



Case Study: Busch LLC and Vakuum-Härtereie Petter GmbH

Dry vacuum technology in heat treatment processes offers advantages for a contract hardening company.

Vakuum-Härtereie Petter GmbH (VHP) based in Quickborn, Germany, is a contract hardening facility that specializes in high-quality heat treatment under vacuum. The company has a total of nine vacuum ovens. The materials handled are mainly high-alloy steels, but non-ferrous metals are also heat-treated. The core activities of VHP are hardening, annealing, brazing, soldering, and tempering. VHP's customers include companies throughout Germany in the food, medical, forming, and transmission technology sectors. It offers custom heat treatment for individual customers, and a variety of processes and parameters are available to generate the desired surface properties with reproducible and documented results.

BACKGROUND

Originally, the company had oil-lubricated rotary vane vacuum pumps installed that needed oil changes and replacement of all filters every six months, causing increased costs for servicing, oil, filters, and the disposal of used elements. In 2015, one of these rotary vane vacuum pumps was replaced by a Busch Cobra NX screw vacuum

pump as the forepump of a three-stage system to supply a heat treatment oven. The objective was to find an efficient alternative to the vacuum generators previously used. After a year of testing, VHP is pleased with dry screw vacuum technology.

The benefits of high-quality heat treatment under vacuum include: no operating fluids present in compression chamber; increased pumping speed that allows more rapid heat treatment processes; and minimal maintenance and costs.

Vacuum technology is an indispensable part of metal heat treatment. The fundamental role of vacuum in heat treatment processes is to prevent unwanted reactions between the material components and ambient oxygen, as these may have an adverse effect on the surface properties of the metal. The pressure reduction also allows the process to be controlled more precisely. The pressure, temperature, and duration of the process can be set to suit specific materials and controlled according to material characteristics such as the vapor pressure curve. Quenching of the metal after heating is usually carried out with nitrogen, but in some cases, argon is used.



the ovens. These vacuum pumps act as the forepumps of three-stage systems incorporating booster and oil diffusion vacuum pumps. This vacuum pump arrangement can achieve ultimate pressures of up to 1×10^{-5} mbar in the oven process chamber. If required by the process, the pressure can be increased by introducing controlled amounts of nitrogen.

THE SOLUTION

The Cobra NX screw vacuum pump is a new development by Busch, and it has been designed specifically for heat treatment applications. No operating fluids are present in the compression chamber, making contact between the pumped medium and oil or other operating fluids impossible. This is achieved by two screw profiles, which contra-rotate in the compression chamber without making contact with each other or the housing. This simple construction makes the Cobra NX a robust and economical forepump for the vacuum supply system.

The Cobra NX was operated for a year in a three-shift system, and according to VHP directors Wallberg and Bernd Raabe,

no servicing work was carried out within this period. They also observed other advantages: the power consumption remained the same as the old vacuum pump, but the substantially increased pumping speed allowed heat treatment processes to be carried out more rapidly. The low noise levels generated by the Cobra NX test unit were also a pleasant surprise. Both VHP directors agreed that the Cobra NX is the ideal forepump for their future requirements, and when ordering new ovens, will choose models equipped with Cobra NX screw vacuum pumps.

Busch Vacuum Pumps and Systems is one of the largest manufacturers of vacuum pumps, blowers, and compressors in the world. Its products are at the forefront of vacuum and low-pressure technology. The family-owned company with more than 2,700 employees worldwide offers more than 50 years of expertise in vacuum system manufacturing and can provide customized solutions for a variety of vacuum applications. Its global headquarters is in Maulburg, Germany, and it operates production plants in Switzerland, Great Britain, the Czech Republic, Korea, and in the U.S., Virginia Beach, Virginia. ♁

VHP has worked with vacuum technology for more than 30 years. The extensive experience gained in this sector allows the company to concentrate on complex heat treatment processes.

“The more challenging customer requirements become, the happier we are,” said VHP’s managing director, Frank Wallberg.

THE CHALLENGE

VHP has traditionally used oil-lubricated rotary vane vacuum pumps to supply all

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