Welding Gases

Welding is a lot more complex than it appears at times. One of the real areas of confusion for many people, when they first take up welding, is what kind of gas should you use?

There are **10 basic gases that are used in welding,** and they can be mixed together to create even more options!

The good news is, however, that you can learn to quickly choose between them to get the job you want to be done, done well.

Our **guide to the different types of gases available should reduce any confusion** you have and make sure that every time you weld, you choose the right gas for your work and you do so with confidence!

Inert and Reactive Gases In Welding: A Brief Overview

There are two types of gas that is applicable to welding:

- **Inert gases.** Inert means "nonreactive under a specific set of conditions". This includes but is not limited to the noble gases (which are generally nonreactive in most conditions). Noble gases are also elemental (pure elements) but other inert gases are usually compounds.
  However, it's important to remember that all inert gases can be made to react given specific conditions and this is why choosing your gas for welding is an important step.
- **Reactive gases.** As the name suggests these gases are chosen for their ability to react with other elements or compounds. They can create changes in the state of the weld or the welding conditions.

What Is Gas Used for In Welding?

There is a range of different uses for gas in welding. This can include: keep the arc clear of impurities (such as dust, other gases, dirt, etc.),

Also used for assisting arc stability and ensuring proper metal transfer for many welding processes. making sure that the welding pool stays clean below the seam (this is known as purging), for blanketing and for heating too.

If you don't use gas properly in welding you can end up with a weak or porous weld or find that there is too much spatter while welding. Spatter won't ruin the weld, but it does reduce productivity as it requires effort to clean it up.

The Different Type of Gas Used For Welding

There are 10 different "pure" gases that can be used in welding. They are:

Argon (Ar)

Used in many welding processes, from the inert noble gases. Argon will not react with most other substances (though it will at extremely high temperatures). As the 3rd most common of the gases on Earth – it's also a very cheap choice to use (in the US).

It's a shielding gas used when working on stainless steel, aluminum, and titanium. It cannot be used in pure form for ordinary carbon steel because the arc will not be stable enough. Argon and CO2 mixture on the other hand provide the necessary arc stability for welding mild steel.

Argon welding gas is mainly used for shielding and in particular to keep contaminants in the air at bay.

It can be brought to bear in the primary welding stage, or it can be used to purge the underside of the joint. It's a sure choice for a MIG welding gas and the number one choice for TIG welding.

An Argon cylinder is a staple of most welding areas as argon welding is very common, indeed.

Carbon Dioxide or CO_2

Also known as MIG gas Another very common option among natural gases (we exhale CO_2 as do all animals – though plants inhale it). It is cheap and easy to produce on an industrial scale. CO2 welding gas (mostly used gas for MIG welding) is used for shielding the arc and molten pool.

CO2 costs even less than Argon does but there is a distinct reduction on the quality of the weld when compared with Argon and it can lead to more spatter than Argon too.

So, it's more often used in a mix with something else than as pure CO_2. Argon CO_2 blends are very common.

Oxygen (O2)

We breathe Oxygen and it's fairly important to all other life on Earth. It tastes of nothing, smells of nothing and is very reactive. To use Oxygen in welding, it's normally mixed with other shielding gases to change the fluidity of the molten metal and it can speed things up too.

You can also use it to add heat when welding. If you mix it with acetylene, you can create a flame that will be enough to weld steel (the only flame that will).

Oxygen can also prevent the need for a "shielding flux filler wire" in your welding.

Helium (He)

Helium has a unique property that it doesn't freeze – you can get a liquid state but not a solid one. It also makes you talk funny if you inhale it, which is where most of us encounter it.

There's not much Helium on Earth and it's hard to produce, so, it's quite expensive when compared to other choices of welding gasses. It is used for shielding both by itself and in blends as it can help offer deep penetration and boosts the heat input but it can be hard to get a consistent arc start with it.

It works best when blended with Argon which compensates for the inconsistent starting properties of Helium. This kind of blend is used when welding nickel alloys for example.

Nitrogen (N)

The most abundant natural gas and makes up the majority of our atmosphere. Nitrogen can be used in shielding (for plasma cutting or laser welding).

It can be mixed to form blends with other shielding gases and that allows for some specialist usage, this gas won't work with carbon steel but can work very well with nitrogen-rich metals.

It's also a good choice when you want to do blanketing as it is very cheap and can be used in large spaces without worrying about the cost impact.

Hydrogen (H)

Hydrogen is a very reactive and simple element and yet, despite that, it's mainly used as a shielding gas in welding. It's used in blends in very small percentages and this is very safe and it can help increase the heat of the blend, It's also used in a process called "atomic hydrogen welding".

This requires pure hydrogen and it creates an incredible heat of up to 7200° F which helps weld metals with incredibly high melting points. It's worth noting that atomic hydrogen welding is very dangerous and you would need very specialist training to do it.

The three gases below acetylene, propane, and propylene are used in oxy-fuel welding and are extremely flammable.

The Different Type Of Mixed Gases Used In Welding

Argon & CO2

The most common mixed gas for shielding in welding is a CO_2 Argon Mix. It can run from 95% – 75% Argon and 5% – 25% CO_2. In most applications, this will create a pleasantly smooth weld and keep the amount of spatter to a minimum.

The thicker the steel you're looking to weld, the more Carbon Dioxide you require in the mix and the thinner it is, the more Argon you need. This is also one of the main mixtures used as MIG welding gas, and more about that you can read In this article

Argon, CO2, & Oxygen

If you're looking for a little more fluidity in the weld pool then you're probably looking for an Argon, CO_2 gas & Oxygen mix. You get fairly similar properties to the Argon, Carbon Dioxide blend when it comes to the finished weld.

However, in addition to the improved fluidity, it can also improve the travel speed of the welding process and make a welder much more productive.

Argon, Helium, CO2

There is a wide range of different mixes available when your chosen weld gas is an Argon, Helium, Carbon Dioxide mix. Depending on what it will be used for the mix will either be dominated by Helium or Argon.

The gases used, make this mix suitable for welding anything from carbon steel to stainless steel, and it can even be used as an aluminum welding gas. (a good mixture for welding stainless steel with MIG machines).

Helium & Argon

If you're looking for gas for welding Aluminum then you're probably going to go with Helium & Argon mixed together. In addition to Aluminum, it's also suitable for welding alloys.

Why? Well because the mix provides a deeper level of penetration and also delivers a wide-finish on the weld itself.

Argon & Oxygen (o2)

This mix of gases isn't suited to stainless steel and if you are welding steel with it – it will normally be light gauge steel. Its purpose is to help with the material fusion of the steel.

You won't normally find very much Oxygen in this argon gas mix because otherwise, it would burn too hot and argon gas welding is for finer things and thinner materials.

Argon & Hydrogen

If you're TIG welding with gas then a mixture of Hydrogen and Argon is ideal when you need a clean weld. The hydrogen prevents any oxygen in the air from getting into the weld and causing oxidation.

The waste product of this reaction is water which quickly evaporates under the heat of welding.

Nitrogen & Hydrogen

This mix has a fairly specialist use and it's a shielding gas for the preparation of austenitic (that is high in chromium and nickel with low carbon) stainless steels.

It enables a higher level of penetration whilst making the welding process go faster. It also helps to improve the mechanical properties of the stainless steel end product.