



Paperless Production

A Chinese manufacturer monitors the production process for copper pipes with a Turck RFID system with decentralized control using BL20 gateways

Copper pipes are wound on material frames during several production steps

Humans have been using copper for around 10,000 years. It is easy to work and has characterized an entire age. Why is the metal in such demand today? Because it is an excellent conductor of heat and electricity and is highly ductile as well as being highly durable. It can also be fully recycled. Chinese companies in particular are at present the source of the enormous demand on the world market, and they install around half of the copper mined globally. Not only in cars and high-tech products but also for example in houses, where copper pipes are the preferred choice for plumbing and heating installations.

Production control system requires real-time data

In order to stay competitive, companies have to increase their efficiency while being able to respond better to changes in requirements. The transition from

production-oriented to service and requirements-oriented production also means: greater coordination between man, machine and the product and the provision of more accurate information about the current material flow. A major Chinese manufacturer now has a solution using a production control system – using real-time data from the field. An RFID solution for this was recently supplied by Turck (Tianjin) Sensor Technology Co. – consisting of over 180 read/write heads and some 1,400 robust tags with IP69K protection.

Multi-layer process in metal forming

The company monitors machine and plant parameters such as power, flow rate or air pressure in its SCADA system. For the management of copper pipe production this is more difficult since they are the result of



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Gao Jianqiang | Turck Engineering Control Systems



Turck's Q175 read/write head accesses other remote tags via UHF-RFID technology

many individual processing steps. The process is still standard directly after smelting: with the casting of a round billet and the thermal forming at approx. 950 °C, in which a press converts the billet into a pipe. This involves the insertion of a metal cylinder (mandrel) horizontally into the heated metal, which looks like a macaroni noodle.

Various processes are performed with cold shaping in order to shape the pipes to the required diameter. A drum winding machine draws the pipe several times through narrow metal plates called dies, while a mandrel inside the pipe ensures that the internal diameter also reaches the required dimension. Whether it's pre-drawing, shaping the inner thread, soft annealing or finishing – the production process is distributed in which the work is performed in independent machines.

The product of the previous process becomes the raw material for the next machine – away from a rigid production line. Workers in the Chinese concern previously transferred all the production data manually – for example, information on raw material or process parameters. This was very labor intensive and meant that the data was rarely up to date.

Robust RFID tags for mounting on metal

In order to simplify material management, system

integrators at Turck Engineering Control Systems therefore provided an RFID solution in direct proximity to the machines. This is used to control the entire production process. The engineers made use of the fact here that the copper pipes are located on round metal frames during the production steps in the cold forming stage. The material information about a batch can be linked with the relevant frame, to which an RFID tag can be attached easily. For this Turck uses robust hard tags that are specially suited for mounting on metal and also stay fixed to the frame even when it is

QUICK READ

The production of copper pipes involves many production steps at independently operating machines. Turck equipped a Chinese manufacturer with an RFID system in order to control material flow and avoid the need for labor intensive manual documentation. Q175 read/write heads read out the numbers of metal frames from robust UHF tags. The BL20 modular I/O system transfers this to the company's production control system and at the same time controls the decentralized operation of the RFID readers.



The robust UHF tag can be mounted directly on the metal frame



A programmable gateway in Turck's BL20 I/O system controls the decentralized RFID readers – a great benefit considering the large number of production stations in the company

being rotated at high speed. The number of the particular material frame is stored on a tag, and is then assigned in the production management system to a particular batch. To do this, the production management system accesses the database.

Information exchange between RFID reader, UHF tag and MES

A Q175 RFID UHF read/write head is installed in the close proximity of each workstation. This reads the number of a material frame; and notably with UHF technology, since there is some distance between reader and tag, and the RFID tags are not always located directly in the detection range of the reader due to the rotations of the frame. The link to the production management system enables the exchange between tag, read/write head as well as the higher-level manufacturing execution system (MES).

When a copper pipe is drawn, the machine unwinds it from a metal frame, guides it through the reduction dies and then winds it back onto another frame at high speed. The RFID system ensures that the material data for the pipe can also be uniquely assigned when it is transferred to a second frame. To do this, the Q175 UHF readers read the frame numbers from the RFID tags and transfer them to the production management system. This again assigns the material data about the copper pipe to the appropriate frame and logs the production step at the same time. RFID assists in this way throughout the entire material flow.

Ethernet gateway as independent controller

The communication between the read/write heads and the production management system is provided

by Turck's BL20 I/O system, which also controls the decentralized operation of the RFID readers. In addition to different connection modules such as for RFID devices, it consists of a BL20-PG-EN-V3 programmable multiprotocol Ethernet gateway. This acts as an independent controller of each local RFID system, since no local PLC is in place and a number of field devices have to be addressed in real time.

"The gateway interacts with the MES, which considerably reduces the field wiring," says project manager Gao Jianqiang at Turck Engineering Control Systems. "Thanks to its powerful data processing capability, the RFID system operates completely independently. If a new read/write head has to be connected only a small I/O expansion module needs to be added."

Conclusion: Integration helper for Industry 4.0

Turck's RFID system supports the increasingly digitalized manufacturing of the Chinese copper pipe manufacturer. It offers a real-time material tracking capability in production management, which also serves quality control, ensures the clear assignment of materials and transfers data on time inside the ongoing process. "This has considerably improved efficiency and punctuality in production," project manager Jianqiang sums up.

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