

Intro to Welding

Safety is your responsibility

Safety

Environment

Others in the area should be notified that you intend to weld and informed of what to expect. (noise, smoke and loud sounds as a general rule)

Flammable things may be close by, if so make them safe! The 3D printers use acetone to finish some of their parts this may be close to the welding area and in an unmarked pale, visually inspect the area you will be working in!

Arc created by the machine during use is dangerous to eyes and skin. Protective gear and equipment must be used. Close welding curtains to protect others and inform them to avoid exposure to the light of the arc.

Plated steel should be avoided, if it must be done the paint, chrome, galvanization etc. should be removed from the heat affected area.

Containers should be empty and cleaned, at welding temperatures many things ignite and explode. Flammable substance containers should not be welded.

Work Area should be organized and clean stopping periodically to maintain this.

Sparks can travel long distances, at least 30 ft and ignite cloth, sawdust, paper/cardboard, even lumber. Know where your sparks will go especially with **grinding**, directing them into an area that is safe and ventilated.

Ventilation may be inadequate or used incorrectly, filling the room with smoke should be avoided. Respirators should be used if any doubt exist as to the air quality.

Cylinders that contain pressurized gas are dangerous. They should all be secured at all times and a thorough understanding of their dangers and operation is needed before use.

Apparel

Clothing should be cotton or another flame resistant type.

Shirts and welding jackets with long sleeves and a buttoned up collar prevent arc burn.

Shoes should be boots or at least close toed with pant cuffs straight to prevent sparks from catching and setting a pant leg on fire.

Gloves made for welding and covering skin between hand and cuff link.

Respirators in the absence of adequate ventilation.

Helmet for welding with a shade 10 lens

Machine

Inspection of the machine will tell you that

It was put away properly by a courteous previous user

Gas tank is secure with a backed out regulator and turned off valve

Inside the case the wire is feeding properly and tensioned correctly

Welding gun is clean and has all parts with wire feeding

Setup

1. Make sure the machine is plugged in
2. Check that the pressure regulator is backed all the way out
3. Turn on the gas (left) all the way until the valve seats in the open position
4. Turn the pressure regulator in (right) until the desired pressure is achieved (15-20 cfh)
5. Unroll cables so they are straight and out of the way, position the machine and work so they reach the part to be welded and work for your welding position.
6. Attach the ground cable to the work.
7. Turn on the machine and ensure that gas flows and wire feeds

8. Adjust the machine for the work you will perform. Both machines have a chart on the inside of the lid.
9. Lay the torch down carefully so the trigger doesn't pull feeding energized wire into the room.
10. Turn on fans and close welding curtains.

Shut down

1. Turn off the welder
2. Clean the torch head
3. Coil the cables on the machine
4. Turn off the CO2 and back off the regulator
5. Clean work area and put away project
6. Put away all tools in their home including welder
7. Open curtains and turn off fans

Changing things

Turn the machine off when any work is performed inside it.

Contact tips need replacement periodically, the hole in the center will be distorted and weld consistency will be poor. Each machine has a special tip that is made for a specific wire size these numbers can be found on the spool of wire, the contact tip and the drive rollers (they should all match) Remove the cup, cut the welding wire protruding from the tip and unscrew. Thread new tip on snug, replace cup.

Welding wire runs out and is easy to change. Make sure the right wire spool is used and pay close attention to the end as you feed it a slip of the hand can let the spool unwind itself into a rat's nest.

Damaged or dirty wire should be scrapped and **not** installed in the machine. Feed the wire through the guide and drive rollers into the liner and reassemble the drive assembly. Turn off the gas to conserve and pull the trigger to feed the wire. The cord should be straight and the contact tip removed until the wire exits. Reassemble the torch and turn gas back on, check settings and weld.

Gas Cylinders go empty. A typical cylinder will not drop significantly in pressure until moments before it is depleted at which time your weld will exhibit severe porosity and fail to provide strong attachment of the pieces. Turn everything off as you would in a shutdown and disconnect the fitting closest to the bottle (watch the plastic washer!). If the bottle has a threaded neck a corresponding cap is close by and must be installed! (gas companies require this) Installation involves reinstalling the plastic washer and tightening the regulator to the cylinder. (make sure it sits upright) A chain or other securing method must be used on a cylinder without a cap! No teflon tape is needed on typically used fittings.

Tightness and torque on most things is snug or a little tighter than what you can do with your bare hand. Gas fittings should be wrench tight but don't kill it, wire tensioner should be as low as possible to feed the wire through pinched fingers.

Welding

Factors

Settings depend on the work being performed, a guide is provided inside the lid of the welders. Typical specs that pertain to the settings are wire kind (solid core), shielding gas (CO₂), wire size (0.030 typical in the Lincoln) and (0.035 typical in the miller)

Wire speed determines how fast the wire feeds

Voltage determines power applied to the work piece

Distance from contact tip to work should be a consistent and smooth $\frac{1}{4}$ - $\frac{3}{8}$ inch away from the work piece.

Speed of travel should produce a nice bead equally distributed on both pieces of metal about 1 $\frac{1}{2}$ -2 times the thickness of the material.

Angle of the torch should be slightly pushing for solid core wire and positioned so weld is applied evenly (prevent sagging by angling up as applicable)

Penetration is estimated by discoloration on the reverse side of the weld.

Surface preparation will always lead to a better weld. (cleaning/grinding)

Positioning and rhythm is critical to a beautiful weld, move the work or yourself to find a comfortable position and take a couple practice passes without pulling the trigger

Clamp work to hold it stable and prevent heat distortion

Good welds have a slight bump to them and their width is 1 ½-2 times the thickness of the material.

Discoloration of the steel on the back side of the weld indicates good penetration.

Wrong

Porosity is usually caused by lack of shielding gas. Check the cup to make sure it is clean and free from obstruction. Check the gas gauges to make sure its on and flowing. Dirt and paint can also cause porosity.

Wire feeding problems can be caused by getting too close to the work, worn tips or improper tensions. check the machine paying close attention to the area after the drive rollers and before the liner, if the wire is bunching here it will need to be cut out carefully and re threaded through the liner.

Bulky welds are caused by fast and slow travel speeds and low voltages

Flat welds are caused by over voltage

Holes burned in the metal are caused by too much voltage and slow travel speeds

Distortion of material comes from too much heat, insufficient clamping and failure to compensate for shrinkage.