

Contrac electrical actuator

Continuous casting of steel



Contrac electrical actuators for cooling water spray valves improve steel quality

Contrac

Introduction

Tight control of cooling water sprays significantly influences steel quality in a continuous casting process. Water cools the mold in the initial stages of solidification. As the steel strand exits the mold, the outside steel walls solidify before the middle section, which remains molten. Closely spaced water-cooled rollers support the strand. Cool water sprays, called the secondary cooling process, increase the solidification rate. The water spray nozzles are arranged between the rollers on both sides of the strand.

The cool water sprays affect control of the heat removal rate that creates the solid shell. The heat extraction rate varies dramatically with time as the slab surface temperature changes. Sudden fluctuations in the temperature gradients within the solidifying metal cause thermal stresses, which often lead to cracks. This is especially true near the solidification front, where even small tensile stresses can form hot tears. So tight control of spray cooling is important.

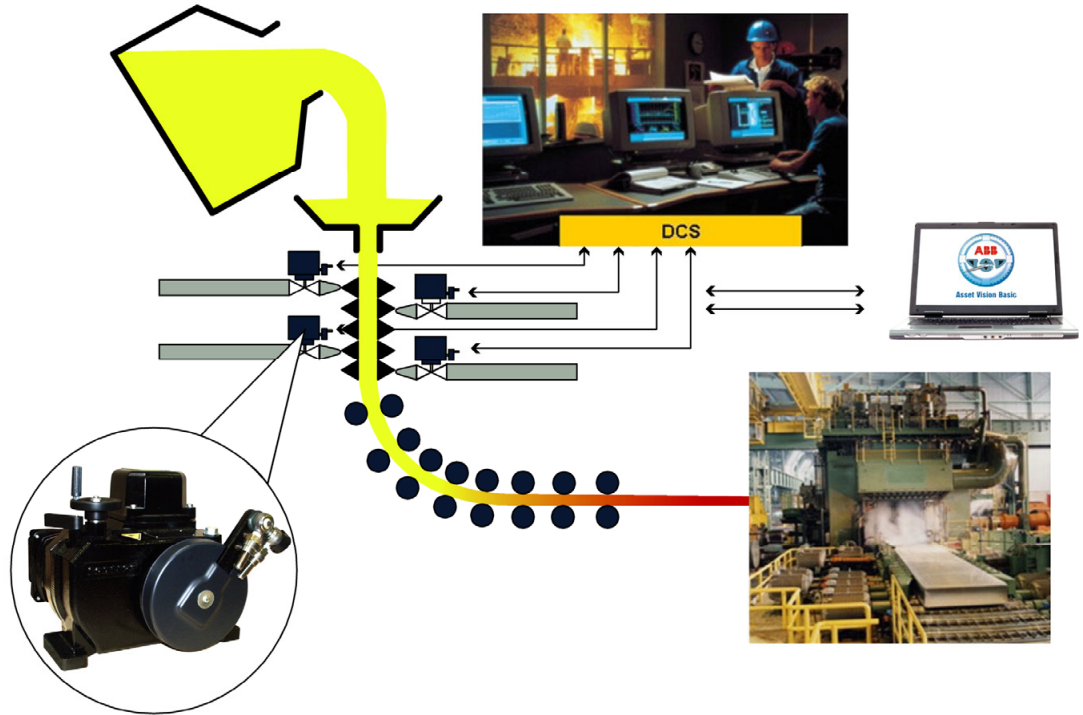
Major steel manufacturers may have more than 40 mathematical models to manage this sophisticated process. The idea is to match the rate of heat removal at the surface with the internal supply of latent and sensible heat. This will lower the metal surface temperature in a smooth and continuous manner.

Improving steel quality

A continuous casting steel plant was experiencing poor product quality. Engineers pinpointed the problem to the actuators that operated the 16 valves controlling the cooling water flow rates. These rates ranged from about 150 to 1500 l/min (40 to 400 gpm) with nozzle pressures of about 8 to 12 bar (116 to 174 psi), depending on the valve positions in the secondary cooling system. These actuators had a dead-band of nearly 5 %. This condition adversely affected the steel surface and caused an irregular steel density.

As a first step the steel plant replaced some of the existing actuators with ABB Contrac model PME120 rotary actuators. The torque rating for these particular models is 100 Nm (80 ft lb) with a response sensitivity of $\pm 0.05\%$. Contrac actuators provide high positioning accuracy, resolution and speed. The tighter control performance afforded by the Contrac actuators significantly improved steel quality. As a result the steel plant decided to replace all the original actuators with these ABB Contrac units.

01 Contrac electric rotary actuators offer high response sensitivity and positioning accuracy, leading to tight control of cooling spray water valves for quality steel.



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The ABB solution

02 Cutaway view of a typical Contrac actuator

Contrac intelligent electric rotary actuators from ABB suit continuous duty, modulating, or pulse input control applications. The Contrac actuator incorporates micro-processor-based electronic unit that provide remarkable positioning accuracy of the final control element. The remote mounted electronic unit includes a Local Control Panel with pushbuttons, which can be conveniently located for easy access permits engineers to set up actuator travel action and performance parameters, reducing commissioning time by 50 %.

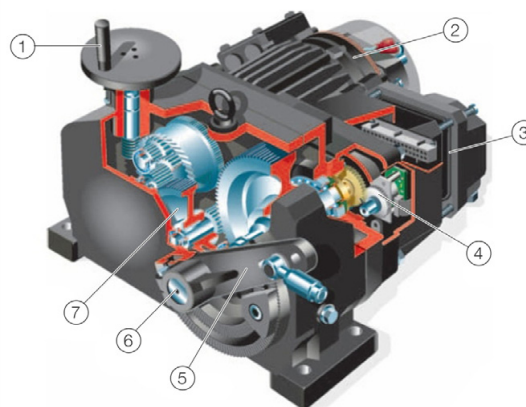
The operating angles range from 30 to 270 degrees without need of additional modification. Rotary actuators are available for rated torques of between 100 to 16000 Nm (80 to 12000 ft lb) and all share a similar design. A special 1~Phase power electronics unit controls the actuator and acts as the interface between actuator and control system, providing position feedback, travel alarms and ready to operate signals.

The positioning of the final control element is based on a variable torque principle to ensure that the valve is constantly subjected to a control load. This provides precise position stability and fast response to position demand changes, reducing process variability. Actuator speed changes can be accomplished electronically without the need for gear set changes. This allows custom adaptation to the process for optimum control.

Additional Contrac benefits include:

- Maintenance free for ten years
- Breakaway torque at end positions twice the rated torque
- Adjustable mechanical stops to prevent manual over travel
- Anti-coast spur wheel gear train with ball bearings
- Robust, oil lubricated gearing with high mechanical efficiency.

Using ABB's Asset Vision diagnostic and engineering software tool, the actuator's performance can be monitored online. Any required maintenance can be scheduled in a timely way according to plant outages.



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|-------------------------|----------------|
| ① Manual handwheel | ⑤ Lever |
| ② Motor | ⑥ Output shaft |
| ③ Electrical connection | ⑦ Spur gearing |
| ④ Position sensor | |

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More information



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