Success with Busch

Dry Vacuum Solutions

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BUSCH
Vacuum Pumps and Systems

Dry Vacuum Technology
for R&D Reactor Solvent Recovery

BUSCH Vacuum Pumps and Systems

Initial Situation

- Diversified oil, gas, and chemical technologies
- Vacuum and pressure required
- Variable operational design required

Customer required a systemized solution which would draw a vacuum level around 10 mm Hg at the skid inlet boundary, while also supplying a pressurized process stream in excess of 10 psig at the skid boundary discharge. Due to the nature of research and design operations, a robust design which could accommodate future operational variability was required.

Generally, due to expansion and compression effects of vapor streams achieving both, vacuum and pressure inline can prove to be a difficult task. However, Busch worked within customer provided design constraints to produce an innovative design which could accommodate the required performance.

Solution

Vacuum and pressure – all-in-one system

- Provides vacuum at skid inlet
- Provides pressurized process stream at skid discharge

The system supplied by Busch to the customer was comprised of a COBRA dry screw vacuum pump (figures 1 and 2), and two small diaphragm type compressors (with one compressor acting as an installed spare), and various other control and observation instrumentation required for safe and robust operation. The system was designed with inherit variability in operation due to the changing needs of research and design applications.

Peace of mind with contamination free operations thanks to dry pumping technologies

In contrast to other traditional technologies, dry running pumps, available through Busch, negate sealing liquid requirements. This entails a dry compression chamber without process stream contamination present in liquid sealed pumping technologies. This enables the customer to spend less time and money on downstream separations and/or unwanted side effects of process-sealing liquid interactions, and more time on design aspects elsewhere in the plant.

Experience based system design and understanding with Busch

Building on over 50 years of vacuum experience Busch's thorough understanding of the dynamic behavior of vapor expansion and compression in a multi-staged system, enabled Busch to collaborate and aid in the customer's system design. Often, due to compression dynamics in multi-staged vacuum-pressure systems there is a mismatch of capacities between the vacuum and compressor pumps (with vacuum pumps having a much larger nominal pumping speed than the compressors). Busch was able to identify an operational solution utilizing different control instrumentation as well as design considerations including recycle lines and safety features to enable simple vacuum and pressure operation seamlessly.

Compliance with hazardous area rating

The Busch vacuum system was designed for operation in an NFPA Class I, Division II, Groups C & D hazardous area. The motor and electrical instrumentation were specified for compliance with the applicable NEMA and NEC ratings. In complying with these applicable codes the vacuum system was designed to reduce the hazards of explosion to acceptable levels within the environment.

Compliance with plant codes

Busch understands that customers value consistency within plant design and operation, and thus worked with the customer to ensure the system was designed with common plant design features/codes and specifications were taken into consideration. This enables uniformity in maintenance and design throughout the customer's plant, even on the Busch vacuum/pressure skid.

Figure 1: COBRA NC dry screw vacuum pumps

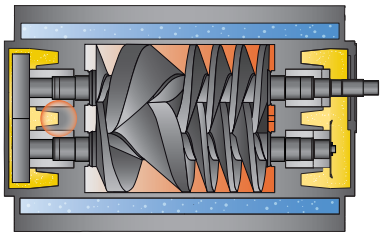

Figure 2: Cross-sectional view of a COBRA dry screw vacuum pump compression chamber

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Dry Vacuum Technology
for Phenolic Resin Production

Initial Situation

- Vacuum supply to reactors producing phenolic resin
- Frequent failures
- Expensive maintenance
- Excessive internal wear

The vacuum system previously used by the phenolic resin manufacturer comprised of two rotary vane vacuum pumps, each with a capacity of 590 ACFM. These units were both boosted by a Roots vacuum pump with a pumping speed of 1180 ACFM.

The system proved to be unsatisfactory due to intermittent pump failures, which were caused by resin particle accumulation in the rotary vane pump compression chambers. This led to frequent service interruptions and increased maintenance costs.

As a consequence, the manufacturer's management replaced the vacuum system with a more suitable and cost-effective solution.

Solution

Vacuum system with Busch COBRA screw and Panda roots vacuum pumps

- Vacuum control system provides huge energy savings
- Dry system, no oil costs
- Minimal maintenance costs

The system supplied by Busch comprises of two COBRA screw vacuum pumps and a Panda Roots vacuum pump (figure 1), with capacities of 235 and 1180 ACFM respectively. Power consumption is reduced by a vacuum controller: the system delivers the same pumping speed as before, but requires only 27.5 kW – a reduction in energy consumption of 30%. The dry operating principle of the system provides further savings, as no oil is required.

Dry vacuum technology improves operational reliability and eliminates oil costs

In contrast to oil-lubricated rotary vane vacuum pumps, vacuum technology by Busch is completely dry-running. As no oil is present in the compression chambers, a downstream oil separator is not required and replacement costs for clogged filters are eliminated. Filters now require replacement less frequently, contributing to problem-free production. The replacement of oil-lubricated rotary vane vacuum pumps by dry screw vacuum pumps has improved system reliability.

Maintenance costs minimized

The vacuum supply provided by the previous system was insufficient, forcing a retrofit of roots vacuum pumps to provide additional boost to the rotary vane vacuum pumps. The rotary vane vacuum pumps often failed, incurring high maintenance and repair costs. The replacement pumps supplied by Busch are subject to minimal internal wear, substantially reducing maintenance expenditure.

Compliance with ATEX directive

Busch vacuum systems are completely in compliance with the ATEX directive, ensuring that all equipment is fit for its intended purpose and can be used safely. Hazardous conditions exist only during the start-up phase, as solvent vapors could be present within the system. Busch vacuum systems conduct an automatic inertisation sequence on start-up, eliminating any risk of explosion.

Fault-free operation

Thanks to Busch dry vacuum technology, the manufacturer's vacuum system has now been operating flawlessly for two years. There have been no technical problems or failures of Busch equipment, and expenses for maintenance and upkeep have reduced dramatically. The vacuum system is serviced and checked once a year by Busch staff.

Figure 1: COBRA dry screw vacuum system

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