

Understanding your business



Ask the expert

Air Products shares their philosophy on welding aluminium – how to avoid porosity, the importance of preparation and the benefits of using the right gas mix.

- What can I do to prevent porosity occurring when welding aluminium?
- Do I need different tools when welding aluminium?
- What is the optimum gas mix for welding aluminium?
- Ask the expert

What can I do to prevent porosity occurring when welding aluminium?

Porosity can be a significant problem when welding aluminium, caused predominantly by the absorption of hydrogen in the weld pool, which forms pores in the solidifying weld metal. Common sources of hydrogen are moisture and hydrocarbons from contaminants on the parent metal, filler metal, the surrounding atmosphere, or from surfaces in contact with the weld area. However, the most common source of hydrogen is the resilient refractory oxide film, which gives the material its resistance to corrosion and re-forms rapidly on a clean aluminium surface in air. This oxide layer must be removed prior to welding, not only to eliminate the risk of hydrogen absorption but also because of its high melting point of over 2000°C, compared to 660°C of aluminium itself.

To avoid porosity it is essential to clean the material surfaces thoroughly by mechanical cleaning or chemical etching to remove the oxide film and other surface contaminants.

After thorough cleaning and preparation of the surfaces, welding should take place as soon as possible (within the working shift), as the oxide film will begin to re-form immediately.

When MIG or TIG welding, it is important to consider the cleanliness of the filler wire. It should be purchased to a recognised standard in a shaved or double-shaved condition to ensure that residues from drawing lubricants (the primary source of hydrogen in aluminium filler wire) are removed.

Do I need different tools when welding aluminium?

Tools used for the cleaning and preparation of aluminium prior to welding will depend on the component size and wall thickness. However, they will need to be used for welding aluminium only, to avoid cross contamination. Generally, the oxide layer is removed using scrapers, rasps, routers and mechanical stainless steel wire brushes. For inter-pass cleaning and/or back-chipping, power saws, milling blades and mechanical stainless steel wire brushes are used.

Special attention should also be given to the gas supply system, including the quality and integrity of welding torches. Gas supply lines and hoses need to be high quality and preferably manufactured from non-hygroscopic materials such as polychloroprene (Neoprene) or metals such as copper or stainless steel.

What is the optimum gas mix for welding aluminium?

MIG or TIG welding of aluminium can only be welded successfully with an inert gas or gas mixture. High purity argon ($\geq 99.998\%$, 10ppm minimum dew point) is the benchmark shielding gas for both MIG and TIG welding. However, its performance as a shielding gas for welding aluminium can be enhanced by adding helium.

Using an argon/helium mix, such as Alumaxx[®] Plus, part of the Maxx[®] range of shielding gases, gives the welder the best operating characteristics of both gases. Argon is particularly effective in providing superior arc starting and stable arc conditions. When combined with helium's higher thermal conductivity, it produces high quality welds giving increased travel speeds, a greater depth of fusion and a smoother and flatter surface profile.

For a fuller version of this 'ask the expert' column and past columns too, please visit www.airproducts.co.uk/weldingexpert.

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