Adapting compressors to new challenges
Siemens performance enhancement programs for compressors

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The optimal strategy to meet new requirements

Siemens compressor performance enhancement protects investments and creates value added.
In many industries rotating equipment is the backbone of core processes. This is why compressors and their drives are designed to operate continually over a long period of time. However, market conditions can easily change, and so can best operational practices and framework conditions. This means that equipment modifications become necessary.

In such cases, the replacement of main compressor components or even entire compressors and drives is usually one of the major cost factors. A revamp can be a cost-effective solution enabling existing machinery to work more efficiently, meet new requirements, and conform to new emission reduction guidelines.

While some main compressor components are replaced during a revamp, many existing parts and ancillary equipment can be reused. This minimizes costs and ensures a relatively short shutdown period.

Siemens, a global powerhouse in compressor and turbine technology, has the expertise and experience to provide revamp solutions for compressors as well as for entire trains as a one-stop solution.

Revamp solutions from Siemens:
- customized design
- state-of-the-art compressor technology
- the know-how of a market leader
- unique knowledge of the entire train history with OEM equipment
- outstanding experience in revamping all types of turbocompressors
- strong rotor dynamic engineering capabilities
- a unique service partnership
Every plant has specific technical, operational, financial, and environmental requirements. This is why knowing the entire history of an individual machine is a real advantage – just like the wide experience in revamping compressors of all types the Siemens experts have acquired over several decades.

This rare combination makes possible unique insights that enable implementing the latest state-of-the-art technology, precisely identify hidden potential, and enhance both short and long-term turbomachinery performance.

There is a single point of contact for the customer for all questions, as each revamp project is assigned to a dedicated service team. This ensures that the entire project keeps running like clockwork. Be it replacement parts, professional advice on delivery, and installation or project coordination: the Siemens expert in charge is just a phone call away.

Knowledge that pays off

Familiarity with the individual machine and its entire history is what puts the Siemens experts one step ahead.
Precise planning is half the story

The adaptation of a compressor is a cost-efficient way of answering to new process conditions. However, there are several factors to be considered in order to make the investment pay off quickly. This is why the Siemens experts offer their support as early as when the customer defines the new operating conditions. The experts then perform a feasibility study as a first step. Such a study helps evaluate whether a revamp is economically feasible and the scope of engineering required.

In a next step, a number of investigations, which can be relatively extensive, enable precise findings on how the compressor can be adapted to new process parameters in a highly efficient manner. Necessary and advantageous changes to mechanical items are defined. Furthermore, applicable environmental regulations are taken into account.

The exact knowledge of the operational and maintenance history of a plant and its compressor trains provides a clear view of its improvement capacity. It even makes possible the incorporation of new features in a way that facilitates future revamps. This keeps the compressor as versatile as possible and opens new potential for the optimization of capital and operational expenditures.

Back on track faster

One part of the story is the extensive reuse of existing parts that yield economical benefits. Revamps also provide even more advantages that deserve to be considered: the installation of new machinery usually goes hand in hand with long lead times and notable construction efforts resulting in substantial downtime. A revamp can be performed much quicker. This means shorter downtime of the production facility and, therefore, a much better overall cost situation. Above that, the life cycle of the machinery is extended, which can translate into further savings. Stored spare parts can further be used and the acquired operating experience does not become obsolete.

Experience means value added

Siemens is a manufacturer with a wealth of hands-on experience in compressors and turbines – experience that transforms directly into cost advantages for the customer: the Siemens experts know exactly how to handle a revamp project of any size. They are aware of a compressor’s hidden reserve and know how to best make use of them. They have the know-how it takes to get any revamp done in the shortest possible time.

Discover for yourself on the following pages how Siemens’ revamp expertise has led to lasting benefits in various industries and applications.
Pressure change in offshore hydrocarbon production

The pressure in a reservoir dropped due to depletion, so a reduction in the first-stage suction pressure from 80 bar to 50 bar was demanded in order to increase the overall recovery rate. This meant that the entire process had to change. Major restrictions resulted from the design of the offshore platform, whose original construction was based on single-lift mounting. The new compressor needed to fit the existing stools and bedplate exactly, and a footprint solution that would run until the end of field life was demanded by the operator.

An STC-SV vertically split casing with an initial inner bundle of three impellers opened the possibility to retain the casing and all ancillary systems and react to further reduction in suction pressure by exchanging the inner bundle alone. All modules were produced, tested, and pre-commissioned onshore to minimize activities on the platform.
Upgrade for reinjection
The gas-to-oil ratio of a new unit was much higher than predicted, with 50 percent more gas than the compressor was designed for being produced. Revamping possibilities were evaluated in order to make the compressor train cope with the additional gas volume and higher temperatures, eventually resulting in an upgraded compressor design.

However, the drive train, the electric motor, and the gearbox also required an upgrade due to the higher power demand of the compressor. Hence, a more powerful electric motor of equal footprint and a new gearbox were included in the package.

Adaptation to associated gas weight
Due to short remaining reservoir life, the customer decided to tie-in an additional field and produce the oil and gas over the existing facility. The reservoir prediction gave a substantially lower mol weight for the gas from the new field, and reduced head capacity with the consequence that the compressor operating point moved to the left of the curve causing the machine not to meet the contractual volume flow. This meant that the customer would not have been able to meet contractual requirements with the existing compressor train.

Modifications based on the new operating data included new compressor internals for the compressor to meet the new head and flow demand.
Cases from refineries and the chemical industry

Process changes in a refinery
A refinery was upgraded to cope with new low-sulfur requirements for modern fuels. The existing two-stage hydrosulfite compressor with a relatively high-flow low-head design needed to be revamped to a low-flow high-head design. This was achieved by changing the compressor from a two-stage setup to a four-stage system.

A feasibility study demonstrated that machine redesign was possible by replacing the internals of the existing compressor. The new configuration now comprises four impellers instead of the original two. Moreover, the impeller diameter was increased to ensure the required pressure ratio can be achieved.

The complete aerodynamic internal compressor design was changed while the existing casing was retained, thus meeting the new process requirements at the lowest cost and lead time.
Integrally geared compressors in a PTA plant
An STC-GV (125-5) integrally geared compressor was revamped in order to enable a production increase of about ten percent. However, the customer demanded the changes to be kept to an absolute minimum. It was stipulated that the drive and gear units had to stay. Therefore, the Siemens engineers used eccentric bearings to increase the distance of the axis. This resulted in an improved gear ratio with a higher rotation speed. Only one rotor had to be changed in addition.

Ethylene machine in a PTA plant
An STC-SV (8-5-A) single-shaft compressor required revamp to make possible a production increase, which entailed severe process data changes: volume changed by about 40 percent, drive power demand by about 44 percent.

Keeping the housing of the old compressor was preferred in order to keep changes in the process control system with the feeder lines to a minimum. The feeder lines of the stator parts were met, and the number of impellers was reduced from five to four, thus turning the machine into an STC-SV (8-4-A). Moreover, a new motor and a new gear unit with diagonal split joint were installed to meet the higher performance requirements. The diagonal split joint was required to meet the compressor’s center height in order to meet the footprint of the original machine.
Focus on dry gas seal technology
First introduced in 1987, Siemens dry gas seal technology has become a proven approach that stands for reliable operation. Today, a considerable number of compressors is equipped with dry gas seals, more than 20 percent of them upgraded compressors of older design. Dry gas seals not only eliminate the particular challenges associated with wet-seal systems, they also help reduce seal exchange time, power losses, and maintenance costs, and improve the overall operating health of turbomachinery.

Convincing advantages
Dry gas seal upgrades stand for proven technology, reliable operation, and reduced plant downtime. The system is designed in accordance with API 614 and even exceeds the requirements of this standard. It reduces maintenance effort, bearing inspections and instrumentation repairs can be performed considerably easier. The oil itself remains cleaner, and oil leakages into processes become a thing of the past. All instrumentation is valved and arranged to permit on-line testing without upsetting the operation of the compressor.
Focus on oil system revitalization
Siemens provides a targeted solution that addresses the common reliability problems of older oil systems, their increased maintenance requirements resulting from damaged components, and the consequential resource drain and loss of profits.

Substantial increase of reliability and availability
New strategies in system design, engineering progress in component technology, and new approaches in operational philosophy are the basis for oil systems that are more reliable, functional, and ergonomic than currently common systems.

Upgrade options comprise packages for pumps, filters, and coolers, and the installation of a continuously coalescing oil filter to remove free water. Along with the replacement of a considerable number of parts, system piping and component placement are reconfigured and optimized to obtain a more ergonomic design that supports easy operation and maintenance.

Such an upgrade results in improved reliability of the entire system, as the ability to maintain proper oil pressure and temperature, as well as high cleanliness levels, help minimize outage risks and translate into increased bearing and seal life. An upgraded system is even capable of performing cold oil startups without problems.

Focus on air trains
Air compressors are used in air separation plants, for the production of compressed air, in the steel industry, in the fertilizer and chemical industry, and in many other fields of application. In most cases, integrally geared compressors and axial-flow compressors are used for these tasks. These two compressor types are traditionally characterized by high efficiency.

Volume increases of up to 15 percent can be obtained through the modification of flow-guiding components, the exchange of the impellers, or the exchange of the rotor blades. Structural changes are kept economically justifiable in such cases, and suitable studies allow the definition of possible increases and the precise estimation of required structural changes beforehand.

Focus on control system modernization
While compressors themselves have relatively long life cycles, many control system components become obsolete or discontinued within a comparatively short period of time. In such cases, optimizing the control system hardware using the modular Siemens compressor automation system SCAUT can ensure reliable performance upgrades of the plant and machinery for years to come. Depending on individual factors, a partial exchange or a total optimization of the controls may be advisable. Both can be performed by Siemens experts, who also have the know-how and experience to handle and integrate third-party devices.