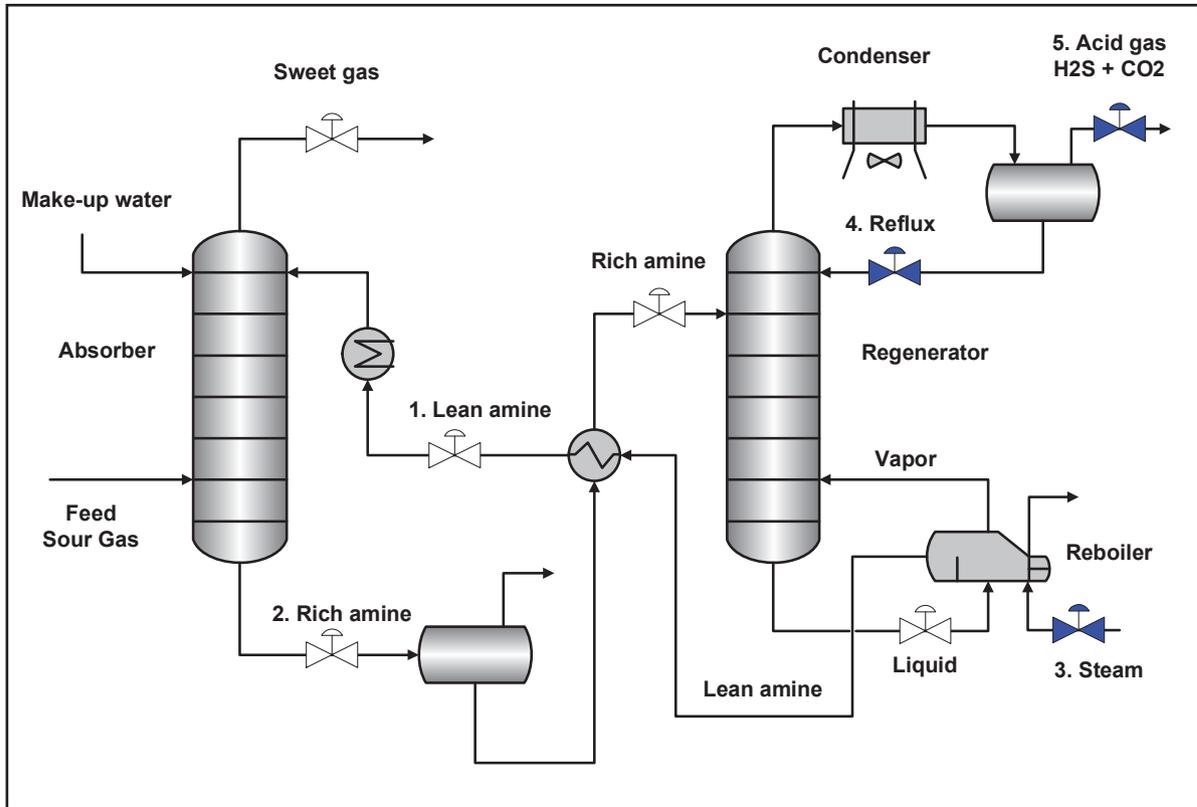


# Amine plant - stripper



## Process overview

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 H<sub>2</sub>S. This provides some improvement in sulphur recovery efficiency. The amine solution is pumped to the top of absorber containing multiple trays and packing. H<sub>2</sub>S and CO<sub>2</sub> 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 so-

lution 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 H<sub>2</sub>S and CO<sub>2</sub> content. This is controlled by the amount of solution circulated and steam generated in the reboiler.

## Amine plant challenges

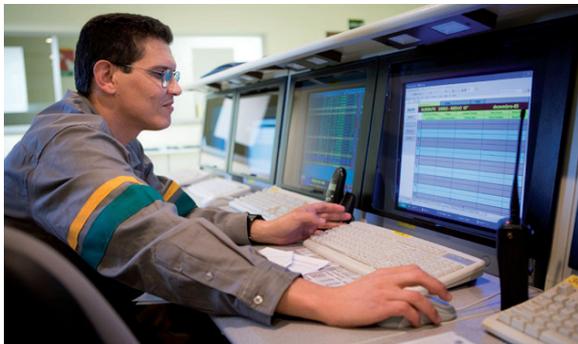
Major operating considerations for amine units are maintaining the condition of the amine solution, minimizing losses and preventing hydrocarbon carryover to the sulphur plant. This can be obtained by controlling amine concentration, amine circulation rate, lean amine temperature into the absorber and 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

### 3. Reboiler

**Challenge** – The rich amine leaves the flash tank and passes through lean/rich exchanger to the top of the regenerator, the pressure is further reduced while temperature is increased to about 128 °C. This releases the acid gases which are sent to the sulphur plant. The lean amine leaves the stripper and passes through the lean/rich exchangers back to the acid gas absorber. Reboiler valve controls the amount of heat input to the stripper and therefore the efficiency of gas stripping from the solvent. Steam is typically used as heating media, sometimes other refinery process streams. Accurate control performance is required for efficient stripper operation.

**Metso solution** – Finetrol eccentric plug valve

**Benefits** - Valve plays a significant role in control loop, especially when high loop performance is targeted. Broad control range and stable control behaviour provides accurate control performance that keeps process deviations to a minimum. This makes it possible to operate the stripper closer to the edge of the operating envelope. Savings are realized in reduced energy consumption in the reboiler. Process reliability can be improved by ND9000 on-line diagnostics that provides full transparency to valve performance.



Finetrol

### 4. Reflux

**Challenge** – Reflux valve is used to control the amine separation from the acid gases. The operation of the reflux control is a balance between the amine separation from acid gases and reboiler energy consumption, the higher the reflux rate the more heat is required. The lower the reflux rate the more amine is lost with acid gases, but less heat is required in reboiler.

**Metso solution** – Finetrol eccentric plug valve

**Benefits** - Valve plays a significant role in control loop, especially when high loop performance is targeted. Broad control range and stable control behaviour provides accurate control performance that keeps process deviations to a minimum. This makes it possible to operate the stripper closer to the edge of the operating envelope in order to get the maximum acid gas purity. Savings are realized in reduced energy consumption in the reboiler and maximum amine recovery. Process reliability can be improved by ND9000 on-line diagnostics that provides full transparency to valve performance.

### 5. Acid gas control

**Challenge** – The amine stripper pressure is typically kept in minimum in order to reduce the energy consumption in the reboiler. Higher pressure increases the amine separation from acid gases, but requires more energy in reboiler. Stability is typically required in order to keep the stripper in stable conditions. Fugitive emission control is important for acid gas service and in many cases NACE can be applied.

**Metso solution** – Finetrol eccentric plug valve / Neldisc butterfly valve especially for large sizes.

**Benefits** - Broad control range and stable control behaviour provides accurate control performance that keeps process deviations to a minimum. This makes it possible to operate the stripper in a stable way and maximize amine separation from acid gases. Savings are realized in reduced energy consumption in the reboiler and reduced amine losses. Process reliability can be improved by ND9000 on-line diagnostics that provides full transparency to valve performance. Rotary design low emission with reliable stem packing provides simple and cost effective way to reduce overall fugitive emission.

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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