	60	6	2.5 to 3.5
10	7	70	6	2.0 to 3.0
12	8	70	6	1.5 to 2.0

¹Various manufacturers do not adhere to the numbering of tips as set forth in this table; therefore, some tips may carry different identification numbers.

Questions:-

1. Define the types of gases?
2. Define the types of Flame?
3. Write three gas cutting equipments with detail.

Next week:-

Arc welding power source- Transformer, rectifier, motor generator set and inverter type welding machine. Care and maintenance . advantages nad disadvantages of AC and DC welding machine.

Assignments:-

Common gases use for welding and cutting. Flame temperature and uses. Chemistry of oxy-acetylene flame. Types of oxy-acetylene flame and uses. oxy-acetylene cutting equipments, parameters and applications.

Checked by.....

Instructor.....