

## TECHNICAL ABSRACT - *The Radyne Approach to Spring Wire Processing*

As technology has advanced a new system of hardening and tempering spring wire has emerged. At the forefront is the Radyne Spring Wire Line, designed and manufactured by Inductotherm Heating & Welding Limited, in the UK. These Radyne lines heat treat a single wire at high speed. They have proved to be a success throughout the world providing a quality wire consistently for cold coiling.

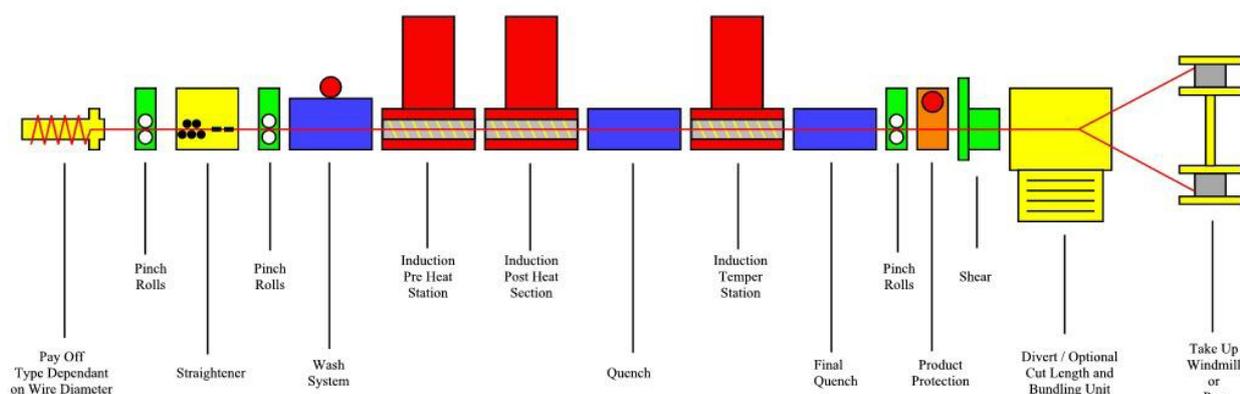
These modern lines offer the efficient and clean technology of induction heating and safe and environmentally clean water quenching systems. The new induction harden and temper lines produce material to a more consistent specification. The benefits include:

- Very little decarburisation due to the extremely short heating times.
- Minimal grain growth during heating.
- The ability to heat treat the more exotic alloy steels that require higher hardening temperatures.
- In some cases produce material with higher tensile strength whilst maintaining ductility.
- High efficiency environmentally friendly heat treatment process.

Radyne Spring Wire Lines are manufactured to a very high mechanical standard, using precision built modules that are designed and built to be easily installed, maintained and operated within the rigours of a wire production facility.

At the heart of the wire line is a PLC/PC control system that utilises modern communication techniques to ensure ease of installation and reliable operation by minimising the number of interconnections that have to be made for the running of the line. The control system allows multiple wire setups to be stored in the PC memory, which are then downloaded to the PLC when required. The PC also operates a monitoring system that continually takes running data from the line and stores it for both immediate viewing and long term historical review.

The modern lines are designed to produce up to 3 tonnes of wire per hour and up to 17mm diameter wire. Materials that are processed include carbon steels, chrome silicon and chrome silicon vanadium, such as SAE9254, EN10270/2 (2001), 55CrSi and wire to A229 specification.



**Figure 1:** A simplified layout of the Radyne Spring Wire Line, excluding optional inline drawing block

One of the most important aspects of the Radyne line is its ability to run continuously, without slowing or stopping to change feed coil at payoff or remove a coil at take up. The operator welds the end of the first coil to the beginning of the second coil whilst the line is running.

The control and tension of the wire is achieved using pinch rolls. These pull the wire off the pay-off and through the straighteners. The wire is then pulled through the heat treatment part of the line by a third set of pinch rolls. At all times, the wire tension is tightly controlled to ensure that the diameter of the material is not taken out of specification by stretching.

Over half the Radyne Spring Wire Lines have been supplied with inline drawing block allowing the customer to load the payoff with rod or wire. A maximum 30% ROA can be achieved with a single inline drawing block and drawing inline can reduce the risk of handling damage to the wire compared to offline drawing.

The heat treatment stage involves heating the wire first to around the Curie point (700°C) and then up to the desired hardening temperature, which is dependant on material (900 – 1100°C). The wire is quenched using water at a controlled rate so as to obtain the correct austenitic structure, and without cracking the wire surface.

Once hardened, the material is then tempered back to achieve the final fully tempered martensitic material specification by heating to the correct temperature (400 – 600°C). The wire is again cooled by water quench before being sent to the take-ups.

As induction is a non contact form of heating, problems with traces of materials such as lead do not exist and there is less chance of surface damage on the wire. Also there is no need for media as in a fluidised bed which has to be replaced and the maintenance on an induction heating system is very low.

The other major efficiency of induction is instant heat. Induction does not require any warm up time or cool down time. When production is not required, be it lunch break, weekend or holiday shutdown the induction furnace can be switched off and does not use any energy.

Because quenching is carried out using water instead of oil, problems such as fire hazards, the purchase of the oil and then the cost of its disposal no longer come into the cost of production and the working environment is also greatly improved.

After the final set of pinch rolls the wire passes through a product protection stage that applies a protective coating to the wire, a hydraulic shear; that cuts the weld out and a divert system to guide the wire to the correct take-up.

In 2012 Inductotherm Heating & Welding Limited will install another two of these high speed, high capacity Radyne Spring Wire Lines.

For more information please visit [www.inductothermhw.co.uk](http://www.inductothermhw.co.uk) or contact Mr. Gareth Blackman by email at [gblackman@inductothermhw.co.uk](mailto:gblackman@inductothermhw.co.uk)



**Figure 2:** Vertical & horizontal straighteners between pinch rolls



**Figure 3:** Optional Inline Single Drawing Block



**Figure 4:** Typical Radyne heat treatment modules

