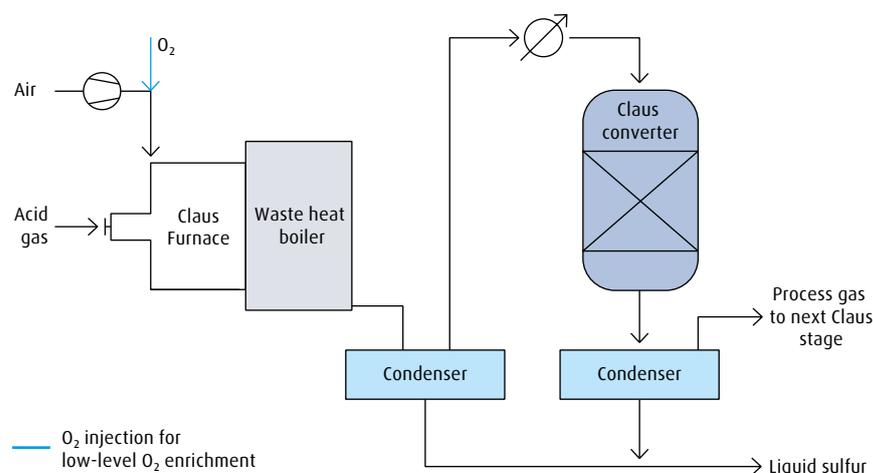




SURE[®] low-level oxygen enrichment in Claus plants.

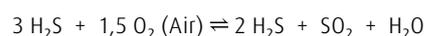
Low-level oxygen enrichment implemented



Intention and Effects

Low-level O₂ enrichment versus Limitations at Claus plants

Claus plants serve the conversion of highly toxic and stinking hydrogen sulfide (H₂S) to harmless elemental sulphur. Therefore, in the upstream thermal Claus step a highly concentrated H₂S stream ("Acid gas") is partially oxidized to SO₂:



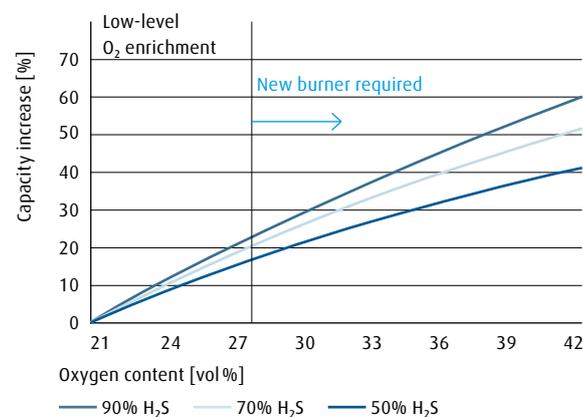
Respective oxidant is normally – i.e. according to the state of the art – ambient air containing a high proportion of inert nitrogen.

As mainly a gas application for revamps, SURE[®] low-level O₂ enrichment replaces part of the air going to the Claus furnace by technical oxygen, thus also reducing the amount of inert nitrogen which has to be routed through the whole Claus installation. By this nitrogen reduction two major effects are gained which in essence allow for counteracting limitations given by design and overall process conditions; i.e. by application of O₂ enrichment :

1. Additional volume is available to be filled up with more acid gas as possible at design condition; i.e. feed throughput can be increased (= more plant capacity).
2. Less inert gas components have to be heated up when flowing through the chain of Claus installations.

Capacity increase by SURE low-level oxygen enrichment

Already within the low-level O₂ enrichment range the increased capacity can, as shown in the diagram, be quite substantial. Accordingly the implementation of O₂ enrichment markedly improves the flexibility and redundancy of Claus operation, especially if more than one Claus unit is operated.



Temperature increase in the Claus furnace

The most significant temperature effect achieved by LL-O₂ enrichment is in the Claus furnace, where certain minimum temperatures have to be achieved in order

- to ensure sufficient destruction of trace compounds (NH₃ and/or BTX)
- to stabilize the Claus furnace operation as a whole, e.g. when the H₂S content in the Claus feed is low.

The application of LL-O₂e, typically coming with a temperature increase in the range of 100 °C, often is the measure of choice to realize a certain temperature requirement in the thermal Claus section.

Minor hardware changes for low-level O₂ enrichment

For realisation of low-level O₂ enrichment a tailored oxygen injector (OXYMIX® Injector) has to be implemented into the process air pipe. As this is the only hardware modification necessary at the Claus installation, it is quite uncomplicated to stage field trials with low-level O₂ enrichment. Such trials show the effects, but also the limitations of O₂ application at the Claus unit in question, i.e. based on experiments and not (only) on studies.



OXYMIX Injector designed for 200 m³/h of oxygen.

Benefits

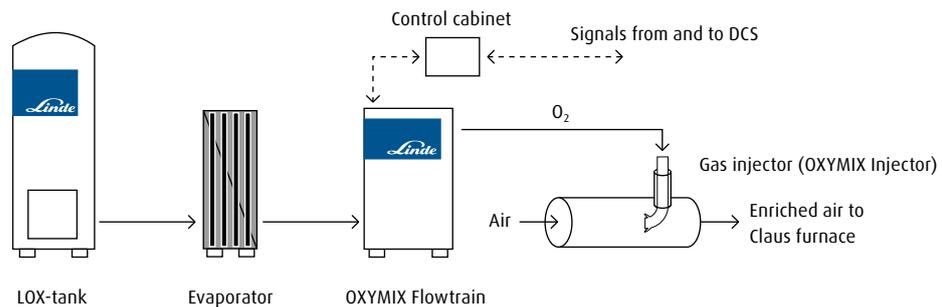
SURE low-level O₂ enrichment is a low invest solution for uncomplicated revamp of Claus plants, i.e. a rapid-payback solution. It enables oxygen enrichment up to 28% without any changes to the Claus unit.

As major benefit, SURE low-level O₂ enrichment is coming with increased flexibility in operation; i.e. in particular

- increase of Claus unit capacity
- enhancing the reliability of Claus operation

System

The complete system typically consists of a liquid oxygen (=LOX) tank, an oxygen evaporator, a OXYMIX® Flowtrain device to meter the amount of oxygen, and an OXYMIX Injector to ensure that the addition of oxygen into the air pipe is safe, efficient and according to the standards.



Services

- On-site demonstration of the technology and tests using own hardware as described to prove the effects and identify limitations of O₂e. (SURE ammonia service includes ammonia sampling analysis to show destruction efficiencies at different O₂ enrichment levels.)
- Simulation of SURE low-level oxygen enrichment in Claus plants.
- Contribution to HAZOP.
- Delivery and installation of LOX tank, evaporator, OXYMIX Flowtrain metering and safety system.
- Delivery of OXYMIX Injector for safe and efficient O₂ admixing into process air.
- Reliable and flexible O₂ supply.
- Ongoing technical support.

Hardware available

- Data Sheet "OXYMIX Injector"
- Data Sheet "OXYMIX Flowtrain"

O₂ enrichment beyond the low-level

For higher enrichment levels as 28% Linde has developed two Claus technologies being based on the SURE burner (a self-cooled tip-mix burner with separate ports for acid gas, oxygen and air supply):

- SURE mid-level O₂ enrichment for O₂ levels up to 45% and capacity increase up to 75%
- SURE high-level O₂ enrichment for O₂ levels up to 100% and capacity increase up to 150%

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