Expertise to improve heat treatment process efficiency

Eurotherm®

Analog thyristor (SCR) power supply replacement solution

Upgrading analog thyristor power supplies to an EPower advanced digital power control solution improved the reliability and efficiency of vacuum furnaces in an AMS 2750 certified heat treatment facility, helping to reduce maintenance and energy costs.

Our customer is part of a long-established global thermal processing company offering heat treatment services to regulated and general industries. Its world-leading heat treatment facilities offer specialized technologies to cover a broad range of materials, components, and standards.

The customer

One of many thermal processing sites around the world, this particular facility is used to heat treat components in vacuum and controlled gas processes. The components are typically for use in aerospace and automotive applications. Therefore, the site must maintain its Nadcap accreditation.

Challenges

Previously, the facility used analog thyristor (SCR - silicon controlled rectifier) technology for most of its furnace power supplies. The analog thyristor devices controlled the heating elements in phase angle mode via a transformer. These analog power supplies performed well during the initial heating of the furnace. However, they had a few drawbacks that were impacting reliability, efficiency, and quality.

- At control outputs below 100%, the analog thyristor caused high harmonic distortion on the power supply and a poor power factor, as well as a significant decline in energy efficiency.
- Harmonics in the system were reducing the life of electrical equipment.
- Due to poor power factor:
  - Energy was being wasted in the system, leading to unnecessary extra costs for filters and capacitor banks.
  - The facility could not be expanded due to a lack of capacity on the main electrical supply, affecting the availability of the furnaces.
- The analog thyristors caused difficulties in the control of the furnace heaters. The required stability and accuracy could not be achieved causing process repeatability issues.

Goal

Improve vacuum furnace power supply reliability. Increase process performance, energy efficiency, and furnace availability. Enable expansion of the facility within the bounds of the main electrical supply.

Story

Heater power was controlled by a three-phase analog thyristor controller. Over time, power factor issues led to the need for power factor correction (capacitor banks) and filter devices. This resulted in increased maintenance time and cost, and the low energy efficiency was limiting the extension of the facilities.

Solution

Three-phase digital power control cabinet with transformers, based on the Eurotherm by Schneider Electric™ EPower™ advanced thyristor controller, with Predictive Load Management.

Results

- Improved power factor (better than 0.9) on the facility main supply
- Equipment expansion was made possible due to full availability of the main power supply
- Decreased maintenance time and cost
- Optimized energy efficiency and reduced peak demand charges
- Up to 10% energy savings
- Improved process repeatability
- Two year return on investment

A high efficiency, cost effective solution

Eurotherm provided a turnkey power system solution based on EPower advanced thyristor controller with air cooled transformers. This system has now been in operation for over 10 years.

Reduced CapEx and OpEx

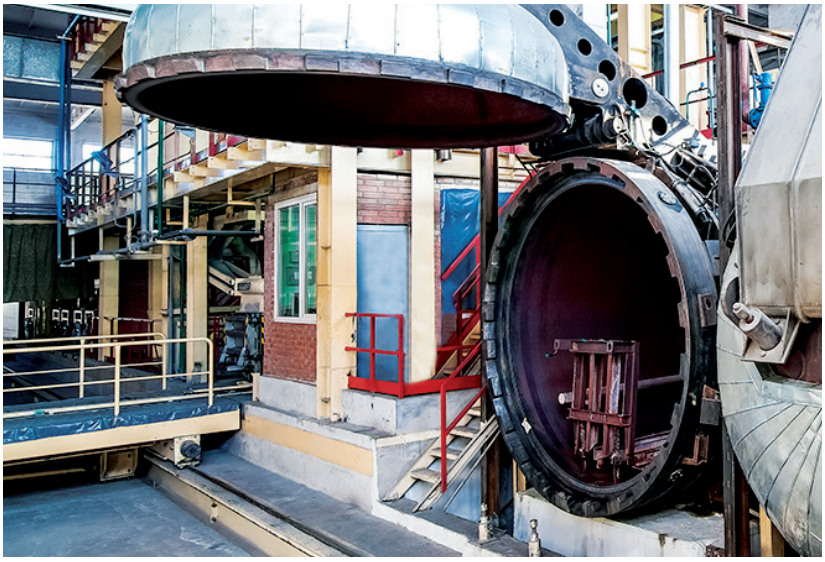
Improved power factor achieved by hybrid control in the EPower controller meant costly unreliable power factor correction equipment was no longer needed to meet the power factor limits set by the energy supplier. Therefore, the Eurotherm power cabinet solution cost less than the analog thyristor solution, and enhanced system robustness.

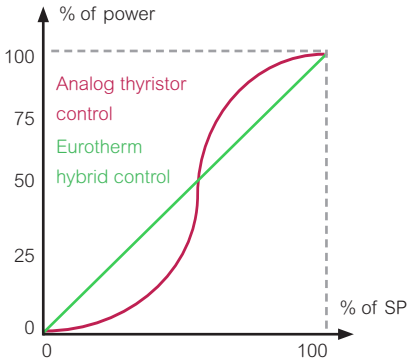
The power factor was greatly increased due to less harmonic content, and peak power demands were reduced by the EPower Predictive Load Management strategy, resulting in electricity cost savings of 10%.

The power factor improvements also allowed the main electricity supply to be fully utilized to run extra equipment at the same site, without upgrading the supply.

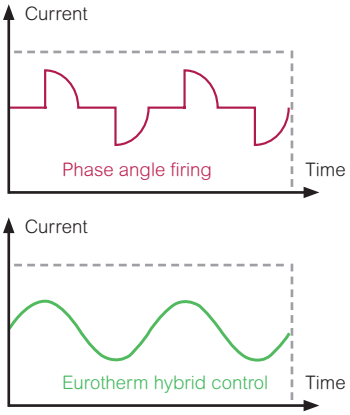
Better measurement accuracy and control precision improved temperature linearity and process repeatability to help maintain Nadcap class uniformity.

In this case, based on local energy costs, the EPower solution achieved a two year return on investment.





Eurotherm digital thyristor power control helps to provide linear control across the entire output % range, whereas the analog thyristor is non linear over the setpoint (SP) range.



Analog thyristor controllers waste energy by drawing more power from the supply than is required by the heater, due to harmonic generation at most setpoint levels.

Industry 4.0 ready technology

The EPower advanced thyristor controller is EcoStruxure-ready and has been carefully designed to provide optimum efficiency in industrial electrical heating systems. EcoStruxure™ is Schneider Electric's IoT-enabled system architecture and platform.

- Digital, high accuracy power control
- Predictive Load Management:
  - Smooths the energy consumption to avoid peak power demand
  - Optimizes the availability of furnaces through real-time control capability

Discover
EPower controller

Discover
Heat Treatment

Contact us

Life Is On | Schneider Electric

Eurotherm Limited

Faraday Close, Worthing
West Sussex BN13 3PL
United Kingdom
Phone: +44 (0) 1903 268500

www.eurotherm.com

Document Number HA033601 Issue 2 SE part Number 998-21329389_GMA_UK

INVESTORS IN PEOPLE

Published April 2021