

SO₂-liquefaction at Western Mining, China

Introduction

At Xining in the Qinghai province of China, Western Mining has installed a Kaldofurnace to produce lead. Lead-ore is reduced to metallic lead and gas of sulphur dioxide (SO₂) is formatted.

Since SO₂ is environmental hazardous and industrial attractive the SO₂ should be recovered in a gas handling system.

The complete system with Kaldofurnace and gas handling system is supplied by Outotec Sweden AB - former Boliden Contech AB.

As sub supplier to Outotec, REF TECH has been responsible for the whole system for the liquefaction of the sulphur dioxide.

Of financial reasons some of the components are manufactured in China - however supplied on strict instructions from Outotec and REF TECH.

The recovered SO₂-liquid is stored and from the storage the product is fed to either a sulphur acid plant or shipped for other consumers.



From bid, feasibility study to supply

The project started with a bid-round where REF TECH supported former Boliden Contech AB with our liquefaction know-how.

The bid-round resulted in an award for Boliden Contech to make a feasibility study for the whole plant with Kaldofurnace and gas treatment system. For the recovery process - the liquefaction system – REF TECH was contracted for the study. The concept is a total integration of all functions within the gas handling plant and the study needed, consequently, frequent contacts between the different parties.

After acceptance of the feasibility study Boliden Contech became the responsible for the final work.

Within this contract REF TECH got the award for the liquefaction process.

The liquefaction process

After cleaning, drying and pressure-boosting the gas is cooled to a low temperature (-65°C) which allows SO₂ to liquefy. The pressure boosting of the gas is necessary to overcome pressure drops through the entire system and to give an optimum pressure in the liquefier.

The site at Xining is located on an altitude of 2600 meter which reduces the possibility of liquid formation. Due to the reason of energy saving and temperature flex, a set of pre-coolers precedes the liquefier where the process gas is pre-cooled by the relatively cool "tail gas" leaving the liquefier.

A lean content of SO₂-gas remains in the tail gas and is fed to a sulphur acid plant located on the same site. After the acid plant the tail gas is sufficient free of SO₂ allowing it to be released to the atmosphere. The liquid formatted in the liquefier is collected and pumped off for storage.

The liquid from the storage can, when the liquefaction plant runs idle, be evaporated and fed to the acid plant or it can be shipped as liquid to other consumers.

The refrigeration system

As refrigeration system for the cooling of the SO₂-liquefier a three-stage screw compressor set-up is selected with R410A as refrigerant.

The selection of system is based on good flexibility, reliability and low energy consumption.

In addition, in order to gain flexibility and energy saving all compressors are frequency powered.

The refrigerant-selection is a balance of high efficiency at the low temperatures, used on these applications, and the potential of high temperatures during summer period.

For all three compressor stages oil-injected Howden WRV-compressors are used but with an integrated oil system common for all compressors.



LP-compressor: WRV 365/165

IP-compressor: WRV 321/132

HP-compressor: WRV255/110 (to the left)

The refrigeration loop is cooled by cooling towers via a water-cooled condenser.

Within the refrigeration loop, the SO₂-liquid is warmed to ambient temperature – not only to gain efficiency – but also get correct product conditions for the SO₂-storage.

The control system is fully automatic and is integrated in the main control system for the complete Kaldo plant.

The functionality is close related to other functions of the plant and the operation is basically operated from the furnace control room.

Further information

Svenska Rotor Maskiner International AB

+46 705 64 82 12

ingvar.nilsson@rotor.se