LEFT: A close-up of the brazing solution in action. The induction coil, which is dual-turn with an inner diameter of 42mm, handles various dimensions of banjo fittings ranging from 5-18mm in diameter. BELOW: The end result. Exceptionally clean banjo fittings brazed in a flux-free protective atmosphere.

Cutting costs—and environmental impact—when brazing diesel engine banjo fittings.

How innovative protective atmosphere brazing cuts production times for high-grade banjo fittings.

The Agco Sisu Power facility in Linnavuori, Finland makes more than 30,000 diesel engines a year, many of which are used by the world's leading manufacturers of tractors and other farm machinery. As part of their efforts to boost productivity and minmize environmental impact, Agco Sisu Power began to explore alternatives to flux-based brazing of diesel engine banjo fittings. At the same time, the company was also interested in more cost-effective alternatives to the silver brazing alloy they were using in the brazing process.

The decision to adopt a flux-free solution was prompted by several compelling reasons. Although excellent at preventing oxidation, fluxing agents are highly toxic. This of course slows down the brazing process. The flux has to be handled with care. Operators must wear protective gloves, a precaution that does not help such a precise process

as brazing. Then there is the need to individually apply the flux to each workpiece—something which is problematic in an automated line. Moreover, the flux remaining on the brazed parts must be removed. Flux removal usually involves pickling, acid baths or mechanical scrubbing, all of which add time and costs.

Agco Sisu Power turned to the Swedish office of induction heating specialists EFD Induction for possible answers. But there were a few conditions. Any proposed brazing solution must satisfy five criteria: the brazing method had to be automated, and feature automated brazing alloy feeding; the brazing had to be performed in a protective atmosphere; the solution had to feature copper alloy (which is ten times cheaper than silver alloy); brazing temperature had to be 1150°C; a single two-turn induction coil had to braze a range of differently dimensioned magnetic steel Bayonette nipples (tube diameters 5-18mm).

After a series of tests, the engineers at EFD Induction came up with an automated protective atmosphere brazing solution based on nitrogen and hydrogen. The nitrogen is used to expel oxygen in the protective chamber before the introduction of the hydrogen. An inflow of nitrogen that is five times the chamber volume is also used prior to opening the chamber. The alloy selected is an alloy made of 99.16% copper, the remainder being silver and phosphorus. Power is supplied by two EFD Induction Sinac SH generators.

The solution was sucessfully installed at Agco Sisu Power last year. The brazing process is now flux-free, and production times and associated costs have been reduced due to the removal of the flux-cleaning stage.