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Abstract

Objectives/Scope:

In Hawiyah Gas Plant Sulfur Recovery Unit, a modified claus process is used to recover elemental sulfur from the acid gas containing H₂S. To achieve this, there are two reactions in the SRU.

Methods, Procedures, Process:

The first one is in the reaction furnace where H₂S reacts with O₂ in the air stream to convert one third of the H₂S to SO₂. The remaining H₂S reacts with the produces SO₂ to produce elemental sulfur in the converters. The temperature in the reaction furnace should be maintained around 2000 DEGF to ensure that the BTX is destructed to avoid deactivating the catalyst in the converters. As a result, air and acid gas are pre-heated in the acid gas and air preheaters prior entering the reaction furnace. Several outlet temperatures were tested for the acid gas and air preheaters in order to maintain the temperature in the reaction furnace above 2000 DEGF. HGP managed to save energy by reducing the outlet temperatures of acid gas air preheaters and three re-heaters. These changes were made without impacting the reliability and the performance of the unit. The acid gas and air preheaters outlet temperatures were reduced from 500 and 700°F to 400 and 570°F. A test was done to ensure that the BTX destruction will not be affected by this temperature reduction. The savings for this optimization study is estimated to be 680 MSCFD of fuel gas.

Results, Observations, Conclusions:

In addition, for the catalytic section, the reaction in the converters favor lower temperature. However, there are two limits that should be considered. The first one is that the converters temperature should be maintained above the sulfur dew point to avoid any sulfur accumulation in the catalyst bed. The second limit is that in the first converter, higher temperature is favored for the hydrolysis reaction of the side products. With maintaining these two limits, the outlet temperature of the re-heaters was reduced from 604, 425 and 383°F to 572, 411 and 371°F. It is worth to mention that the first reheater utilizes fuel gas for heating the acid gas stream and the other two reheaters uses HP steam. Based on the theory and HYSYS simulation, higher sulfur recovery was achieved by having lower bed temperatures in the converters which is about 0.22%. In the first re-heater, the fuel gas consumption reduction is 79MSCFD. On the other hand, HP steam consumption in re-heaters 2 and 3 was reduced by about 0.28Mlb/day.

Novel/Additive Information:

This study will help other gas plants in reducing the fuel gas or steam consumption. In addition, this study has improved the sulfur recovery percentage.