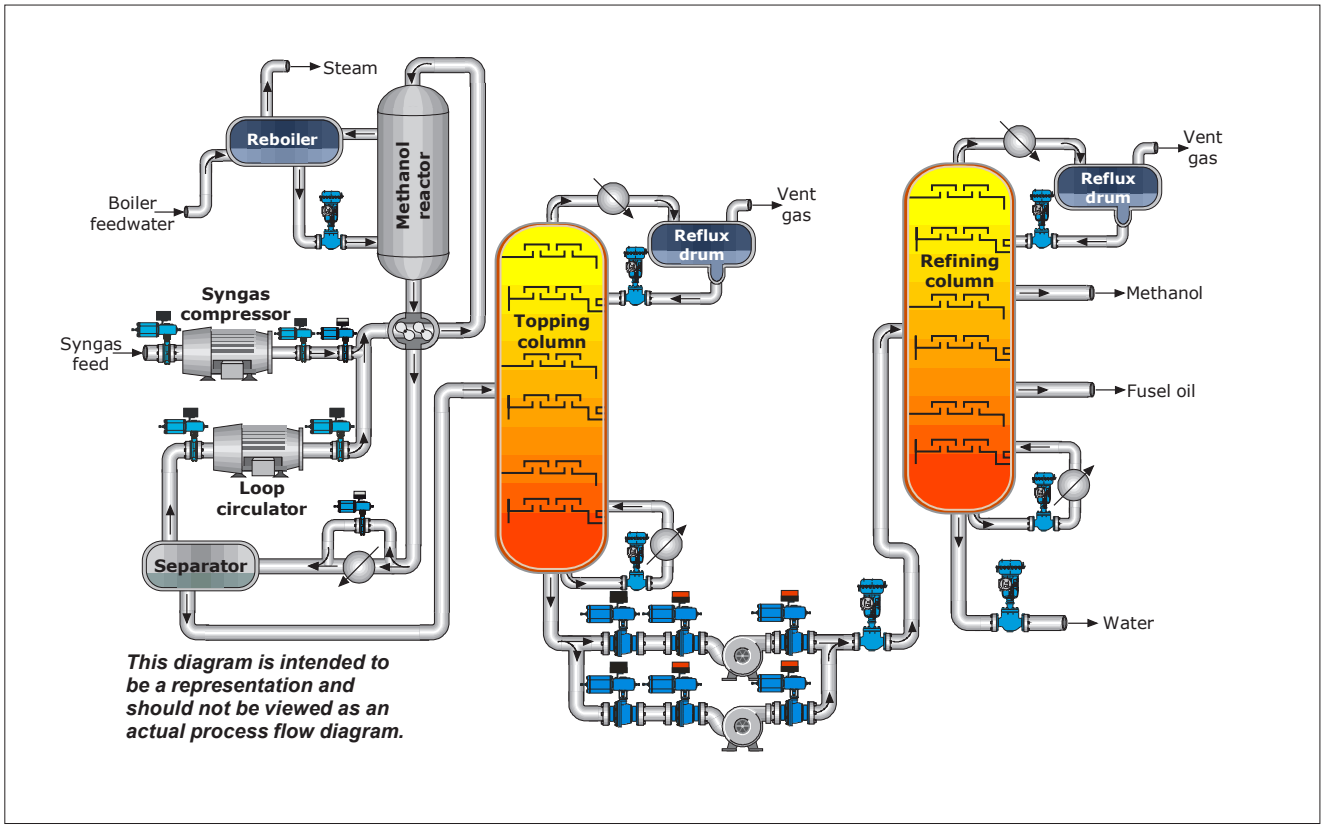
Methanol synthesis



Process overview

In a methanol synthesis process, methanol is produced from syngas, which is a mixture of hydrogen gas and carbon monoxide. Methanol is mainly used for producing other chemicals or as fuel for specialized vehicles.

The syngas, which is used as feedstock, usually originates from a steam reformer. This syngas is compressed to around 50-100 bar (730-1450 psi) before being admitted to the methanol synthesis loop.

The compressed syngas is preheated by heat exchange with the hot reactor effluent before it enters the reactor. The reactor operates at a temperature of around 200-280 °C (390-540 °F).

The effluent exiting the reactor is cooled and then condensed to separate unreacted syngas, which is recycled back to the converter. The crude methanol is then taken to a distillation section.

Usually, the distillation section consists of two columns in which light ends are removed in the topping column, while water and heavy alcohols are removed in the refining column.

Methanol synthesis valve applications

Optimal performance in a methanol plant requires properly performing valves. Poorly responding valves in the synthesis loop negatively affect overall process efficiency leading to lost profit. Valves must also utilize robust stem sealing to prevent toxic methanol from being emitted to the plant.

Synthesis loop on-off valves

The methanol synthesis loop has on-off valves for isolating the feed to the loop itself and for isolating various equipment including heat exchangers and compressors.

These valves are subject to high temperatures (around 200-280 °C / 390-540 °F) and pressure (up to 90 barG / 1300 psig). Fugitive emission control is also important due to toxicity of the medium. Tight shut-off is required to conserve energy.

Neles™ solution for synthesis loop on-off

Neles high-pressure trunnion mounted ball valves provide the optimal solution for synthesis loop isolation

- **Tight shut-off,** up to ANSI Class V/ISO 5208 Rate C with metal seats and ANSI Class VI/ISO 5208 Rate B with soft seats
- **Live-loaded gland packing and rotary design** ensures minimized emissions
- **High temperature design** for operation in up to 425 °C (797 °F)

For larger pipe sizes, **Neles triple-eccentric butterfly valves** are an economical choice.

- **Emission certified** per ISO 15848 and TA-Luft/VDI 2440
- **High temperature compliant,** can be utilized in temperatures as high as 1150 °C (2100 °F)
- **Compliant with low and high pressures** – available in pressure classes 150-2500#

Neles high-pressure ball valve

Synthesis loop control valves

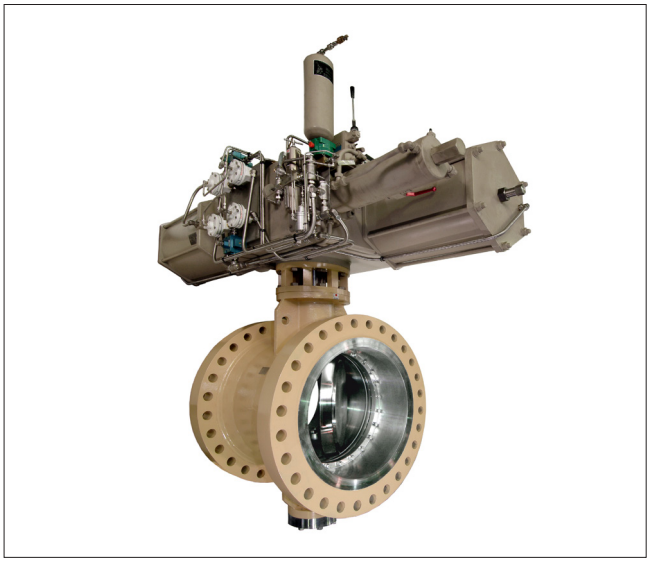
There are various control valves within the methanol synthesis loop which control the flow of the medium within this loop. These include valves for admitting new flow into the loop and valves for temperature control.

These valves face similar challenges as the on-off valves in terms of temperature and pressure. Since high pressure is expensive, energy losses in valves must be minimized.

Neles solution for synthesis loop control

Neles triple-eccentric butterfly valves with a two-piece shaft design offer a field-proven and efficient solution for synthesis loop control.

- **Triple offset design,** reducing wear and providing extended operational life in control and shut-off applications
- **Wide product range,** available in pressure classes up to 2500# and temperatures up to 1150 °C (2100 °F)
- **High capacity** due to the two-piece shaft design, minimizing pressure drop and enabling smaller valve sizes to be used
- **Lower pipe stress** as smaller valve sizes enable smaller actuators to be utilized, leading to less applied torque
- **Online diagnostics** provided by intelligent ND valve controller

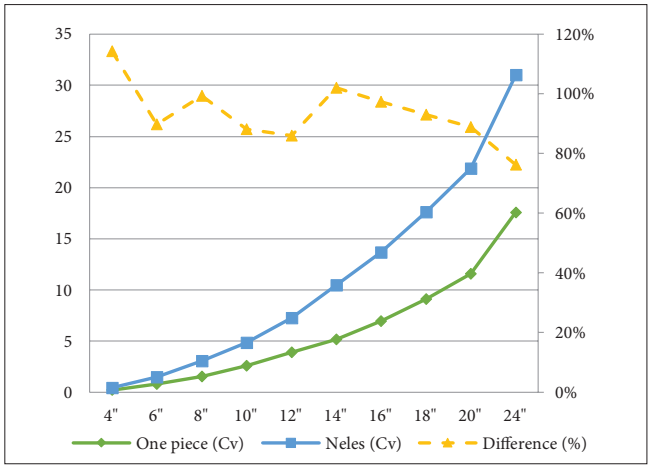


Neles triple-eccentric butterfly valve

The unique two piece-shaft gives the following advantages:

- **Lower pressure drop** across the valve, reducing operation costs, due to the higher flow capacity
- **Use smaller valve size** for the same flow amount, reducing capital costs
- **Smaller actuator** due to lower torque requirements, further decreasing capital costs
- **Lower pipe stress** as less torque is applied by the actuator
- **Less torque** also allows better controllability of the valve

For example, a flow 2000 m³/h (8800 US gal/min) through a valve giving a pressure drop of 2 bar vs 3 bar (30 psi vs 45 psi) allows potential energy savings of about $45 000 per year in pump operations.



Flow coefficient comparison of 150# butterfly valve: Cv on the left (thousands), valve size on the bottom

Benefits

- Reduce operation costs with higher flow capacities giving a smaller pressure drop, reducing pump energy consumption
- Reduce capital costs with smaller valves and torques resulting in a smaller valve + actuator package
- Reduce maintenance costs with modular and simple valve designs
- Ensure safety of personnel and minimize material waste with emission certified valves
- Reliable and field proven valve designs

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