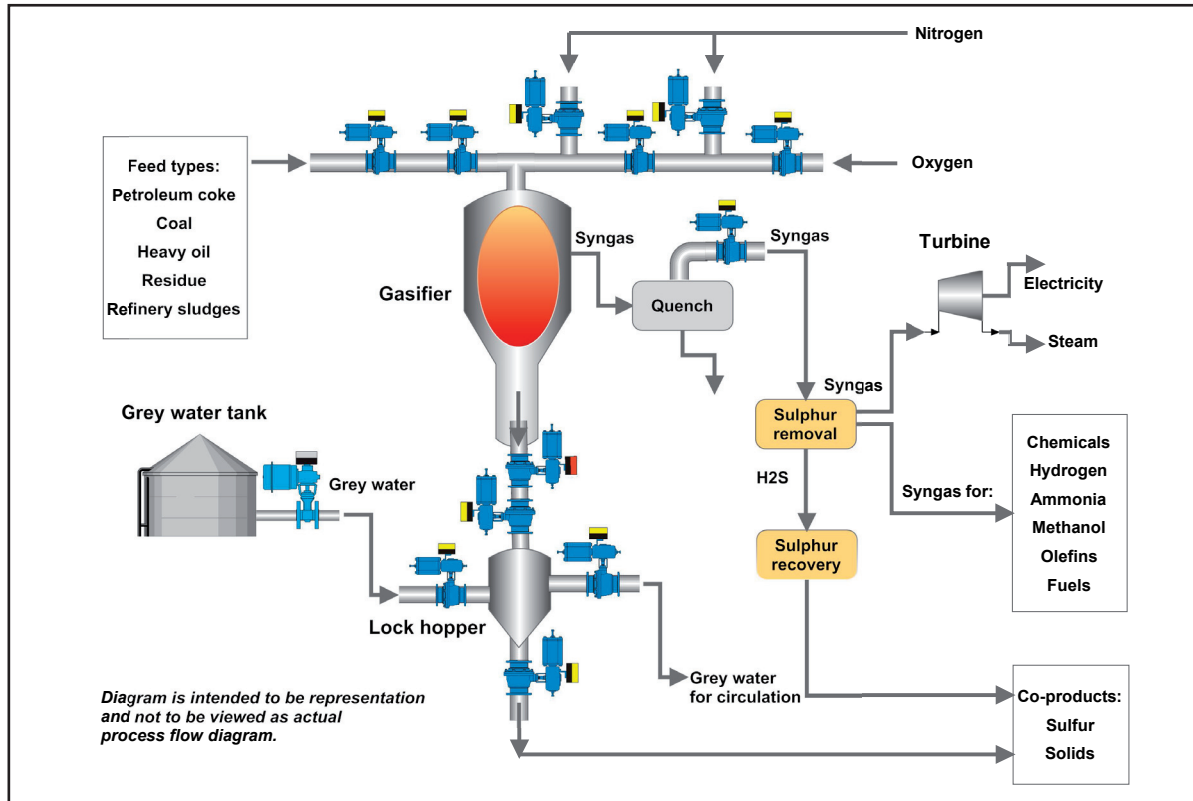


# Coal gasification



## Process overview

Gasification is used for converting carbonaceous materials to a combustible or synthetic gas. It involves the reaction of carbon with air, oxygen, steam, carbon dioxide, or a mixture of these gases at about 1200°C to produce a gaseous product that can be used to provide electric power and heat or as raw material for the synthesis of chemicals, fuels or hydrogen.

After the carbonaceous material is converted to gaseous state, undesirable substances such as

sulfur compounds and ash may be removed from the gas. Gasification process is operated with the oxygen supply controlled generally 35 % of the theoretically required for complete combustion, so that both heat and new gaseous fuel are produced as the feed material is consumed.

Pyrolysis under gasification conditions decomposes the feedstock thermally to yield solid carbon and a gas product stream that has higher hydrogen content than the original feed material.

## Coal gasification challenges

The target of coal gasification is to convert coal from a solid to gaseous fuel through partial oxidation. Once the fuel is in a gaseous state, undesirable substances, such as sulfur compounds and coal ash, may be removed from the gas. Reliability with long lasting performance in demanding conditions must be taken into account throughout the gasification process when selecting valves for control, on-off and ESD-applications.

**Health, Safety, Environment** – Valve leaking poses both an environmental and safety issue due to risk of fire, toxicity and volatility of gases. Emergency shutdown and on/off valves must be able to perform their action in a process or equipment failure.

**Top-class products at maximum yield** – The market calls for clean products and high quality. It is important that the process is stable, flexible and under control. Proper control valve performance in the gasifier improves the accuracy of throughput control and adversely affects to the plant performance and also the downstream processes.

**Maintenance costs** – Critical valves in the coal, oxygen, nitrogen feeds as well as slurry handling at lock-hopper section play an extremely important role in successful gasifier and overall process performance. Poorly performing valves in the process that need frequent service will have a direct impact on the productivity of the process.

**Plant run-time** – Gasifiers need frequent maintenance, typically every two months. Therefore they are built as three units, so that when one unit is shut down for maintenance, two units continue operating. Companies operating gasifier are looking for longer plant run-times since downtime means production losses and is a remarkable cost including maintenance costs. This requires reliable equipment and process control.

## Metso solutions

We are all tuned up to answer these challenges through our coal gasification application experience and product offering for control, safety and automated on/off duty that ensure high valve performance in gasification plants. Metso's automated, rugged ball valves are designed for efficient and reliable process operation in the most demanding gasifier on-off applications.

**Safety** – Metso intelligent valves have been designed to provide market leading safety. Rotary stem operation reduces fugitive emissions and protects from leaking. Metso is the only single source emergency shutdown valve supplier who has the experience and knowledge to combine intelligence with most reliable valves and actuators. Technology selections like rotary stem operation and inherently fire safe design ensure that latest emission and fire safety standards can be applied. Reliable valves with Neles ValvGuard™, intelligent SIL3 approved safety valve controller and partial stroke testing device will ensure that plant emergency shutdown valves will always perform properly when needed.

**Efficiency** – Throughput losses due to heavy residue sticking and poor control performance will be avoided with intelligent control valves. Flow through the process unit may be changed as the need arises with rangeability of 150:1 and further with full bore ball valves. Our advanced intelligent digital valve controllers for control, on-off and ESD applications ensure high positioning accuracy and fast response. Correct valve selection and sizing with our Nelprof-program we can assure the best valve performance and process control.

**Availability** – Simple rotary designs, same face-to-face dimensions, and global service network and inventory management will help you to optimize your maintenance activities. Rotary valves have been in service for several years without requiring maintenance and show no sign of leakage. The proven performance of Metso valves with long lasting metal seat tightness and shut-off capabilities makes them an ideal solution for control, on-off and critical coking applications.

**Reliability** – Valve performance trend data collected by our smart valve controllers and analysed by Metso FieldCare, open FDT/DTM technology based configuration and condition monitoring software, makes it possible to predict and respond to maintenance requirements and reduce unscheduled downtime. This gives full transparency to the valve performance in process control.

### Oxygen supply valve (1)

**Challenge** – Valves need to provide full compatibility to oxygen service from a design and material point of view, and to provide long term tightness in continuous operation.

**Metso solution** – Trunnion mounted ball valves, depending pressure class requirement; D1F in Class 600 and T2 series in Class 900 and 1500 service, having full metal to metal seats and tungsten carbide hard facing on sealing surfaces, will provide safe and reliable long term operation. Metso material selection is based on international material codes for oxygen service, like BAM, to ensure safety and reliability in process.

**Benefit** – With over 20 years of experience, Metso has manufactured high pressure ball valves with full metal-to-metal sealing capability in Nickel based alloys to oxygen service. Metso offers also a unique powder metallurgical HIP process to produce high quality pressure retaining parts in Ni based alloys. Metso metal seated technology provides long term service-free valve operation with long lasting internal and external valve tightness.



*Trunnion mounted ball valve with intelligent SwitchGuard controller*

### Nitrogen supply valves (2)

**Challenge** – Valves need to provide safety and reliability in isolation service from a design and material point of view, and to provide long term tightness in continuous operation. Valves are in key position to provide safety in separating the coal gasifier from oxygen supply during process.

**Metso solution** – Trunnion mounted ball valves, depending pressure class requirement; D1F in Class 600 and T2 series in Class 900 and 1500 service, having full metal to metal seats and tungsten carbide hard facing on sealing surfaces, will provide safety and maintain reliable long term tight shutoff.

**Benefit** – With long field experience, Metso has manufactured high pressure ball valves with full metal-to-metal sealing capability to safe and reliable

long term tightness and performance.

### Coal feed valves (3)

**Challenge** – Coal powder feed into reactor creates challenging conditions for frequently cycling valves to prevent built up in seat and body cavities and to prevent erosion and wear damages on sealing surfaces and in flow ports. Material and coating selection will be challenged by erosive and corrosive service fluid and conditions.

**Metso solution** – Metso has experience for over 40 years in developing and testing materials and hard facing technology in metal seated valves. Metso is a leading supplier of valves to severe services, like catalyst handling, slurries containing solids and high temperature applications.

**Benefit** – Hard facing on sealing surface is able to resist hard abrasive particles of flow medium, and maintain valve cycle life and tightness for long service intervals. Valve design especially in seating area provides protection against solids' built up in seat cavity, and seat design provides a scraping effect on sealing surfaces to allow valves maintain tightness under frequent operation. Valves can be equipped with additional flow port lining and protection with AISI 410 series stainless steel removable and easily replaceable liners, to extend valve operation life against wear and erosion in flow port areas.

### Coal slurry lock-hopper valves (4)

**Challenge** – Coal slurry and cinder water are creating challenging conditions for frequently cycling valves to prevent built up in all cavities and to prevent wear damages on sealing surfaces and in flow ports.

**Metso solution** – Metso sealing technology is based on using Spray and Fused type hard facing on trim parts to maximize the cycle life and wear resistance in liquid base service medium where parts are affected by damages like erosion and corrosion.

**Benefit** – Hard facing on sealing surface is able to resist hard abrasive particles of flow medium, and maintain valve cycle life and tightness for long service intervals. Valve design especially in seating area provides protection against solids' built up in seat cavity, and seat design provides a scraping effect on sealing surfaces to allow valves maintain tightness under frequent operation. Valves can be equipped with additional flow port lining and protection with AISI 410 series stainless steel removable and easily replaceable liners, to extend valve operation life against wear and erosion in flow port areas.

### Intelligent controlling solution for process critical on-off valves in coal gasification

Neles SwitchGuard SG9000 is an intelligent on-off valve controller that is specially designed to meet challenges of process critical on-off applications. SG9000 gives the possibility to set the on-off valve stroking times and profiles according to the process needs. Its high pneumatics capacity also gives the possibility to reach fast stroking times without the need for any additional accessories such as volume boosters or quick exhaust valves. In addition, predictive maintenance can be practiced with the help of the diagnostics that SG9000 provides on the on-off valve performance. To simplify the installation, different mechanical or inductive proximity switches can be installed inside the SG9000 housing removing the need for tandem mounting.

As an option for SG9000, Metso can also provide traditional control solution based on separate solenoid valve and limit switches.



The information provided in this bulletin is advisory in nature, and is intended as a guideline only. For specific circumstances and more detailed information, please consult with your local automation expert at Metso.

#### Metso Automation Inc.

**Europe**, Vanha Porvoontie 229, P.O. Box 304, FI-01301 VANTAA, Finland.  
Tel. +358 20 483 150. Fax +358 20 483 151

**North America**, 44 Bowditch Drive, P.O. Box 8044, Shrewsbury, MA 01545, USA.  
Tel. +1 508 852 0200. Fax +1 508 852 8172

**South America**, Av. Independência, 2500- Iporanga, 18087-101, Sorocaba-São Paulo  
Brazil. Tel. +55 15 2102 9700. Fax +55 15 2102 9748/49

**Asia Pacific**, 20 Kallang Avenue, Lobby B, #06-00, PICO Creative Centre, Singapore 339411, Singapore.  
Tel. +65 6511 1011. Fax +65 6250 0830

**China**, 19/F, the Exchange Beijing, No. 118, Jianguo Lu Yi, Chaoyang Dist, 100022 Beijing, China.  
Tel. +86-10-6566-6600. Fax +86-10-6566-2575

**Middle East**, Roundabout 8, Unit AB-07, P.O. Box 17175, Jebel Ali Freezone, Dubai,  
United Arab Emirates. Tel. +971 4 883 6974. Fax +971 4 883 6836

[www.metso.com/valves](http://www.metso.com/valves)