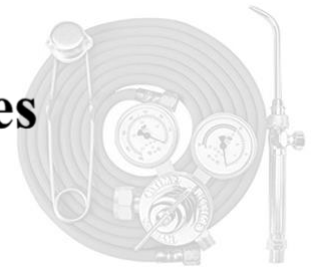


# Metals 200-201

## Safety and Single Fuel Torches

### Certification



## Welcome!

Pre-requisites for this class: Metals 100-101 and 102

### Goals/Agenda:

- Safety reminders
- What processes use a torch or heat, and in what ways?
- Identify and understand the tools and equipment at the soldering station.
- Review the Acetylene torch safety guide (at the back of this packet).
- Hands on practice igniting and shutting down the following three single fuel torches: Butane, Propane and Acetylene-air.
- Identify and understand the anatomy of the flame, practice identifying the temperature indicators, understand the relationship between fuel, flame and temperature of workpiece.
- A bit about Solder
- Shutting down the solder station.
- Project sampler Demo: Butt joint, T-joint, Sweat joint, Spot solder and post solder.
- Hands on practice with each joint. Hands on practice with annealing, to complete certification requirements.
- Checkout

Let's get started!

### Safety reminders:

- Appropriate attire for firework: work style boots or shoes, cotton or natural fiber clothing (no poly), long hair tied back and no dangling objects.
- Safety glasses
- Tongs and other gripping tools for handling hot metal and other tools.
- Ventilation (our vent should be on whenever there is live tanks or fire is being used). *Some other instances include some chemical patina processes or sealants.*
- First aid, fire extinguishers, and exits.

- Set up all tools, supplies and work pieces where you need them before you light any torches.

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### **Metalcraft and Jewelry solder station expectations:**

- NON-ferrous work material only-*Please no steel or iron!*
- Clean up when you are finished, putting things back where they belong not where you found them.
- If we are low on a supply write it on the shop log and let the captain know.
- Please do not solder or heat material directly on the solder station bricks. Always use kiln bricks or *solderite* pad.
- Properly shut down torches and bleed lines before stowing.
- Absolutely NO torch cutting
- No bonfires, please. We have a pit out back for that!

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### **What processes use Fire or heat?**

- Annealing: heat causes the molecular structures to excite and expand, as the metal cools it relaxes back into an imperfect structure allowing it to be more malleable. Necessary for many smithing processes.
- Soldering: a process of connecting two pieces of metal through high heat with an alloy
- Casting: a process of using extreme heat to melt metal and pour molten metal into a mold, creating a positive.
- Balling wire: a way to finish ends of wire, or the beginning of rivets.
- Enameling: a process using consistent high heat to make glass molten and bond it with the metal base.
- Patina: decorative finish caused by temperature change and oxidation of the metal.
- Metal clay: a material that is worked like clay and baked like clay producing a metal product.

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### **Identify and understand tools and equipment at the soldering station.**

- Tanks and Regulator system
- Torch hand piece and hose

#### **Station equipment and utensils**

- Flint lighter/sparker
- Fire brick and cover
- Pickle pot

- Quench pot
  - Flux
  - Solder
  - Cleaning supplies, and neutralizing agents
  - Solder pick, tweezers, hemostat, 3rd-hands, T-pins and binding wire
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## **Review the entire Acetylene safety handout.**

What is identified in the handout?

In which direction should you light the torch?

Which is lighter Propane or Acetylene?

What should you have at the ready?

What are three things to avoid?

What is the proper PSI setting of the acetylene torch?

Name three common sense reminders.

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## **Practice igniting and shutting down the three single-fuel torches.**

### **Butane:**

- Small hand-held torch with canister filled with butane
- Turn gas on by rotating knob on top counter-clockwise (left) until you hear gas escaping. Press the igniter button to light the flame.
- Turn gas off by rotating knob on top clockwise (right) until it is snug and flame completely disappears.
- The butane torch body can be refilled from a full can of butane.
  - Invert the torch body and locate the filling nozzle on the bottom. Invert the can of butane and fit the tip over the nozzle and press straight down toward the torch body. When the body is full, butane will start to spray out around the connection. Stop filling. The overflow will quickly evaporate.

### **Propane:**

- Portable gas canister (blue usually) Open the valve until you can hear gas escaping. Using the electric start included in the torch head, light the torch. It is possible to light using a sparking flint. Never a flame.

### **Acetylene:**

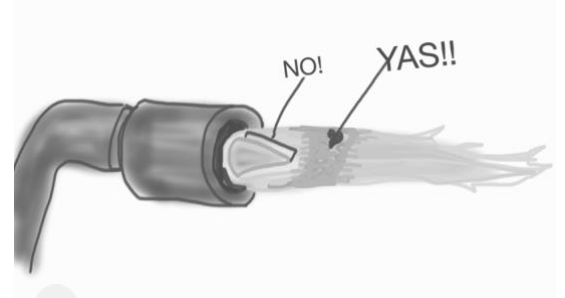
- Acetylene and is connected to a torch hand piece that mixes it with ambient air
- Acetylene fueled flames reach over 2000 degrees F.

- Follow the “Operation” section in the attached handout: Acetylene Torch & Silver Soldering Safety to pressurize the system and light the torch using the flint sparker or electric sparker.
- Follow the “Operation” section in the attached handout to shut down the system and bleed the hose.

*Dual Fuel system (Oxygen-Acetylene) is not covered in this class. Metals 202 covers this torch system and some of its uses. The Metals 202 class is on a request basis. (The more people request it the more likely it will be taught.)*

## Identify and understand the basic anatomy of a flame.

The flame from acetylene torch and most flames (when you can see them) will have an identifiable cone towards the bottom of the flame. We will call this the **nose** of the flame. **The nose should never touch your metal.** The **breath** of the flame is the sweet spot or focal point of the flame. This is where all the magic happens. The breath lies just beyond the tip of the nose. The **tongue** of the flame is to heat slowly-warm-your metal (this is the wispy part of the flame beyond the breath).



There are several sizes of torch heads that will allow you to adjust the amount of heat created and the area of coverage.

### **Temperature indicators:**

When working with heat and metal there are visual cues from the metal reacting to the heat that allow us to judge when to adjust, complete or stop an action. Different metals have different indicators and some require specific conditions to be able to witness those very subtle changes. ie: low light when working with silver allows you to see the very subtle color changes in the metal.

For the **copper** we are working with you will visibly see three changes in the metal as we are applying heat. The first is a rainbow apparition across the metal when it reaches the starting temperature of annealing (or rearrangement the molecules) If you continue to apply heat you will reach an eggplant color all over the metal, it is now annealed. The next complete change, the metal becomes a very deep red it is rather dark. This temperature should allow hard solder to flow evenly. Bright orange or red is too hot for the processes we will be working with, and soon after the metal will begin to melt.

### **Solder types:**

*Silver solder-* an alloy of silver, copper, nickel and sometimes zinc

- Hard: flows at approximately 1450 F
- Medium: flows at approximately 1360 F
- Easy: flows at approximately 1325 F

- Super easy: flows at approximately 1207 F

Tip: *always start with your highest melting point solder, as assembly progresses use lower melting point solder. Easy should be reserved for repairs.*

**How does solder work??** It 'flows' between the two pieces of hot metal at its melting point through capillary action. There must be a very small space for the solder to flow into and through, heat from either side of the seam helps to draw the solder down into the seam.

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## **How to shut down the soldering station:**

- Unplug pickle pot and make sure the lid is on.
- Cover and stow the quench pot
- Return utensils to jar or bin under the soldering deck
- Close the flux jar and stow it
- Complete the shutdown procedure for gas tanks
  - Close the tank valve
  - Pointing the torch head into the vent, open up and bleed lines until both pins drop to zero.
  - Close torch valve
  - If cool stow for future use.
- Shut off lights and ventilation unless others are using the space (remember to check the glass station)
- When firebrick is no longer hot, cover with wooden lid. If you must leave before it is cool enough, place a sign on or near the firebrick to indicate it is still hot

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## **Project Sampler Demo:**

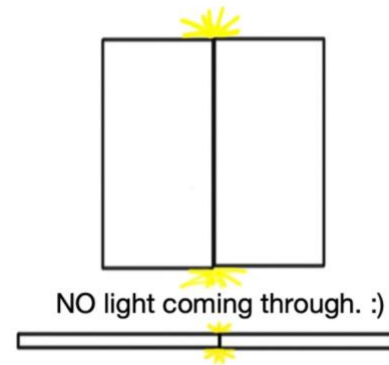
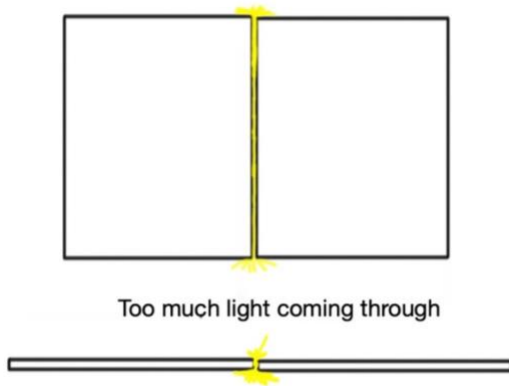
The Joints!! There are five main types of joints used in heat processes. They are: butt joint, T-joint, Sweat joint, Spot and post.

These five we will cover in order; each learner will complete the joint before moving on. I will demo the set up and soldering of each joint then you will complete the task.

**Butt joint:** For this joint we will be cleaning our metal and making sure that the two ends we want to solder match as perfectly as possible. You will use a file and Maybe sand paper to minimize the distance between the two pieces. When held to the light there should be little to no light visible through your joint. The two pieces will butt up against each other to create the joint, as seen below.

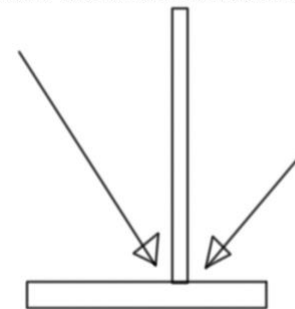
Not so much ↓

Yes! ↓

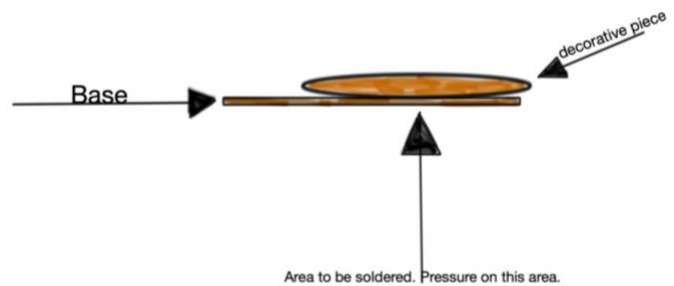


**T-Joint:** as with the butt joint you want the metal to be connected to be as clean, and level as possible. Matching up rather closely. For this joint the two pieces of metal will intersect each other. You will want to employ some tools for this set up as seen in the demonstration. While only placing the solder on one side of the joint you will heat from both sides, top and bottom. Keeping even heat on the pieces is necessary to allow the solder to flow.

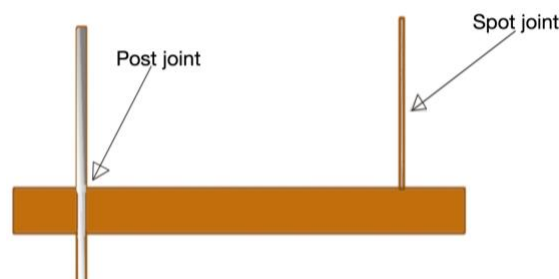
T-Joint- heat from both sides. Solder on one side.



**Sweat joint:** Also known as an overlap joint. This operation is done in two parts, as demonstrated. Remember to apply pressure during heat cycle to assure connection.



**Post and Spot joint:** These two joints have specific uses. While a spot solder is not a structurally sound joint it comes in handy in many a tight spot. The post solder going through the base sheet or surface is a much stronger joint (more points of contact).



Your

Turn!!

**Complete all five joints.** Check in when finished or when you have questions.

When you are finished with your joints, you will need to clean up your area and put away tools you have used that no one is currently using. Bring your handout and completed sampler to the instructor for checkout.

## Checkout :

- Ignited and extinguished all three torches
- Read and understood Acetylene handout
- Changed Acetylene torch head
- Completed all five joints
- Cleaned up to instructor satisfaction
- Answered check out questions below
- Attended two separate occasions to use the torch

Date: \_\_\_\_\_ Instructor: \_\_\_\_\_

Date: \_\_\_\_\_ Instructor: \_\_\_\_\_

### Questions:

1. Name several hazards that are present while using torches and how to mitigate them.
2. How do you prepare your work station before soldering?
3. In what ways can you be sure that the station has been properly shut down and prepared for the next use?
4. What is the proper PSI setting of the acetylene torch? What should you do if it is higher?

5. Where is the nearest fire extinguisher? The nearest exit?
6. Name three tools that could be damaged if the material is too work hardened?
7. Name all of the joints you made during this class.

**After completion of the sampler, you must attend two different sessions (arranged with the instructor) where you will use the torches in your work. The instructor must be present for the first two times you use the torches after this class**

