

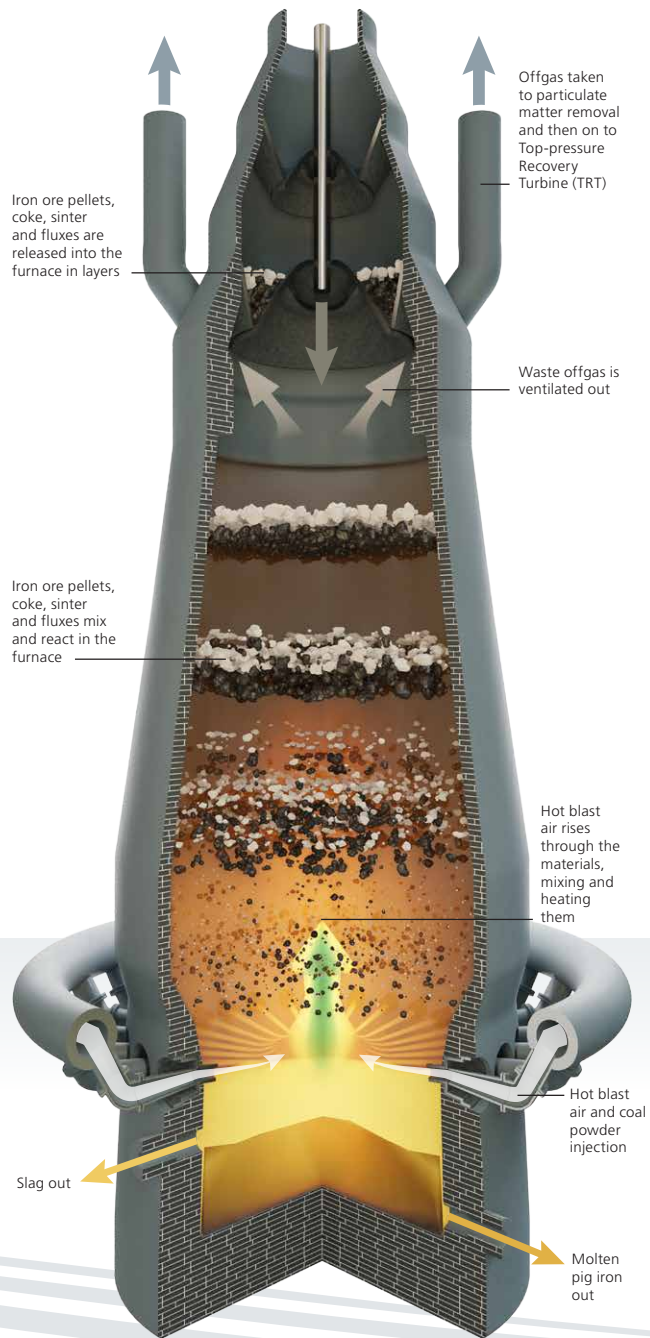


rotork[®]

Keeping the World Flowing
for Future Generations

Application Focus:
Blast Furnace

The Blast Furnace Process



Blast furnaces are used in steel mills to smelt pig iron from iron ore. Its name comes from the “blast” of hot air and gases forced up through the furnace. The operation of a blast furnace is a continuous process.

Iron ore pellets, coke, sinter and fluxes (limestone) enter the top of the blast furnace in layers. Hot blast air at approximately 1,200 °C enters the furnace through tuyere nozzles near the base and rises upwards, through the layers of iron ore, coke, sinter and fluxes. Additional fuels such as oil, natural gas and pulverised coal are also added to the hot blast to increase efficiency of the furnace.

Blast air heats the materials, mixing them and causing chemical reactions as they fall downwards in the furnace. Carbon from the coke is burnt by the hot blast to form carbon oxide (CO). The CO reacts with the oxygen of the iron ore to create carbon dioxide (CO₂).

Through the heat of the blast furnace and additional carbon from coke, the CO₂ breaks back down into CO. The process repeats itself from the bottom of the blast furnace to the top, at which time the CO and CO₂ is captured in the offgas system.

Waste gases, called offgas (CO and CO₂), are created and ventilated out at the top of the furnace. The gases move to a dropout chamber for particulate removal before being cooled and sent for further processing or for energy generation in a Top-pressure Recovery Turbine (TRT).

Particulates recovered from the offgas are used in the sintering process and recycled back through the blast furnace as sinter.

At the bottom of the furnace, the materials have now become molten pig iron with a top layer of slag and are continually tapped out of the furnace.

The slag is tapped out, processed and used as road or construction aggregate. The molten iron is tapped out and moves to a secondary furnace where it is refined in to steel prior to casting.

In this document we identify the three main challenges where modern, reliable flow control equipment provides solutions for blast furnace plant managers.

Rotork produce flow control solutions for critical blast furnace applications

Products designed with safety, integrity and industry leading lifespans

Vibration resistant, explosionproof and suitable for use in high temperatures

Rotork reliability reduces maintenance, improves efficiency and increases productivity

Coal Powder Injection

Challenge

Excess coking of tuyeres reduces the efficiency of blast furnace operation and requires unplanned plant shutdowns to decoke the input nozzles. Accurately controlling the coal powder injection rates will minimise the coking.

Process

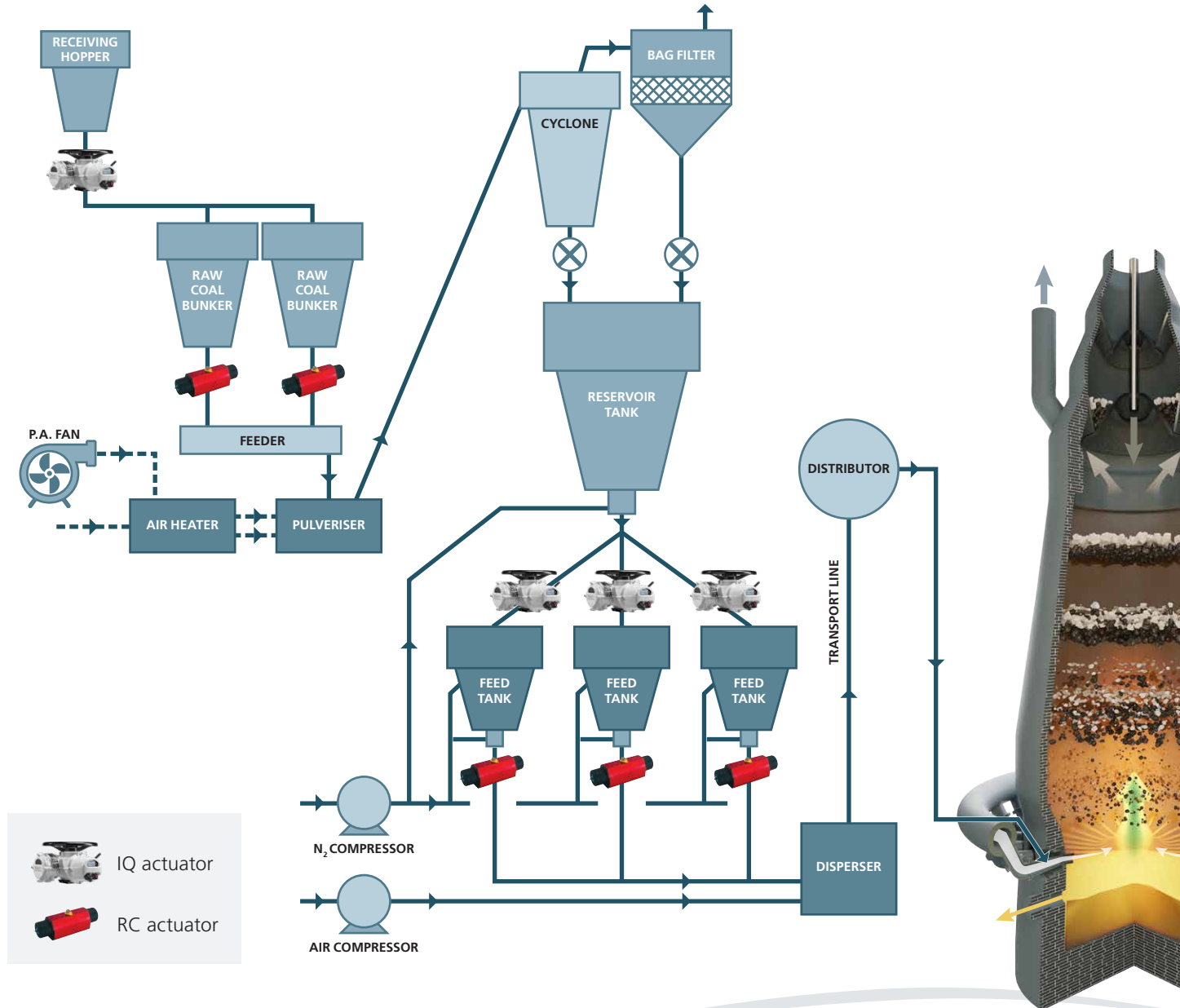
Coal powder is injected in to the furnace together with the hot blast air, through the tuyeres. The coal powder is used as an additional fuel source and burns in the furnace, increasing the overall efficiency of the blast furnace.

Solution

Rotork supply a range of electric and pneumatic actuators for precise and repeatable valve control on coal injection systems, accurately dosing coal powder in to the tuyeres.

IQ and RC actuators are explosionproof and rated for use in Safety Integrity Level (SIL) applications and Safety Instrumented Systems (SIS). They are designed to the highest safety standards for safe and reliable long term valve operation without any need for human input.

The diagram shows points where Rotork IQ and RC actuators are used to control processes. There are many processes involved in coal powder injection systems and many valves and dampers that need controlling; some require control for flow rate and others for safety shutdown requirements.



Blast Air and Offgas Ventilation

Challenge

Flow of offgas must be carefully controlled to avoid back flow in to the blast air supply system. Back flow can cause the air supply system to fail and molten slag to enter the air system, blocking the tuyere nozzles and leading to pressure build up inside the furnace and its possible destruction.

Process

Offgas, heated by gas burners, then heats checker bricks in the stove. Stove configuration is then changed to force cold air through the checker bricks, absorbing heat and becoming hot blast air. This mixes with cold air to reach the desired temperature, and enters the blast furnace through tuyeres.

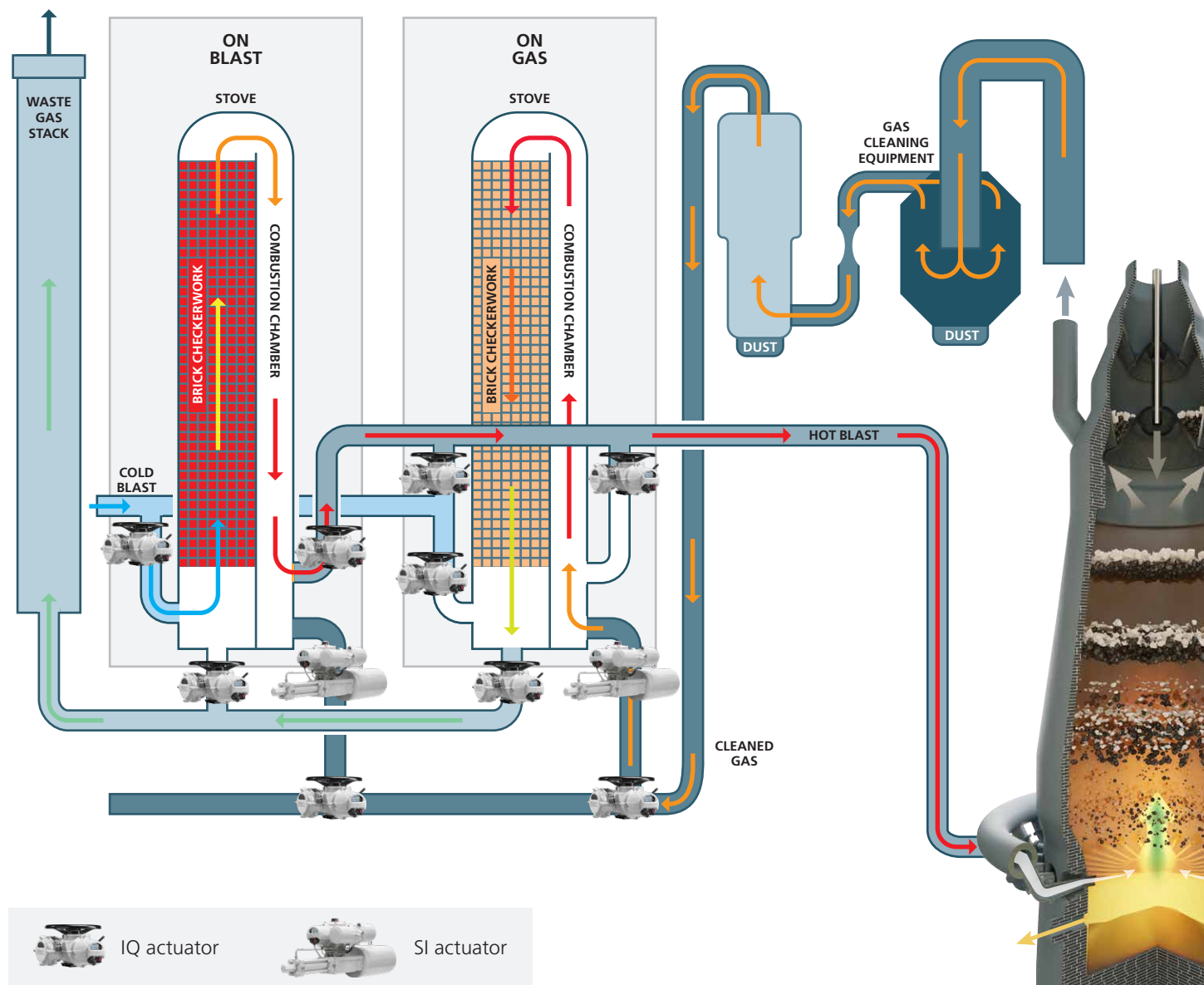
Solution

Rotork supply a range of heavy-duty valve actuators suitable for the demands of blast air and offgas ventilation control.

IQ electric actuators are supplied to control air distribution systems, providing reliable and repeatable duty in high temperature, hazardous and explosive atmospheres.

SI electro-hydraulic actuators are specified for safety critical operation of hot blast air and gas pipelines, providing fast acting, highly accurate and fail-safe valve control.

The diagram shows the complex pathways of the blast air systems. It shows two stoves, one in 'On Blast' service, heating cold blast air and one in 'On Gas' service, using gas to heat incoming offgas and heat up the checker brick, ready to switch the 'On Blast' service.



Top-pressure Recovery Turbine (TRT)

Challenge

Plant design must incorporate safety systems to protect workers and equipment. TRT turbines represent a large investment for the steel works. In the event of turbine failure or a runaway TRT, the gas channel must be isolated to protect the unit and prevent accidents.

Process

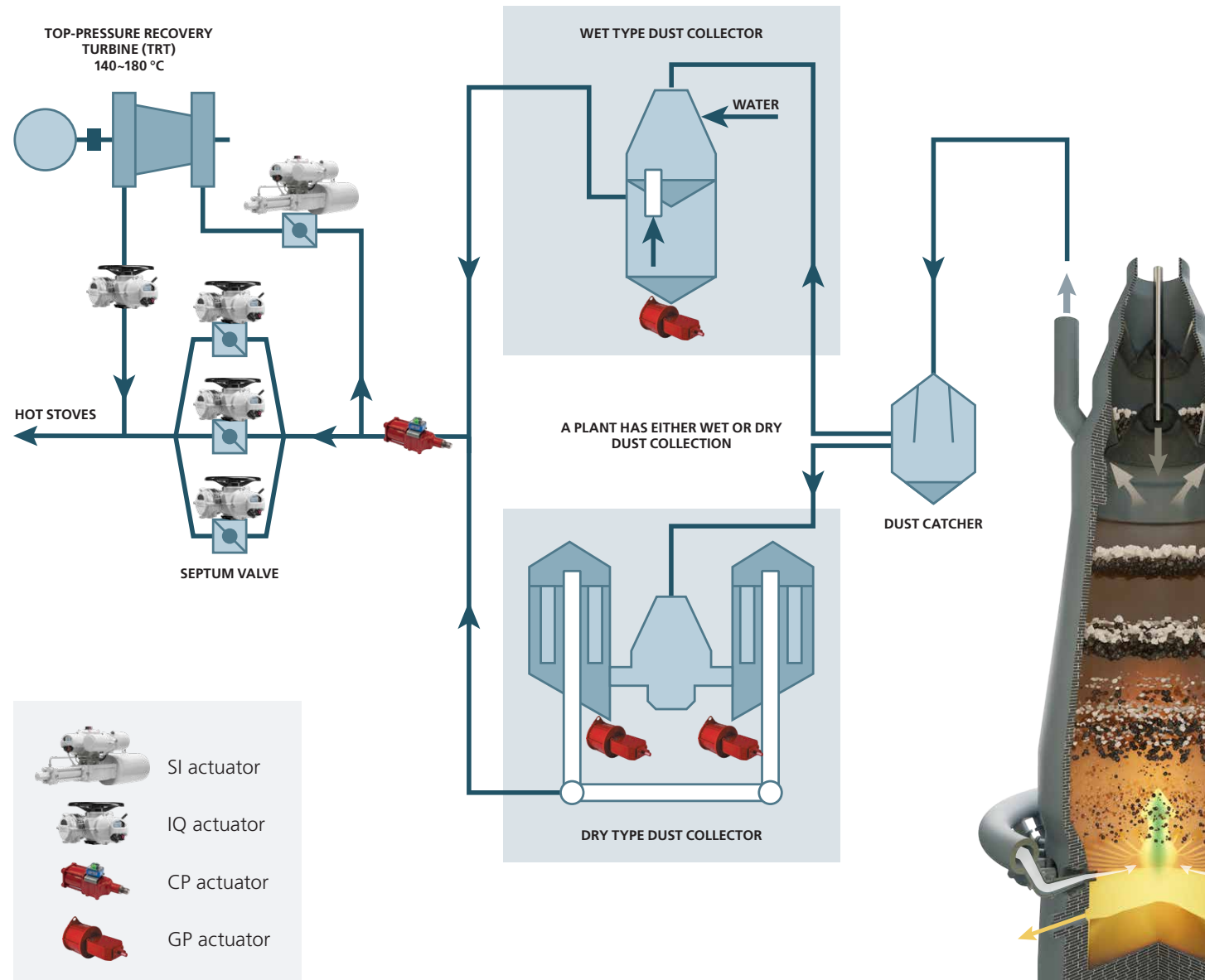
Hot offgas is channelled to the TRT to control the top pressure of the blast furnace and to generate electricity. The offgas is first processed to remove particulates before entering the TRT. Offgas leaving the TRT is channelled to the hot stoves.

Solution

Rotork manufacture a range of valve actuators suited to the safety related flow control requirements of TRT systems.

SI electro-hydraulic actuators are specified in Emergency Shutdown (ESD) systems. They are certified for use in safety related SIL applications and Safety Instrumented Systems (SIS). SI actuators are highly reliable and are capable of closing valves within 0.5 seconds.

The diagram shows where Rotork SI actuators are used in safety shutdown applications that require fast valve operation. It also shows where Rotork CP/GP and IQ actuators are used for normal flow control within the offgas collection and recycling processes.



IQ Range Intelligent Multi-Turn and Part-Turn Electric Actuators



Coal powder injection
Blast air and offgas ventilation

Reliability and Performance

- Accurate, reliable actuation of multiple valve types
- Compact size with high torque output
- Proven to reduce plant maintenance and keep production running smoothly
- Fast and easy on-site assembly without additional instrument air piping
- Almost maintenance free with no filter/regulator element to change
- Double-sealing design reduces affects of humidity, improves reliability and reduces downtime

RC200 Extremely Compact Scotch-Yoke Pneumatic Actuators

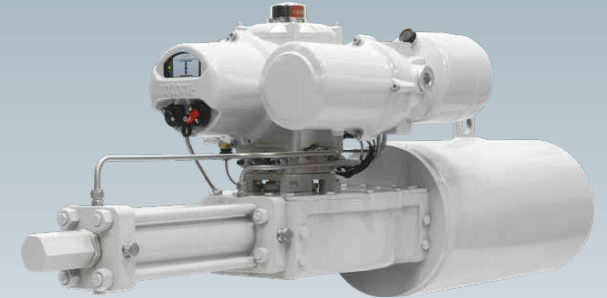


Coal powder injection

Compact and Robust

- Reliable double-acting and spring-return operation for use in tight spaces
- Compact size with high torque output
- Fast and easy on-site assembly
- High quality manufacturing
- We can provide package solutions to save you time and reduce maintenance by combining actuator, limit switch, solenoid valve and filter regulators

SI Range Intelligent Self-Contained Electro-Hydraulic Actuators

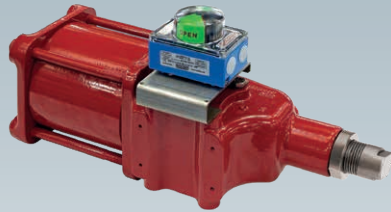


Blast air and blast furnace gas ventilation
Top-pressure Recovery Turbine (TRT)

Safety and ESD Shutdown Capabilities

- Provide fail-safe actuation for ESD applications
- Fast shut-down response protects your investments
- Designed to meet today's control and safety needs
- Designed for operation in high temperature environments and arduous conditions
- Double-sealing design reduces affects of humidity, improves reliability and reduces downtime

CP Range Scotch Yoke Pneumatic Actuators



Dust collection
Offgas ventilation

Compact and Robust

- Reliable double-acting and spring-return operation, fail close/fail open
- Compact size with high torque output
- Fast and easy on-site assembly
- High quality manufacturing
- We can provide package solutions to save you time and reduce maintenance by combining actuator, limit switch, solenoid valve and filter regulators

GP Range Heavy-duty Scotch Yoke Pneumatic Actuators



Dust collection
Offgas ventilation

Compact and Robust

- Reliable double-acting and spring-return operation for high torque applications
- Torque output up to 600,000 Nm (442,537 lbf.ft)
- Fast and easy on-site assembly
- High quality manufacturing
- We can provide package solutions to save you time and reduce maintenance by combining actuator, limit switch, solenoid valve and filter regulators

Service and Aftermarket Solutions



All plant operations

Lifetime Management

A complete solution to the risks associated with the life cycle of your equipment

Intelligent Asset Management

Advanced analytics to improve reliability and availability of key assets

Spares

Comprehensive OEM spares available worldwide

Life Cycle Management

Controlled strategies for managing the risks of ageing equipment



A full listing of our worldwide sales and service network is available on our website

www.rotork.com

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