

## Experiences with the REEL Heat Exchangers and HF Sniffers Installed at EGA Al Taweelah

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### Abstract



The P100 project at EGA Al Taweelah increased the primary aluminium production of the three potlines by adding 66 cells. This expansion resulted in increased pot gas temperatures and more fluoride evolution from the pots, thus adding extra load to the existing Gas Treatment Centres (GTCs). Each of the three potlines have two GTCs. The eastmost GTCs, where the potroom extensions are located, are the most affected. To mitigate the added load on the east GTCs, REEL's pot gas heat exchangers were installed. In addition, the REEL HF sniffer system was implemented to monitor the HF performance of each of the 32 compartments in the three GTCs. The system helps improve overall emission as any deviation in operation can quickly be narrowed down to a single filter compartment. This paper describes the experiences from the operation of the REEL HEX and HF sniffers after two years of operation.

**Keywords:** Potline gas treatment centre, Pot exhaust gas cooling, HF monitoring.

### 1. Introduction

Primary aluminium producers consider different approaches to increase their metal production. Strategies such as increasing the amperage of the reduction line, or adding additional pots, utilising existing capacity [1] are often found more cost effective than construction of new potlines. This paper will review the Gas Treatment Centre (GTC) and how the GTCs were upgraded to meet the goals of the potline expansion project at EGA Al Taweelah in 2021, including operational experience over the last two years.

The main purpose of the GTC is to remove HF (gaseous hydrogen fluoride) from the pot gas and recover the fluoride. Alumina, the raw material for the reduction process, is brought in contact with the fumes. Fluorides are adsorbed on to the surface of the alumina particles. High removal efficiency is important to protect the environment from harmful emission, and to recover fluorides back to the pots. Elevated gas temperatures [2], or suboptimal distribution of gas and alumina flow, are both factors reducing GTC performance.

Adding more pots to an existing potline does necessarily mean more pot gas has to be treated. This is often accompanied with amperage increase, giving elevated pot gas temperatures. The challenge is more gas volume and heat that must be handled by the existing GTC [2]. To handle the pot gas flow during peak summer hours, the GTCs were originally designed with spare capacity allowing for introduction of ambient air to bring down the temperature of the gas flow. This spare capacity in GTCs was used to accommodate for the additional pots by replacing the dilution air with heat exchangers (HEX), cooling the pot gas before entering the GTC.

Alumina flow through the GTC dry scrubbing did increase when adding the pots. Operating the GTC closer to its limits, both with regards to alumina and gas throughout, calls for better process control. The sniffer system is a tool for extractive sampling of HF. It is used to monitor GTC performance in each individual dry scrubbing filter module. Operational issues or abnormalities can be detected early. Operation can then be optimised to maintain the lowest emissions.

To meet strict requirements on emissions and reliability, the HEX was installed to improve process capacity together with the sniffer giving improved process control. The two technologies were combined and successfully implemented as presented in the following.

## 2. Capacity Increase and the Potline Extensions Project

In the potline extension at Al Taweelah, all 66 new pots were connected to the existing GTCs [1]. Pot gas from new pots were collected with REEL's impulse ducts, a solution which optimises gas flow minimising pressure loss in the potroom duct. In Potline 1, 13 pots were connected to the east inlet of GTC-5311, and 13 pots via an overhead duct to the west inlet of GTC-5311. Likewise in potline 2 and GTC-5321. In potline 3 additional 14 pots were added to GTC-5331, increasing the number of pots from 222 to 236. Pot gas flow specification was unchanged.

**Table 1. Al Taweelah potline extension in 2021.**

	GTC-5311	GTC-5321	GTC-5331
Pots per GTC before extension	192	192	222
Pots added in 2021 (A + B room)	13 + 13	13 + 13	14
Pots routed via EHEX (East + West)	30 + 30	30 + 30	-

The objective of the potline extension project was to increase production capacity in a cost-effective manner by maximising the utilisation of existing equipment. As described by Teeling et al. [1], debottlenecking studies were conducted for various areas. For the GTCs, upgrades included improvements in primary alumina distribution, secondary alumina conveying capacity, pot gas cooling with EHEX and process optimisation with the HF sniffer. The next sections will explain the implementation and operation of the two latter systems as these were the main contributors.

## 3. Gas Cooling with Heat Exchangers

In total, 4 REEL External Heat Exchangers (EHEX) are installed. Location is in the courtyard near the east and west inlets of GTC-5311 and GTC-5321. The EHEXs are located upstream the GTCs. Each EHEX is cooling gasses from 30 pots, two EHEX and 60 pots per GTC. It is important to note that the 26 new pots, located at the furthest distance from the GTC, were connected directly to the GTC. While the collecting ductwork for 60 existing pots with a more central location were re-routed via the 2 new EHEX (one on each side of the GTC). An overview is presented in Table 1.

The main benefit of the HEX technology in the EGA Al Taweelah expansion is that acceptable temperatures can be maintained during summer without addition of dilution air. The addition of cooling air is disadvantageous, not only because it is increasing the gas volume, but also because the gasses are diluted before dry scrubbing, thus reducing the efficiency of HF adsorption [3].

Pot gas HEX is also a very relevant technology when it comes to potline amperage increase project. One strategy to maintain cell energy balance while the internal heat generation is increasing, is to reduce the anode cover height [4]. The additional heat is then mostly picked up by the pot exhaust gases. Cooling pot gasses with HEX is an excellent option in such cases.

The potline extension debottlenecking strategy has proven successful. REEL's HF sniffer, and combined with EHEX gas cooling, made it possible for the GTCs to handle the increased pot gas load while maintaining performance with regards to HF emission control.

## 6. References

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