9

INDUSTRIAL ARTS: SHIELDED METAL ARC WELDING (PREPARE WELD MATERIALS)

Learner's Material

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Republic of the Philippines

Technology & Livelihood Education – Grade 9
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Learner's Material
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Table of Contents

PREPARE WELD MATERIALS

PREPARE WELD MATERIALS

Content Standard	Performance Standard
The learner demonstrates understanding of basic concepts and underlying theories in preparing weld materials.	The learner independently demonstrates competency in preparing weld materials needed for the job.

INTRODUCTION:

This module contains information and suggested learning activities on Preparing Weld Materials. It includes instruction and procedure on how to prepare the materials for welding.

Completion of this module will equip you with the necessary knowledge and skills to help you better understand the suceeding module on on Setting up Welding Equipment.

This module consists of five (5) learning outcomes. Each learning outcome contains learning activities supported by instruction sheets. Before you perform the instruction, read the information sheets and answer the self-check and activities provided. To ascertain your competence, your teacher will assess what you have acquired when the knowledge necessary to perform the skill portion of the particular learning outcome.

Upon finishing this module, your teacher will give you an assessment to check your achievement of knowledge and skills requirements of this module. If you pass the assessment, you will be given a certificate of completion.

SET-UP CUTTING EQUIPMENT

- Set-up cutting equipment in conformity with the acceptable occupational health and safety standards.
- Check cutting equipment fittings, connection, and power source in accordance with workplace procedure

PRE-ASSESSMENT TEST

Directions: Write the letter of the correct answer in every item. Provide a separate answer sheet.

1. Injection torches can use fuel gases with pressure as low as:
   a. 7 psi (0.49 kg/cm^2) c. 6 oz./in^2 (26.3 g/cm^2)
   b. 2 psi (0.14 kg/cm^2) d. 9 oz./in^2 (39.4 g/cm^2)

2. Oxygen and acetylene hoses should be color coded. Which of the given answers is correct?
   a. Oxygen green, Acetylene black or red
   b. Oxygen green or black, Acetylene red
   c. Oxygen green, Acetylene red
   d. Oxygen green or black, Acetylene red or black.

3. It is considered as a line pressure gauge.
   a. Regulator c. High pressure gauge
   b. Low pressure gauge d. Valve gauge

4. A typical characteristic of a neutral flame is
   a. Acetylene and with excess Oxygen
   b. Balance of Acetylene and Oxygen
   c. Oxygen and with excess Acetylene
   d. Acetylene burning in the atmosphere

5. OFC is an acronym for:
   a. Oxy-fuel cutting c. Oxygen fueled cutting
   b. Oxy-fused cutting d. None of the above

6. The term "cracking" means:
   a. Blowing-out of dirt lodged in the valve.
   b. Release of gas from the torch valve.
   c. Release of gas from the pressure gauge.
   d. Release of gas from the torch tip.

7. An electrode oven with a maintaining temperature of 70 ^oC +/- 10.
   a. Drying oven c. Portable oven
   b. Holding oven d. Heating oven

8. An oven which holds a temperature of 150 ^oC +/- 20.
   a. Holding oven c. Heating oven
   b. Portable oven d. Baking oven

9. Which of the following electrodes is used in mild steel?
   a. E–316-15 c. E-9015
   b. E-7018 d. E-6013

10. Which of the following electrodes is used in low alloy steel?
   a. E-316-16 c. E-7015
   b. E-9016 d. E-6012

11. To prevent the cylinder valves from breaking down, these should be provided with _____.
   a. Covers
   b. Protective caps
   c. Wraps with chains
   d. Hazard sign

12. Why is cleaning of surface and edges of metal so important?
   a. It provides good appearance of the cut material
   b. For the sake of following intructions.
   c. Dirt and other substances are detrimental to weld quality.
   d. It makes it easy to fit-up joint.

3. Removal of metal scales, old paints and rust in metal is easy with the use of a:
   a. Grinder
   b. Scraper
   c. Chipping hammer
   d. Metal sand paper

14. Why is air tight fit-up necessary for Tee-joint preparation?
   a. Dirt or contaminant will not stock inside.
   b. It prevents gas pockets associated with unfit fit-up.
   c. Rust attacks metal easily.
   d. None of the above

15. Beveled joint is considered "critical" in the category of weld. This means that _____
   a. Weld joint is necessary for radiography.
   b. Weld joint is for visual inspection.
   c. Weld joint with no inspection
   d. All of the above

INFORMATION SHEET 1.1

OXY-ACETYLENE

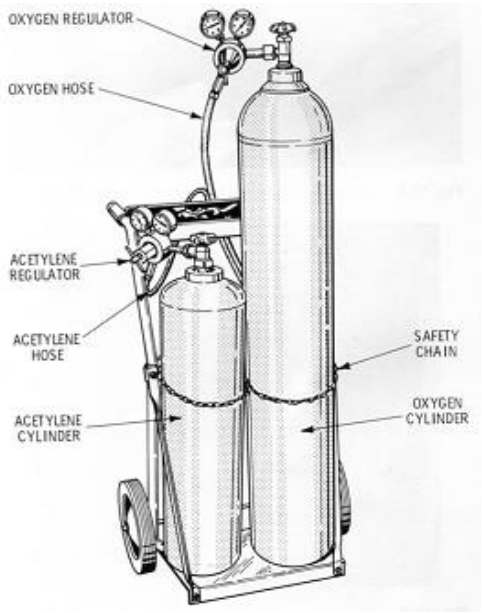
Introduction:

Preparation of materials prior to welding is just one task to perform in the shop. The appropriate cutting equipment must be installed and properly used in order to meet the cutting requirement.

The activity is focused on the set-up of cutting equipment and includes the accurate mixture of gases applied to all cutting operations.

Oxy-Acetylene Cutting Equipment

A typical oxy-acetylene cutting and welding outfit requires compressed oxygen and acetylene gases that are stored in the seperate cylinders. Oxygen gas is placed in the tall tank and the acetylene gas
is stored in the small tank.



Parts of a basic oxy-acetylene outfit:

1. Oxygen Cylinder - A tall tank cylinder where oxygen gas is stored.

2. Acetylene Cylinder – A tank of lesser height where acetylene gas is stored.

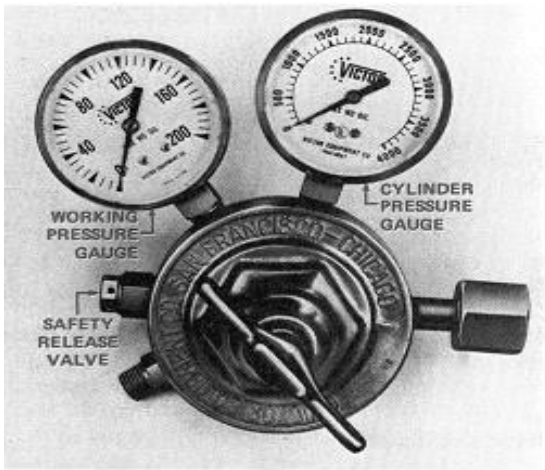
3. Regulator (Oxygen) – a device to regulate the flow of oxygen.

4. Regulator (Acetylene) – a device to regulate the flow of acetylene. It has an arrow pointing towards the torch body.

5. Acetylene Hose (Red) – A type of hose wherein acetylene gas flows towards the Directions of the torch body.

6. Oxygen Hose (Green) – A type of hose wherein oxygen gas flows towards the Directions of the torch body.

7. Safety Chain - A metal chain wrapped around the body of the cylinders and tied securely to the metal frame stand.



Pressure Regulator

All regulators do the same type of job. They all work following the same principle whether they are of low or high pressure; single or multiple stages; cylinder, manifold, line, type with the gas they regulate. The regulator which reduces high pressure to lower working pressure must be held constant over a range of flow rates and volumes.

1. **Working Pressure gauge**
   It Measures gas pressure that flows or is released from the torch body to the nozzle or tip.

2. **Cylinder Pressure gauge**
   It is a registered gas pressure found in the cylinder.

3. **Safety release valve**
   It is made up of a small ball held tightly against a seat by a spring.

4. **Gauge**
   It measures the amount of pressure or force of the gas that flows or is released from the cylinder.

5. **Regulators**
   They hold the forces on both sides of a diaphragm in balance.

Acetylene cylinder valve

Oxygen cylinder valve

There are varieties of inlet or cylinder fittings available to ensure that the regulator cannot be connected to the wrong gas or pressure. A few adaptors are available that will allow some regulators to be attached to a different type of fitting.

Two most common types:

1. Adapt a left-hand male acetylene cylinder fitting to a right-handed female regulator fitting or vice-versa.

2. Adapt a female acetylene cylinder fitting to a male regulator fitting.

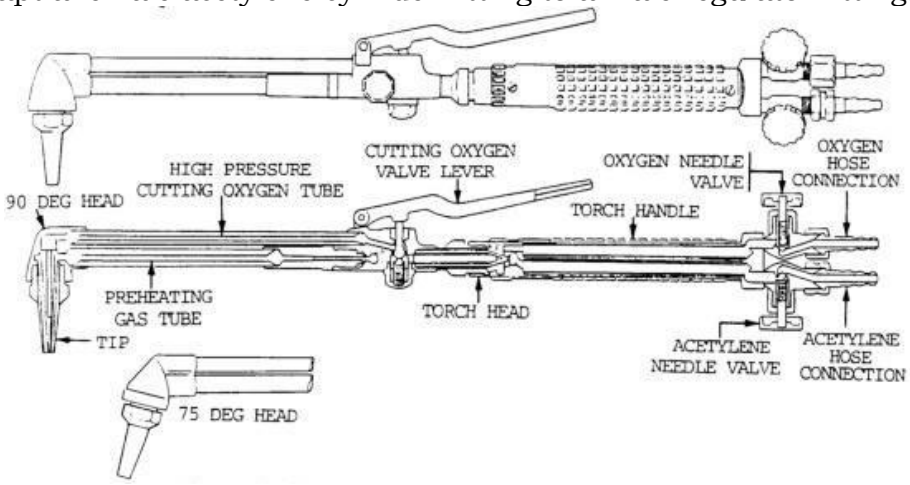
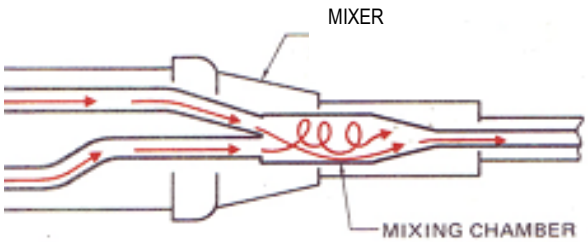


Figure 1. Cutting attachment for welding torch.
Courtesy of www.weldguru.com

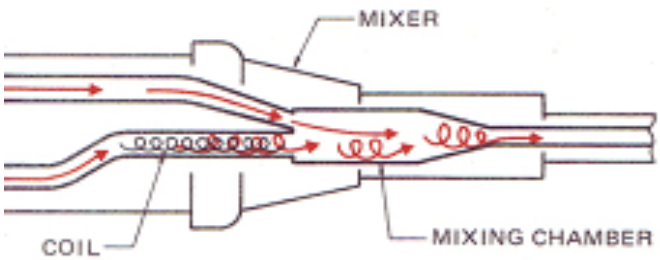
Cutting Torch

Oxy-acetylene cutting torch is the same as oxy-fuel cutting torch. The assembly of torch vary in sizes for different types of work. There are small torches for jewelry work, large torches for heavy plates and special torches for heating, brazing and soldering. Some use fuel-air mixture. There are no industrial standards for tip size, tip threads, or seats. Each style, size, and type of torch can be used only with tips made by the same manufacturer to fit-in the specific tank.

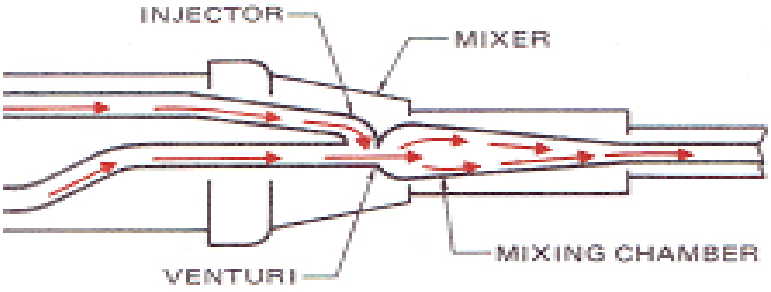


The diagram shows how two gases, the fuel gas and oxygen are mixed-up in the chamber with equal pressure. The two gases are completely mixed before they leave the tip and create the flame. (These are methods of mixing oxygen and fuel gas to produce flames)

1. By using equal balance pressures, the gases are mixed in the mixing chamber.
2. By using a higher oxygen pressure, the gases are mixed in the injection chamber.



A diagram showing a metal coil in the oxygen tube spinning the gas and ensuring a complete mixing of gases.



A diagram showing an injector mixing system. The injector torch works both with equal gas pressure or low fuel gas pressures. The injector allows oxygen at the higher pressure to draw the fuel gas into the chamber, even when the fuel gas pressure is as low as 26.3 g/cm^2. The injector works by passing the oxygen through a venture which create a vacuum to pull the fuel gas in and then mixes the gases together. An injector-type torch should be used in a low-pressure acetylene generator or a low-pressure residual.

ACTIVITY SHEET 1.1

PROCEDURE IN SETTING-UP A CUTTING TORCH

1. Secure oxygen and acetylene cylinders to the cart or wall before the removal of the safety caps.

Slots are provided as anchoring point for the safety chains on the welding cart.

Source:http://www.youtube.com/watch?v=BqOguEo-ors&feature=related

Remove the valve protection cap from the cylinder which is secured in the cart.

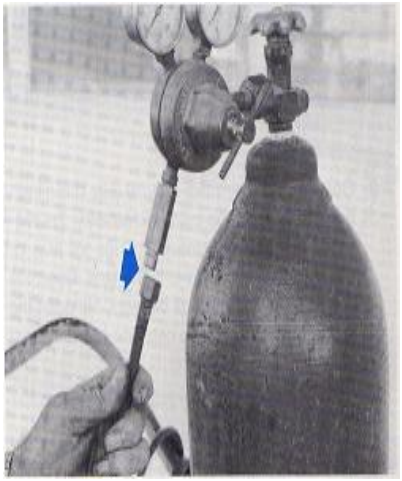
2. After removing the safety caps, stand to one side and crack open, then quickly close the cylinder valves to ensure no dust or any other foreign body may cause for igniting fire.

Source:http://www.youtube.com/watch?v=BqOguEo-ors&feature=related

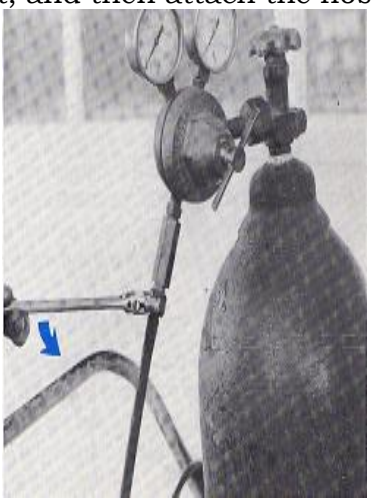
3. Visually check all parts for any damage.
4. Attach the regulators to the cylinder valves, and tighten securely with a wrench.

Installing regulator using flare nut or adjustable wrench
Source:http://www.youtube.com/watch?v=BqOguEo-ors&feature=related

5. Attach the reverse flow valves in the gas outlet, and then attach the hose.

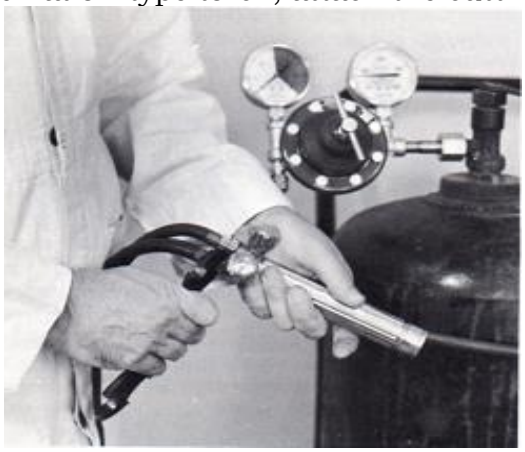


The reverse flow valve is already attached to the regulator before attaching the hose connector.



Tighten the hose connection.

6. If the torch is a combination-type torch, attach the cutting head.



Attach the torch flame pipe to the hose

7. Install the cutting tip in the torch.

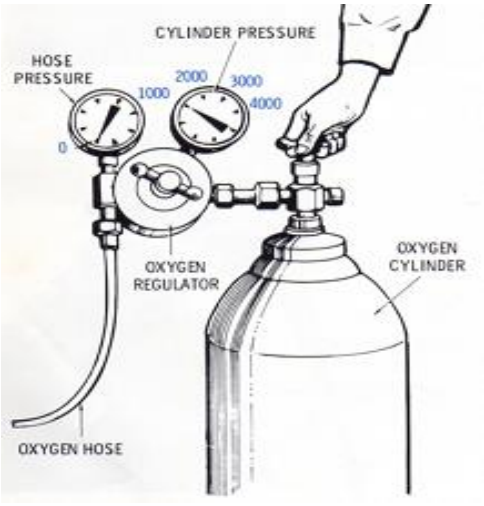
Typical cutting torch assembly with attached torch tip

8. Before the cylinder valve is opened, back-out the pressure regulating screw so that the valve opens the gauge back to zero for welding pressure.

Turning the adjustable handle to back-out pressure and turning zero pound on meter gauge reading

Source:http://www.youtube.com/watch?v=BqOguEo-ors&feature=related

9. Stand on the side of the regulator as the cylinder valve is opened slowly.



Opening of cylinder valve to merge in the hose

Note: Oxygen valve is opened all the way until it becomes tight while acetylene valve is opened not more than half turn.

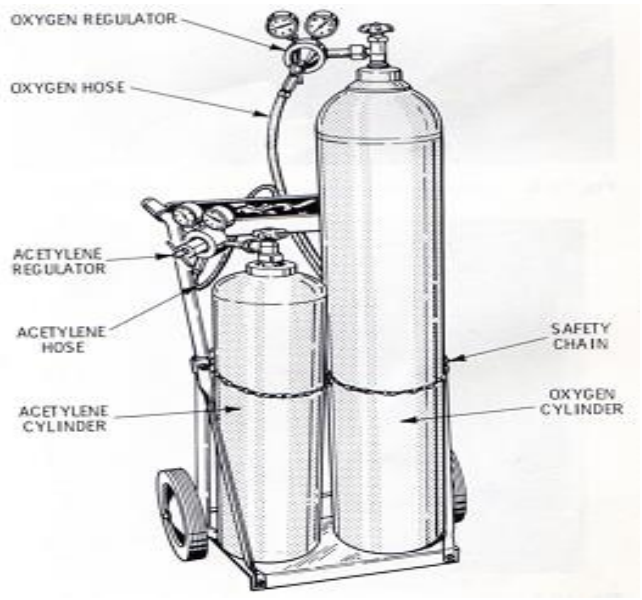
10. Open the acetylene torch valve (needle valve) and then turn the regulating screw slowly until 2 psi to 4 psi (1 ksi-2ksi) for working pressure gauge. Then close the needle valve (acetylene).

11. Open the oxygen torch valve (needle vlave) and turn the regulating screw slowly until 4 to 6 psi for the working pressure gauge, then close the needle valve(oxygen).

If you are using a combination welding and cutting torch, the oxygen valve nearest the hose connection must be opened fully before the flame adjusting valve of cutting lever will work.

The oxygen valve near the hose connection must be opened fully, before the cutting lever will work.

12. Cutting set-up is ready for the next task.



CALIBRATION OF THE CUTTING EQUIPMENT

During the set-up and operation of the cutting equipment, there are several observable things that might occur which need immediate attention. One of these is the failure of the cutting unit to function well thus requiring adjustment and correction. The student will be guided on some of the recommended practices.

Oxygen and acetylene pressures for different cutting and welding jobs

Tip #	Thickness of metal (mm)	Oxy-acetylene Pressure Psi(kpa)	Acetylene Flow (cfh)	Oxygen flow (cfh)
00	0.3	1	0.1	0.1
0	0.7	1	0.4	0.4
1	1.5	1	1	1.1
2	2.3	2	2	2.2

3	3.1	3	8	8.8
4	4.7	4	17	18
5	6.3	5	25	27
6	7.9	6	34	37
7	9.5	7	43	47
8	12.7	8	52	57
9	15.8	9	59	64
10	19.0	10	67	73

LEGEND:

mm- millimeter

cfh – cubic feet per hour

psi – pounds per square inch

The table shows the tip size, thickness of metal, work pressure and the speed. For cutting, use larger size of tip with corresponding data as shown in the aforementioned table. This information will support the succeeding activities in relation to cutting of materials.

Checking gas leaks

Check gas leaks

There is now a pressured gas throughout the system. A mixture of soapy water is applied to all regulators, hose connection and fittings to check for leakage.

After checking, gas leaks may occur through the reaction of a soap solution, the connection has to be tightened properly. If no more leaks are found, reopen the torch valve.

Caution:

Leaking cylinder valve stem should not be repaired when gas pressure is present. Turn off the valve, disconnect cylinder and mark or label the defective unit before any repair is done.

Cracking oxygen and fuel cylinder valves

"Cracking" is one way of blowing out any dirt lodged in the valve. The quick release and the sudden closing of the valve should be done. This is applicable for both oxygen and fuel gas.

Caution:

Face the valve of cylinders away from any source of ignition or any object or person that might be harmed by the flame when it is lit.

Checking or cutting tip for leaks

Check the assembled torch tip for a good seal, place your thumb over the end of the tip, turn on oxygen valve, and spray the tip with a leak detecting selection.

SELF-CHECK 1.1

SETTING UP A CUTTING TORCH

Directions:

Use the check-list below as basis for judging whether you meet the required competency. Write YES or NO for your answer in a separate answer sheet.

Performance Indicators	YES	NO
1. Can secure Oxygen and Acetylene cylinders to the cart or wall correctly.		
2. Can remove safety caps and crack cylinder valve properly.		
3. Can check all parts for any damage.		
4. Can attach regulators to cylinders securely.		
5. Can attach flow valves and hoses to the gas outlet.		
6. Can install the cutting tip.		
7. Can back-out the pressure regulating screw before opening the cylinder valves.		
8. Can adjust the regulating screw to satisfy the working pressure needed.		
9. Can set-up cutting outfit correctly ready for use.		

Note: Have learners assess their performance. For criteria needing assisstance, provide the appropriate intervention/s.

CUT AND PREPARE EDGE OF MATERIALS

- Cut materials according to specified dimensions/specifications.
- Prepare edge of materials according to specified dimensions/specifications.

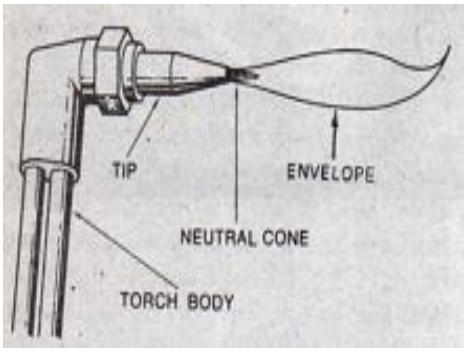
INFORMATION SHEET 2.1

CUTTING MATERIALS WITH OXY-ACETYLENE

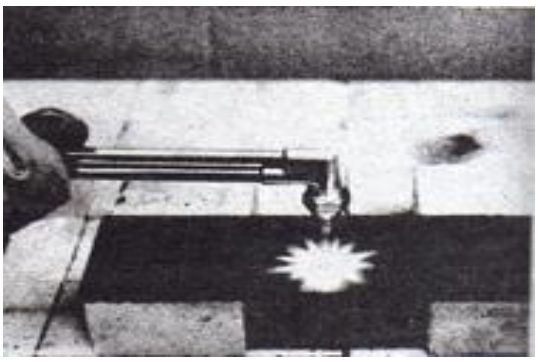
Introduction:

Metals are formed into structures by assembling or connecting each member parts through the process of welding. Therefore, the materials of varied sizes and thickness are cut and shaped with specific measurement and dimension. In this activity, the student shall develop skills in cutting materials with oxy-acetylene and discover other cutting outfit.

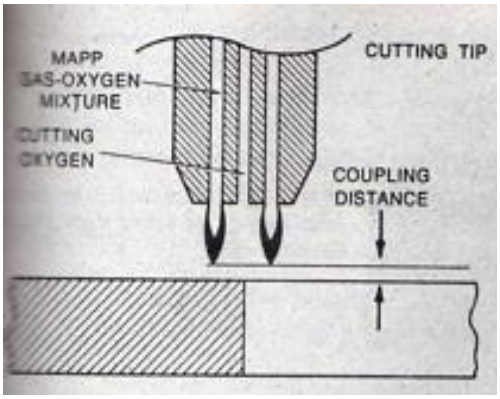
❑ **Flame Cutting Procedure**



Pre-heat flame is properly adjusted all the safety measures must be taken before you do the actual cutting. You may see how fast cutting goes, but drills and practices will build confidence.

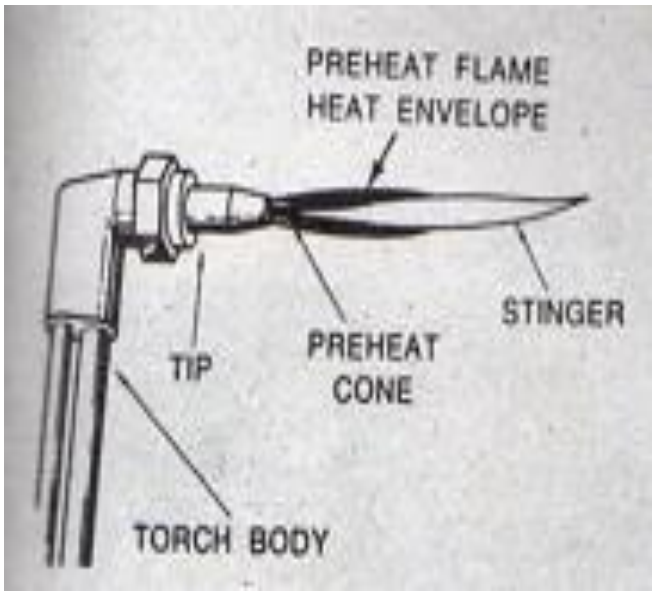


Using the neutral pre-heat flame, heat the spot where you intend to start until the flame turns cherry red. The pre-heat flame should be held just above the metal surface so as to protect pre-heat holes against metal flow back from the pure cutting oxygen. It is also done to keep the torch end away from the heat reflected by the metal surface.



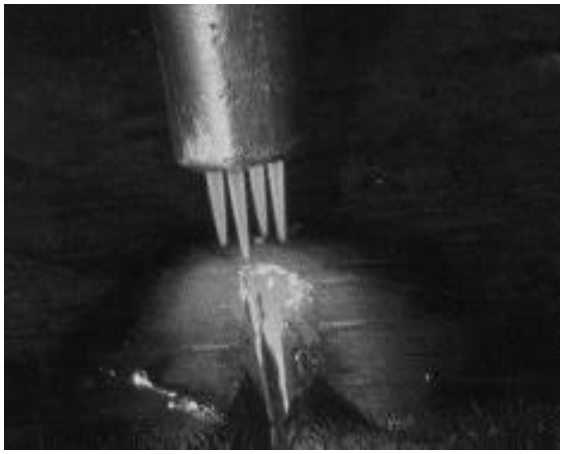
The distance between the end of the pre-heat cones and the surface of the material being cut is known as the coupling distance. When cutting plates up to 76 mm (3 inches) thick and with Mapp ® gas, the coupling distance must be about 3.25mm (1/8"). For cutting, coupling distance should be increased to get more heat from the secondary flame cones. Materials (plates) over 305mm thick (12 inches) should be cut using 19.9-31.8mm coupling distance.

Straight Cutting



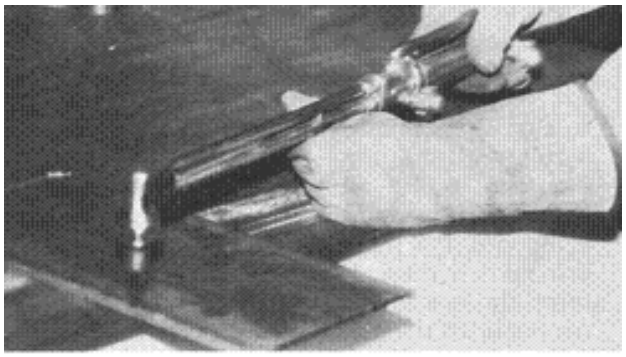
The stinger is pure oxygen flowing out of the center hole of the cutting tip.

Once it starts, it can continue through the metal

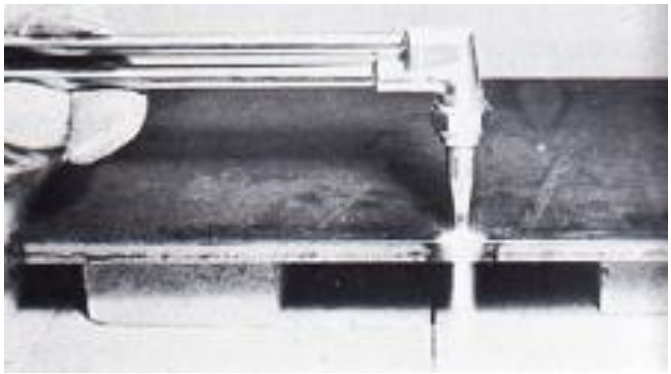


The cut should travel fast enough so that the top edge does not melt.

Once the pre-heated spot is cherry red in color, the cutting oxygen lever should be slowly depressed. This allows the pure cutting oxygen to attack the metal thus removing the metal by flame pressure and oxidation when allowing the cutting oxygen to flow out slowly, the spot will not be cooled by the fresh oxygen stream. Cooling could happen if a large gush of oxygen is blown on to the heated spot all at once. The visible oxygen cutting stream coming from the center hole of the tip when the cutting oxygen valve is opened is called the stinger.



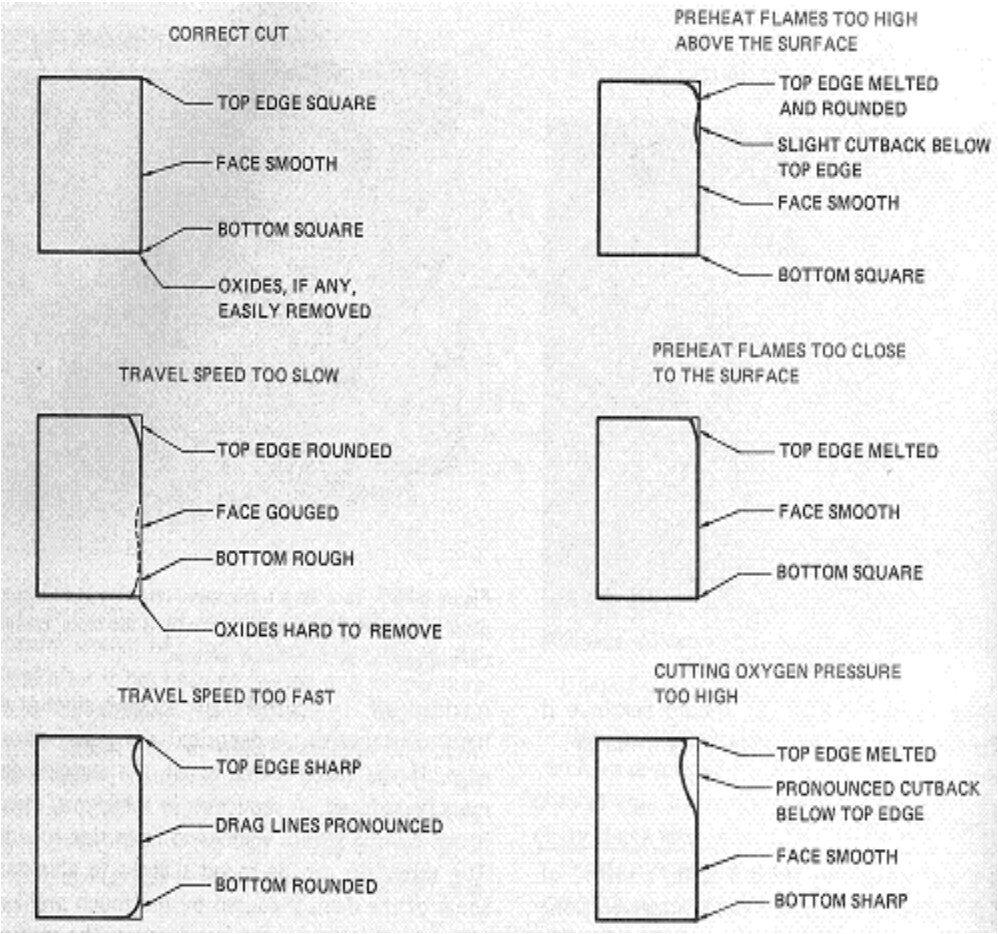
Manual hand cutting of sheet cut starts with the torch drawn over the gloved hand. The welder must be comfortable and be free to move the torch along the line to be cut. It is a good idea for the welder to get into the position and practice the cutting movements a few times before lighting the torch.



Source:http://www.youtube.com/watch?v=BqOguEo-ors&feature=related

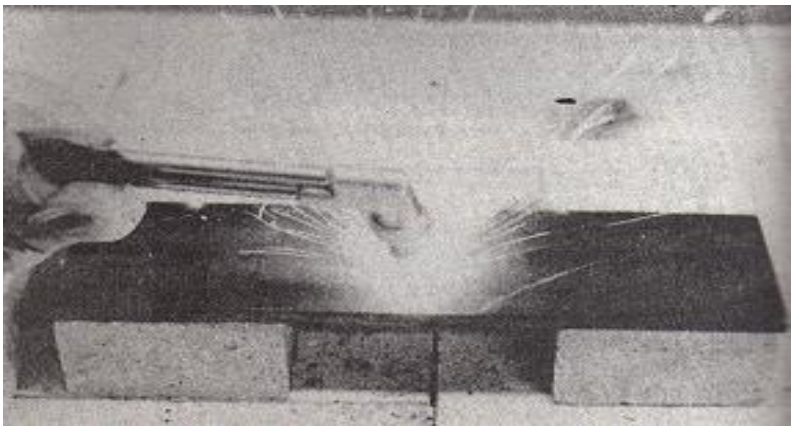
Steady hands are required in manual oxy-acetylene cutting, especially when even straight cuts are needed. Once the cut starts, the torch must be moved steadily in the Directions of the cut.

Profile of Flame-cut Plates

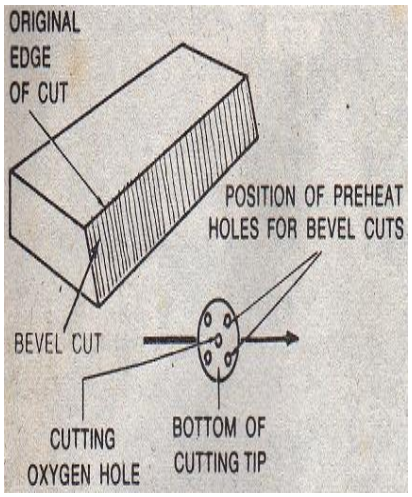


The physics of a cut, as the cut progresses along a plate, records of what is happening during the cut which is preserved along both sides of the key. This record indicates to the welder what is correct or incorrect with the pre-heat flame cutting speed and oxygen pressure.

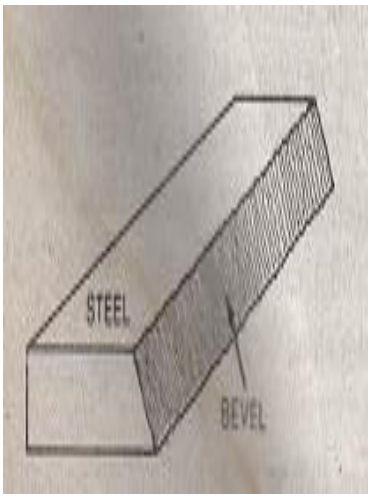
Bevel Cutting



When bevel cutting is required, the torch head must be inclined in the position to the preheated metal along the top edge of the parts. This allows the metal to form the required bevel angle. The tip should be kept high enough so that the outlet holes are away from any splashing molten metals. Bevel cuts in the production are usually done by a radiograph. This produces a more accurate cut with less gas.



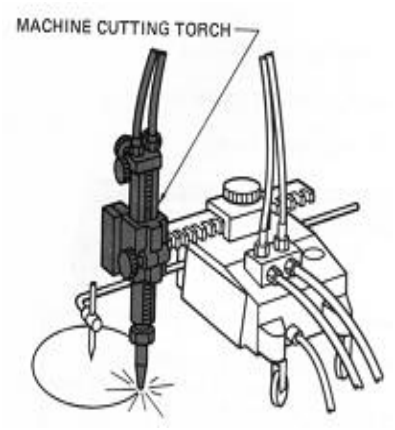
Position the four pre-heat holes for a fixed cut.

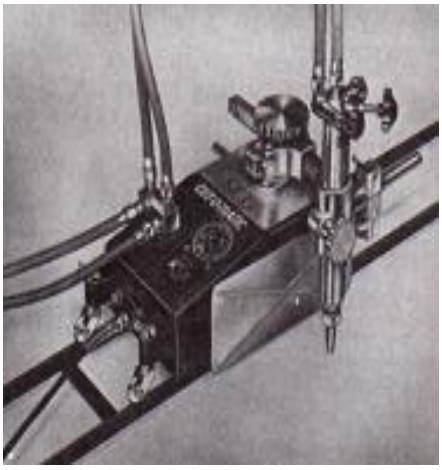


A bevel cut made by oxy-acetylene cutting

Other cutting equipment/machines for plates and pipes

After performing task on oxy-acetylene and fuel gas cutting, there are other designed cutting equipment/machines that produce mass cutting of materials at the largest welding production segment in the workplace. The illustration/drawing shown on the next page, are the cutting machines with work descriptions for the students to comprehend more.

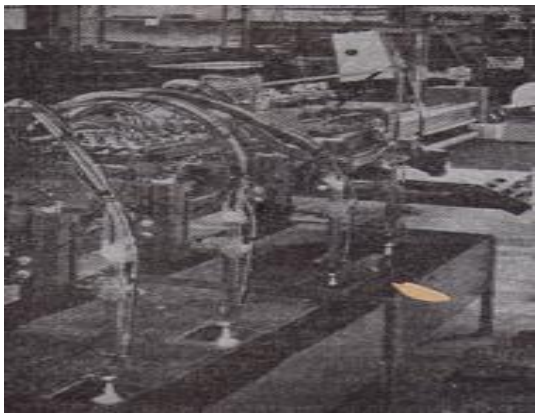




Portable flame-cutting machine

A machine cutting torch sometimes referred to as a *flow pipe* operates in a similar manner to a hand cutting torch. The machine cutting torch may require two oxygen regulators, one for each. Pre-heat the oxygen and the other acetylene for the cutting oxygen stream. The addition of a separate cutting oxygen supply allows the flame to be more accurately adjusted. It also allows pressure to be charged during a cut without disturbing the other parts of the flame.

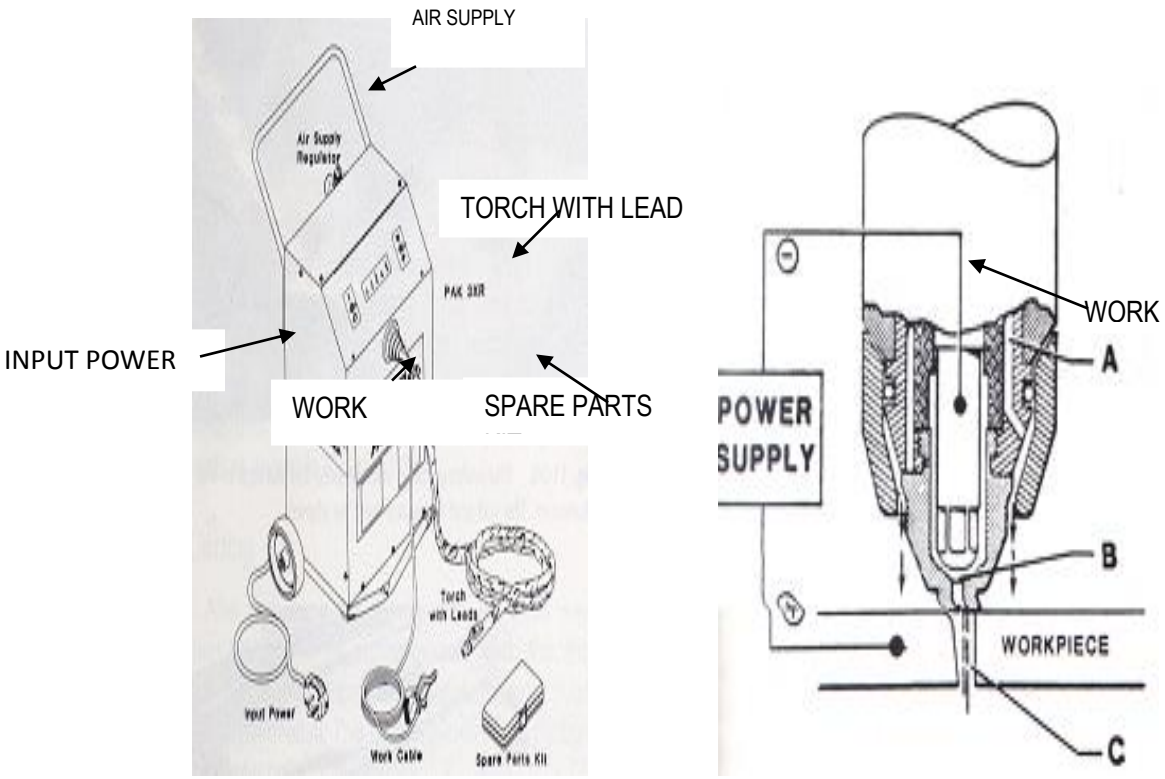
Flow pipe



A cutting machine can make several complex cuts at one time. Automatic torches are set the same for pre-heating as the manual torches. However, the motor drives the automatic torch along the line of cut at a speed it could easily be regulated using a variable control mechanism.

When the starting point on the joint is cherry red, the cutting oxygen is engaged for a continuous flow of oxygen. Then, the torch travel running mechanism is moved at a speed necessary for a smooth key edge. The torch head on most automatic cutting torches can be tilted to several angles for marking different bevel cuts. Using these machines, many different and complex cuts are made evenly.

Radius rods are also available for automatic cutting torches and for circle cutting. Multiple cutting heads are commonly used for automatic cutting machines, especially where many pieces of the same shape are required.



Plasma Cutting equipment

Plasma is a gas that has been heated to a high temperature and converted (ionized) so that the gas becomes electrically conductive. The plasma cutting process uses plasma to transfer an electric arc to the metal. The metal is heated to its melting point by the heat of the arc and is blown away by air.

Parts of a Plasma Arc cutter

- Power cable that works for 210-220 volts.
- The work table.
- Torch with head cable
- Air supply regulator valve.

The plasma torch tip has several openings. These openings help operate the torch. (A) shows how air keeps the torch on each side of the metal cool and keeps the hot metal from spattering. (B) allows the air to enter when the arc struck between the metal and the electrode is producing a pilot arc. When the tip is brought close to gas, it produces a stiff constricted cutting arc. This delivers a high concentration of heat to a very small area. See illustration above.

SELF-CHECK 2.1
CUT AND PREPARE EDGE OF MATERIALS

Directions:

Use the checklist below as basis for judging whether you meet the required competency? Write YES or NO as your answer in a separate sheet.

Performance indicators	YES	NO
1. Can adjust pre-heat flame correctly.		
2. Can heat the spot and recognize the cherry red color.		
3. Can adjust cutting coupling distance based on thickness of metals to be cut.		
4. Can start hand-cut with the torch drawn over the gloved hand.		
5. Can move free and comfortably while cutting.		
6. Can cut bevel by using correct angle.		
7. Can check cutting outfit before cutting.		

Note: Have learners assess their performance. For criteria needing assistance, provide the appropriate intervention/s.

CLEAN SURFACES AND EDGES

- Clean surfaces and edges based on the job requirements.
- Use correct tools and equipment for cleaning surfaces and edges in accordance with the job requirements.
- Use appropriate Personal Protective Equipment (PPE)
- Perform proper housekeeping (5S)

PREASSESSMENT TEST

Directions: Chose the letter of the correct answer. Use separate answer sheet.

1. Why is cleaning of surface and edges of metal so important?
   a. It provides good appearance of the cut material
   b. It is given in the instruction.
   c. Dirt and other substances are detrimental to weld quality.
   d. It makes it easy to fit-up joint.

2. what tool is used to easily metal scales, old paints and rust.
   a. Grinder
   b. Scraper
   c. Chipping hammer
   d. Metal sand paper

3. Why is an air tight fit-up necessary for Tee-joint preparation?
   a. Dirt or contaminant will not stick
   b. Gas pockets associated with unfit fit-up are avoided.
   c. Rusting of joint is avoided.
   d. None of the above

4. Beveled joint is considered "critical" in the category of weld. This means that:
   a. Weld joint is necessary for radiography
   b. Weld joint is for visual
   c. Weld joint needs no inspection
   d. All of the above.

5. Root face of beveled joint will not exceed a maximum of _____
   a. 3 mm
   b. 5 mm
   c. 3 mm
   d. 6 mm

INFORMATION SHEET 3.1

CLEANING SURFACES AND EDGES OF MATERIALS

Introduction

Proper cleaning of metal surfaces and edges must be in mind before any fit-up and tacking takes place. There must be an acceptable cleaning procedure applied in the surface of the plates and pipes before welding joints. The cleaning of surfaces and edges is considered one step for achieving quality in the preparation of materials.

Below are acceptable practices in the preparation of surfaces and edges of the materials.

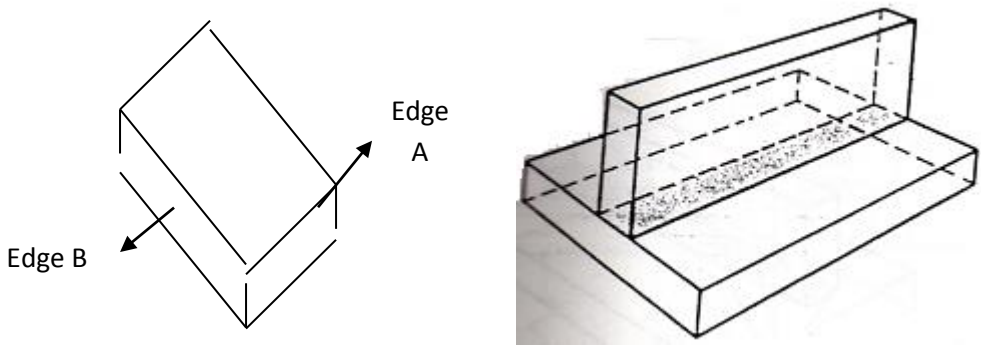


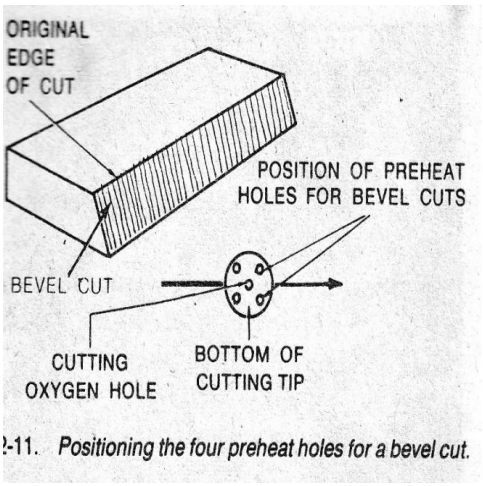
Figure # 1

Illustration: Figure 1

Edge A needs to grind smoothly and squarely so that no gaps appear on the fit-up and the surface of the other plate to form Tee-joint. These two sides of the plate are placed together to see to it that no gaps are found, then are tightly assembled. The contaminants that are found in the fit-up must be cleaned and removed for welding safety.

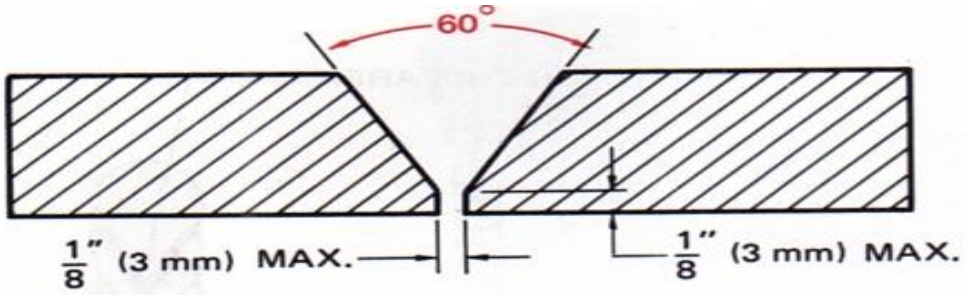
Safety measures:

Before tacking, air tight fit-up must be checked so as to avoid air pockets in the fitted edge or surface.



-11. *Positioning the four preheat holes for a bevel cut.*

The drawing showing A and B plates are beveled cut. The gas cutting results are not properly done, the surface is not smooth and with irregular line cut caused by incorrect cutting. The surface must be smoothened with the use of a grinder until such appearance is accepted. Dirt and contaminants such as rust, oil, grease, water, scale and old paint must be removed from the surface using appropriate tools and solution.



After root face is made and smoothened on the beveled surface, the two plates are placed together facing each other with an approximate gap before tacking may be done. This kind of preparation is applicable for plates and pipes of different types of materials. The root face must not exceed the maximum of 3mm thick from wall thickness of 6mm to 20 mm.

PREPARE WELDING CONSUMABLES

- Identify welding electrodes according to classification and specifications.
- Maintain and keep electrodes in electrode oven based on prescribed temperature.
- Prepare specified consumable gases based on job requirements
- Select correct materials in accordance with job requirements

PREASSESSMENT TEST 2

Directions: Choose the correct answer from the options given for every item. Write the letter only. Use a separate answer sheet.

1. An electrode oven with a maintaining temperature of 70 ^{o}C +/- 10 is called _____.
   a. Drying oven
   b. Holding oven
   c. Portable oven
   d. Heating oven

2. An oven which holds a temperature of 150 ^{o}C +/- 20 is called _____.
   a. Holding oven
   b. Portable oven
   c. Heating oven
   d. Baking oven

3. Which electrode is used for mild steel ?
   a. E–316-15
   b. E-7018
   c. E-9015
   d. E-6013

4. Which electrode is used for low alloy steel?
   a. E-316-16
   b. E-9016
   c. E-7015
   d. E-6012

5. To prevent the cylinder valves from breaking down, these should be provided with _____.
   a. Cover
   b. Protective caps
   c. Wrap with a chain
   d. Hazard sign

INFORMATION SHEET 4.1

PREPARE WELDING CONSUMABLES

Introduction:

All welding consumables used in the welding production should be maintained and controlled to remain sound and acceptable. Handling of various electrode types and different gasses used in welding fabrication and production that requires critical post weld inspection needs special attention in performing tasks, like preparing these consumables in order to produce quality and acceptable welds. Electrodes are also selected correctly in accordance with electrode specification and welding procedure requirements. Therefore, the student/welder

will have to develop their skills and knowledge on the maintenance and control of all consumables, as well as, the correct choice of using them.

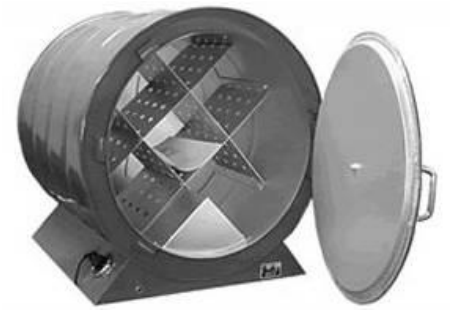
Some recommended acceptable practices for the maintenance, selection and control of welding consumables are presented.

Baking/Drying Oven

Source: http://img.directindustry.com/images_di/photo-g/welding-electrode-drying-and-storage-oven-476384.jpg

Welding production and fabricators that usually accepts welding jobs are under the welding code provisions. First and foremost, there must be a standard plan for electrode control and maintenance. Electrodes are kept in the stockroom for sometime because of the influence of atmospheric conditions. These electrodes have to pass the drying or baking process. All electrodes for baking will be removed from a sealed plastic and placed inside the oven in a classified manner (based on types and diameter size of the electrode) in the oven shelves and marked accordingly. After loading, set the drying oven temperature from 200 °C – 300 °C maintaining the temperature for a period of two hours. Once the maximum time for drying (2 hours) is reached, shut-off the oven.

- **Holding oven**



Source: http://www.rodovens.com/photos/ovens/k-450.jpg

After drying, remove the electrodes from the oven and store them in the storing oven with a maintained temperature of 150 °C plus/minus 20 °C. The electrode must remain in the oven without reducing the temperature as per

requirement. The electrodes are maintained and controlled under the supervision of a storekeeper, as he is responsible for the issuance of these electrodes to the welders and fitters.

- **Portable oven**

Source: http://www.antasweld.com/Upload/PicFiles/2009.12.13_7.9.36_9747.jpg

Normally, welders perform welding activities in the shop. In cases where welding is done in a worksite, the welder should provide himself with a portable oven sometimes called *welder's oven*. The welder's oven should be plugged to a power source. The temperature that should be maintained is 70 ^{o}C plus/minus 10 ^{o}C. The unused electrodes shall be returned to the storing oven at the end of the day's work.

Types of Electrodes, Diameter size, Current (amp) and Power Sources

Mild Steel Electrodes

Electrodes	Diameter Size	Current	Power Source
E-6010	3.25 mm.	90 A – 120 A	DC +
E-6013	3.25 mm.	90 A – 120 A	AC, DC +
E-6011	3.0 mm.	80 A – 110 A	AC, DC +
E-6012	3.0 mm.	80 A – 110 A	AC, DC -

Low Hydrogen Electrodes

E-7015	3.25 mm.	90 A – 110 A	DC +
E-7016	3.25 mm.	110 A – 130 A	AC, DC +
E-7018	3.25 mm.	110 A – 130 A	AC, Dc +

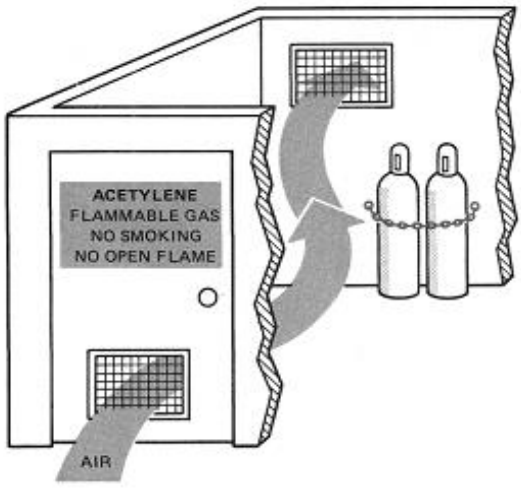
Stainless Steel Electrodes

E-308 -16	3.25 mm.	90 A – 110 A	AC, DC +
E-316-15	3.0 mm.	80 A – 90 A	DC+
E-316-15	3.25 mm.	90 A – 110 A	DC +
E-310-16	3.0 mm.	80 A - 90 A	AC, DC +

Low Alloy Steel Electrode

E- 8018	3.25 mm.	110 A -130 A	AC, DC +
E-9016	4.0 mm.	140 A – 180 A	AC, DC +
E-9015	3.25 mm.	110 A – 130 A	DC +
E-8016	3.0 mm.	90 A – 110 A	AC, DC +

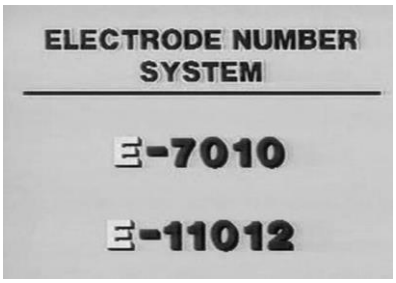
Different types of electrodes, size, current, and power source are the recommendable data for electrodes that can be the basis for selection. Only four (4) types of electrodes are reflected in this information, but this will help you understand their proper use and their existing specification. Further studies about electrodes will help you discover many things about welding consumables.



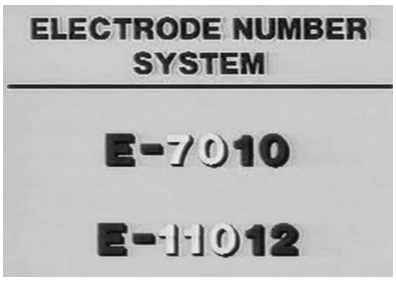
The industrial gases must be stored in a separate storage room and must have proper air ventilation. The place should be equipped with fire hazard signs and also a unit of fire extinguisher to be installed in a location near the series of filled full tanks for accessibility. Cylinders must be provided with protection caps to prevent the valves from being broken. Defective tanks, fitters, and others must be separated and marked defective.

Leaking fuel gas cylinders should be out of the building. Place the cylinders in an open space and put a danger sign. Slowly release the pressure until the gas is totally removed.

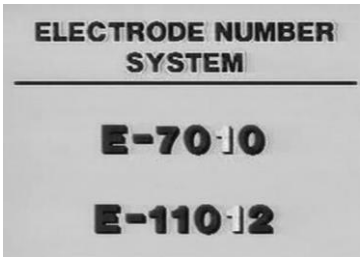
Welding Electrodes



E- stands for *electrode* and is used for electric arc welding process



The first two or first three digit numbers designate the tensile strength of a metal in thousand of pounds.

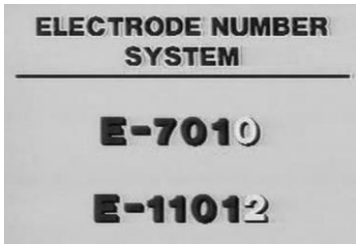


The next digit means welding position. If it is:

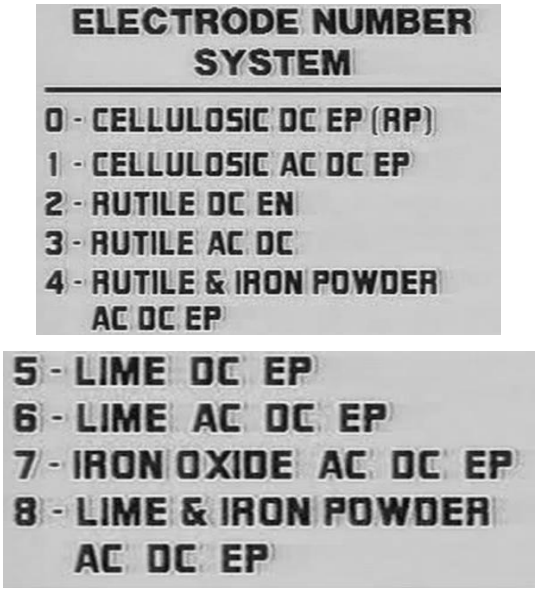
1-All position

2-In Flat and Horizontal position

4- Vertical down



The last digit indicates the type of coating and the polarity of the electrode.



Various electrode rating and its respective polarity

PROTECTIVE WELDING EQUIPMENT

- Prepare Personal Protective Equipment (PPE) in accordance with the occupational health and safety standards.
- Check welding protective equipment in accordance with safety procedures.

PRE-ASSESSMENT TEST 3

Directions:

Match column A with column B. Write the letter of the correct answer on the blank provided before the number. Use separate answer sheet.

_____ 1. Face shield	**a.** Hand protective device during welding.
_____ 2. Respirators	**b.** Head and hair protection while welding.
	c. Feet and legs protection

_____ 3. Leather Jacket

_____ 4. Welding cap

_____ 5. Welding shield

_____ 6. Leather apron

_____ 7. Safety gloves

_____ 8. Safety boots

_____ 9. Full leather sleeves

_____ 10. Safety glass

d. Worn always in shop during tour of duty.

e. Additional protection that covers body and shoulder.

f. Added protective device in front side of the body.

g. To be worn in the area with toxic fumes.

h. Face and eyes protection.

i. Used to protect eye and face while grinding and cleaning weld.

j. Shoulder legging sleeves.

k. Used for picking up hot metals.

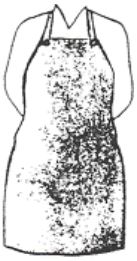
INFORMATION SHEET 5.1

WELDING PROTECTIVE EQUIPMENT

Introduction:

The general work clothing is worn by each person working in the shop. All of these clothing materials must not have frayed edges or holes. In addition to the clothing, extra protection is needed for each person who is in direct contact with the materials. Tongs and pliers are used in picking-up hot metals.

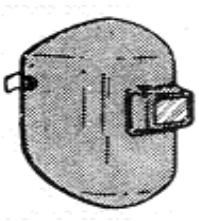
Leather Jacket



Leather Apron

Leather welding gloves

Welding shield



Face shield

Safety glasses

Welding cap

Safety boots

Respirator

Full-leather sleeves

Additional protection may be applied using: leather jacket, apron, welding gloves, welding shield, face shield, safety gloves, welding cap, safety boots, respirators, and full leather sleeves. Full clothing protection will practically protect the whole body of the welder.

For your safety, it is proper to know the uses of your protective gadgets while working with metals.

Safety glasses protects the eyes from weld sparks and must always be worn by a worker in the shop.

Welding shield covers the face and allows the welder to see legibly on weldment while performing welding.

Face shield is a transparent hard plastic covering the face while clearing and grinding.

Welding cap worn by welder as an additional safety for head and hair.

Respirator is an equipment that protects the welder from fumes and odor of industrial waste.

Leather apron is a front body protection device while welding.

Leather jacket is worn by welder during welding difficult position.

General clothing refers to the usual personal clothing of a welder such as over-all, welding apron, or welding jackets.

Safety Gloves are worn by welders to protect the hands from heat and burns.

Welding Goggles are protective glasses set in a flexible frame that fit snugly against the face.

Welding shoes are made of chrome leather and they protect our feet from spattering heat.