Carbon Potential

KS98-Application

Carbon Potential Control and Data Acquisition

Programme control of two loops

C-level calculation

Digital control via real time

Data aquisition with data monitor KS 3010

KEY WORDS

Control of C content, measurement data monitoring, carburization process, pit furnaces, case hardening, Nernst equation, oxygen sensor, automotive industry

DESCRIPTION

Manufactured steel components are carburized (hardened) in a pit furnace. Carburizing is the process in which an atmo- sphere is created within the furnace by burning a hydrocarbon fluid (methanol) and then introducing an acetone-based fluid. Carbon from this atmosphere diffuses into the surface of the component to be treated. The component's surface hardness depends on the amount of carbon introduced and the furnace temperature.

Previously, an open loop system was employed, whereby the customer allowed the hydrocarbon fluid to enter the pit furnace at a pre-determined flow rate. This approach no longer produced the desired result, and the error rate was considerable. Furthermore, the automobile manufacturers are insisting that the sub-suppliers install an automated system for more precise control of carbon level and temperature during heat treatment. In addition, the automation system shall provide reports of the CP value and temperature for each batch.

IMPLEMENTATION

After examining the application, we suggested a solution based on the KS 98 and a Data Monitor KS3010.
The customer had been using a single-fuel system, and so we suggested furthermore changing to a dual-fuel system to have better control of the CP level. A Zirconium oxygen sensor was installed for measuring the carbon potential. By means of the Nernst equation, the sensor produces a mV signal that represents the oxygen content of the atmosphere in the furnace. This signal is then converted into a CP value (%) using a data table that takes into account the values for temperature and CO.

CONFIGURATION

The Carbon Potential Level Control is realised with KS 98. The KS 98 is configured here as a dual loop version with Loop 1 for temperature control with a programmer, Loop 2 for CP value control, also with a programmer.

Moreover, the KS 98 has been configured to accept different types of oxygen sensor such as Barber Coleman, Nova Tech, Drayton, Marathon, etc.

Application-specific display pages are created in the KS 98 to provide the operator with clear indication of the process. Different recipes are also stored in KS 98, containing the respective heating and CP profiles for various components.

The output relays control the solenoids for the hydrocarbon fluid. As the KS 98 has a real time clock and timers, automatic soot removal functions are also performed. Every 2 or 3 hours, compressed air is blown into the oxygen sensor, which removes any soot deposits.

Fig. 1: Configuration page

Online Measurement and Data Acquisition with Data Monitor KS 3010. The process value output of the KS 98 retransmits the CP value as a 4...20 mA signal that is connected to the Data Monitor KS 3010. So online measurement of the CP is possible. In addition, the KS 3010 has been configured to generate customized batch reports, which specify batch number, part number, CP value, temperature, alarms, etc.

By means of the built-in floppy drive, the measurement data can be stored for subsequent evaluation in a PC, for example with MS-Excel.

The control strategy also enables the implementation of SQF (seal quenched furnaces), in which the flows of dilution air and enrichment gas for carburization can be controlled with the KS 98.

UNLIMITED VERSATILITY

The flexible configurability of the KS 98 enables the above application to be extended with pre-configured library functions such as password protection, timer, programmer, etc., or even „home-made" partial Engineerings. With additional operating screens, for example 6-line text display, trend display, and bargraphs, the projecting engineer is able to increase the plant's operational functions. Moreover, by means of a user-specific menu structure, the transparency of the process data can be adapted precisely to individual requirements.

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