A flexible joining process made possible by high-tech

MIG-brazing

The specific advantages of MIG brazing have established this alternative joining process in numerous branches of industry.

The classic area of application, for processing galvanised sheets, has since been joined by a number of applications for uncoated, high-alloy and low-alloy steels.

Process principle MIG brazing requires inverter power sources with a special characteristic. A wire composed largely of copper serves as the filler metal here. SG-CuSi3 and SG-CuAl8 are used particularly often. It is the filler metal which is responsible for the critical difference from conventional GMA welding.

Owing to the low fusion temperature of the filler metal - this lies between 900 °C and 1,100 °C - no fusion of the base metal takes place in MIG brazing. The 1,500 °C fusion temperature of the base metal, steel, is not reached.

A solid join between the workpieces is brought about by diffusion (Fig. 1).

Pic 1: Optimum gap bridgeability

There is no need at all for any of the fluxes that are usual - and often cause problems - in conventional brazing processes. The arc burning at the (positive-poled) wire electrode activates the surface.

Pure argon is the shielding gas most often used in MIG brazing. Mixed gases with an active component of up to 1 % CO2 or oxygen, for example, are advantageous for a large number of applications.

The low process temperature in MIG brazing has a positive effect on the application. Because zinc vaporises at a relatively low temperature (907 °C), very poor results are obtained when attempting to join galvanised sheets by welding.

In MAG welding, a great deal of porosity and spattering results. The vaporisation of the zinc makes the arc very unstable and causes heavy fume generation.

In MIG brazing, on the other hand, the base metal is not fused, and so much less zinc vaporises. Also, there is much less heat input, which means that far less distortion occurs.
The brazing seam is much less prone to corrosion, as the zinc layer is left undamaged even in the seam zone itself. A further advantage results from the good gap bridgeability of the process.

MIG brazing is used for all the types of joint known from GMA welding (butt, fillet, flanged and lapped joints). Electrode melt-off normally takes place in the pulsed arc, with one single droplet detaching itself from the wire electrode per pulse.

The material is transferred into the weld pool without any short circuiting. As a result, the arc is almost entirely free of spattering.

For a stable, reproducible process, a high-grade power source is indispensable. Inverter power sources with pre-programmed parameters for copper-based welding wires make the welder's job much easier and deliver outstanding brazing results.

The amperage range in MIG brazing typically extends from 40 A to 130 A, with brazing speeds that are usually between 70 and 100 cm/min. These values relate to the mean amperage of the pulsed arc.

It follows from this that the region being used here lies towards the bottom of the power source's operating range. The background current is often 20 A or less.

An inverter power source with a high switching frequency of 100 kHz delivers an extremely smooth welding current - which is a fundamental prerequisite for a stable plasma column.

Pic 2: Low-spatter brazing process

A good example of suitable power sources is provided by the fully digitised series of Fronius machines.

Copper-based wires commonly have diameters of 1.0 mm and 1.2 mm.

The wirefeeding arrangements must take account of the special properties of these soft wires. The usual recommendation is for toothed feed-rollers with a polished semicircular groove, and for four driven rollers.

Seamless flux-cored copper wires are now also available on the market. The chemical composition of the powder additives has an advantageous effect in terms of sidewall-wetting.

Because of its near-freedom from spatter, the pulsed arc also ensures dependable results when flux-cored wire is being used. What is more, using flux-cored wire has the advantage that the material that is joined in this way has a higher yield strength.

With the single-wire technique, considerable increases in brazing speed can be achieved be making suitable parameter selections (on good inverter power sources, of course).

On lapped joints on galvanised sheets, brazing speeds of up to 300 cm/min can be achieved, with reproducible results - provided that it is possible to regulate a stable, short arc length.
Owing to the disturbances caused by the vaporisation of zinc, very great demands are made of the power source here. Rising to this challenge is one of the key aspects of the concept behind the digital Fronius power sources.

A large number of MIG brazing applications may be found in the automobile industry. Under large-scale manufacturing conditions, this innovative process is used in both manual and fully automated configurations.

There are also many applications for the process in the craft sector and in industrial SME's.

Pic 3: Hose clip made of CrNi-Stahl

To sum up

MIG brazing, coupled with high-grade fully digitised Fronius inverter technology, is suitable for a wide range of different applications.

Low-temperature-melting copper alloys such as SG-CuSi3 are used as the filler metal.

This makes it possible to braze both galvanised sheets and CrNi and unalloyed steels with very low heat input.