Abstract:

Welding is a universal process to join metal together. This report will look at two particular types of weld: MIG, and TIG. MIG uses an automatically fed wire which connects the pieces together. TIG uses an electrode to create the electric path which melts the metal and creates the weld. Both welding processes uses an inert gas to protect the weld. And since welding a dangerous especially if one is not trained, safety is very important no matter the skill level. TIG welding is very similar to MIG welding however TIG welding requires a lot more skill and practice. But both are great methods to weld and this report will show the important devices that make it possible.

Keywords:
Argon, inert gas, metal, MIG, TIG, welding
Welding has always been an important skill used in a variety of manufacturing applications however it is skilled trade that not everyone can learn easily. Welding is generally used to join two pieces of metal together without significantly destroying the steel's structural integrity. Metal beams can be connected by drilling holes and connecting adjacent pieces with a bracket, nut, and bolt, but it would require a lot of precision placed holes and a lot of manufacturing time before the actually construction. Welding is a quick, easy, and cheap way to joint metal together compared to other methods. This is an informative report to describe the basic format and process on how to weld.

There are several different types of welds used out in industry however the more commonly used types of welds are MIG, TIG, arc, and oxyacetylene. This report will look at two particular types of weld: MIG, and TIG. Since both have the same general concept and are similar in process, people are often confused between the two. Each method has its own unique trait and has its own list of advantages and disadvantages which will be discussed later.

**MIG Welding**

MIG stands for *metal inert gas* and the basic premise behind MIG welding is that it uses electricity to melt a continuously fed wire which joins the pieces of metal together. During the actual welding process, an inert gas is sprayed from the tip of the welding gun which helps to protect the weld from corrosion due to the atmosphere. That is a quick summary of what happens however there are several different components that make up the entire system and each one will be looked at more closely.

**Welding Control Box**

The majority of the process happens before the actual welding procedure, it all starts with the welding control box. This device regulates a lot of factors that go into a weld. The device controls the amount of voltage that goes into the tip of the gun and the feed rate of the wire. For different gauge thicknesses, there is an ideal voltage and an ideal feeding rate to weld the material. If the voltage is too high it can burn a hole through the material, and if it’s too low it may not melt anything. And if there is an insufficient supply of wire, will make the connection practically useless.

Inside most welder control boxes is one large spool of wire and a series of rollers that push the wire out to the welding gun. There are different MIG wires to choose from, and the selection of one depends on the material to be welded. There are also different diameters of
wire to choose from too. For production work, 0.035”, and 0.045” are the most common diameters. However to ensure a successful weld every time, one should check manuals and documents to find the proper power rate and wire feed rate. For more information about MIG wires, one can go to the link provided below.

http://www.mig-welding.co.uk/calculator.htm

If there happened to be any problems while welding, one could easily determine where and how to fix the problem. The most common problem with a welding control box is generally the wire feed jams up. This is caused by a sharp turn or a kink in the welding guns supply line. This does happen from time to time, but if there is something more severe with the wire feed, you may want to check this part of the machine out first.

Gas Tank
Both welding processes (MIG & TIG) use some type of inert gas to protect the weld. In most cases the gas used for this process is usually argon gas or some type of an argon mixture. The gas shields the weld as it forms and serves as a protective layer against the atmosphere. Without the gas the welds will have some coloration along with weld not looking neat and uniform.

Along with every welding tank there should be a pressure regulator. Pressure regulators reduce the high pressure gas that is stored in the cylinders to a usable pressure for welding. In most general cases it should be set between 5 and 25 PSI.

If any problems were to concur with the inert gas tank, it would probably be the tank is near empty or that it was not turned on. One could tell when this happens because the weld will start splattering little balls of metal, and the weld path would turn nasty colors of brown and green.

Welding Gun
The welding gun is where the welding takes place. The gun consists of a trigger that allows the wire feed and the flow of electricity to occur at the tip of the gun at the values set on the welding control box. The tip of the gun has a replaceable copper nozzle that guides the wire. The nozzle also varies in size to fit the particular diameter wire so each tip is made for a specific system so they vary depending on what system you are using. The tip also allows the gas to pass through it order to protect the weld.
The concept behind MIG welding is that it uses an arc of electricity to create a short circuit between a continuously fed anode and cathode. The anode is the positive side being the wire-fed welding gun and the cathode is the negative side being the welded metal piece.

The Ground Clamp
The ground clamp is the cathode (negative part) in the circuit and completes the entire circuit for the electricity to travel. The clamp should either be clipped directly to the piece of metal or onto a metal welding table. The clip must make good contact with the piece in order to weld so it is advised to grind off any rust or paint that may prevent making a solid connection with your work piece.

Safety
Some important safety precaution should be taken.

Since MIG welding produces lots of heat and lots of harmful ultraviolet light, you will need a welder's mask and welder's gloves. You will need a mask and gloves because of the flash created, it will burn your eyes and your skin just like the sun will if you don't protect yourself.

Another important safety factor in welding safety is knowledge of the material being used. The most critical fact: **DO NOT WELD GALVANIZED STEEL**. Galvanized steel contains a zinc coating which produces carcinogens and poisonous gases when burned. Exposure to the stuff can result in heavy metal poisoning, flu like symptoms and permanent physical or mental damage.

For more additional information about MIG welding, you can visit one of these websites.

http://www.mig-welding.co.uk/

http://lincolnelectric.com/knowledge/articles/list.asp

TIG Welding

TIG welding is very similar to MIG welding. TIG stands for **tungsten inert gas** which uses a tungsten electrode to melt and join the pieces together. A TIG weld generates heat by electricity jumping from an electrode (tungsten metal) to the metal surface.

In most cases when you by a tungsten rod they come in a package as cylindrical rods. For the best results, you want the tip to be a fine point, similar to a pencil. The finer the tip, the clear the weld will be. So grind the tungsten rod to a point. When you weld the tip will
eventually become rounded due to heat as you weld but it still result is a more uniform looking weld. To insert the tungsten metal rod, simply screw the back of the electrode gun, insert the rod into the hole, and replace the back of the gun. The tip of the electrode should be exposed about 1/4” out.

**Welding Control Box**

Similar to MIG welding, TIG also uses a welding control box. Below is a link to calculate the proper voltage necessary.


**Gas Tank**

The inert gas tank usually uses pure argon for materials like copper and aluminum and you would use an argon/carbon dioxide mixture for welding steel together. Again the gas is important to keep the weld from becoming corroded. The metal will rust (or in the case of aluminum, oxidize) ridiculously quickly at the high temperatures.

**Welding process**

The process is a little different in this case. For TIG, the welding gun typically does not have trigger to start, rather the electricity is controlled by a foot-pedal. Hold the electrode about an inch away from the metal and never try and touch the electrode to the metal. If you do, the molten material will leap onto the electrode and makes it more difficult to create a good weld. If this happens, stop, turn off the welder, remove the tungsten rod, and grind it down again. Your other free hand will hold the filler material. When the spark is generated, try a supply a constant feed of filler to void the gap in the material. Since one has to be ambidextrous, it takes a lot of time and skill to master this technique.

If everything is in good working condition, jam down on the foot-pedal to quickly dump a bunch of current on the piece and heat the metal. The idea is to very quickly heat the metal and start the weld pool. The metal will become a fluid, if you heat the metal for too long, it will start and warp the material. Once you have a weld pool started, you can ease off the pedal a little, to control the amount of heat and current being applied to the metal. Try to alternate sides to keep the welds even, and to keep one side of metal from getting too hot and warping. If the metal starts to burn or melt away, too much current is being dumped in, back off the foot pedal. If the metal is getting flaky and not turning into a liquid, supply more power (step on the pedal harder).
In summary, the advantages and disadvantages to each welding method is listed below.

Some advantages to MIG welding are
- The ability to join a wide range of metals and thicknesses
- A good weld bead
- Minimal of weld splatter

Some disadvantages to MIG welding are
- MIG welding can only be used on thin to medium thick metals
- The use of an inert gas makes this type of welding less portable
- Produces a somewhat sloppier and less controlled weld as compared to TIG

Some advantages to TIG welding are
- The ability to join a wide range of metals
- Creates a good weld bead
- A minimum of weld splatter

Some disadvantages to TIG welding are
- Skilled trade, requires use of two hands and a foot
- The use of an inert gas makes this type of welding less portable
- Produces a cleaner and more controlled weld as compared to MIG