

AMES TRUE TEMPER.
Lawn & Garden Tools - Since 1774

MANUFACTURE OF SOLID SOCKET SHOVELS AND SPADES USING BORON STEEL

AT A GLANCE

True Temper is a metal product manufacturer making forged solid socket shovel blades.

This project involved the investigation, piloting and implementation of a switch from carbon steel, the current raw material for blade manufacture, to boron steel. This would allow the use of water as a quenching medium instead of oil and would eliminate the use of a tempering oven, providing savings in oil, hazardous waste and energy.

Design and piloting work was completed. While payback for this project was low at 0.5 years, it was decided at a corporate level not to proceed with the plant scale implementation of the project.

Savings which were demonstrated from the piloting and design work would include the following if fully implemented at the site:

- Eliminating the use of oil as a quenching medium – 7000 litres/annum.
- Reducing hazardous process waste – oil contaminated solids, millscale etc. 3,500 kg/annum.
- Eliminating tempering oven and its associated emissions to atmosphere – 110 tonnes/annum TOC (as C).
- Eliminating VOC emissions from quench oil operation – 18 kg/annum.
- Reducing plant energy usage by removal of the LPG fired tempering oven – 84,000 litres LPG/annum.
- Annual net savings of €50,000.

There would also be additional benefits of surplus decreased labour, improved product flow, reduced material handling and movement, more floor space and a significantly cleaner operation.

True Temper Ltd.

True Temper Limited manufactures high quality “added value” forged solid socket shovel blades (shovels and spades) at its Cork facility for their parent company Ames True Temper in the U.S. and for a sister company Garant Inc. in Canada. Blades are also manufactured for the Irish and UK markets.

AIM OF THIS PROJECT

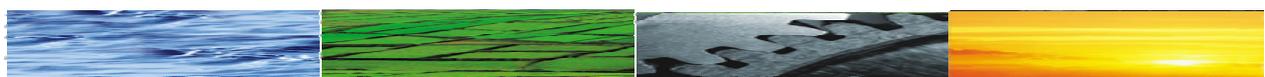
Part of manufacture of the blades involves a process of hardening and tempering to achieve the required hardness and toughness of the finished blade. This is obtained by quenching the fully formed blade from a temperature of 900°C through immersing it in quench oil followed by a tempering process where the blade is heated to 460°C and held at this temperature for approximately 90 minutes.

The aim of the project was to switch the type of raw material used to manufacture shovels and spades from carbon steel to boron steel. The basic composition of boron steel is equivalent to low-alloy, low-carbon steel except for the addition of very small amounts of boron. The addition of boron greatly increases the hardenability of the steel, which means its ability to become hard not only on the surface but also further inside.



Photo 1 Existing process - close up of product coming out of oil quench

The low carbon content of this steel in contrast to the steel presently used would enable it to be quenched in water rather than oil. This would allow the elimination of quench oil and substitute it with a closed loop water quench, and would also eliminate the need for a tempering



oven with its associated energy use. Tempering of the proposed boron steel would be achieved by soaking in the “existing” heat acquired when product is conveyed through paint line curing oven process.

This project was initially identified as part of a value stream mapping study.

PROJECT DESCRIPTION

The project work carried out was as follows:

- Rigorous analysis and testing of the most appropriate boron steel grade to be used.
- Pilot production runs using an existing water quench tank from another process line.
- Extensive mechanical and structural testing of the resulting product from the pilot runs.
- Final full scale process design and equipment specification and final vendor quotation.

- Eliminating the use of oil as a quenching medium – 7000 litres/annum.
- Reducing hazardous process waste – oil contaminated solids, millscale etc. 3,500 kg/annum.
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It is estimated that gross savings of €62,000 per annum could be realised by removing the existing heat treatment system through the reduction of labour and variable overhead costs, energy costs, waste disposal costs and maintenance and environmental compliance/monitoring costs.

There would be a negative impact due to the extra cost of boron steel over carbon steel resulting in estimated net annual savings of €50,000. Capital equipment cost is €33,000 (including EPA CGPP grant aid funding of 25% of equipment cost) which gives a payback of 0.5 years.



Photo 2 Existing process – crates of product going from oil quench (RHS) into tempering oven (LHS)

ACHIEVEMENTS

The project was successfully developed and piloted. The product met all requirements in in-house and external testing.

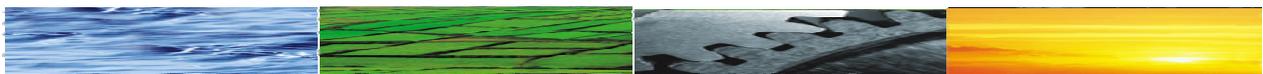
The final full-scale process was designed, equipment was specified and vendor quotations obtained and full analysis of payback carried out. However it was decided at a corporate level not to proceed with the plant scale implementation of the project. The potential savings of the project, if fully implemented, were:



Photo 3 Water quench from another line being used for pilot trials

OBSERVATIONS

During the actual testing of the water quench in a number of pilot production runs it was



encouraging to observe the redundant oil-quench tank and tempering oven and the visible cleanliness and overall potential of the new operation.

LESSONS

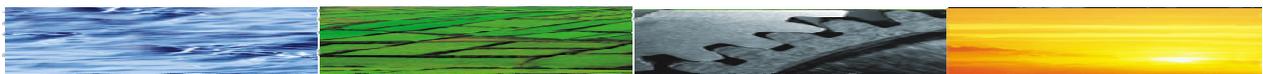
While distortion is a factor to be considered when quenching in water from a temperature of 9000C particularly solid shank shovels because of the varying thickness of the blade due to its “double taper”. Tests have indicated that distortion does not present any problems.

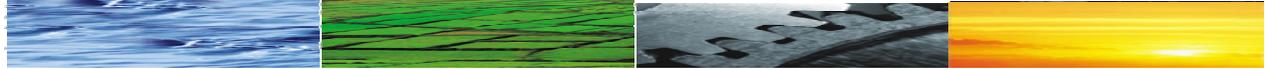
MORE INFORMATION

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CLEANER GREENER PRODUCTION IS...

the application of integrated preventive environmental strategies to processes, products, and services to increase overall efficiency and reduce risks to humans and the environment.

- Production processes: conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes
- Products: reducing negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal.
- Services: incorporating environmental concerns into designing and delivering services.

CLEANER GREENER PRODUCTION REQUIRES...

new attitudes, better environmental management, and evaluating available technology options. We need to take good environmental practice to the stage where it is an inherent part of any business operation.

HOW IS CLEANER GREENER PRODUCTION DIFFERENT?

Much of the current thinking on environmental protection focuses on what to do with wastes and emissions after they have been created. The goal of cleaner, greener production is to avoid generating pollution in the first place. This means:

- Better efficiency
- Better business
- Better environmental protection
- Lower costs
- Less waste
- Less emissions
- Less resource consumption

WHY IS THE CLEANER GREENER PRODUCTION PROGRAMME BEING RUN?

The Irish Government, through the National Development Plan 2000 - 2006, has allocated funds to a programme for Environmental Research, Technological Development and Innovation (ERTDI).

The long-term goal is to ensure that cleaner, greener production becomes the established norm in Ireland. The programme seeks to promote environmentally friendly business through increased resource productivity, waste reduction, recovery of materials, improved efficiency in a product value chain, energy management, and a change of culture within organisations.

The programme aims are focussed on avoiding and preventing adverse environmental impact rather than

treating or cleaning up afterwards. This approach brings better economic and environmental efficiency.

WHERE CAN I GET FURTHER INFORMATION?

This case study report is one of the reports available from the companies that participated in the second phase of the Cleaner Greener Production Programme. A summary of all the projects and CD containing all the reports are also available.

More information on the Programme is available from the Environmental Protection Agency

Dr Brian Donlon,
Environmental Protection Agency,
Richview,
Clonskeagh,
Dublin 14,
Ireland

Or their website www.epa.ie, by selecting the link to cleaner production.

PROGRAMME MANAGERS:

The Clean Technology Centre (CTC) at Cork Institute of Technology has been appointed to manage the programme.

The CTC was established in 1991 and is now nationally and internationally regarded as a centre of excellence in cleaner production, environmental management and eco-innovation across a range of industrial sectors.

