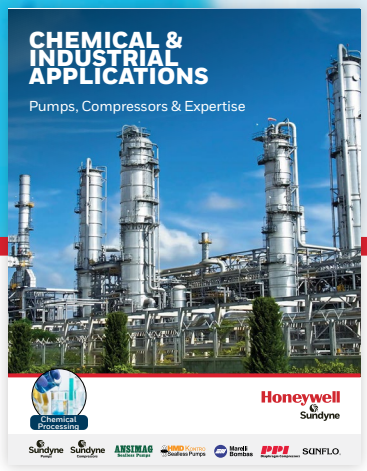
SULFURIC ACID APPLICATIONS

Pumps, Compressors & Expertise



Honeywell
Sundyne

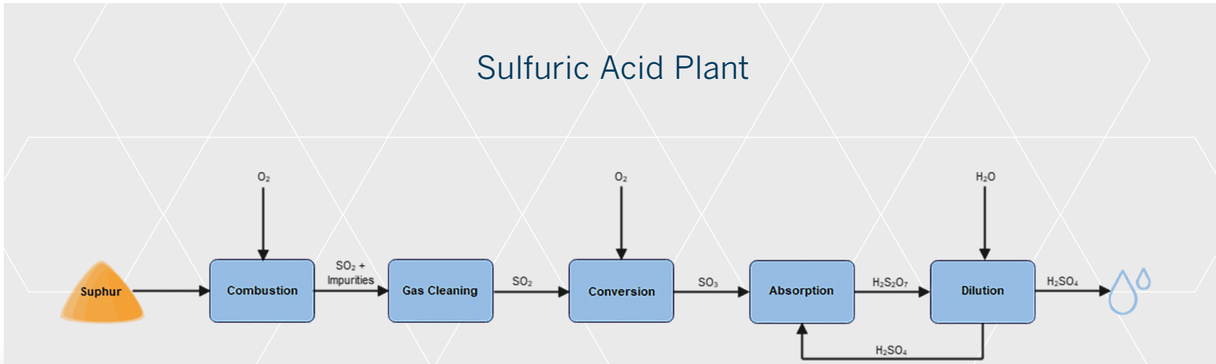
Sundyne Pumps
Sundyne Compressors
ANSIMAG Sealless Pumps
HMD KONTRO Sealless Pumps
Marelli Bombas
PPI Diaphragm Compressors
SUNFLO®

Sulfuric Acid Plant Contact Process

Sulfuric acid is one of the most important and widely produced chemicals within the chemical process industry. It is used in the production of fertilizers, pesticides, metals, detergents, paints & pigments, paper, fibers, plastics and batteries. The Contact Process is the means by which almost all Sulfuric Acid is currently produced. In the conversion of Sulfur into Sulfuric Acid, the Contact Process consists of four processing steps followed by a dilution step:

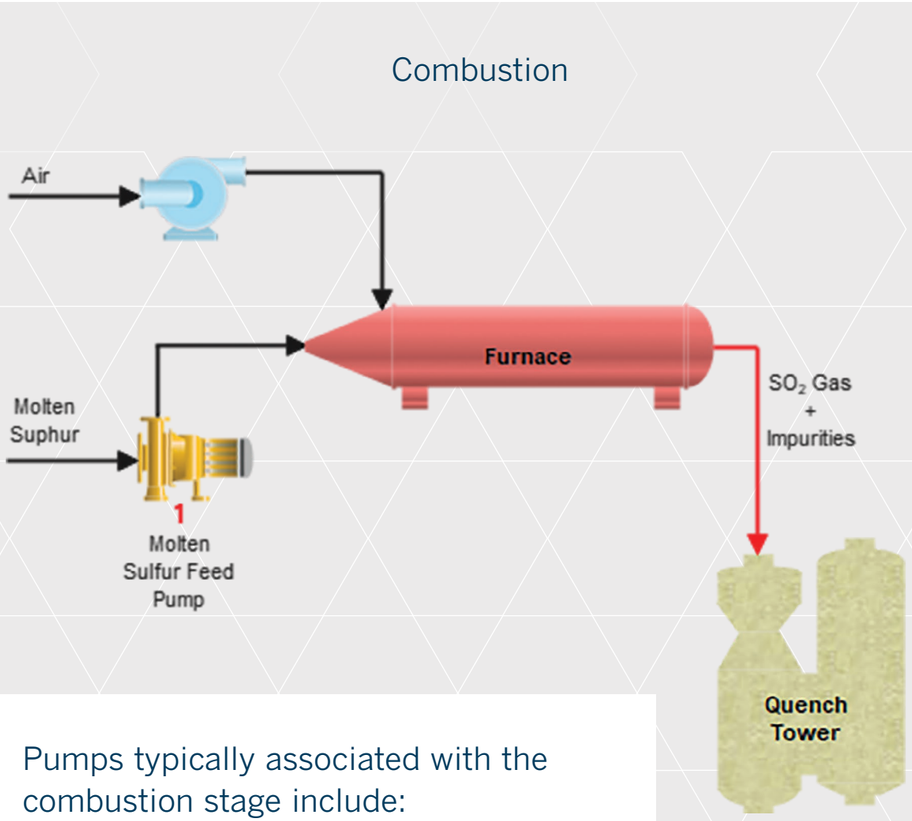
1. Combustion
2. Gas Cleaning
3. Conversion
4. Absorption
5. Dilution

Each step is shown in the following process diagram:



Combustion

In the combustion step, sulfur, either obtained from natural deposits or through the de-sulfurization of natural gas or crude oil, is thermally decomposed (burnt) in a furnace. Prior to burning, solid sulfur is heated to its molten form and subsequently injected into the furnace. In the burning process, the sulfur (S) reacts with the oxygen (O_2) in air to form sulfur dioxide (SO_2). Any impurities present in the sulfur are also burned with the sulfur and carried over in the vent gas stream.



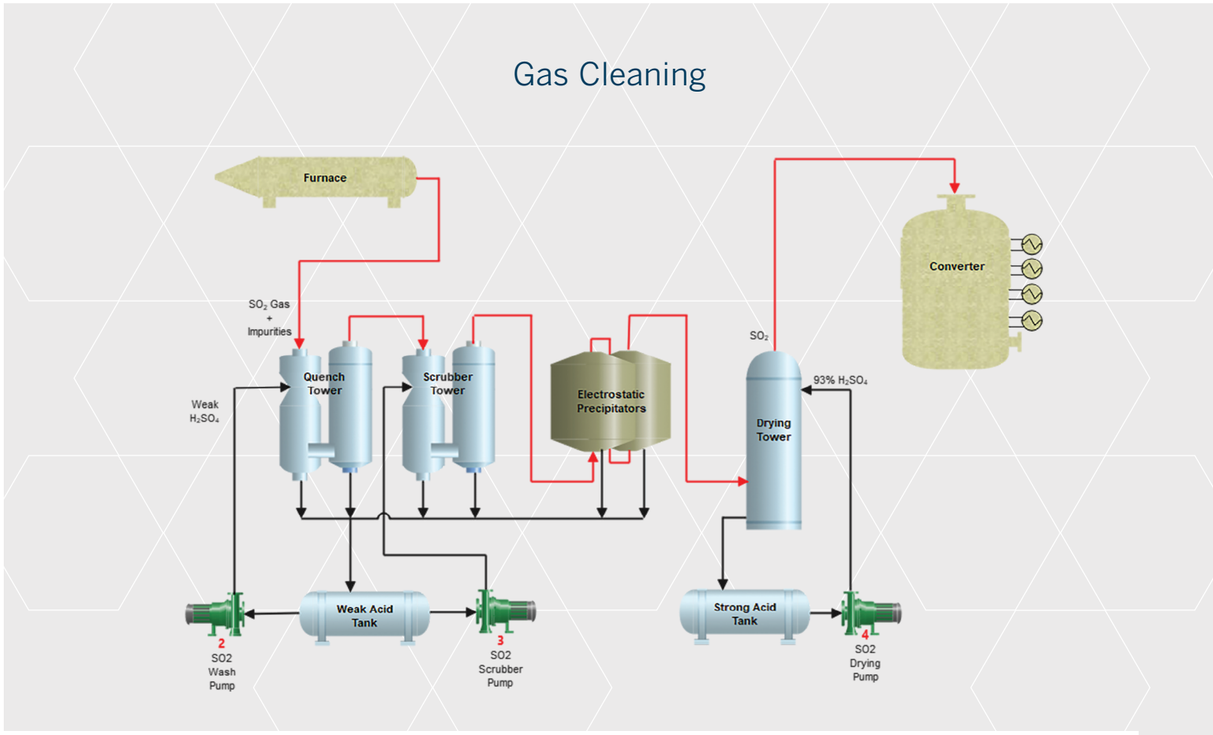
Pumps typically associated with the combustion stage include:

Ref#	Application	Pumped Liquid
1	Molten Sulfur Pump	Molten Sulfur

Gas Cleaning

The purpose of the Gas Cleaning step is to clean the SO_2 in the combustion gas exiting the furnace so that it is free of all impurities (ash and/or other solids) prior to being sent to the Converter for oxidation. Any impurities in the SO_2 stream could potentially contaminate the catalyst contained within the Converter. Gas Cleaning takes place in several sub-steps.

1. In the first step, the combustion gas flows into a quenching tower where the combustion gas is cooled and some of the carry-over particulates are removed with weak acid spray mist.
2. In the second step, the combustion gas is further cooled and cleaned with weak acid in a scrubbing tower.
3. In the third step, the combustion gas flows through an Electrostatic Precipitator which removes any remaining non-soluble dust particles and acid mist from the SO_2 gas stream.
4. In the fourth and final step, the SO_2 gas stream is dried in a drying tower with concentrated sulfuric acid to remove any remaining water.



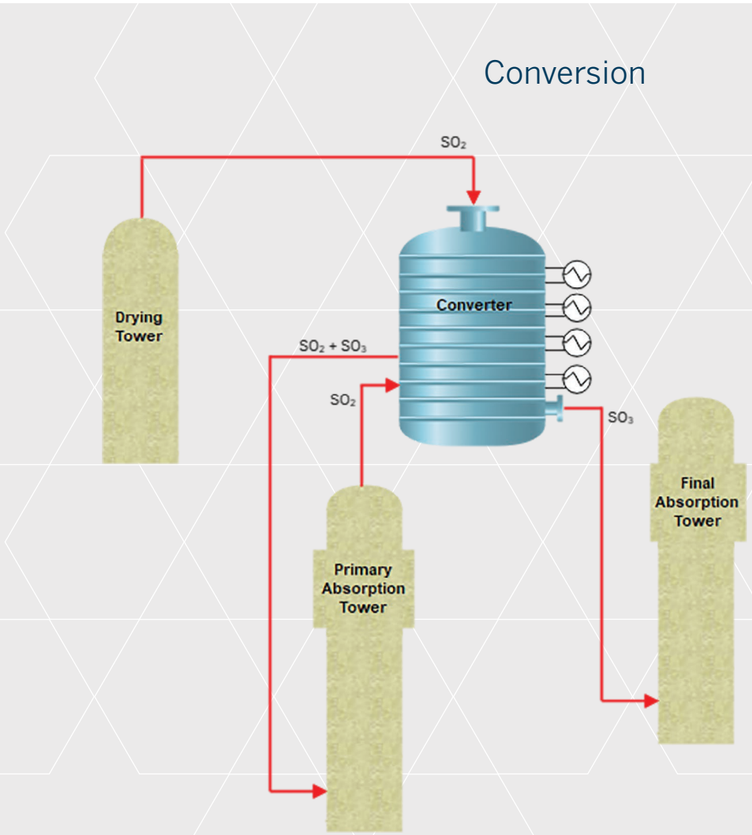
Pumps typically associated with the Gas Cleaning step include:

Ref#	Application	Pumped Liquid
2	SO_2 Wash Pump	Weak Sulfuric Acid
3	SO_2 Scrubber Pump	Weak Sulfuric Acid
4	SO_2 Drying Pump	Concentrated (98%) Sulfuric Acid

Conversion

In the conversion step, the now clean SO_2 gas is oxidized in a multi-stage (typically four stages) catalyst Converter to produce SO_3. Since the oxidation process is exothermic and high temperatures are detrimental to the equilibrium governing conversion reaction, heat exchangers are found on each stage to reduce heat. To achieve EPA-mandated standards on SO_2 emissions and overcome reaction equilibrium constraints, many US Sulfuric Acid Plants have also adopted a Double Absorption technique to recover the SO_3.

In this technique, a gas stream containing both SO_2 and SO_3 exits the Converter after the third stage and is sent to Primary Absorption Tower where the SO_3 is recovered from the gas stream (The SO_3 recovery process will be discussed further in the Absorption step). The remaining SO_2 is returned to the Converter where it is further reacted and converted into SO_3 in the fourth Converter stage. The SO_3 exiting the Converter after the fourth stage is sent to the Final Absorption Tower for recovery.



Typically, there are no process pumps associated with the Conversion.

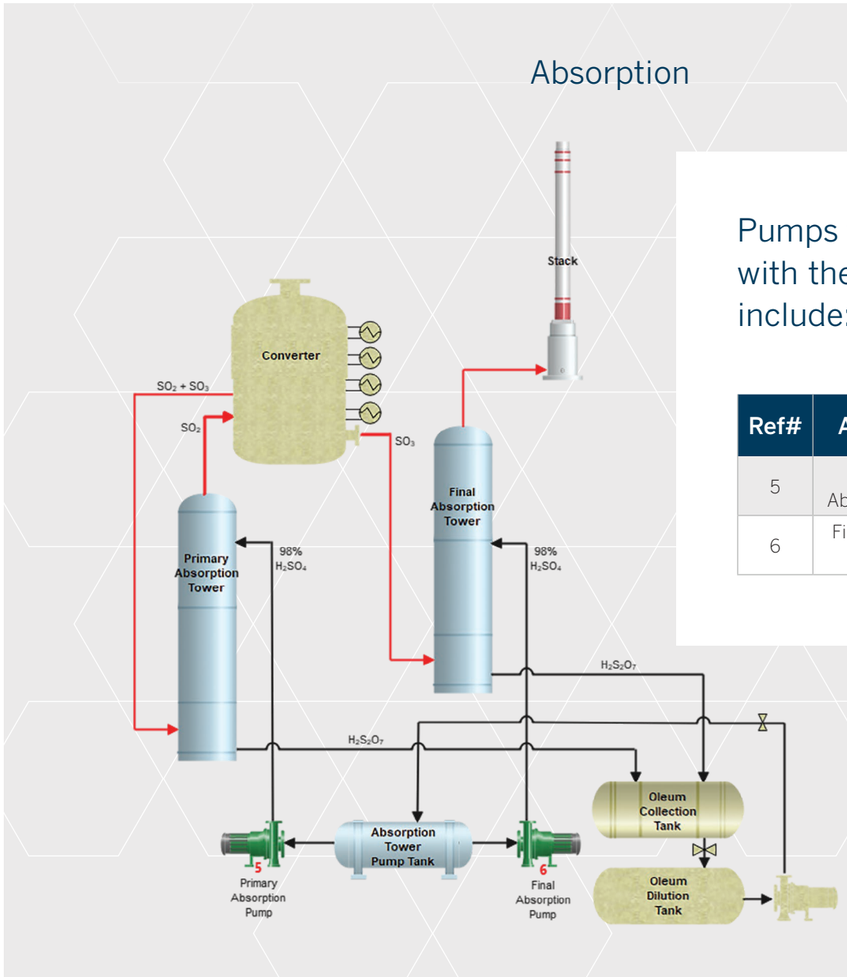
Absorption

As mentioned in the Conversion step, to achieve EPA mandated standards on SO_2 emissions, most US Sulfuric Acid Plants have adopted a double absorption technique. This technique utilizes two absorption columns. In the first (primary) column, SO_3 is recovered from the third stage of the converter and in the second (final) column recovers all remaining SO_3 from the fourth stage of the converter. In both columns, the SO_3 is absorbed into concentrated sulfuric acid.

This reaction produces oleum, also known as fuming sulfuric acid ($H_2S_2O_7$). The Oleum produced in both columns is collected in a common collection tank. The concentrated sulfuric acid used in this step is produced from the oleum (the conversion of oleum into concentrated sulfuric acid will be discussed in the Dilution step).

Note: while SO_3 is soluble in water, water is not used to recover the SO_3 due to its highly exothermic reaction. In this reaction a highly corrosive sulfuric acid mist is produced.

After all remaining SO_3 has been absorbed in the Final Absorption Column, the now "clean gas" is sent to the Stack for safe dispersion into the atmosphere.

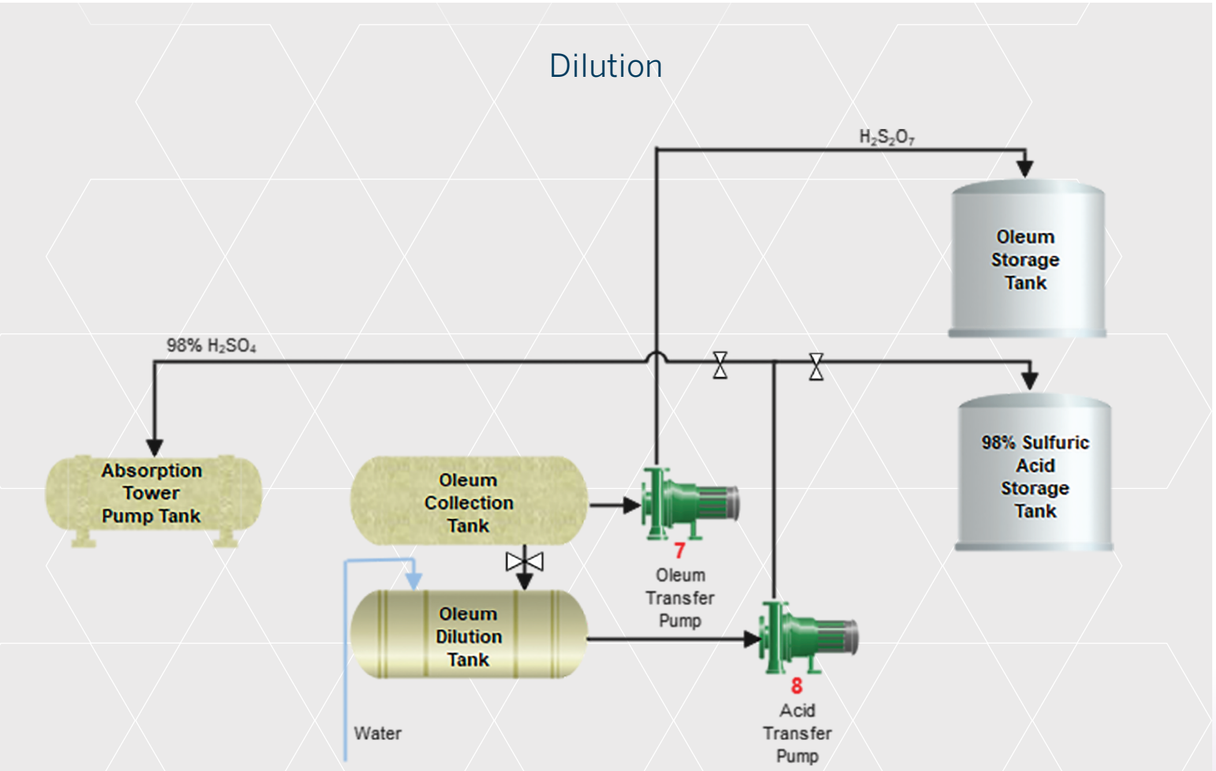


Pumps typically associated with the Absorption step include:

Ref#	Application	Pumped Liquid
5	Primary Absorption Pump	98% Sulfuric Acid
6	Final Absorption Pump	98% Sulfuric Acid

Dilution

The oleum produced in the absorption step can either be sent to storage or to a dilution tank. The oleum sent to the dilution tank is diluted with water to produce sulfuric acid of varying concentrations. The varying concentrations of sulfuric acid can also be sent either to storage or used to replenish the sulfuric acid used in the Gas Cleaning and Absorption steps.



Pumps typically associated with the Hydrochloric Acid Synthesis unit include:

Ref#	Application	Pumped Liquid
7	Oleum Transfer Pump	Oleum
8	Acid Transfer Pump	98% Sulfuric Acid

Criteria for Selecting Pumps Used in Sulfuric Acid Units

All of the chemicals used in this process are reactive elements that are toxic and corrosive. They should not be inhaled by plant personnel, even at low concentrations. Operators should consider the following requirements when selecting pumps for sulfuric acid production:

Worker Safety & Environmental Protection by Eliminating Leakage:

External emissions are one of the biggest issues relating to pumping equipment used in sulfuric acid production. Sealless pumps are typically used to move materials through each stage of production. Sealless pumps have no seals to replace, which means fewer (or no leaks) and no emissions.

Reliability via Superior Chemical Resistance:

Materials of construction for a pump's internals must be carefully considered. The harsh nature of sulfuric acid production can wreak havoc on a pumps internals. Many of the chemical catalysts used in the process add further demands on pump linings. A wide range of metallic and ETFE materials of construction should be available.

Simplified Maintenance:

The sheer volume of sulfuric acid production illustrates the need for reliable equipment that minimizes plant downtime, as many plants producing these chemicals run operations around the clock.

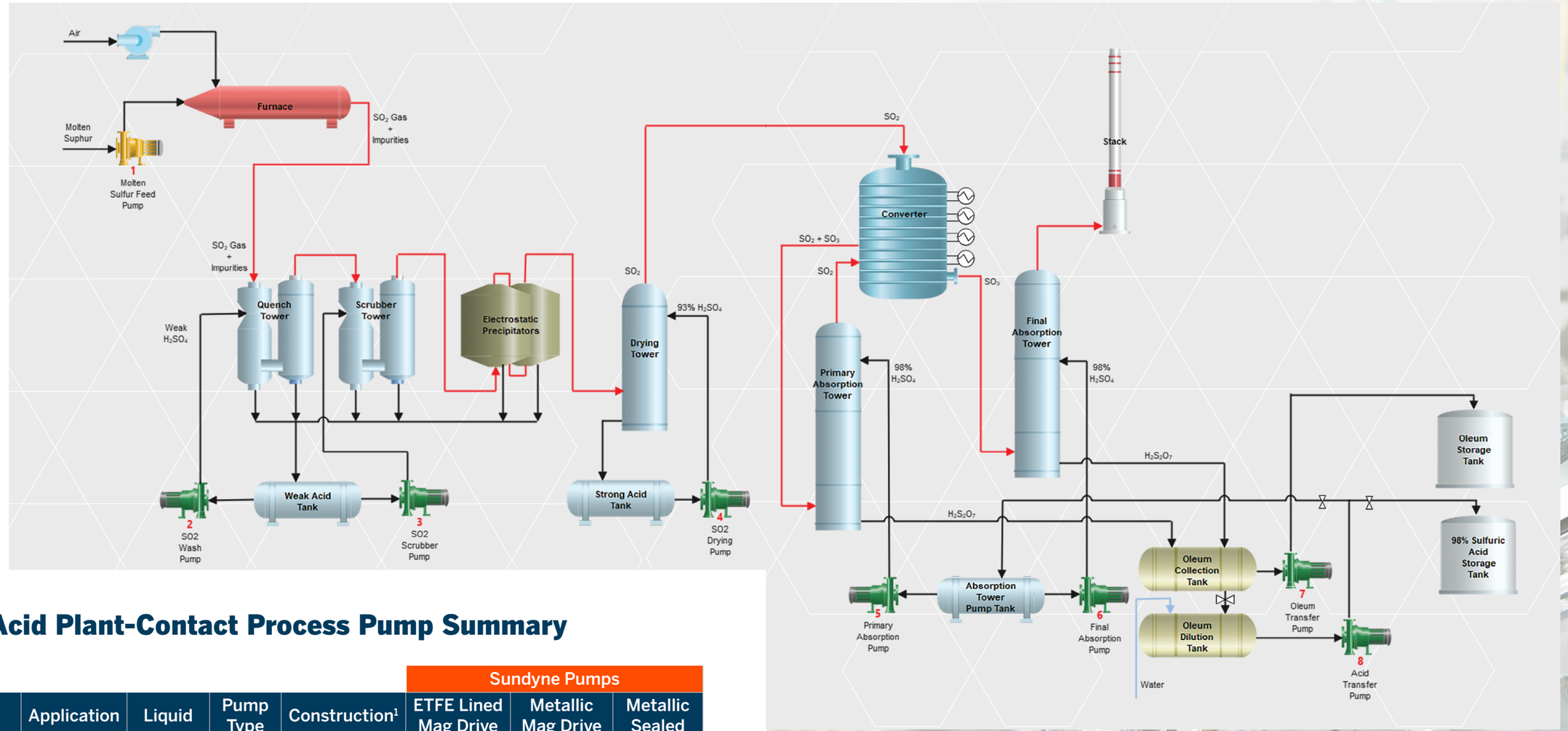
The ability to streamline maintenance (and plan predictive maintenance activities) helps operators increase plant uptime. Sealless pumps eliminate the need for seal support systems, and they have fewer wetted parts, which minimizes maintenance costs and increases Mean Time between Maintenance (MBTM) intervals.

Energy Efficiency:

Sulfuric acid production is an energy-intensive process. Electricity can account for 40 to 50 percent of operating costs. In many cases, the ability to manage this expense determines the plant's profitability. Plants producing sulfuric acid should seek pumps with an efficient hydraulic envelop and low net positive suction head (NPSH) hydraulics. Small footprints are always preferred, not only to save space on the shop floor, but also to facilitate simple access for maintenance. And features such as a rear casing can bolster efficiency by eliminating eddy currents and preventing hysteresis losses during operation. This type of functionality eliminates heat generation and reduces energy costs.

Sundyne pumps are specifically designed to address these requirements. The chart that follows identifies a number of pump options for addressing each stage of the sulfuric acid production process.

Complete Contact Process Diagram



Sulfuric Acid Plant-Contact Process Pump Summary

						Sundyne Pumps		
Equip No	Unit	Application	Liquid	Pump Type	Construction[1]	ETFE Lined Mag Drive	Metallic Mag Drive	Metallic Sealed
1	Combustion	Molten Sulfur Pump	Molten Sulfur	316SS	HMD Kontro	Marelli ISO	HMD Kontro	Marelli ISO
2	Gas Cleaning	SO_2 Wash Pump	Weak Sulfiric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
3	Gas Cleaning	SO_2 Scrubber Pump	Weak Sulfiric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
4	Gas Cleaning	SO_2 Drying Pump	98% Sulfuric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
5	Absorption	Primary Absorption Pump	98% Sulfuric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
6	Absorption	Final Absorption Pump	98% Sulfuric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
7	Dilution	Oleum Transfer Pump	Oleum	ANSI / ISO	ETFE / 316SS	Ansimag K+/KI, HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO
8	Dilution	Acid Transfer Pump	98% Sulfuric Acid	ANSI / ISO	ETFE / 316SS	Ansimag K+/K , HMD Kontro ALI	HMD Kontro CSA/I	Marelli ISO

[1] Construction materials referenced are a sample of the materials commonly specified in pump data sheets. Sundyne, LLC does not warrant the suitability of these (or any) materials in a particular service or application. Suitability is the sole responsibility of the purchaser and/or user.

When it comes to Sulfuric Acid applications, Sundyne is the **Safer**, **Better**, **Best** choice.

Safer for Operations
Better for the Environment
Best Total Lifecycle Value

For more information please visit www.sundyne.com and fill out the Contact Me form. A Sundyne representative will contact you.

Honeywell
Sundyne

Sundyne, LLC
14845 West 64th Avenue
Arvada, Colorado 80007 USA

marketing@sundyne.com
Phone: 1 303 425 0800
Fax: 1 303 425 0896
www.sundyne.com

Dijon, France
Eastbourne East Sussex, UK
Madrid/Toledo, Spain
Tokyo, Japan
Pune, India