EML2322L – MAE Design and Manufacturing Laboratory

TA Outline (Welding & Plasma Cutting Demonstrations)

WELDING DEMONSTRATION

1. Conduct the welding demo ***(~28 minutes)***:
   A. Focus on MIG (*metal inert gas*) welding, which is formally designated GMAW (*gas metal arc welding*)
   B. Show the students the common parts of the machine ***(~3 min)***:
      1. power supply
      2. gas cylinder / regulator / hose ***(turn on vertical tank valve if you're the first group of the day; turn off if you're the last group of the day)***
      3. spool of metal wire inside machine (covered with a thin layer of copper for corrosion resistance; copper cleanly vaporizes at welding temperature)
      4. welding gun thru which the wire and gas pass
      5. wire rollers (demonstrate how they push the wire through the lead)
      6. ground clamp which completes the electrical circuit
   C. Give students welding masks; show them how to adjust the head-straps properly (not too tight or they will break); caution them to be careful to not drop the helmets
   D. Review welding safety rules for our lab ***(~2 min)***
      1. close the welding curtain
      2. wear jacket and gloves to protect your hands and body from UV radiation
      3. NEVER pick anything up off the welding table without gloves
      4. call out ***"EYES"*** **and wait 2 sec** before pulling trigger to warn anyone in the area
   E. Demonstrate proper MIG welding to the students ***(~5 min)***
   F. Allow students to rotate through, each running two or three 1″ fillet welds; actively correct their technique on the first pass and let them do the others on their own with verbal and physical correction as needed ***(~15 min)***
   G. If anyone wants more time to practice and learn, they can sign up for a training session during the TA hours; the signup sheet will be on the TA table
   H. If you are the last group of the day, turn off the shielding gas tank using the vertical ROUND handle on the top of the tank (***NOT*** the small brass knob on the regulator)

2. Demonstrate the spot welder to the students so they know they can use it for sheetmetal parts (use gloves; only for use with STEEL; must have access for tongs; weld corners of sheetmetal demos together) ***(~3 minutes)***

(SEE THE NEXT PAGE FOR THE PLASMA CUTTING DEMONSTRATION OUTLINE)

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PLASMA CUTTING DEMONSTRATION *(~5 minutes)*

1. Make sure the air valve is turned to the ON position (inline with air line) and turn plasma cutter ON using the main power switch on the rear of the machine

2. Attach the ground clamp / lead to the welding table / workpiece and set the output current to 20A (its lowest setting) using the adjustment knob on the front of the machine

3. Explain the plasma cutting process to the students:
   A. Like welding, it only works on electrically conductive materials
   B. Power supply creates electric arc to melt metal; ground clamp completes the electric circuit
   C. Compressed air blows thru the center of the plasma torch to remove the molten metal from the cutting zone
   D. Our plasma torch is moved manually to follow a 2D cutting path, but CNC versions exist; our plasma cutter can be used to cut lower precision free-form shapes out of sheetmetal; we have guides to assist in cutting straight lines and arcs

4. Draw a cut path on a piece of scrap sheetmetal with a Sharpie located in the front drawer of the TIG welder; ***double check that the cut path is clear of the welding table***

5. Use the darkly tinted plasma cutting glasses to protect your eyes; students can use the same glasses or their welding masks; if you allow the students to use the glasses, tell them to be careful with them, as they are EXPENSIVE); put the MIG gloves on as well

6. Lower plasma torch until the tip is ~1/16″ off the part's surface during piercing; once the cut begins, drag cut by sliding the tip (or shield) of the cutting torch right across the part surface

7. Call out ***"EYES"* and wait 2 sec**; pull the trigger to make the cut; move the plasma torch fairly quickly or the molten metal will coalesce behind the plasma arc *(~2 in/sec torch velocity)*

8. If you are giving the last demo of the day, turn the air valve OFF (perpendicular to air line), turn the plasma cutter's power switch OFF and thoughtfully wind up the cutting torch cable being careful not to kink any of the wires/cables

9. Students should carefully return the glasses to the bags and hang the bags on the eyeglass rack; again these glasses are EXPENSIVE and the students should be told to treat them as such

10. *TA NOTE: students* ***SHOULD NOT*** *operate the plasma cutter on their own during labs, without TA supervision to ensure the machine and welding table are not damaged*