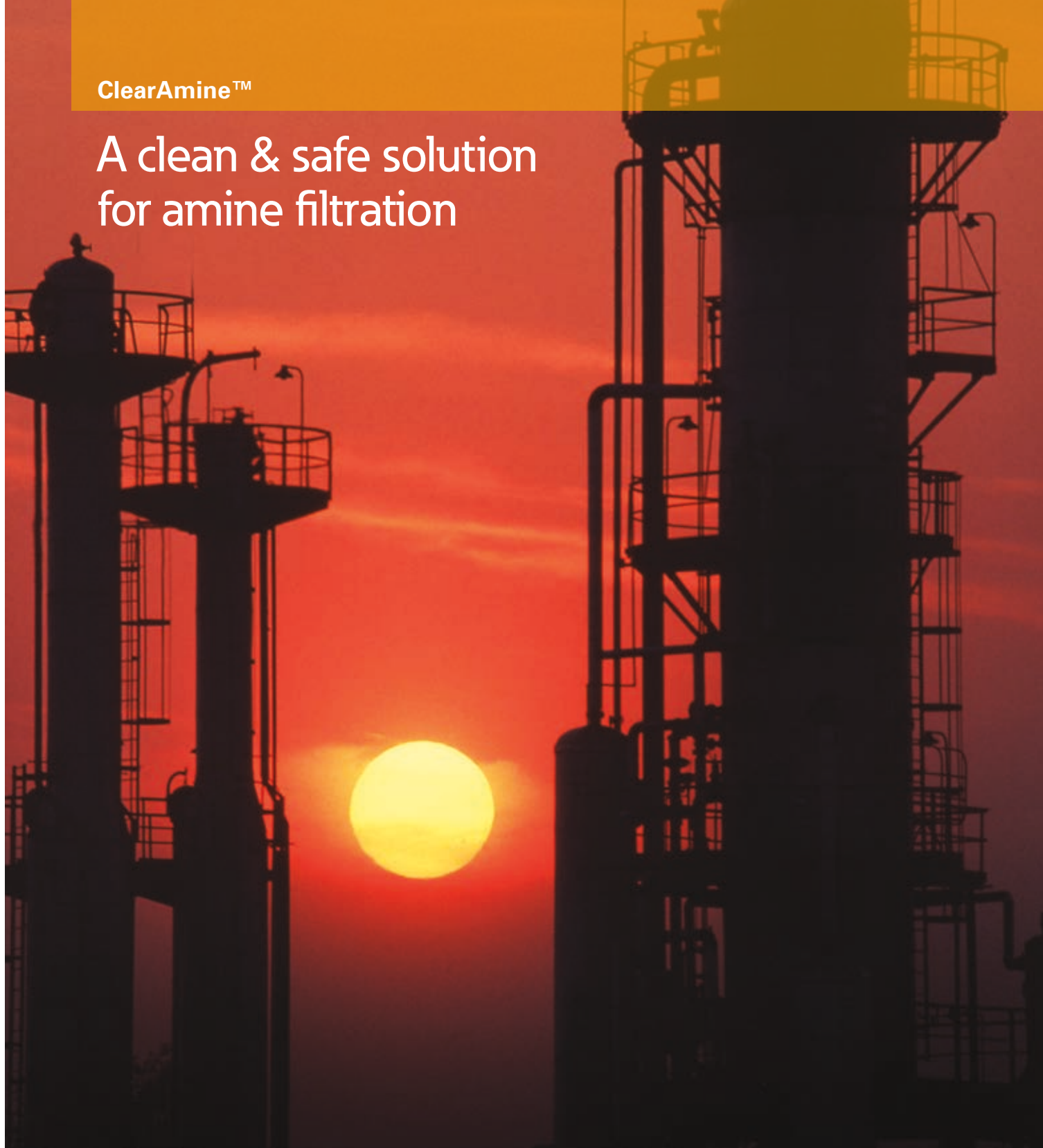


ClearAmine™

# A clean & safe solution for amine filtration

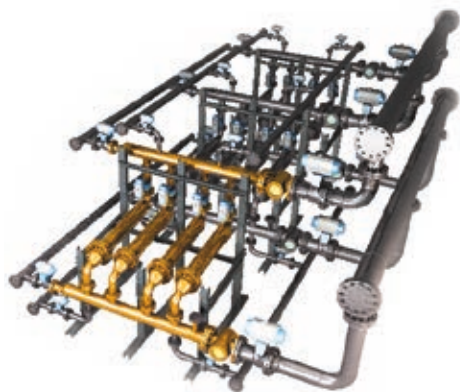


**EATON**

*Powering Business Worldwide*

# ClearAmine

## A sustainable solution that's cost effective, operator safe, with less environmental impact



The system above shows three banks of four filter stations each. One bank is highlighted in orange.

### ■ **Protect your investment**

Amine filtration is the key to trouble-free refinery operation. Pipe scale, rust, iron sulfide, sand and other solids build-up in closed-loop amine systems. They foul flash drums, heat exchangers, strippers, re-boilers and carbon filters and also attract hydrocarbons, which cause system foaming. ClearAmine provides an efficient method of removing harmful solids to protect your investment, extend equipment life, and maximize your amine system's effectiveness. When used alongside of disposable bag or cartridge equipment, the life of the filter media is greatly extended.

### ■ **Reduce operating expenses**

Disposable media equipment may be initially less expensive but the costs quickly multiply— even short term. With the ClearAmine automated self-cleaning system there are no bags or cartridges to purchase, no material to inventory and track, no hazardous waste landfill fees and greatly reduced maintenance and handling costs. Over a ten-year period, you can expect nearly a 60% savings compared to a disposable media system (see back page).

### ■ **Increase plant safety**

With no cartridges or bags to change out, exposure to hydrogen sulfide and other dust and fumes is minimized or eliminated. Lower labor interaction overall will contribute to the safety of your operation.

### ■ **Improve filter productivity**

Continuous non-stop amine filtration is achieved with a slip stream process on single unit systems. A multi-bank configuration can also be used for larger or more complex operations. The level of contaminants within the amine solution is maintained at a specified limit to protect on-line equipment without compromising productivity.

### ■ **Decrease carbon footprint**

The ClearAmine system provides an opportunity to be proactive in regard to environmental stewardship. The self-cleaning filter uses no cartridges or bags that can contribute to the ever-increasing content of landfills. You also reduce the environmental impact of gasses associated with the decomposition of spent material.

### ■ **Cut labor cost**

The ClearAmine system is engineered with superior mechanical integrity for enhanced serviceability, reduced maintenance man-hours and zero downtime costs. The near fully automated system keeps the level of operator interaction to a minimum.

Flanged valves (vs. socket welded valves) in standard ANSI dimensions simplify serviceability and replacement.

Sight glass on inlet and outlet headers allow for safe operator inspection and system optimization.

Computational Fluid Dynamics (CDF) were used to configure inlet and outlet heads to improve backwash effectiveness and reduce pressure differentials.

Filter stations are precision angled for optimal fill and drainage effectiveness.

Programmable Logic Control with electronic interface for off-site monitoring and control.



### AccuFlux™ filter media

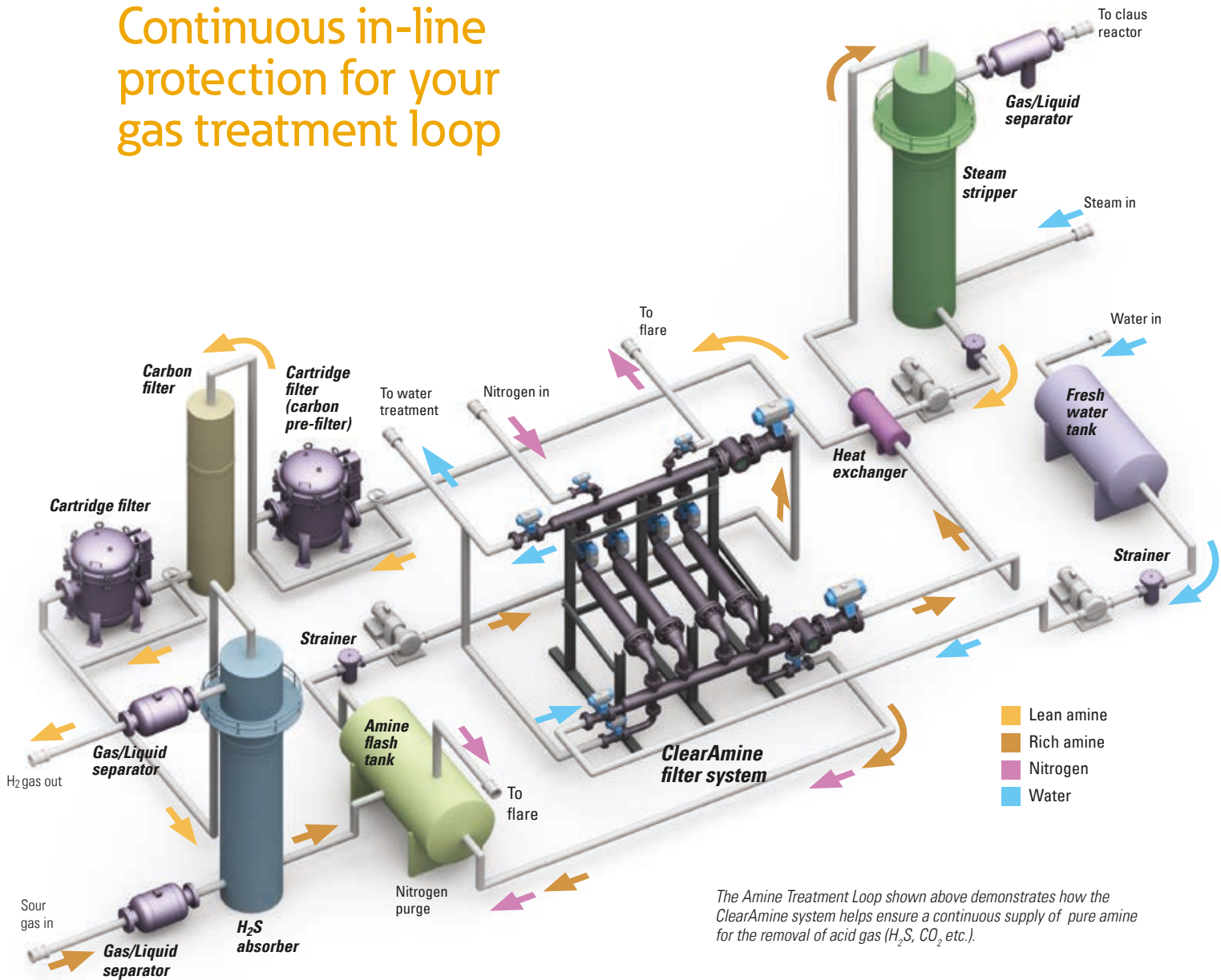
The patented AccuFlux media provides the key to more consistent separation and higher efficiency. The multi-element design maximizes filtration area for lower flux rate, higher

velocity operation and easier backflush cleaning. Each filter station contains an array of 316 stainless steel tubes covered in a woven stainless steel wire mesh. Solids are retained on the media surface

forming a porous particulate cake and particles as small as 2 microns are eliminated from the amine stream which further increases filtration effectiveness.



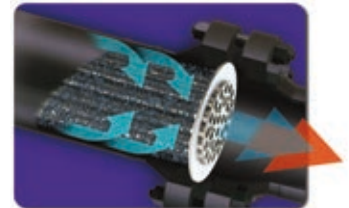
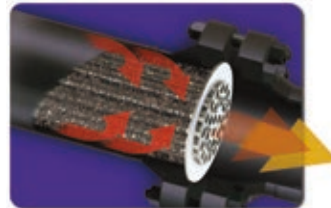
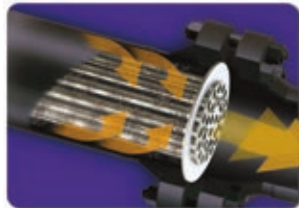
# Continuous in-line protection for your gas treatment loop



The Amine Treatment Loop shown above demonstrates how the ClearAmine system helps ensure a continuous supply of pure amine for the removal of acid gas ( $H_2S$ ,  $CO_2$ , etc.).

## Contaminant filtration

The ClearAmine system consists of banks of filter stations with AccuFlux elements in each station. Dirty amine flows from the top headers to all stations with contaminant collecting on the outside of the element tubes — building a particulate cake. Clean amine flows from inside the elements, out to the lower outlet header and back to the amine stream. As contaminant builds on the elements, the differential pressure between the inlet and outlet of the filter increases. When pressure reaches 15 psi, the system automatically initiates a backwash cycle.



## Backwashing the media

1. At the beginning of the backwash sequence, each bank of stations is closed from the ongoing filtration of other banks in the system. A bypass loop is used if a system consists of only one bank. Then each station within the bank is isolated and individually purged of amine using nitrogen or fuel gas.

1A. An optional cake wash step is available for high  $CO_2$  fluids to ensure all solvents are removed from the filter cake.

# Eaton experience

Eaton is known and trusted in the petrochemical industry with filtration systems in thousands of plants worldwide. We stand behind our products with comprehensive parts and service programs. At Eaton, we provide complete solutions that are sustainable economically and environmentally while protecting the safety of your workforce.

At almost any point in your refinery, effective, efficient filtration can deliver tremendous benefits including:

- longer equipment life
- reduced downtime
- improved safety
- protection of costly process materials
- extended runtime between turnarounds

With installations in many of the world's leading refineries, we bring the benefit of experience to your facility with a full range of solutions. We understand the needs of your application — so our solutions meet your business goals and deliver rapid return on your investment.



AFR-Series backwashing pressure filter is an expandable design for high volume, low viscosity use — such as deep-well injection of seawater or produced fluid and chemical flooding applications.

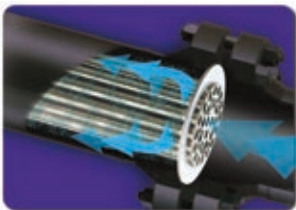


ReactoGard® V — Self-cleaning filter system is perfect for fixed-bed reactor catalyst protection and many other applications where low maintenance, high efficiency and limited space are issues.



The Eaton automatic self-cleaning strainer is designed for the continuous removal of entrained solids from liquids in pipeline systems. Model 2596 features the idL™ shaft seal to prevent leakage. Available in cast steel, stainless steel and other requested materials.

Eaton's Model 90 fabricated simplex strainer ranges from 1" to 48" in pipeline size and can be ordered in carbon steel, stainless steel or other specified materials. The Model 90 offers an in-line design featuring ANSI Class 150, 300, or 600 flange connections. Higher pressures are also available.



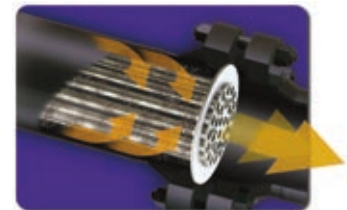
2. The stations are then sequentially Hydroshock™ cleaned with up to 300 gpm at 60-80 psi of water. This dislodges and flushes accumulated particulate out to your water treatment facility.



3. The filter tube is again injected with nitrogen gas to eliminated all water from the station and avoid dilution of the active amine stream.

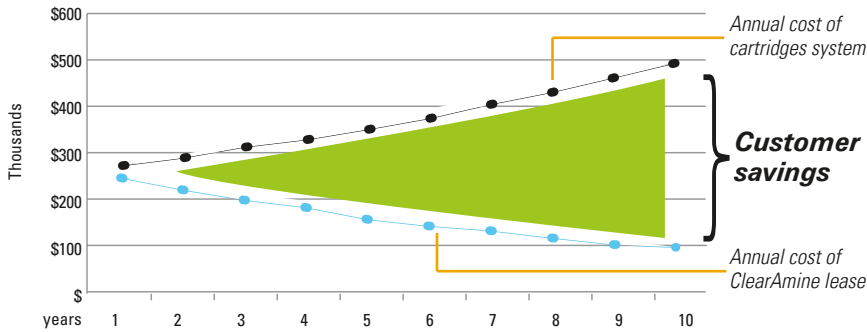


4. Amine is allowed to enter the entire station with the outlet valve closed so all nitrogen gas can be vented.



5. The vent closes, the outlet valve opens and the filterbank is back on-line, filtering amine.

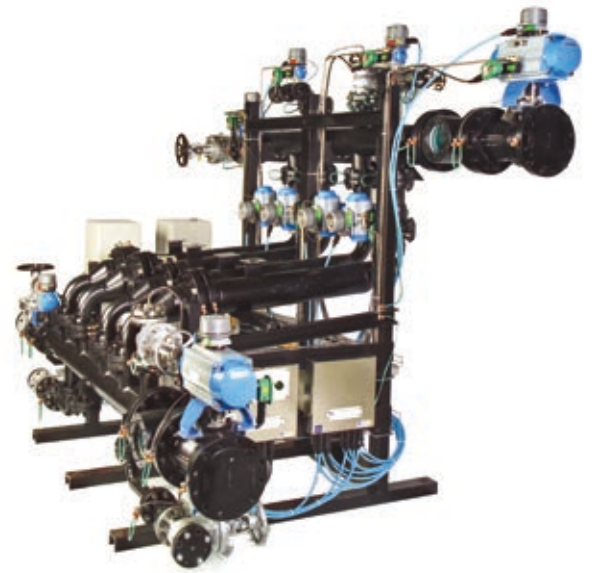
# ClearAmine value



Customer options	Total 10 year cost
Cartridge system	\$3.7M
ClearAmine lease with maintenance	\$1.7M
ClearAmine equipment purchase	\$1.0M

The chart above demonstrates how the lease of a ClearAmine system can save nearly 60% from the cost of a cartridge system.

\* The values above represent a typical system.  
Actual estimates will vary based on need and application.



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