Engineering Innovation Center
Fabrication Shop
Basic Welding Training
The Engineering Innovation Center Fabrication Shop was established for support of undergraduate student course work. Every effort will be made to make the shop available for these projects. Students of Engineering who desire to use this equipment for educationally-related activities are required to attend training.
Welding Safety

- Proper attire and PPE (Personal Protective Equipment) are required when using welding or metal cutting equipment
  - Some PPE is provided, but students must be aware of the attire and equipment required
- Use welding screens when performing welding operations to protect other fabrication shop occupants
- Open windows adjacent to welding station to ensure adequate ventilation
- Clear welding table of all flammable/combustible items before beginning operations
- Full Body coverage is essential when performing any type of welding.
  - Sunburn and blistering can occur if skin is directly exposed to light and heat produced when welding
- **NEVER LOOK DIRECTLY AT THE BLUE LIGHT PRODUCED BY WELDING**
Proper Attire and PPE

- Full length Cotton Shirts
  - Must be 100% cotton (Denim Long Sleeve Shirt)
  - NO SYNTHETIC FABRICS - sparks and slag will melt through and burn operator

- Leather Boots
  - Closed toe leather shoes acceptable, but boots lacing up past ankle preferred

- Cotton pants (Blue Jeans)

- Safety Glasses

- Welding Hood
  - Turn welding hood on to WELD mode

- Thick leather gloves for welding
  - Workpiece and adjacent clamps or apparatus will become extremely hot
  - Gloves can burn through, do not grasp metal that has just been welded
MIG Welding

- MIG – Metal Inert Gas
  - Low Skill Level
- Also known as GMAW (Gas Metal Arc Welding) or wire welding
- Process
  - Turn Gas/Machine On
  - Adjust Wire Feed Rate and Voltage
  - Attach Ground
  - Trigger Operated Gun feeds Wire and Gas
- Must be dressed in proper PPE
Stick Welding

- Also called SMAW (Shielded Metal Arc Welding) : Intermediate Skill Level
- The “stick” functions as the electrode, filler material, and shielding gas
- Process
  - Turn Machine ON
  - Attach Ground
  - Insert Rod into Clamp and Arc off to part to initiate weld-
  - Many different types of rods are available, different material/gas produced
- Must be dressed in proper PPE
TIG Welding

• Tungsten Inert Gas Welding, also called GTAW (Gas Tungsten Arc Welding: Advanced skill level

• TIG Steel
  – Most forgiving and easiest material to TIG Weld.
  – **Clean joint to be welded with grinder**
  – Set machine to DCEN (direct current electrode negative)

• TIG Aluminum
  – **Clean joint well, no oil or debris can remain**
    • Clean with grinder (no steel particles in grinder) and rubbing alcohol/acetone
  – Set Machine to AC (alternating current)

• TIG Stainless Steel
  – **Clean joint VERY well, no oil or debris can remain**
  – Set Machine to DCEN (direct current electrode negative)
  – Stainless tends to warp when too much heat is applied

• Must be dressed in proper PPE
Plasma Cutting

• Use of electricity and compressed air to cut conductive metals
  – Carbon steels, Stainless steels
  – Aluminum
  – Copper, brass
  – Cast metals

• Process
  – Clear workspace of flammable containers and clutter
  – Fix work piece to table or workspace with clamps
  – Clamp plasma cutter ground to work piece
  – Set up and fix guide rail for plasma cutter or draw cuts onto work piece with soapstone
  – Turn on machine, adjust airflow and current for proper penetration
  – Do not touch cutter tip to work piece, hold just above surface

• Must be dressed in proper PPE
Oxy-Acetylene Torch

- Mixture of Oxygen and Acetylene to cut steel
  - For cutting Ferrous Irons
  - Can not cut Aluminum or Stainless Steel
  - Can cut up to 12 inches thick
  - Can also be used to heat materials
- Acetylene is the fuel not oxygen
- Must be dressed in proper PPE
  - Must use goggles rated for Torch cutting
- More than 1/7th the capacity of the cylinder should not be used per hour
  - This causes the acetone inside the acetylene cylinder to come out of the cylinder and contaminate the hose and possibly the torch.
- Acetylene is dangerous above 15 psi (about 1 atm)
  - It is unstable and explosively decomposes.
- Proper ventilation when welding will help to avoid large chemical exposure.
Hand Grinder

• Grinding is used to remove excess material or to polish metal
  – Hand grinders can be fitted with buffing discs, sanding disks, or grinding disks

• Proper PPE
  – Full Face Shield or Welding Hood on “Grind” Mode
    • YOU MUST WEAR SAFETY GLASSES WITH FULL FACE SHIELD
  – Leather Gloves and Shoes
  – Cotton (Denim) pants and shirt

• Be aware where your sparks are flying
  – Do not grind where sparks are flying onto your body
  – Adjust the guard as needed to prevent injury or damaging equipment
Unsafe practice or obvious abuse of equipment constitutes a danger to people and damages equipment. Therefore the Fabrication Shop Manager or any person observing an unsafe act should stop unsafe practices in the Fabrication Shop. Students violating any of these rules will have their Fabrication Shop privileges revoked for a period of at least two weeks. Longer periods may be assessed, depending upon the judgment of the Fabrication Shop Manager and the Engineering Innovation Center Facility Manager.