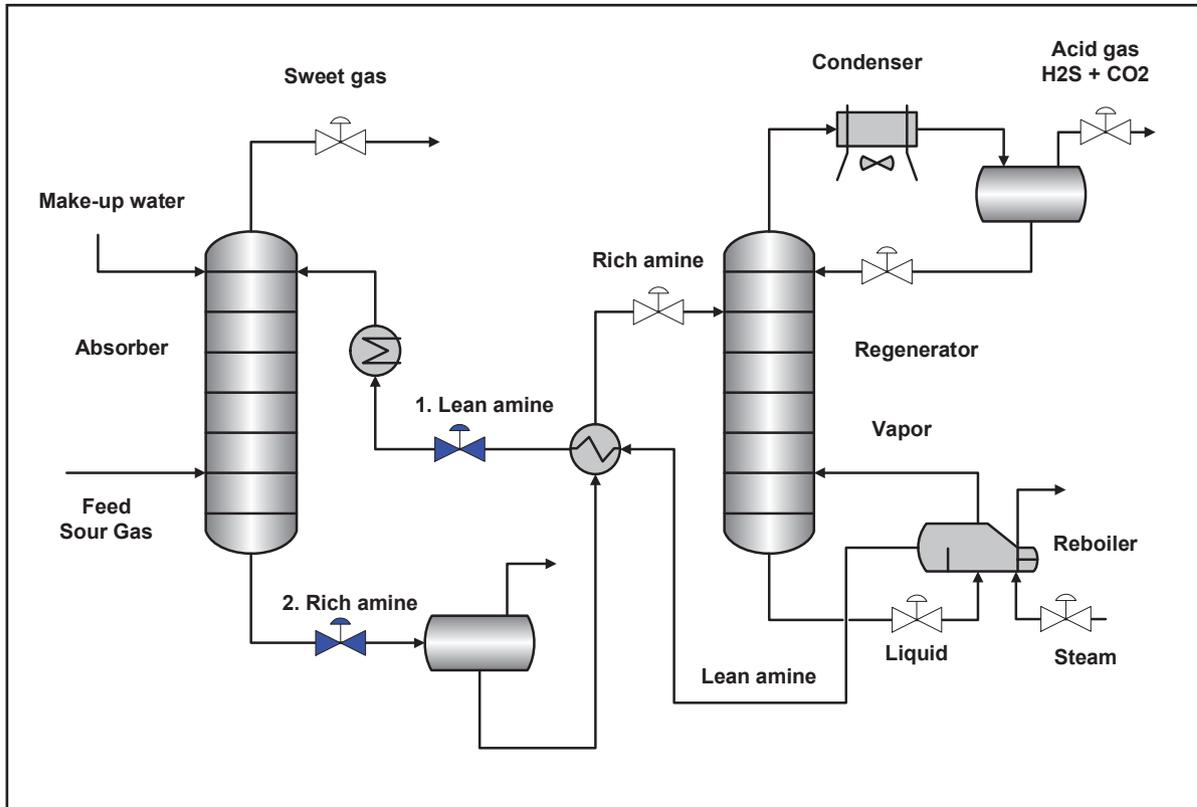


Amine plant - absorption



Process overview

Gases from various refinery processing operations contain hydrogen sulphide and occasionally carbon dioxide. Some H₂S in refinery gases is formed as a result of conversion of sulphur compounds in processes such as hydrotreating, cracking and coking. Environmental and pipeline regulations require that most of the H₂S must be removed from refinery fuel gas and converted to elemental sulphur.

In general, the diethanolamine (DEA) process has been the most widely used for refinery gas treating. Methyl-diethanolamine (MDEA) can be used to replace DEA to reduce the absorption of carbon dioxide and thereby produce an acid gas with higher content of H₂S. This provides some improvement in sulphur recovery efficiency. The amine solution is pumped to the top of absorber containing multiple trays and packing. H₂S and

CO₂ are removed from the gas by absorption into the solution. Rich solution from the absorber flows into a flash tank that is operated at lower pressure permitting the venting of any entrained light hydrocarbons from the system. The rich solution is then preheated and acid gases stripped from the solution in a regenerator or stripper by steam generated in reboiler. Acid gases from the top are sent to a sulphur recovery unit. The lean solution is cooled and sent back to the absorber.

Many refiners have multiple amine absorbers and a common amine regeneration unit. Some refineries have one regeneration unit for cleaner purposes, such as hydrotreaters and another for FCC or cokers. Operating conditions are usually such that the treated gas meets the specifications for H₂S and CO₂ content. This is controlled by the amount of solution circulated and steam generated in the reboiler.

Amine plant challenges

Major operating considerations for amine units are maintaining the condition of the amine solution, minimizing losses and preventing hydrocarbon carryover to the sulphur plant. This can be obtained by controlling amine concentration, amine circulation rate, lean amine temperature into the absorber and stripping steam generated in the stripper reboiler. Optimization of an amine plant is a balance between capacity, energy and corrosion.

Health, Safety, Environment – Valve leaking poses both an environmental and safety issue due to risk of fire and toxicity of volatile gases. ESD 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. Poor control valve performance reduces the accuracy of throughput control and adversely affects to the plant performance and also the downstream processes.

Maintenance costs – Poorly performing valves in the process must be serviced because they will have a direct impact on the efficiency of the process. The cost of unscheduled maintenance will be quite high, up to 70% of the cost of a new valve in some applications. Add this to the cost of removing the valve from the line and disruption of the process and the total cost will be much higher.

Plant run-time – Refineries 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 refining application experience and product offering for control, safety and automated on/off duty that ensure high valve performance in amine plants.

Safety – Rotary stem operation reduces fugitive emissions and protects from leaking. Packing construction meets the latest emission standards. Our products are fire tested and apply to the latest standards. Neles ValvGuard™ partial stroking will ensure that plant emergency shut-down valves will always perform properly when needed.

Efficiency – Throughput losses due to sticking and poor control performance will be avoided with high performance rotary 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 ND9000 digital valve controller ensures higher positioning accuracy and faster response to reduce process variability. 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.

Reliability – Trend data collected by our smart valve controllers and analysed by FieldCare configuration and condition monitoring software based on open FDT/DTM technology 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.



Absorber applications

1. Lean amine control

Challenge – One of the most important specifications in amine process is the acid gas content in the treated gas. The amine circulation rate is one of the two typical process variables to be optimized. The amine flow rate is manipulated according to the acid gas loading to the absorber. Variations in the flow rate have an effect on the process efficiency, lean amine temperature and lean amine loading. Absorber tray efficiency control is important in order to optimize gas absorption capability. Variations in amine quality, such as solids and foaming affect to the systems stability and absorption efficiency.

Metso solution – Finetrol eccentric plug valve for general and rotary globe valve for small capacity applications. Self-flushing q-trim is available as option for cavitation control.

Benefits – Valve plays a significant role in control loop, especially when high loop performance is targeted. With our control valves the variability can be reduced. This makes it possible to operate the absorber closer to the edge of the operating envelope. The savings are realized in reduced amine consumption. Long lasting metal seat tightness minimizes amine losses and gland packing structure reduces the emissions to the environment. Process reliability can be improved by ND9000 on-line diagnostics that provides full transparency to valve performance. Wide rangeability with rotary valves ensures that lean amine circulation rate can be changed as need arises during the run period.



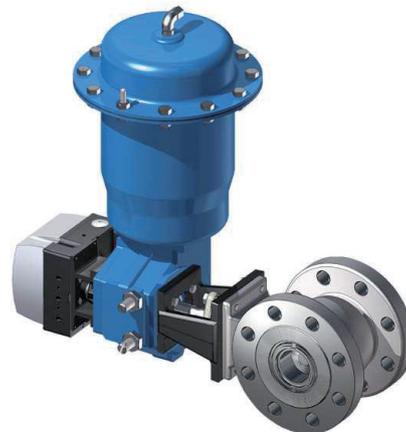
Neles RotaryGlobe

2. Rich amine let-down

Challenge – Rich amine let-down valve at the bottom controls the liquid level in the absorber. Rich acid gas loading must not be too high due to potential corrosion problems. The rich amine from the bottom is sent to a flash tank which is at lower pressure, causing the leftover methane or ethane gas to be released and used as fuel gas. Depending on the absorber pressure the pressure drop across the valve can be from few barG up to 170 barG. Two-phase flow, flashing or outgassing can be expected in this application.

Metso solution – Finetrol flow to close for medium pressure applications and T-series top entry valve for high pressure applications (up to ASME 1500). Variety of hard coatings and q-trims are available for severe flashing applications.

Benefits – Long lasting metal seat tightness and rotary stem reduces amine losses and the gland packing structure reduces the emissions to environment. Ensure plant availability by controlling flashing, erosion and corrosion. Process reliability can be improved by ND9000 on-line diagnostics that provides full transparency to valve performance.



Finetrol

Optimize your amine plant performance, reduce energy and maintenance costs and produce top-class products with our intelligent rotary control, on-off and ESD-valves.



Neles intelligent valve controllers



Visibility to switching applications



Reliable ESD -solutions

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.

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