



APV Paramine System

For High Temperature & Gas Processing Applications



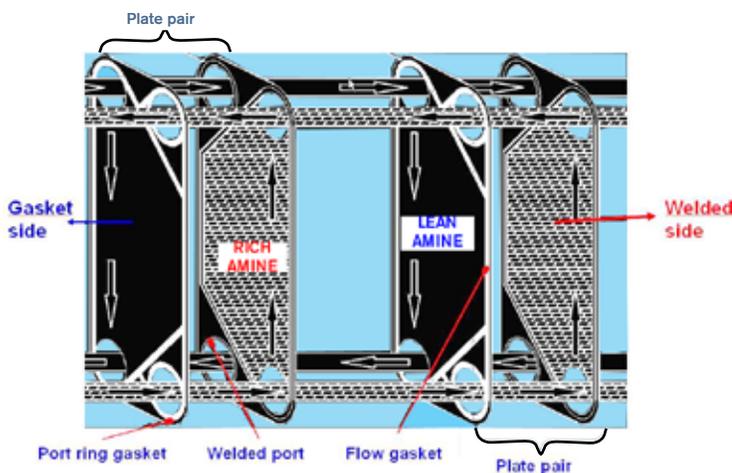
APV Paramine System

For many years, end users have employed plate heat exchangers in place of shell and tube exchangers due to their high efficiency, low capital cost, smaller installed space, lighter weight and design flexibility. Today, the APV Paramine System overcomes the sealing difficulties experienced in gasketed plate heat exchangers by sour gas found in amines and takes the plate heat exchanger to new temperature limits.

The APV Paramine System is a unique process specially designed to resist high concentrations of sour gas. It can also be used with other fluids to operate at much higher temperatures than a typical plate heat exchanger with the traditional elastomeric gaskets. NBR and EPDM elastomeric gaskets are limited in temperature to between 240°F (115°C) and 330°F (165°C) depending on the material and curing process used. The APV Paramine System can operate at temperatures as high as 410°F (210°C).

How the Paramine System Works

The APV Paramine System consists of a patented laser welded plate channel and a gasketed channel. Two heat transfer plates are laser welded together to form a leak proof channel for one of the fluids. The channel between the plate pairs would contain the other fluid and be sealed with the Paramine gasket.



The APV Paramine System is ideal for handling high concentrations of hydrogen sulfide, carbon dioxide and other sour gases in the rich stream. It is typically used for applications in the chemical, oil and gas, bio-fuels and gas sweetening processes.

Paramine for Heat Recovery Applications

Plate Heat Exchangers are the natural choice for high heat recovery applications, given their high thermal efficiency over shell and tube exchangers. Since the traditional plate heat exchanger is limited by gasket material, the APV Paramine System is the perfect solution, especially if operating temperatures go beyond the elastomeric gasket limits or when gasket compatibility is an issue for the fluids being handled. A Texas chemical company has an APV Plate Heat Exchanger in successful operation using the APV Paramine System for just that reason. The APV model LR2M10 is being used to heat tri-ethylene glycol from 88°F (31°C) to 241°F (116°C) using 400°F (204°C) tri-ethylene glycol.

Paramine for Gas Sweetening Applications

Another good example of where the APV Paramine System works well is in a desulphurization system, or gas sweetening process, where sour gas has to be treated to remove hydrogen sulfide (H₂S), Carbon dioxide (CO₂), Carbon monoxide (CO), and/or carbon sulfide (CS₂). This process is found in natural gas treatment, refineries, coke oven applications and ethylene production.

Plate heat exchangers are used to reduce the energy costs associated with the operation of the absorber and stripper columns because they can recover more heat than a shell and tube exchanger. In refineries, for example, recovering more heat means the operating temperatures increase to around 275°F (135°C).

A high content of hydrogen sulfide (H₂S) and carbon dioxide (CO₂) in an amine at gas processing plants can dramatically reduce the life of the elastomeric gasket in traditional plate heat exchangers. In some cases, the traditional NBR or EPDM materials can fail in less than a year, leading to significant production loss and process downtime.

To remedy this situation, attempts have been made to use another technology: the all-welded heat exchanger. However, its design is inflexible and there are additional concerns with resistance to thermal stress. Fully-welded unit are much more expensive than a plate heat exchanger, and have higher fouling tendencies, lower thermal efficiency, are larger in weight and take up more installed space or a combination of these. Please see the chart on the back page to compare how the Paramine system stacks up with other heat transfer technology.

The APV Paramine System was specially designed for this process and is proven to withstand high concentrations of up to 35% hydrogen sulfide and 8% carbon dioxide. The rich amine with the hydrogen sulfide (H₂S) and carbon dioxide (CO₂) travels through the welded plate channel, which eliminates the chance of gasket attack and plate corrosion. The hot lean amine flows through the Paramine gasketed plate channel.

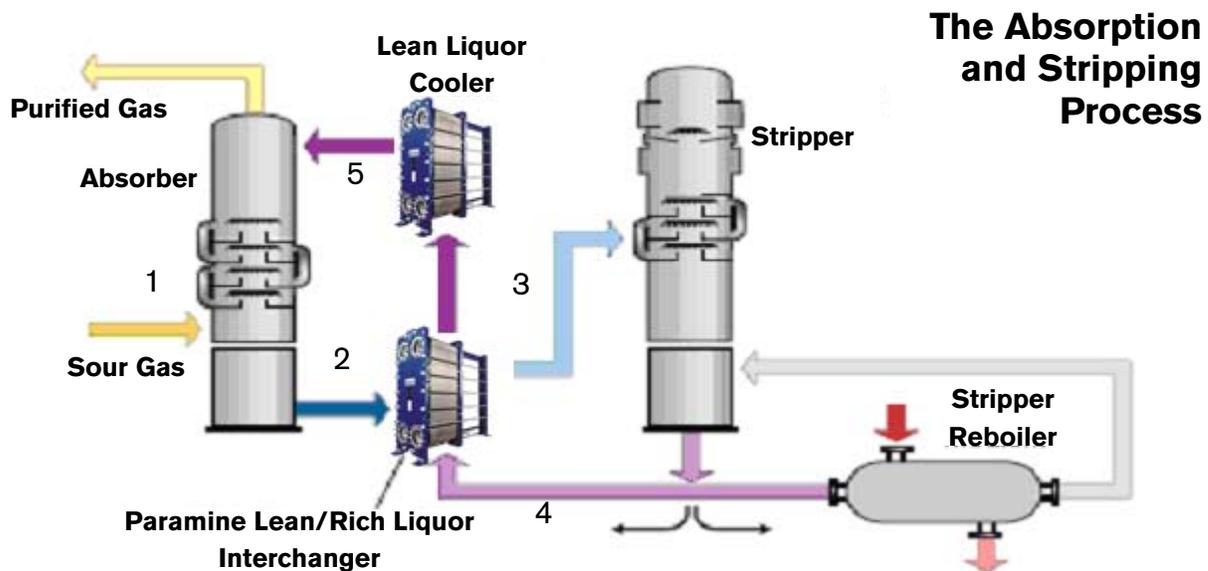


Paramine's Proven Performance

The APV Paramine System has a proven track record with more than ten years of successful installations. It offers superior resistance to higher temperatures and concentrations compared to the EPDM and hydrogenated nitrile gasketed plate heat exchanger, resulting in an operating life that can be up to six times longer.

Some of the customers that are currently using the APV Paramine System include: Shell Caroline in Canada, Shell Athabasca in Canada, Shell Jumping Pound in Canada, BHP Petroleum Ohanet in Algeria and Nexus FPSO. A full reference list and contact information is available upon request.

The APV Paramine System can be used with chemical absorption methods using MEA, DEA, MDEA, Alkali salts, etc. or physical absorption processes using Selexol, Rectisol, Ucarsol, or Flexorb etc. The Paramine System can be used with many other chemicals as well.



The Absorption and Stripping Process

1. The sour gas streams enter the bottom of the Absorber column and flows upward counter-current to the lean liquor solution. The liquor picks up the gases in the solution and leaves the bottom of the column, due to the exothermic absorption reaction. The Purified Sweet Gas, after absorption, flows overhead from the Absorber.
2. The rich liquor travels through the APV Paramine System plate heat exchanger where it is heated using the hot lean liquor from the stripper. This unit is commonly referred to as an interchanger.
3. The stripper column treats the rich liquor solution by removing the H₂S and CO₂. The Stripper Reboiler supplies the necessary heat to strip H₂S and CO₂ from the rich liquor, using steam as the heating medium.
4. The lean liquor solution from the Stripper is cooled in the Paramine Lean/Rich Liquor Interchanger.
5. The lean liquor is further cooled in an APV Plate Heat Exchanger, before entering the absorber column.

Comparison of Heat Exchanger Technologies

	Gasketed Plate Heat Exchanger	Fully Welded Heat Exchanger	APV Paramine System
Handling Operating Temperatures Above 320°F (160° C)	Limited gasket life, typically 6-12 months	Possible corrosion or fatigue cracking of welds leading to total replacement	Exceeds 5 years before the unit needs maintenance
Ability to Increase Heat Transfer Area	Very good	None	Very good
Inspection and Cleaning	Very good for both fluids	Difficult or limited ability	Very good for one fluid
Resistance to Thermal Stress	Excellent	Inherent weakness	Excellent
Repair Ability	Gaskets and/or individual plates can be replaced if needed	Usually impossible	Gaskets and/or welded plate pairs can be replaced if needed
Installed Space	Small	Mid size to large	Small
Installed Weight	Light weight	Heavy	Light weight
Liquid Hold Up	Low	Usually high	Low
Capital Cost Guide	Low	High	Average
Total Cost of Ownership	Average	High	Low



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