**Compressed Gas Safety**

**Unit: 3** **Instructor:** Leonard Guillory

**Lesson Title:** Introduction to Compressed Gas Cylinders

**INTRODUCTION:** This module on compressed gas cylinders contains the following:

- Objectives
- Key lesson outline topics
- Other potential available resources on the lesson topic
- Suggested questions students will be required to answer to assess learning
- A glossary of important terms identified in this lesson

**COURSE OBJECTIVES:**

The main objective of this lesson is to have High School students achieve a basic understanding of compressed gas cylinders.
Students will learn key terms and languages associated with main topic of discussion.

Students will be able to demonstrate knowledge and acquired learning of the presented topic by either completion of multiple assessment questions, actual demonstration or both.

**KEY LESSON OUTLINE COMPONENTS:** (Main topics to be presented and students expected to learn)

1. Compressed gas cylinders and what they are used for.

2. How to safely handle and transport cylinders.

3. How to correctly attach a regulator to a compressor gas cylinder.

4. How to safely store a compressed gas cylinder.

**5. GLOSSARY OF IMPORTANT TERMS DISCUSSED IN THIS TOPIC:**

1. Valve
2. Regulator
3. Cylinder
4. Oxidizer
5. Fuel gas

**6. LEARNING ASSESSMENT QUESTIONS AND/OR DEMONSTRATIONS:**

1. What will you be using compressed gas cylinders for in the weld lab?
2. What type of compressed gas cylinders will you be exposed to in the weld lab?
3. How do you attach a regulator to an oxygen bottle?
4. How should compressed gas cylinders be stored?

INSTRUCTOR NARRATIVE:

This module should help to build the foundation for student understanding of how compressed gas is used in the welding world. And compressed gas safe handling and storage.

Back to the future... WELDERS UNIVERSE



# > Welding Parameters <

Producing a weld bead that's the right size, shape and depth involves many variables. Arc welding students remember most of them by reciting the acronym "CLAMS", since each letter stands for a welding parameter. Here's the list:

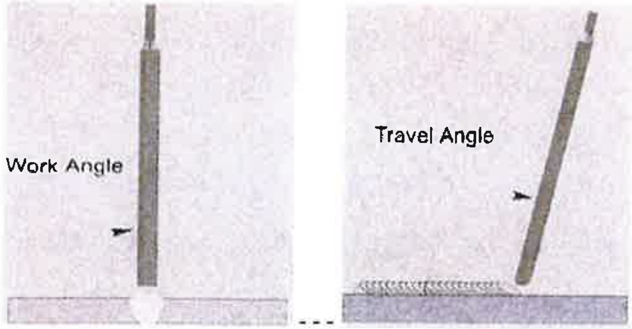
**C urrent** - Amperage generally dictates the size and penetration of a weld bead when you're moving your torch at the right speed. Welders refer to charts from welding machine and electrode manufacturers, or a welding procedure specification (WPS) for their current settings, or try welding on sample plates of the same thickness to see what works best.

**L ength** of Arc - How close to the work plates the welder holds the arc of a wire or welding electrode can affect the amount of current and heat going into the joint. Held close to the work plates, the current and heat in the weld remains high. Held farther away, the electrode produces less heat and more spatter.

As a rule of thumb, in stick welding arc length should match the diameter of the electrode metal. In other words, if you're using a 1/8 inch rod, hold it 1/8 inch from the joint surface. You can increase the length of the arc to reduce heat to the puddle or to limit the deposition of weld metal.

In a wirefeed operation (i.e. MIG or flux-cored welding), the wire electrode is held farther away from the joint than in stick welding. That's because the arc is more concentrated, and thus capable of burning through metal. For this reason, students also learn the difference between Electrode StickOut (the wire length from the contact tip) and Contact-To-Work-Distance . Variations in the ESO or CTWD affect the amount of the current going into the joint, regardless of the wirespeed setting on the machine.

**A ngle** - There are two torch angles to remember when welding. The first is the work angle, which is the relationship between the joint and the torch (or rod). Ideally, you'll hold your torch perpendicular, or 90 degrees, to the joint. The big exception to the rule is T-joints, where the work angle varies between 30 to 50 degrees. The second angle used in welding is the travel angle. This is the relationship between the torch and line of travel. In order to see the joint and puddle, the welder may tip the rod up to 10 degrees in the direction of travel, or sometimes against the direction of travel.




As you can see in the first diagram, the angle of the torch to the work piece (left) is 90 degrees, allowing maximum heat and current focused down into the open groove butt joint. (Think of this as the front view of the work plates.) In the diagram on the right, the travel angle shows a 5-10 degree tilt along the joint. This gives the welder a better view of what's going on in the puddle. When you drag your torch or electrode, the tilt is directed towards the puddle, which helps with penetration and achieving a thick bead. When you push, the tilt is away from the puddle, which limits penetration and heat going into the base metal.

**M**anipulation - This refers to the movement of the welder's hand as he or she guides the electrode along the joint. Achieving tie-in at the toes is paramount, but it's also important to control penetration and heat. As described in Types of Beads, a weave, whip, drag or push motion are all examples of manipulation.

**S**peed - If you move too fast, the size of the weld will be small and achieve insufficient penetration. Move too slow and you'll end up with a fat weld bead and likely too much heat going into your work plates.

The following chart shows how some CLAMS variables impact a weld bead:

All mild steel and low-alloy electrodes are classified with a 4 or 5 digit number prefixed by "E."

Prefix "E" = Electrode

First two (or three) digits = Tensile strength (psi) (stress relieved or as welded)

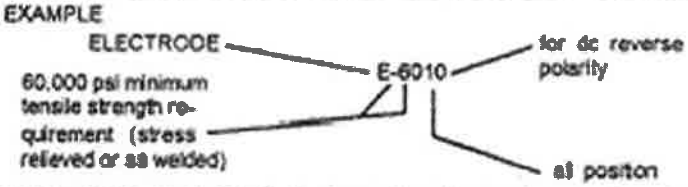
Third (or fourth) digit = Position of welding

1 = all positions (flat, horizontal, vertical, overhead)

2 = horizontal and flat positions only

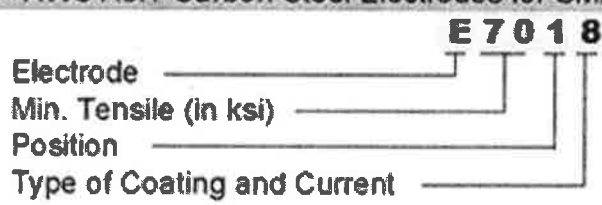
| FOURTH DIGIT | TYPE OF COATING | WELDING CURRENT |
|---|---|---|
| 1 | cellulose potassium | ac or dc Reverse or Straight |
| 2 | titania sodium | ac or dc Straight |
| 3 | titania potassium | ac or dc Straight or Reverse |
| 4 | iron powder titania | ac or dc Straight or Reverse |
| 5 | low hydrogen sodium | dc Reverse |
| 6 | low hydrogen potassium | dc or dc Reverse |
| 7 | iron powder iron oxide | ac or dc |
| 8 | iron powder low hydrogen | dc Reverse or Straight or ac |
| 0* | see reference below | |

EXAMPLE




*When the fourth digit is 0, the type of coating and current to use are determined by the third digit. For example, E-6010 indicates a cellulose sodium coating and operates on dc reverse, while E-6020 has an iron oxide coating and operates on ac or dc.

## AWS A5.1 Carbon Steel Electrodes for SMAW




| Key to Type of SMAW Coating and Current | | |
|---|---|---|
| **Digit** | **Type of Coating** | **Current** |
| 0 | High Cellulose Sodium | DC+ |
| 1 | High Cellulose Potassium | AC, DC± |
| 2 | High Titania Sodium | AC, DC- |
| 3 | High Titania Potassium | AC, DC± |
| 4 | Iron Power, Titania | AC, DC± |
| 5 | Low Hydrogen Sodium | DC+ |
| 6 | Low Hydrogen Potassium | AC, DC+ |
| 7 | High Iron Oxide, Iron Powder | AC, DC± |
| 8 | Low Hydrogen Potassium, Iron Powder | AC, DC± |

# Welding Fundamentals Quiz

Name:

1. Why do we wear ear protection in the weld lab?
2. What does PPE stand for?
3. Who is responsible for safety?
4. What is slag and what is its purpose?
5. What does AC stand for?
6. What DCEP stand for?
7. How should compressed gas cylinders be stored?
8. Name are 5 pieces of PPE worn into the weld lab-
9. True or False: To restart an arc, strike the arc ½' to 1" ahead of the old weld crater and move back until it reaches the rear of the cater then move the weld pool forward.
10. Can you transport oxygen and acetylene cylinders lying down? Why?
11. What starting amperage should your welding machine be set at for 3/16" welding rod?

12. Why should you protect yourself from the UV rays of the welding process?

13. What is the tensile strength of 8018 welding rod?

14. What does a regulator on an oxygen cylinder used for?

15. Can 6010 welding rod be used on an AC machine?

16. Why is the welding slag cleaned off after every weld pass?

17. What is the distance from the end of the electrode and the weld pool called?

18. What does a "key hole" ensure when welding a root pass?

19. List three reasons to use a smaller electrode when welding out of position:

20. How can you minimize spatter while welding?

Bonus question: What does the acronym "CLAMS" stand for (worth 10 points)?