Heat Treatment Australia

Sustainable Manufacturing in Action

- Leading-edge vacuum furnace technology which allows for reduced thickness of metal parts leading to a 15% reduction in machining costs post heat treatment.
- An Aluminium Brazing process which reduces the weight of treated metal parts by 50-60%.
- An Energy Management System which has reduced peak demand and electricity consumption by 30%.
- Advanced manufacturing knowledge which offers opportunities to sectors in addition to defence.

Heat Treatment Australia (HTA) is a national company that provides metal heat treating services to the defence, mining, automotive, transport and agriculture industries.

Heat treatment involves the heating and cooling of metal parts or tools, usually at extreme temperatures, to alter their physical or chemical properties using processes such as brazing, annealing, hardening, quenching, and tempering. The processes are carried out in vacuum furnaces and alter properties such as strength, hardness and ductility.

With over 30 years' practical experience, HTA has acquired valuable insight into its customer's requirements, developing processes to meet their needs. This has included demonstrating good environmental performance. HTA is the only aerospace heat treater in Australia with AS1900 (Aerospace quality system standard) and National Aerospace and Defence Contractors Accreditation Program (NADCAP) accreditations.

HTA has worked hard to develop its manufacturing processes and has been successful in moving into the Aerospace/Defence supply chain over the last 12 years. They are now providing heat treatment services on landing gear as part of the international F-35 Joint Strike Fighter Project.

'Managing manufacturing in a socially and environmentally responsible way is no longer just something that is nice to do, it is essential. Companies in manufacturing today are faced with a future of increased costs and higher expectations and accountabilities to stakeholders, so it follows that a sustainable approach to business operations is absolutely necessary to remain competitive.'

Karen Stanton, Director, Strategy and Corporate – Heat Treatment Australia

Queensland Government

Advanced Treatment Processes

HTA has invested large amounts of time and resources in developing advanced manufacturing techniques and patented processes.

New Vacuum Furnace Process reduces material consumption and machining time

Metal landing gear components are heat treated to increase their strength. HTA use a patented vacuum-furnace with high-pressure gas quenching instead of the conventional oil based quenching process used previously. The use of nitrogen gas rather than oil has both environmental and economic benefits.

The use of a gas allows the surface to be treated homogeneously and at constant temperatures which reduces distortion of the steel.

This leaves the surface of the material free from flaking or discolouration and makes machine finishing more efficient, significantly reducing finishing time.

The vacuum process also significantly reduces the amount of metal required per component e.g. thickness reduction of 6.35 down to 0.5 mm of excess metal.

This reduces component machining costs by as much as 15%, as there is less warping and significantly less machining required after heat treatment. Other benefits include:

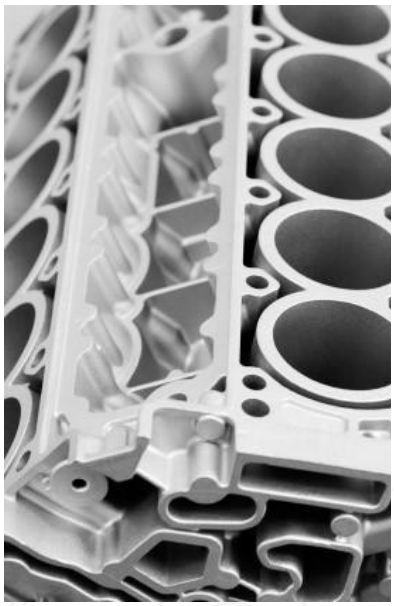
Elimination of around 1.3 kL per year of quenching oil consumption as it is replaced by the gas quenching method.

- The new vacuum system utilises process modelling and mass flow control so that quenching gas used during the heat treatment process is used more efficiently i.e. there is no longer a need to ‘flood’ the furnace as gas is used sparingly in the new process.
- Furnace controls are programmed in-house so that the gas-fired furnace runs for the optimum time. There are no idling periods and quick start up & shut downs times help to minimises energy consumption.
- The treated metal component must be heated to the core. A temperature sensor (thermocouple) is utilised to measure actual temperature of the component rather than within the furnace space which takes away guesswork and fully optimises time required in the furnace. This is known as the ‘soak’ period.
- A cooler working environment (i.e. fully enclosed furnace) eliminates the need for workplace cooling or ventilation.

Aluminium Brazing

The new Vacuum Aluminium Brazing process is being used to heat treat the internal frames (or chassis) for the F35 Joint Strike Fighters.

The technology had been in development for over 7 years before being commercialised in 2010. This leading-edge technology provides a high strength and reliable fusion of lightweight aluminium components rather than parts that are adhesively or mechanically attached.



The process is also now being used to heat treat housing for cooling components of electric car fast chargers for Brisbane based company, Tritium.

Benefits of the process include:

- high pressure, leak–tight chemical joining of aluminium plates which allows for re-design of the components and eliminates the need for bolts, o-rings, or gaskets.

- The superior fusion strength and improved design enables a 50-60% weight reduction in material components and reduced assembly labour times. An ultrasonic cleaning system is now used which reduces cleaning chemical for parts cleaning. The new cleaning system features an in-built filter which removes solids from the spent chemical thereby extending the life of the chemical by 5-10 times compared with the previous system.

Water Savings - Furnace Cooling System

The use of two air cooled (rather than water cooled) condensers for furnace cooling reduces water consumption by around 1 ML/yr. The system significantly reduces service requirements i.e. scaling potential and control of Legionella bacteria that typically occur with water cooled systems.

The second air cooled condenser also has a variable speed drive on the fan which is 30% more energy efficient than the fixed drive model.

Energy Management System

An Energy Optimisation System monitors the real-time energy consumption of about 15 equipment items to help reduce costly peaks in consumption.

The system works on a decision hierarchy where automated load shedding occurs i.e. equipment items are ramped back or turned off when set peak levels are approached. Operators are notified via a light system, with green, amber or red, indicating that load shedding is occurring.

The EMS has reduced peak demand by about 30% with additional savings in reduced electricity consumption (measured as energy per kg of customer parts heat treated) through identifying and targeting inefficient equipment items such as pumps and air compressors. Since installation, the EMS has saved in the order of 60,000 kWh and $24,000 per year.

Waste Reduction

The company recycles around 80% of its total waste including metal, cleaning solvents and used oil. Some initiatives are listed below.

- Defence industry products are transported in custom made wooden boxes with a foam insert that only fits the component it is made for. Customers return the boxes to HTA so they can be continually re-used.
- Newspaper (brought from home and a local school) is used as packaging filler for non-defence related components

Partnerships

HTA are part of the Australian Industry and Defence Network. The company has Australian Customer Approvals for the prime aerospace companies of Lockheed Martin, Goodrich Landing Gear, Goodrich Aviation UK, Northrop Grumman, Boeing, Parker Aerospace, Cobham, Harris and BAE.

The company also fosters strong partnerships with the Defence Science Institute, the University of Queensland and La Trobe University.

HTA's improved processing capability and subsequent Approvals mean that company Intellectual Property can stay within Australian borders. This is resulting in more efficient processing techniques and savings that are benefiting industries other than Defence.

HTA are looking for opportunities to apply their existing knowledge and technological expertise to new markets. For example, the heat treatment of near net shape components, which minimise the amount of machining required post treatment, could potentially be applied to other manufacturers in the mining, agriculture or other sectors.

Steve Over and Sheila Davidson of Lockheed Martin Aeronautics Company meet with HTA Australia

This case study has been prepared by The Ecoefficiency Group Pty Ltd for the Queensland Department of State Development in 2017.