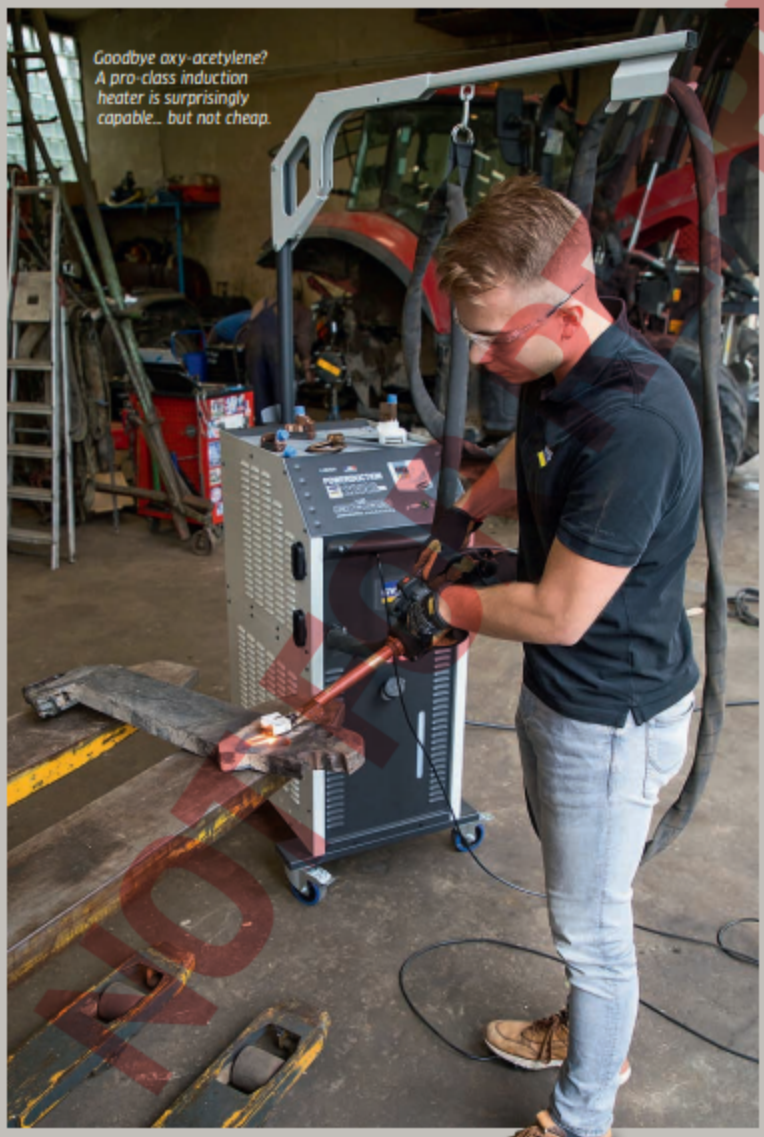
GYS induction heaters:

Heat without fire

Induction heating looms large in manufacturing industries and in domestic cookers. What's it about, and can it help in the farm workshop?



Goodbye oxy-acetylene? A pro-class induction heater is surprisingly capable... but not cheap.

Oxy-fuel gases have warmed up steel on farms since Adam were a lad. With good reason: if the equipment is properly maintained and if the operator follows well-defined procedures, oxy-acetylene in particular is a safe and effective way to heat a wide range of material thicknesses. And you can cut and weld with it. But while the equipment itself is relatively cheap, cylinder rental and gas isn't. Moreover, the two safety-related 'ifs' above generate enough concern that, in these risk-averse days, some companies have banished gas from their workshops.

Yet things still seize up and get bent. So what's the alternative? Induction heating heads a very short list. While it's much more of a single-trick pony – at least at farm level – that trick is a pretty neat one: heating without a flame or physical contact.

What's going on?

Electronics are behind the magic. An induction heating set first changes single- or three-phase electrical power to high-frequency alternating current; that is, one which reverses flow direction rapidly and endlessly. This current goes to an electromagnet which, in response, produces a strong magnetic field which also flips direction rapidly.

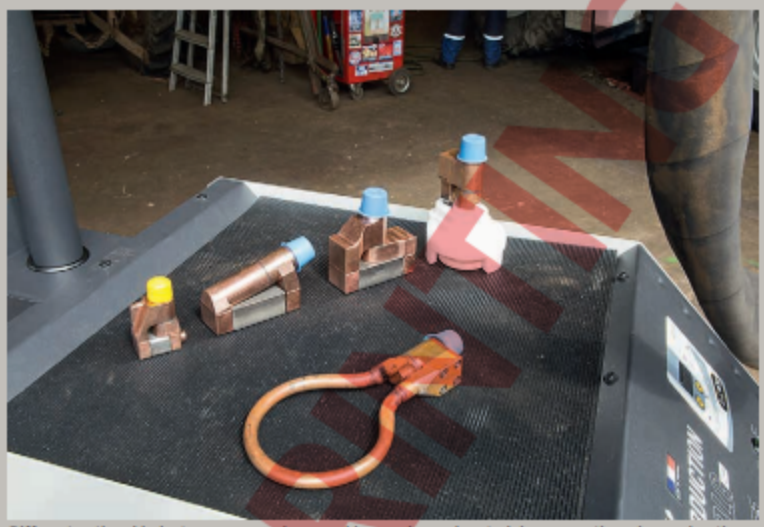
If you then put a conductive object, typically a metal, in that flip-flop magnetic field, alternating electric currents appear in the object – despite it having no contact with the electromagnet. These strong, constantly flick-flacking currents lose some energy as heat as they overcome resistance to their flow, so the whole object heats up.

How hot things get, how quickly they heat, and how far that heat penetrates is decided by two main things: the material's resistance and the intensity/frequency of the magnetic field it's sitting in.

THE SHORT VERSION

- Induction equipment heats electrically conductive materials using a strong magnetic field
- No open flame makes the process intrinsically safe – with caveats
- Swappable accessories match the process to various material shapes and thicknesses
- High initial investment implies high work volume to repay it.

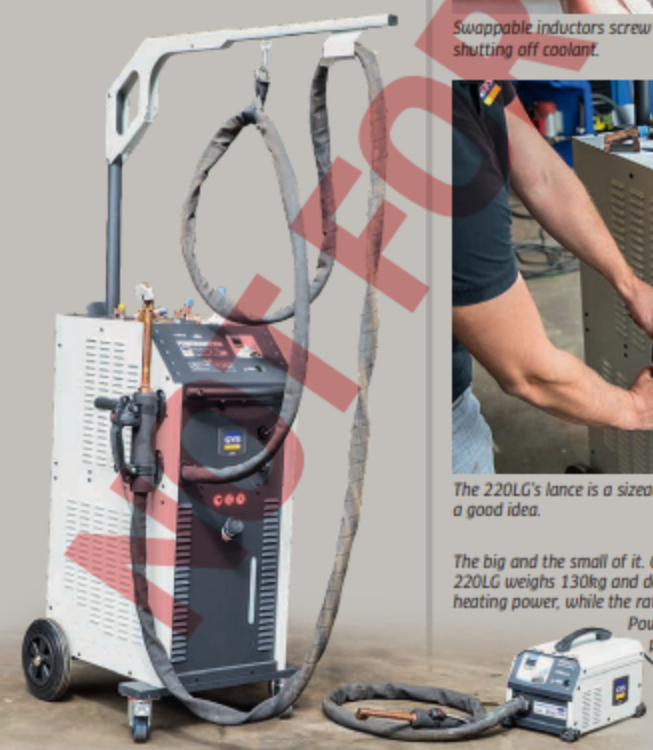
As with MIG and TIG welding sets, induction heating technology has drifted slowly down to farm workshop level. To see what's offered by units at different price points, we look at kit from GYS, a French company specialising in welding and charging equipment since the mid-1960s. Offered though its Rugby-based UK arm and independent dealers, the Powerduction 37LG is a single-phase portable unit listed at £2,799 before VAT, while the top-line Powerduction 220LG needs three-phase power and costs £8,950. Both units are water-cooled, which extends their duty cycle (see below) compared with cheaper air-cooled alternatives.



Different optional inductors cover various working angles and material cross-sections, increasing the base machine's usefulness.

Swappable inductors screw on to the lance after shutting off coolant.

The 220LG's lance is a sizeable lump, making the optional side handle a good idea.



The big and the small of it. GYS's Powerduction 220LG weighs 130kg and delivers 22kW heating power, while the rather more portable Powerduction 37LG puts out 3.7kg and comes in at 15kg.

Ends of a spectrum

Baby of the Powerduction range, the 37LG needs a 13A single-phase supply to produce its rated 3.7kW heating power. It can run from a generator, but only if the power supplied is frequency-stable and spike-free. The unit weighs 15kg (of which 1.5kg is cooling water) and its 2.0m-long mains and output leads allow reasonable reach. Heating is adjustable in 250W steps; duty cycle is generous at 70%, ie the unit can operate at full output for seven minutes in every 10 before shutting down. The maker claims good performance: for example, at full power the 37LG can bring a 10mm bar to red heat in 15secs, or heat to red one flat of a M10 nut in just one second.

At the other end of GYS's range sits the 220LG. As you might guess from the name, hooked up to a 32A, three-phase supply the 220 knocks out 22kW at 100% duty cycle. It's certainly a big boy, weighing 130kg and carrying 30l of coolant. Supply and output leads are 4.0m and 6.0m long respectively, with the latter gantried to take cable weight from the user. Claimed performance is impressive: 2sec to red-heat a M45 nut, 12sec to spot-heat 8mm plate, 4sec to heat 10mm bar.

Each unit's output lead finishes in a lance, tipped with an interchangeable inductor.

While the lances differ in size and design according to the power they must handle, both are water-cooled; water temperature is helpfully flagged on the control panel. You'll see from the pictures that various sizes and types of inductor are on offer. Most are copper blocks surrounding an exposed and potentially fragile ferrite core, the latter used to direct and amplify the magnetic field, while others are loops or pads. Variations of inductor angle, shape, and size lets the user match a tip to the job, whether it's spot-heating an item or full-depth, all-round heating a bar or tube. When changing inductors a button isolates the coolant supply.

Deep heat or shallow?

As mentioned, the extent and penetration of heat depends on the frequency and size of the magnetic field coming from the inductor. Lower frequencies heat deeper, higher frequencies more shallowly. The 37LG runs at 20kHz-40kHz, the 220LG at 20kHz-60kHz. The neat thing is that both units adapt their output frequency on the fly, the aim being to generate as much heat as possible as deeply as possible.

Summary: Induction heating will bring electrically conductive metals to red hot and beyond without using an open flame. The process suits work where heat must be localised; for instance to preserve bearings, seals or rubber boots; where all-round access is difficult, and where the reach of a gas torch flame risks damaging or setting alight wiring, crop residue or old oil/grease.

The GYS units shown here are capable products with price tags to match. Other, more basic kit is on the market, including relatively low-output units which run from a 12V supply. So as always, it will pay to do your research before buying. And the bottom line? Induction heating brings many significant plusses. Yet it can't beat oxy-fuel gas heating on go-anywhere convenience, or cut, weld or warm up big areas. Induction heating certainly has a place in a farm workshop, but don't chuck out the cylinders just yet.

Alexander Bertling, Andrew Pearce

WATCH OUT

There may not be a flame while an induction heater is in use, but there is a strong magnetic field at the business end – strong enough potentially to interfere with a heart pacemaker. That, plus the possibility of steel-based jewellery making a beeline for the inductor head, suggests caution.

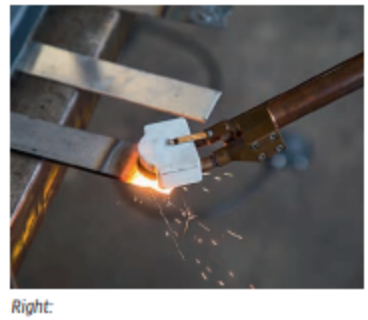
SOME SAMPLE APPLICATIONS

NUTS AND BOLTS

A 90° head (left) puts heat into a nut where access is good, while its flat-faced brother is better where access is limited. In both cases, the sets' adjustable output helps localise heating.

STRAIGHTENING

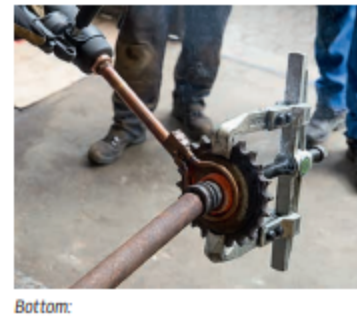
Left:
Where narrow-band heat is needed an induction heater works very well. This 40mm-thick link arm came to red heat after 5mins at the 220LG's full output.



Right:
Careful – sheet steel metal melts fast when too much heat is dialled in at the set.

SHAFTS, PULLEYS, SPROCKETS

Top:
GYS's ring inductors span diameters from 25-120mm, giving 360° heat input. Max power from the 220LG brought this 50mm shaft to workable heat in under three minutes.



Bottom:
Handy: a smaller ring inductor heated only the sprocket boss and not the shaft, so the sprocket pulled off easily.