

Industry: Petroleum Refining

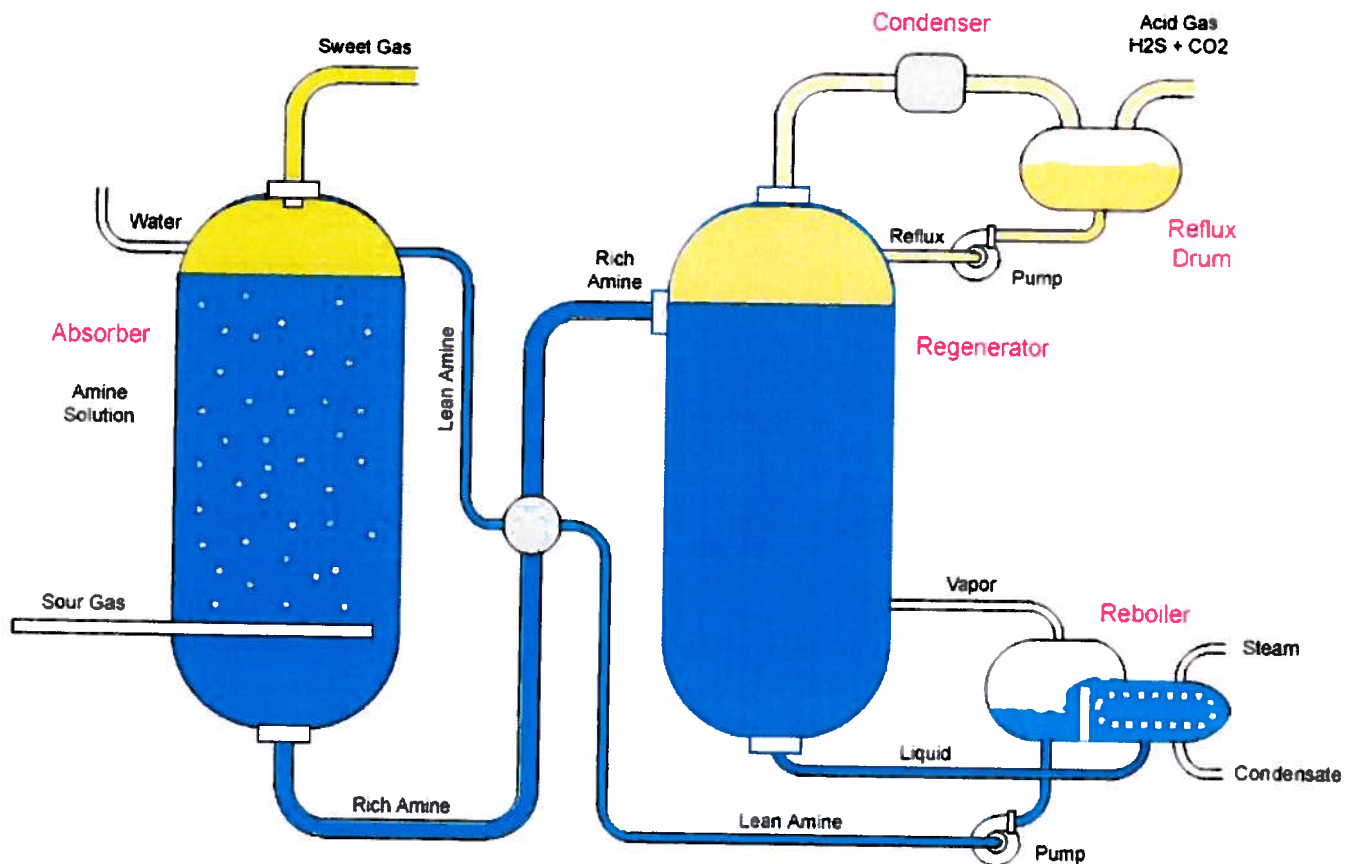
Application: Sulfur Recovery

Combustion Air Blower – Sulfur Recovery
 Recycle Blower – Sour Gas
 Combustion Air Blower – Tail Gas Incineration

Process: The Claus process has become the industry standard for removing sulfur from gaseous hydrogen sulfide found in natural gas and other refinery by-product gases.

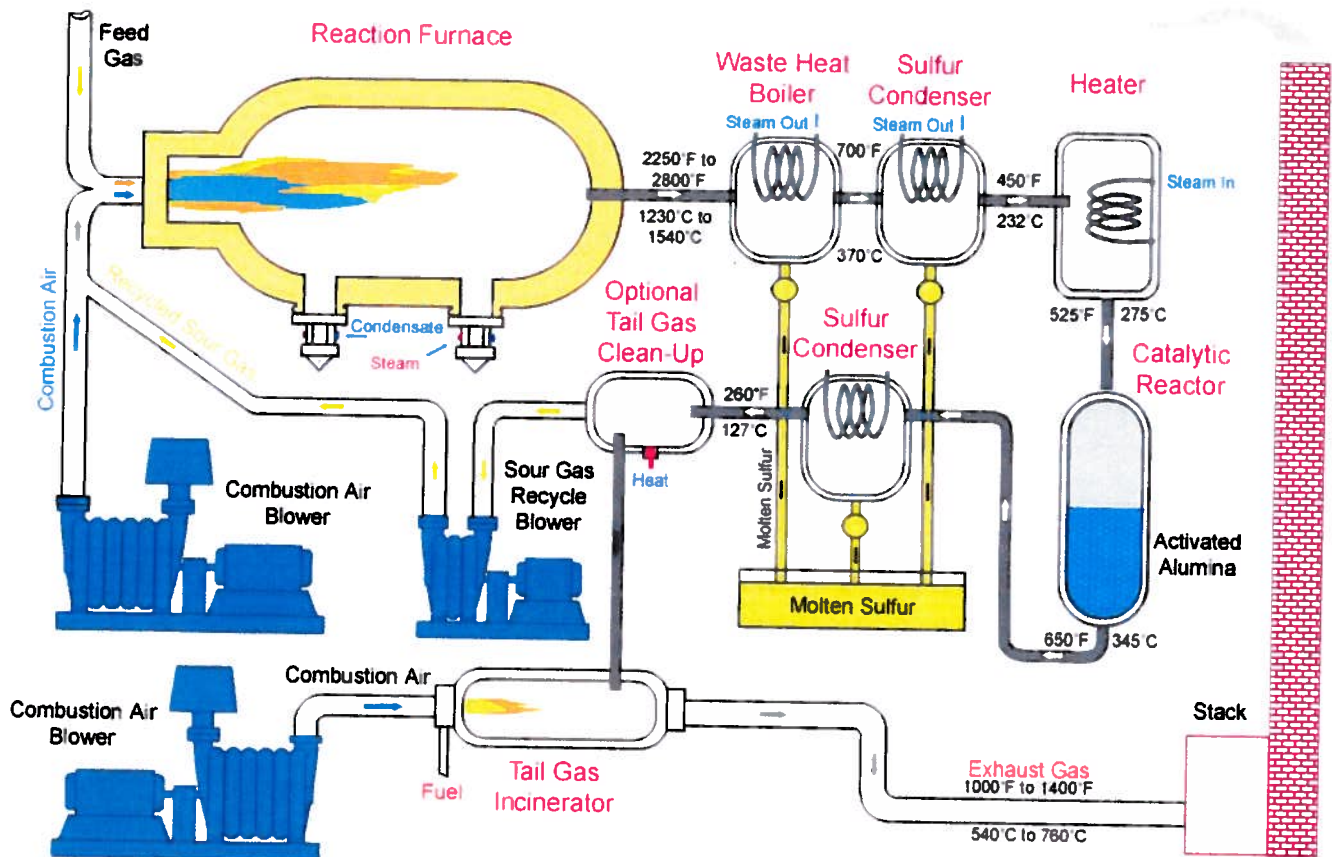
Gases that contain hydrogen sulfide (H_2S) are called "sour gas". H_2S is toxic and complicates the metal piping and equipment exposed to sour gas. Removing H_2S is therefore a high priority. The removal process is called "sweetening" the gas, since removing H_2S also removes the foul odor. The byproduct of removing hydrogen sulfide is sulfur. Millions of metric tons of sulfur are produced and are used for manufacturing sulfuric acid, medicine, cosmetics, fertilizers and rubber products.

Natural gas that exceeds 5.7 milligrams of H_2S per cubic meter is considered sour gas and must be "sweetened". The gas goes through an amine process where the gas enters a tower that contains an amine solution. Amine has an affinity for sulfur and absorbs it. The gas loses almost all of its sulfur. The amine solution, rich in absorbed acid gases is routed to a stripper and reboiler where the amines are separated from the H_2S and CO_2 . The amines are recycled to the amine absorber tower and the hydrogen sulfide is piped to the Claus process for H_2S removal.



"Sweetening" Sour Natural Gas – Amine Process

The Claus process is a two step process which is thermal and catalytic. The process begins with the sour gas being forced into a thermal reaction furnace at temperatures up to 2,800 °F (1,540 °C). The heated gas proceeds through a series of heat exchangers, which reduce the temperature to 450 °F (232 °C). Approximately 65-70% of the molten sulfur precipitates from the gas. Then, the gas is reheated slightly to 525 °F (275 °C) and introduced to a catalytic reactor containing activated alumina. This catalytic step merely boosts the sulfur yield. At this point in the process, remaining combustible gases and sulfur compounds are either re-processed through the reaction furnace, cleaned or simply incinerated.



Sulfur Recovery



Application Database

Centrifugal Products Group

Description: Sulfur recovery designs vary somewhat, but the most common need for a multistage centrifugal blower is for combustion air, feeding the reaction furnace. Frequently, an additional multistage blower is utilized to recycle already processed gas back through the process to increase the sulfur yield and/or decrease hydrogen sulfide content. An additional combustion air blower is occasionally used to enhance combustion of "tail gases" in a tail gas incinerator to further clean the gases before sending them to the smokestack. Finally, blowers are sometimes used to propel the exhaust up the stack, but fans are far more common.

- **Gas Composition:** Combustion Air Blowers
Air

Sour Gas Recycling Blowers (gases pass through blowers)
Although proportions will vary, the following are examples from an actual sour gas recycling application.

Nitrogen	N ₂	58.6%
Water	H ₂ O	35%
Hydrogen	H ₂	2.3%
Carbon Dioxide	CO ₂	1.8%
Carbon Monoxide	CO	0.9
Hydrogen sulfide	H ₂ S	0.47%
Sulfur Dioxide	SO ₂	0.28%
- **Operating Conditions:** The airflows vary, but are high. Pressures are generally around 12 psig, except for the Sour Gas Recycle and Incinerator Combustion Air blowers, which would only require 2-4 psig.
- **Sizing Criteria:** CF Select will determine the most efficient or cost effective exhauster for each situation.

Competitors:

<u>Manufacturer</u>	<u>Technology</u>	<u>Models</u>
HSI	Multistage Centrifugal	
Continental	Multistage Centrifugal	
Spencer	Multistage Centrifugal	
Roots	Positive Displacement	

Gardner Denver Products: Various series of multistage centrifugal blowers are typical offerings for these Combustion Air blowers, but they are usually 1200 to 2400 Series. API 617 Spec Compliance is often required. These blowers are usually specified "copper free" due to the hydrogen sulfide. The Sour Gas Recycle blowers are usually smaller, 8" to 12" and will pass sour gas through and will need steel internals and gas seals, carbon ring or purged labyrinth. The recycle blower also has inlet temperatures of 140 °F to 300 °F and may require bearing shields. Although incinerator blowers require lower pressure capabilities, these blowers are also usually 12" to 24" inlet size. Since condensate can build-up, a section drain pipe assembly is recommended for convenience.

- **Marketing Position:** Refineries and Gas Sweetening Plants are probably not as familiar with Gardner Denver, Lamson or Hoffman as some other market segments; however our multistage centrifugal blowers are commonly used in many industries for combustion air. There is a good chance project engineers are familiar with our blowers.
- **Differentiation Strategy:** Nobody builds more blowers with 20" and 24" inlets than Gardner Denver. We have more "big blower" experience than anyone.



Application Database

Centrifugal Products Group

- Advantages: We have many sulfur recovery installations, around the world.
- Disadvantages: XXXXXXXXXXXXXXXXXXXX

Key Users:

Refineries, Natural Gas Sweetening Plants

More Information:

Contact Marketing Services for the following:

- Sales brochure *Multistage Centrifugal Blowers / Exhausters* (GDCF-1-300)