SCOT®

The leading process for removing sulphur compounds from Claus tail gas

Shell Global Solutions

AT A GLANCE

Customer driver: More-stringent environmental regulations and increasingly contaminated gas

Solution: A Shell Claus off-gas treating (SCOT) process, which uses catalytic conversion and amine absorption processes familiar to plant operators, downstream of a Claus unit

Value delivered: Sulphur recovery levels of up to 99.98% can be achieved.

Proof point: SCOT was developed in the early 1970s, and is the industry's most widely selected tail-gas clean-up process. More than 250 units have been licensed.

Oil and gas operators face growing challenges from increasingly stringent environmental regulations on sulphur emissions. The current World Bank standards prescribe that refineries should emit no more than 150 mg/Nm^3 sulphur dioxide (SO_2). Emissions restrictions on carbon monoxide (CO) are also imminent.

At the same time, newly found oil and gas fields tend to contain higher levels of sulphur species and other contaminants. In combination with the tightening of product specifications, this results in increasing loads of contaminants, such as ammonia and organic sulphur components, in the feed to the Claus unit.

As Claus-based units are limited to sulphur recovery rates of up to 96–98%, tail-gas treating is required to reach higher levels.

PROCESS DESCRIPTION

As shown in Figure 1, the process has three sections:

1. a reduction reactor, in which all the sulphur compounds present in the Claus tail gas are converted to hydrogen sulphide (H_2S)
2. a cooling/quench section, where the reactor off-gas is cooled and the water is condensed
3. an absorption section, in which H_2S is selectively absorbed by an amine solution. The loaded solvent is regenerated and the acid gas released is recycled to the inlet of the Claus unit.

SCOT units can be designed with a dedicated amine regenerator or with a shared amine system.

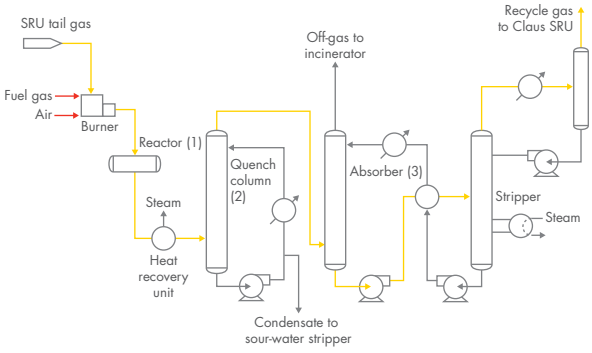


Figure 1: The conventional SCOT process.

ABOUT THE TECHNOLOGY

Shell Global Solutions offers the following optimised SCOT designs, which have been developed to help meet specific requirements.

Super-SCOT

This is a two stage-regeneration design applied to integrated amine systems to meet SCOT off-gas specifications of as low as 30-ppmv H_2S.

Low-Sulphur (LS-) SCOT

This is the key technology for very low sulphur emissions (as low as 10-ppmv H_2S or 50-ppmv total sulphur). A small concentration of an inexpensive additive is added to the amine. This improves solvent regeneration and solvent leanness. Alternatively, LS-SCOT can be used to reduce the steam requirements and keep the H_2S emission level constant.

Low-Temperature (LT-) SCOT

To save fuel, minimise carbon dioxide (CO_2) emissions and maximise catalyst cycle length, a hydrogenation catalyst with increased activity is used to enable the tail-gas treating reactor to operate at lower inlet temperatures.

Mercaptan-destruction SCOT

To remove mercaptans, two parallel hydrogenation catalyst beds are employed: one for the main Claus tail gas and one for mercaptan-containing off-gases. This line-up is typically applied in gas plants handling complex contaminated gas mixtures.

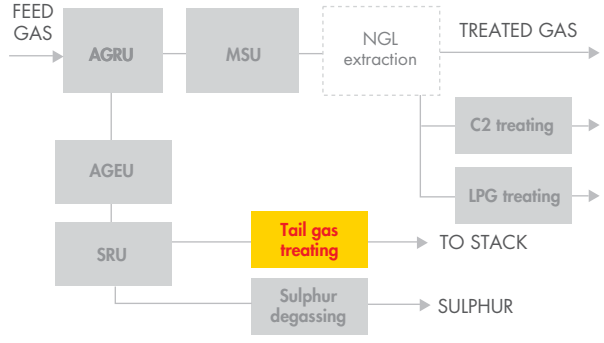
CO-SCOT

Unlike other tail-gas processes, CO-SCOT also reduces the level of CO in the tail gas.

HAVE YOU CONSIDERED HOW YOU CAN

- effectively meet the future regulations for SO_2 and CO emissions for your new or existing tail-gas treating unit?
- cut the operating cost of your tail-gas treating unit?

HIGH-PERFORMANCE GAS-TREATING SOLUTIONS SERIES



PROOF POINTS

NEW ZEALAND REFINING COMPANY

New Zealand Refining Company's Whangarei refinery cut its reactor internal temperature from 280°C to 250°C, which resulted in a 20–22% reduction in fuel gas use, after adopting Criterion Catalysts & Technologies' low-temperature catalyst C734 in its SCOT unit. It selected C734 because of its catalytic activity and low pressure-drop characteristics. The unit has shown stable operation since it started up smoothly in May 2010.

US WEST COAST REFINERY

In 2008, a refinery on the US West Coast adopted LS-SCOT. As a result, reboiler steam decreased 40% without increasing environmental emissions. In addition, by operating with lower steam rates, the SCOT unit is now more resistant to process upsets. The unit has operated for more than three years with this technology, with no solvent degradation or corrosion symptoms.

BUSINESS VALUE

SCOT technology enables very high levels of sulphur recovery and very low levels of SO_2 emissions to be achieved. Consequently, it is a key process for fulfilling increasingly stringent emission specifications, including the most stringent World Bank standards.

Other benefits include:

- high flexibility – The process can operate over a wide range of sulphur intakes. A turndown ratio of less than 10% of design throughput is achievable.
- low maintenance requirements – The unit requires little operational attention.
- excellent reliability – Less than 1% unscheduled downtime has been achieved in Shell-advised units.
- reduced CO emissions.
- good tolerance to incomplete ammonia destruction in the upstream Claus unit.
- no troublesome secondary waste streams.

For further information, please visit our website at www.shell.com/globalsolutions

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