

SULFUR, BY DESIGN

TIPS FOR MOLTEN SULFUR PLANT DESIGN

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Sulfur is often transported in the molten state and is used in a wide variety of industries to make Sulfuric Acid, rubbers, detergents, fungicides, and fertilisers. It is also used for petroleum refining.

Handling of Molten Sulfur however may prove challenging due to its temperature-viscosity relationship. Liquid elemental Sulfur is often handled within a narrow temperature range between 135 °C and 155 °C. This is because at its λ -transition ($T > 160$ °C), Molten Sulfur undergoes polymerisation which leads to a sharp increase in its viscosity from 7×10^{-2} Pa s at 160 °C to $\approx 93\,000 \times 10^{-2}$ Pa s at 187 °C.

This article encompasses a few tips and factors to consider when designing a plant with Molten Sulfur.



<https://www.rheinhuette.de/en/applications/molten-sulphur/>

Steam Jacketing

Pipelines should be jacketed with steam to ensure that the temperature within the product pipeline is regulated and maintained between the desired set-points.

Flange Breaks

Pipelines should have flange breaks approximately every 6m. In the event that the Sulfur solidifies within the pipe, the segment of piping may be identified, and the flanges uncoupled without having to cut through the pipeline.

Flange Coverings

While it is not common to jacket flanges, it is advisable to cover all flanges to prevent heat loss in these isolated spots. Molten Sulfur is extremely sensitive to temperature changes and it may be possible for it to solidify at the flanges in extreme hot or cold conditions.

Vessel Trimmings

It may be possible that the Sulfur could solidify within a vessel or storage tank, in which case a door/manhole, which is large enough to facilitate the removal of the solid product, should be installed.

Pump Selection

Due to its abnormal variation of viscosity with temperature, the pump selection for Molten Sulfur applications is crucial. There are a variety of pumps which may be used (vertical or horizontal), with different sealing systems and materials available. Aspects to consider when selecting a pump are as follows:

- Most pumps used for Molten Sulfur applications have a heating jacket.
- Low flow conditions within the pump could generate an increase in temperature, which could affect lubrication of the bearings.
- The material of construction selected is affected by the H₂S content.
- The design of vertical pumps depends not only on the purity of Sulfur, but also on the size of the Sulfur tank or vessel.