Major revamp of a Sulzer G90/4a EK Brown Boveri

Salt factory goes for proven technology

New technology and systems cannot always withstand fluctuating process parameters and aggressive production environments. A Swiss salt factory witnessed this first hand after having invested in a new steam circulating multistage compressor. When the Sulzer G90/4a EK Brown Boveri in the second plant also battled downtime, they decided to go for proven technology and tasked Energetic with a major revamp. With success, since the compressor is up and running again and performs above specifications, with no important production downtime and at less than 10% of the cost of a new installation. 200 to 60 million years ago, the now Rhône valley in Switzerland was in fact a shallow sea. The sea salt gave rise to the Swiss salt mines, discovered in the fifteenth century. Today, approximately 30,000 tons of salt is being won in this fifty-kilometre-long labyrinth of corridors and shafts. One of Switzerland's main salt producers exploits two sites where salty water is pumped and desalinated through a drying process. This process uses heat exchangers based on steam circulated by a compressor. Evidently, combining salt and heat creates a very aggressive environment, specifically bad for compressors. Heat exchangers indeed allow salt to enter the steam system, causing corrosion and mineral deposits between the internal bodywork of the compressor

and the compressor housing. This results in all kinds of damage, such as deformation of the internal body parts, resulting in leaks and steam reflow. These phenomena badly affect the compressor's uptime and efficiency and could even lead to complete standstill. In that case the factory cannot dry any more salt since this installation is crucial to the production process.

Crucial parts no longer available

The best way to avoid such catastrophe is of course efficient maintenance, including replacing corroded parts timely. But the Sulzer G90/4a EK Brown Boveri used in the salt mine dates back to the seventies. The original equipment manufacturer has been taken over by another compressor manufacturer, who no longer supports this type of machinery. This is why it has become virtually impossible to get your hands on crucial spare parts.

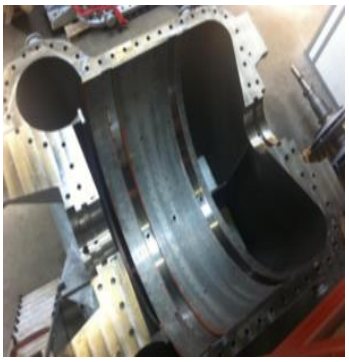
Investments less of an option

When some years ago the Sulzer G90/4a EK steam circulating multistage compressor in one of the sites came to a halt, the salt producer decided to invest in a new integral geared compressor; unfortunately causing more worry than benefits. On the one hand, the plant was forced to remain at standstill for quite some time, while the system was being installed. On the other hand, the new technology proved to be significantly less resistant to the specific environmental context and variability in process parameters (pressure,

flow and temperature changes), which required extra investments in adjustments to stabilize the production process. When the Sulzer compressor in the second plant also started to show problems, the salt factory was anything but keen to replace this compressor by a new one as well."

Revamp pays off

Since they worked with Energetic before for other compressor maintenance programmes, the salt factory asked whether a revision of the steam blower could be a possible solution. Thanks to our expertise we succeeded to get the Sulzer G90/4a EK Brown Boveri back up and running without any performance loss compared to the original compressor data. For less than 10% of the cost of a new system. The client didn't even need to stop production, since we worked with the obsolete steam



circulating multistage compressor from the other plant. During a summer standstill we switched the compressors, including all adjustments required. In a next phase we will look into a way to deploy the other Sulzer G90/4a compressor as back up."

Extensive damage

Energetic disassembled the old compressor and transferred the parts to the Stekene workshop. All parts were inspected for cracks, conform the ISO 3452 standard. The use of replicas allowed to investigate the structure of the material in terms of usability. The installation turned out to indeed be on its last legs, with the diaphragms being eroded and corroded to such extent they had become unusable. The diaphragms' centreline also no longer corresponded with the rotor axis and the labyrinths were complete worn out by corrosion and friction, all with huge losses in efficiency as result. Lastly, corrosion was detected on the split line between the compressor top and bottom casing. The stuffing boxes also had become obsolete, since the casing's seats were totally eaten away by corrosion, as were the compressor casings, totally deformed by significant corrosion between the housing and internal bodywork. Both top and bottom had been affected also, making it no longer possible to calculate the dimensions for the installation of the internal parts, such as the diaphragms. Finally, the plain bearings, oil labyrinths and threaded connections only could be scrapped.

Solved thanks to reverse engineering

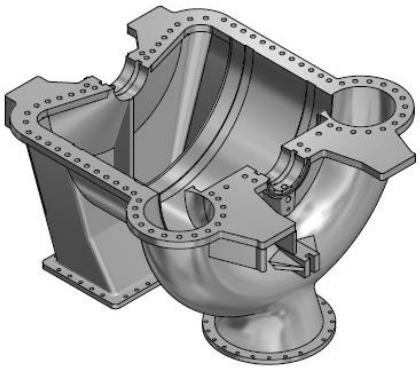
For a total overhaul of the Sulzer G90/4a EK Brown Boveri, Energetic had to apply reverse engineering extensively. Each and every part of the compressor is scanned, using infrared laser, after which we built a complete CAD model of the installation using Siemens NX software. That allowed us to adjust the model to the correct dimensions and tolerance requirements. The top and bottom of the compressor casings were machined in and on the split line. We also redesigned the labyrinths since the T-grooves in the diaphragms had to be re-machined due to corrosion. Naturally we also conducted a material test, from which we could conclude the compressor body consisted of ductile cast iron GGG30. That made us decide to machine away corrosion rather than applying welding techniques, and to redesign the stuffing boxes in order to realign them with the new compressor shape.

We even went further…

All threaded holes were re-machined ‘oversized’, new studs and nuts were bought. The bearings were given a new Babbitt layer, radially and axially, to bring them back to the original machine specifications. To decrease the risk of corrosion in the future, the inside of the steam circulating multistage compressor was clad totally in AISI 316 L profiled sheeting, assembled with countersunk bolts. We opted for a two component system between the compressor wall and the sheeting, to avoid crevice corrosion.

Exemplary cost savings

Once all parts had been revised, Energetic assembled the compressor in the workshop, to check measurements correctness. The installation was then once again disassembled and transported to the client’s site in parts. Right before the arrival of the revamped Sulzer G90/4a EK, during the summer planned maintenance stop in the factory, the old compressor was taken away. This allowed us to start installation immediately, saving us an enormous amount of time compared to implementing a new system. After mechanical completion and hand-over, the revamped Sulzer was started up, with success: performance was perfect, and since then the compressor has been running without any signs of leakage or significant vibration levels. This case is an excellent example of cost saving measures, proving



that old assets can be operational and fully functional for many years still.”

Client quote:

“We are extremely satisfied with our choice to totally revamp the old compressor rather than investing in a new installation like we did in the other factory. We went for ‘proven technology’ all the way, only because we were backed by the support and knowledge of an experienced high tech supplier such as Energetic.”

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