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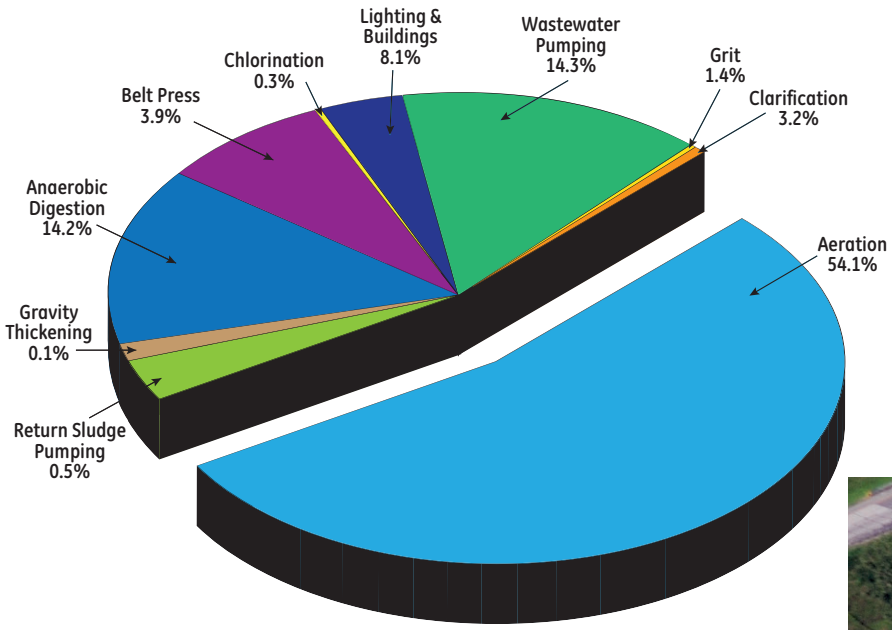
Howden

Revamp Services for Wastewater Treatment

Revolving Around You™

Introduction

Howden's history with centrifugal technology within the wastewater treatment segment dates back to the 1930's. Through the years there have been numerous advancements in wastewater treatment technology not only in aeration equipment, but also in controls and diffuser technology. Wastewater treatment plant electrical usage accounts for 4% of the United States' overall energy consumption with approximately 55% of that power consumed by aeration blower or compressor equipment. Howden recognizes that its customers are continually looking for ways to reduce their energy consumption and help drive down operational cost for their facility. The Roots Revamp Service is a cost effective, energy efficient alternative option to high cost construction projects and replacing a facility's complete aeration system.



Electricity Requirements for Activated Sludge Wastewater Derived from the Water Environment Energy Conversation Task Force Energy for Conservation in Wastewater Treatment
Chart Source: "Water and Wastewater Energy Best Practice Guidebook", December 2006, provided by Focus on Energy, prepared by Science Applications Interface Corporation

Challenge

With wastewater treatment facilities operating twenty-four hours a day year round, efficient utilization of electrical power demand is crucial. The extensive challenge of a municipality is to continuously improve system processes to more efficiently meet system demands while maintaining effluent quality with minimal capital and operational expense.

Solution

By decreasing your compressor's power demand or updating your compressors that are unfavorably sized for their current demand, you can meet your challenges head on. Roots revamp solutions can help you meet the current and future air demand with a continued reliability you've come to know with Roots compressors while decreasing your electrical power demand. Moreover, our revamp services can often be completed with no modification to your existing infrastructure and piping system. We will address this challenge and a solution in the following pages as we step through a typical installation four, 1500 HP, compressor. This example will highlight a possible operational power savings of $80,000 annually per compressor with a total possible power savings of $320,000 annually.

This savings will be achieved as a result of:

- Howden's proprietary, direct flow, dissolved oxygen controls
- Howden's updated impeller design
- Peripheral inlet guide vanes
- Variable diffuser vanes

Summary of Savings

At $0.10/kW-h with an average operation of 6000 hours the annual savings would be calculated as follows:

Annual Savings = Avg. HP Saved x HP to kW Conversion x Cost per kW-h x Hours of Annual Operation

Annual Savings = 180 HP x 0.746 kW / 1.0 HP x $0.10/ kW-h x 6000 hrs

Annual Savings** = $80,500/compressor or $322,000/system

Evaluation Criteria

Design Condition of 30,000 ACFM at 9.0 PSIG.

“Existing Compressor” – Vaneless Diffuser, Axial Inlet Guide Vane, Constant Speed

“Revamp Compressor” – Variable Vaned Diffuser, Peripheral Inlet Guide Vane, Constant Speed

HP of “Existing Compressor” at Design Condition (Point 1) = 1325 HP

HP of “Revamp Compressor” at Design Condition (Point 2) = 1280 HP

HP of “Existing Compressor” at Max Turndown Condition (Point 3) = 825 HP

Max Turndown Condition = 17,500 ACFM

HP of “Revamp Compressor” at Max Turndown Condition (Point 4) = 510 HP

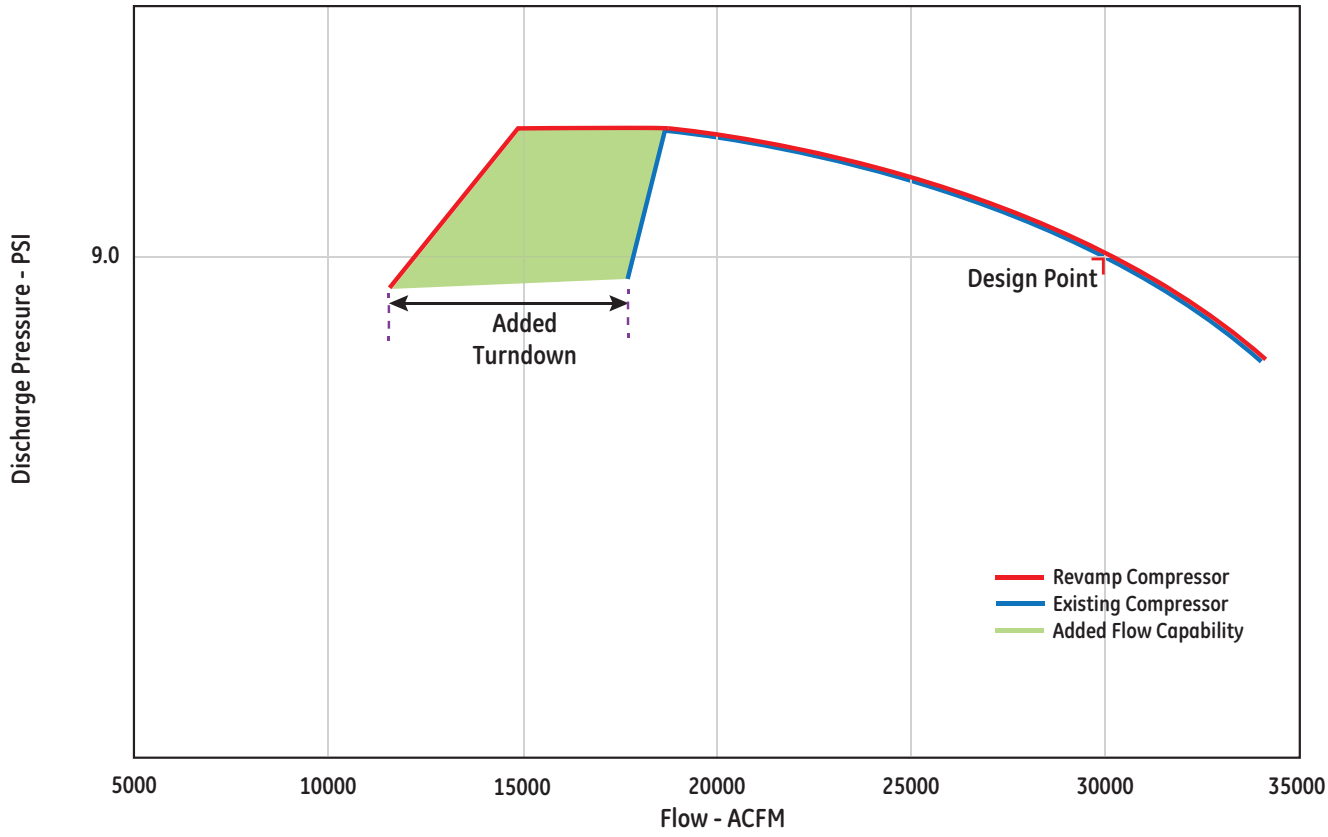
Max Turndown Condition = 12,000 ACFM

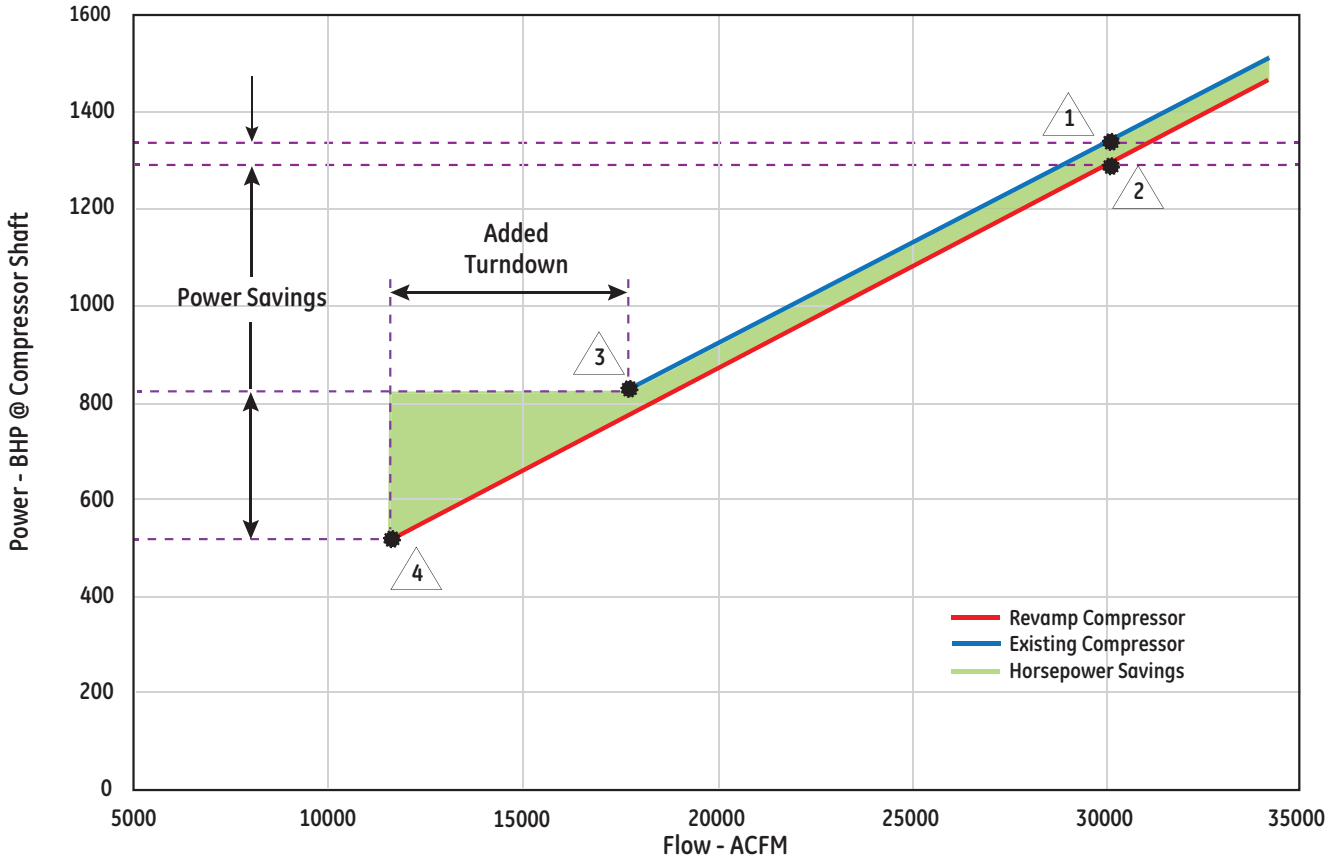
Change in HP at Design Condition = Point 1 – Point 2 = 45 HP

Change in HP at Max Turndown Condition = Point 3 – Point 4 = 315 HP

Average change in HP between Design and Max Turndown = (45 HP + 315 HP) / 2 = 180 HP

**Howden does not guarantee powers or savings outlined. This example represents a typical instance. Results will vary depending upon the customer’s current system conditions and aeration equipment.

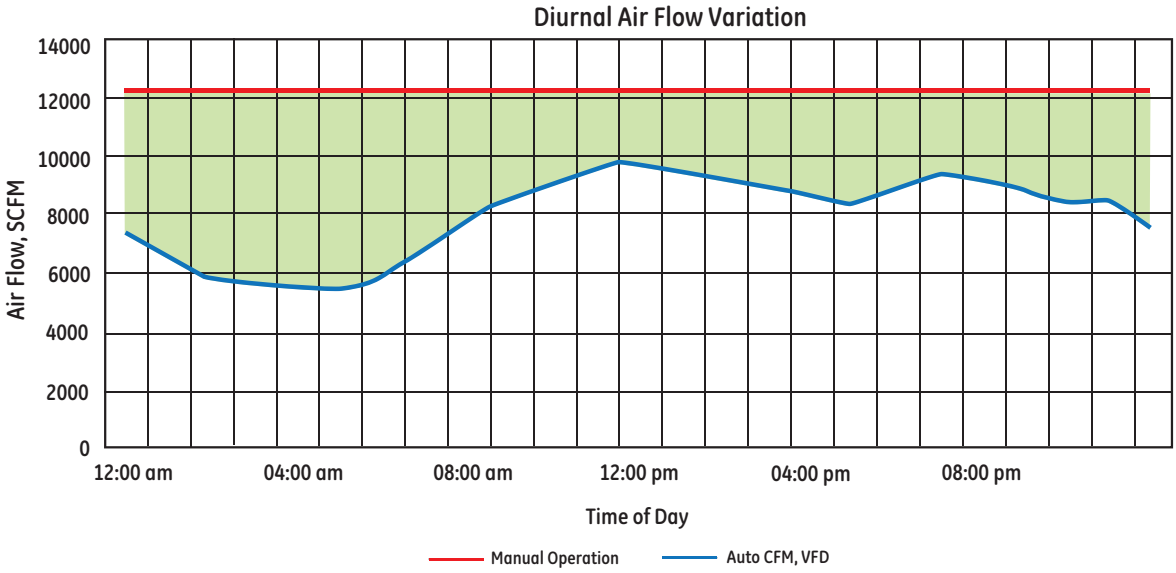

Discharge Pressure - PSI
9.0
Added
Turndown
Design Point
Revamp Compressor
Existing Compressor
Added Flow Capability
5000
10000
15000
20000
25000
30000
35000
Flow - ACFM


Power - BHP @ Compressor Shaft
1600
1400
1200
1000
800
600
400
200
0
Power Savings
Added
Turndown
1
2
3
4
Revamp Compressor
Existing Compressor
Horsepower Savings
5000
10000
15000
20000
25000
30000
35000
Flow - ACFM

Wastewater Controls

Roots wastewater controls are an energy efficient way to optimize the performance of your aeration process through automated direct flow control, Most-Open-Valve (MOV) technology and our proprietary control algorithms as compared to pressure control systems . Direct flow control with MOV logic will minimize the required system pressure, thus, lowering the pressure and power demanded of the aeration compressor as conpared to a constant pressure system.

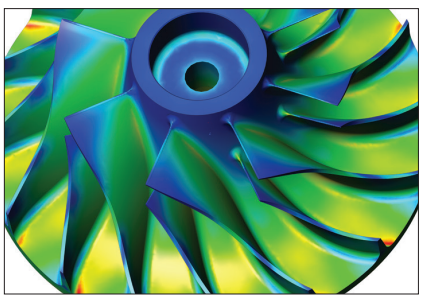
Wastewater controls provide an effective means for determining precise aeration requirements demanded by your wastewater treatment system, reducing air and power demands of the aeration blowers.

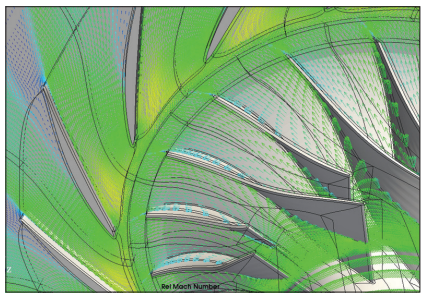


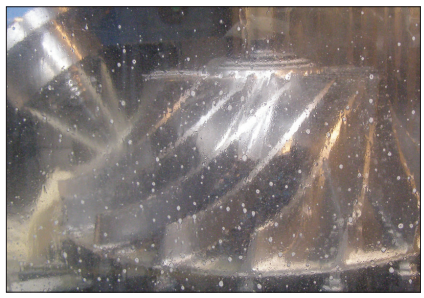
Impeller Assembly

Over the years, Howden has made numerous advancements in aerodynamic designs through utilizing Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) software. These advancements paved the way for the development and manufacturing of higher efficiency impeller assemblies while maintaining the reliability and integrity always provided by Howden.

Most impeller assembly revamps can be done without having to modify any of your existing infrastructure or piping systems in place at you facility. Depending upon whether it is a complete revamp or impeller replacement, Howden may be able to upgrade components at the facility, thus minimizing the downtime of your aeration equipment.



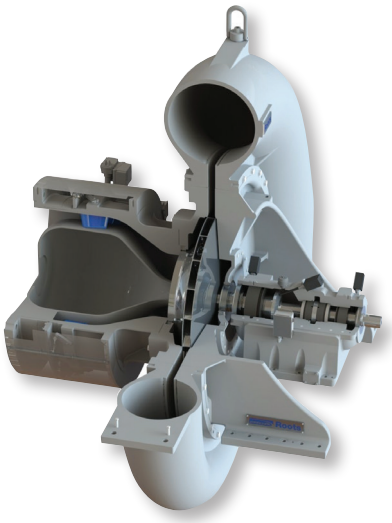


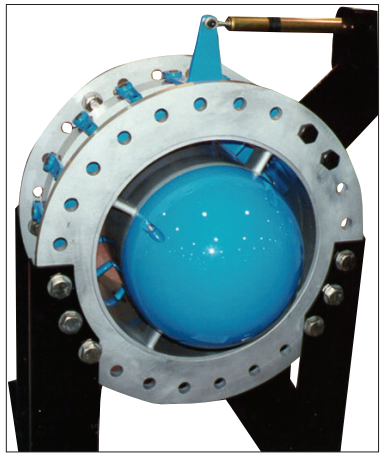


Peripheral Guide Vanes

Peripheral Inlet Guide Vanes (PIGVs) are an effective means of increasing the efficiency of the compressor and provide an additional amount of turndown for the compressor.

PIGVs more effectively direct the inlet air than standard Inlet Guide Vanes (IGVs) and therefore perform the function in a more efficient manner. In many cases, the PIGV housing can be interchanged with your existing standard IGVs with little modification to the existing piping system.





Variable Diffuser Vanes

Variable Diffuser Vanes (VDVs) function by efficiently and effectively, directing and diffusing the air flow from the impeller through the diffuser section of the compressor. The variable capabilities of the diffuser vanes align the vanes with the flow path of the air coming off the impeller. The diffuser vanes' air-foil design aids in providing an efficient deceleration of the air.

Additionally, with the variable characteristics of the VDVs the compressor has the ability to achieve higher turndowns, thus reducing the power demand at off design points and greatly reducing the amount of excess air being supplied to the system.

With the VDVs, Howdenwill also supply control and actuation of the diffuser vanes. Our controls logic will ensure the diffuser vanes position is optimized to meet the system demands while minimizing the compressor's power demand.

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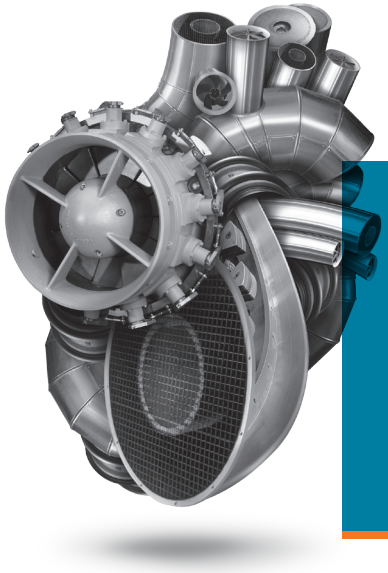

At the heart of your operations

Howden people live to improve our products and services and for over 160 years our world has revolved around our customers. This dedication means our air and gas handling equipment adds maximum value to your operations. We have innovation in our hearts and every day we focus on providing you with the best solutions for your vital operations.

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