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High Temperature Pneumatic Conveyance Solution

Case Study
Meyer Pneumatic Screw Pump

Overview

A North American catalyst supplier was experiencing excess leakage from the dual 18” rotary airlock valve series in their dilute phase pneumatic conveyance system supporting a high temperature alumina application.

The Problem

The client’s high temperature industrial process was frequently disrupted by excess wear to the adjustable shoe on the end of the airlock rotor due to the abrasive nature of the material being conveyed.

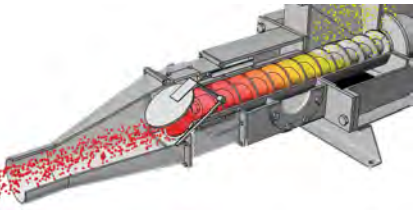
This issue:

- Degraded the seal, causing air leakage
- Caused excessive unplanned manufacturing downtime
- Created excessive parts and labor maintenance costs
- Impacted the pneumatic system’s efficiency, leading to increased load and maintenance on the positive displacement blower driving the process

The negative impact of degraded valve performance on manufacturing operations and maintenance costs was unacceptably high. The client approached Meyer to identify an alternate solution to the double rotary airlock component in their system. The primary goal was to minimize leakage and improve reliability.

Process Specifications

Operating conditions in this dilute phase pneumatic conveyance process the solution must address included:



- Highly abrasive material
- Average operating temperature 580º F
- Design temperature 650º F
- Flow rate average 21 tons/hour
- Flow rate design capacity 25 tons/hour
- System pressure average 5.8 PSI

Analysis

The client’s primary concern was leakage caused by seal degradation. The team started with the best available solution to that issue, then identified and engineered modifications that addressed the additional criteria.

Recommended Solution
Unlike rotary airlocks, which require tight clearances, a pneumatic screw pump utilizes the compression of conveyed material to form a seal. Their resistance to abrasive materials makes them a recognized replacement for rotary airlocks.

Complicating Factor
Tolerances on a standard cast iron screw pump do not meet the unusually high operating temperatures in the client’s process. This necessitated the fabrication of a custom stainless steel solution.

Growth Potential
Meyer Screw Pump Model 66 had suitable capacity for the client’s existing flow rate, but basing the solution on a Model 67 provided expansion capacity.

System Requirement
Belt driven pneumatic screw pumps are standard. The client’s system required the screw pump design be modified to accommodate direct drive.

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Solution

The resulting solution was a one of a kind stainless steel pneumatic screw pump customized precisely to suit the client's unique needs.

The screw pump meets or exceeds key process conditions present in the client's operation, with tolerances that allow for any future increase in flow rate capacity.

- Pressure capacity 7-8 PSI
- Flow rate capacity 40 tons/hour
- Upset temperature 850º F

Customized Solution

This solution required a number of customized components, including:

- High temperature bearings
- High temperature seals
- Heat slinger
- Cooling fan
- Pressure transmitter
- High/low pressure gauge
- High/low temperature gauge
- Direct drive

Customized Service

This project presented unique challenges, and the Meyer team provided an additional level of customer service to support the success of the custom engineered solution.

Bench Testing
Conducted prototype testing with multiple material samples of varying characteristics provided by the client to confirm the screw pump would meet the demands of the client's system.

On Site Engineering
Performed installation and system testing to ensure smooth implementation. Trained client operators and maintenance technicians on the new equipment.

Extended Support
Conducted a follow up site visit after the screw pump was operational to evaluate the outcome and address any potential concerns.

System Optimization
Consulted with client regarding the efficiency of their pipe run downstream from the new screw pump. Provided suggestions that streamlined flow and enhanced system performance.

Results

From initial customer contact through budgeting, product testing, design revisions, drawing approval, custom fabrication, delivery and on site start up with customer maintenance staff training, the project was successfully completed in 19 months.

"It runs so smoothly we can literally forget it's there."

The ~$250,000 solution included the fully customized component, installation, on site support and multiple spare parts.

Results since implementation are:

- Eliminated $150,000 per year in maintenance costs
- Eliminated 265 hours/year of maintenance, enhancing OEE by 3%
- Eliminated substantial indirect maintenance costs related to the issue
- Additional load, wear and maintenance eliminated for the positive displacement blower

2.5 years after implementation, the pump has been running smoothly with no major parts replacements necessary and no unplanned downtime. To date, it has incurred no maintenance costs other than routine wear surface inspection.

The client noted that the screw pump is a substantial improvement to their system. It installed, started up and delivered exactly what it was supposed to.