WHITE PAPERS

MECHANICAL ENGINEERING SERIES

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PREFACE

Your food processing plant's mechanical system is the single most important function necessary to keep your facility operating efficiently. In this white paper, we'll look at special considerations in budgeting for your mechanical requirements and ways to conserve your facility's precious energy resources. We'll also address the importance of having a reliable and redundant mechanical system to keep your plant operating at maximum efficiency.

FOOD PROCESSING MECHANICAL SYSTEMS: FOUR CRITICAL AREAS TO ADDRESS EARLY ON

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1. Water – Water goes into almost every process within a food processing plant. As a result, it's important to understand the source of your water before the design of any mechanical systems can begin. Is the water hard or soft and will it require purification or treatment? Does it contain chlorine? Will you need booster pumps to increase flow rate? The makeup of your water will also determine the types of materials you'll use within the plant. For example, hard water can lead to scale in piping so either the water must be softened or you must choose a material that resists scale.
2. Steam – Most processes within a food plant also require steam. The process equipment used within the plant will drive the capacity requirements, so the mechanical system should be designed to meet those needs. An important point to note here: consider the future needs of the plant when determining steam and boiler requirements. Designing a system to meet the plant's needs today is not the end goal. The design should anticipate future growth and expansion of the plant, both from a space and resource capacity standpoint.
3. Gas – Is natural gas accessible to the plant? Is there an existing line, and if so, does it have the capacity to operate the plant's processes? In most cases, gas will be used to power the plant's process equipment yet existing lines may not offer the necessary capacity. Your local gas company may need to install additional lines.
4. Air balance – Designing a mechanical system to ensure the necessary air balance within the plant is one of the most critical considerations. It's important at the outset to determine the specific function of each area within the plant. While loading docks and non-process areas can have a negative air balance, process areas must maintain a steady, positive air balance. Understanding the size and function of these process areas will determine the number and size of air exchanges required.

FOOD MANUFACTURERS LOOK TO WATER AND HEAT FOR RESOURCE CONSERVATION

More and more food manufacturers are developing energy management and resource conservation programs, focusing on water and heat as the two resources that offer the greatest opportunity for significant savings in the long run.

WATER

- Conservation – Water is the most important, and most wasted, resource in a food processing plant. It's also one of the easiest resources to conserve. Most water loss occurs during the sanitation process. By installing flow restrictions, such as high-pressure, low-volume nozzles on spray washers, a plant can significantly reduce the amount of water used and lost during wash downs.
- Purification – Installing water softeners or filtration systems is one of the easiest, most cost-effective solutions to purify water and reduce energy usage. In addition, the more you treat the water, the less makeup water required for most processes. Cleaner water also helps to minimize wastewater and the expense of treatment at municipal facilities.
- Reuse – Steam is used to process most functions within a food plant. As a result, capturing and reusing this valuable resource can lead to significant cost savings. Low pressure waste steam from boilers can be captured and reused to power a number of processes within the plant. Water from many functions within the plant can also be captured, treated and reused.

HEAT

- Recovery – There are many waste heat sources within a plant from which useful heat can be recovered and reused. For example, waste heat from compressors can be captured and used to pre-heat make up water for the boilers.

Auditing your facility on a regular basis is the most important step you can take in effectively managing your resources. An energy audit can spot leaking water hoses, leaking pipes where compressed air may be escaping, and many other small fixes that offer huge paybacks.

FOUR KEY BUDGET CONSIDERATIONS IN DESIGNING YOUR PLANT'S MECHANICAL SYSTEM

It is critical to plan for the future when designing your food processing plant's mechanical systems. We find that many plants are now undergoing expensive retrofits because future needs were not appropriately considered. Not only are retrofits expensive, but if new equipment is not sized and sequenced effectively, it can significantly affect your energy costs. To avoid these issues, here are four budget considerations to address when designing your plant's mechanical system:

1. Plan for any future plant expansions during the initial design phase. Look at your business plan and consider future production needs, including additional and expanded product lines. Begin with an initial analysis of the building structure and allow for additional square footage to add new boilers, compressors, and production space. You may also consider buying larger compressors up front that will provide additional capacity needed in the future. Using variable frequency drives (VFD) will allow you to manage energy usage during lower production periods.

2. Consider long-term ROI during the initial design phase, not just upfront costs. Your mechanical engineers should be able to provide side-by-side analyses of the long-term operational costs for most of your machines. Consider pairing a chiller with your HVAC system for long-term cost savings. Gas is the most cost-effective fuel to run your plant's processes. If gas is not available to your facility, consider making the investment to bring gas lines in. Retrofitting existing water heaters with gas later on can prove to be significantly more expensive.
3. Choose the appropriate materials that will save you time and maintenance costs in the future. Stainless steel equipment may be more expensive but is often the preferred material to sustain harsh wash downs in a food processing plant. You'll save in both replacement and maintenance costs in the long run.
4. Ensure that you invest in the appropriate quality of water for your plant's processing and sanitation needs. If the water in your area is hard or contains chlorine, you'll want to install purification systems where the water enters the plant. Again, there will be an added upfront cost but treatment costs may prove to be more costly down the road.

FIVE WAYS TO IMPROVE THE RELIABILITY OF YOUR EQUIPMENT AND AVOID DOWNTIME

There is one thing that food processing plants cannot afford: downtime as a result of equipment failure. The loss of a single piece of equipment can halt production and lead to product loss, not to mention a loss of revenue. The costs are simply too high for plants to risk equipment failures.

HERE ARE FIVE WAYS TO INCREASE THE RELIABILITY, AND EXTEND THE LIFE, OF YOUR PLANT'S CENTRAL EQUIPMENT

1. Train plant employees – Employees can play a role in protecting machinery in its daily use through proper operation. Employees should also be able to identify potential problems before they happen. Engage manufacturers programs and train employees on critical equipment.
2. Use high-quality lubricants – High-quality oil may cost more but will benefit your plant in the long run by keeping machines running efficiently and long term. Talk to your equipment vendor about the recommended frequency of preventive maintenance measures to ensure you're on the right schedule to maintain equipment warranties.
3. Invest in equipment redundancy – Your mechanical engineers can recommend which systems require redundancy to eliminate the potential for downtime due to equipment failure. For instance, since air compressors are vital to plant operations, a redundant system minimizes the possibility of system failure.
4. Conduct consistent cleaning and maintenance – A scheduled, documented cleaning and maintenance program minimizes wear and tear on machines, saves money on repair and replacement parts, and extends the life of your equipment. Work with your equipment vendor to develop a formal maintenance program and properly train employees to conduct these tasks.
5. Use automation solutions – Investing in automation can increase your equipment's reliability. For example, a simple processor such as a sequencer allows multiple compressors to communicate with one another and coordinate demand to improve each machine's operating efficiency and extend equipment life.

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Published by Stellar 2014
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