Running Dry for Sustainability
System Plast Support Article

Today's Production Scenario:
Beverage industry production managers are continually challenged with the task of improving efficiencies of their canning or bottling lines. In addition to product responsibilities they are also challenged to reduce water usage, reduce costs for energy and soap consumption, and to improve plant safety. Many companies are also faced with the issues of energy availability, energy costs, as well as looming shortages of fresh water in many developing countries. Some forecasters note several countries could be importing water within the next three years.

The drive to sustainability was brought on by current scarcity in several parts of the globe plus dire forecasts issued by the scientists and researchers: (a) In his book "Water", Marq de Villier notes, "the water table in northern China is dropping one meter per year due to over pumping." (b) International Food Policy Research Institute states, "… one of the main factors limiting future food production will be water." (c) Sitka, Alaska has signed agreements to export 2.9 billion gallons of water to India, the Middle East and West Asia. The Alaska Department of Natural Resources has at least three additional applications for bulk water. (B. Walton for Circleblue.org).

Due to the heightened awareness of conserving natural resources many beverage companies are identifying corporate objectives that include the continuous reduction of both water and energy usage in the coming years. Historically traditional soap and water soap lubrication operations use 4 to 7 times more water in production than they produce in product. An effort to reduce these numbers in the future is definitely evident.

By implementing water and energy saving objectives, corporations not only help the environment, but the implementation of sustainability programs also support a product's brand as a good corporate citizen.

Definition:
What is meant by the term "running dry"?
Running dry means no external lubricant of any type is applied to the surface of the transportation conveyors in a production environment. Lubrication methods and types vary from plant to plant and can consist of actual lubrication products or a concentration of soap and water. A conveyor that truly meets the definition of "run dry" does not have any of these lubrication methods used on the surface of the conveyor chain or belt. Companies have been evaluating how to manage applications with reduced amounts of various lubrication methods without compromising product output. The ideal situation would be to eliminate lubrication in every application, but certain areas are required to be wet as part of the process.

History:
For years, end users have been attempting to run dry by eliminating the use of soap & water lubrication. They realized excessive amounts of soap and water were being used in the process and were challenged to reduce their usage. In most cases this led to

problems with increased chain/belt wear, noise, conveyor pulsation, bottles tipping, higher energy consumption, static electricity, etc. These ill effects could not be absorbed in the process so eventually the traditional methods of soap and water lubrication once again returned to the lines.

Through direct customer interactions System Plast was made aware of the production and maintenance problems that arise when running without soap and water lubrication. System Plast was able to draw from their experience and capabilities of being a total conveyor system supplier to develop a complete solution. The solution included not only the chain and belt products, but product guides and wear strips as well. Various materials for all of these products were developed and tested to provide a combination that resulted in excellent results.

System Plast introduced unique engineered materials to address the market's concern. The main products were New Generation (NG)™ chains and belts and Nolu™-S guide rails and wear strips. These proprietary materials provided very positive results.

NG material plastic chain and belts increased the possibilities to run dry where similar acetal based products resulted in wear and friction problems. NG chains and belts were also successfully tested in applications where previously only stainless steel chains were possible. Due to its lower coefficient of friction, NG material chains and belts provided an operating advantage other acetal materials did not supply.

In addition to the NG chain material, a new wear strip and guide rail material called Nolu™ S was also introduced. Nolu-S is a UHMW based product with a proprietary solid lubricant. This combination of materials created a composition that reduced the coefficient of friction without sacrificing wear life. When used in conjunction with NG chain/belts, this unique formulation allows the end user opportunities to evaluate how they utilize lubrication. In many cases a reduction or elimination of lubrication has been possible.

Designing for dry running: A 21st Century Necessity

Plant and process designers are working to design new line installations for running dry. System Plast engineers can help with design considerations such as:

- Wider conveyors at slower speeds
- Longer inliners/outliners
- Shorter buffer sections for less pack pressure
- Optimized line controls
- Reduction or elimination of difficult transfers

Following new design criteria can reduce a plant's overall production costs and promote environmental sustainability.

Product Design Features to Support Lower Energy and Reduced Water Usage

- New Generation chains/belts are a proprietary material designed to reduce drag, optimize wear resistance, improve corrosion resistance, improve operating stability and reduce chain elongation.

- Nolu™-S is a UHMW-PE base material combined with a proprietary dry lubricant. Compared to standard UHMW-PE it provides:
  - Reduce friction/energy consumption
  - Improve heat dissipation
  - Reduce conveyor run noise
  - Permits higher dry running speeds
  - Reduce chain pull
  - Improve service life/extend life of mating surfaces
  - Will not scratch PET bottles
  - Improve efficiency

- Nolu-S is also made from FDA and USDA approved materials

Product Test Results

Test results have indicated the use of NG chain on Nolu-S wear strips reduces drag forces by approximately 20% when compared to traditional products. Internal testing also showed energy consumption to be reduced by approximately 14%.

Plant Operating Options

Today plants have three options for managing their conveyor systems: (1) water and soap lubrication, (2) dry lubrication products and (3) running dry.

1. Water and Soap Lubrication

Water and soap lubrication has historically been the lubrication of choice as production speeds have increased. Steel chains/belts provide a greater carrying capacity while holding up to glass shards and other debris. Compared to no lubrication, water and soap can help with friction reduction, flushing away product spillage, dissipating heat, reducing static electricity and reducing chain wear.

However, water and soap also provides a perfect environment for bacteria to grow rapidly which strongly conflicts with government and corporate hygiene standards. Dry conveyor surfaces significantly reduce the opportunity for bacteria growth and slime build-up while also enabling the opportunity to eliminate drip pans and soapy water hazards.

As management has reviewed the use of water and soap, they have found excessive water use/cost, excessive soap costs, increased cost for water reclamation, slip and fall safety issues, increased insurance costs, equipment corrosion issues and contamination of bottles/labels/packing materials. Additionally the global shortage of fresh water has applied new pressures to reduce water use in plant production. The ultimate goal is to run lines completely dry - however that is not always possible. In some cases dry lubricant may be an acceptable option.

2. Dry Lubrication Products

Dry lubrication is generally more difficult to control than wet lubrication. A wet (soap & water) lubrication system can be over lubricated and continue to function. In this situation soap and water would be over used and wasted but the process would continue to function properly.

With the use of dry lubricants, the acceptable amount of lubricant used must be controlled within a small bandwidth. Too little lubrication will produce increased chain or belt wear and operating cost due to the increased motor load. On the other hand, over lubrication can create a series of problems such as a build-up of wear paste which can create noise, equipment pulsation, excessive wear and cleanliness issues.

Special cleaning materials and equipment may be required for dry lubricant to avoid the build-up of excessive lubricant and dirt/debris. It is possible for dry lubricant to save up to 80% of water usage when compared to wet lubrication. But it is critical that plants implement the correct equipment and maintenance procedures to eliminate product build-up and slip and fall safety issues. Some companies have chosen to subcontract the lubrication responsibilities with service specialist companies to maintain an efficient program. That, however, can lead to a conflict in responsibility between the responsibility for the lubrication and the responsibility for the line output. Companies must weigh the increased cost of maintenance for dry lubrication before implementing a system.

3. Run Dry Operations

Running with no lubrication provides plant operations the ability to meet a number of objectives.

A. Reduction in health and safety issues such as slip/fall hazards and lower bacteria count.
B. Reduced equipment corrosion and maintenance issues. No drip trays needed.
C. Reduced rejects of labels and packaging materials due to moisture issues.
D. Reduced cost for purchasing water, water reclamation and lubricant costs.
E. Provides company support of sustainability. Reducing water usage, energy consumption, product materials and packaging materials can support corporate sustainability goals and aid in brand marketing.

While not every current application can run dry, the System Plast NG chains and belts used in combination with Nolu-S wear strips greatly increases the ability to run production lines with reduced or no lubrication.

A large number of plants have now successfully moved from wet to non lubricated operations. Some examples include:

High speed can inlines

A brewery tested running dry with acetal based chain in an effort to eliminate water and soap lubrication. The aluminum oxide generated created excessive wear and created the need to replace the chain approximately every three months. This customer replaced the acetal based chain with System Plast NG chain. The NG material chain resulted in a chain life in excess of 15 months or approximately 5 times longer than the standard acetal chain previously in use.

Another brewery equipped their inspection and coding zone conveyor lines with NG chain. After two years of successful running the chain showed no measurable signs of wear. The customer also installed Nolu-S side guides and Speedset quick positioning accessories to reduce scratches and dents on different sizes of cans while properly positioning the cans for coding.

PET bottling plants

A mineral water plant in Europe changed from lubricated stainless steel to dry running NG belts. The result was not just a reduction of water usage and expense but more efficient product handling as well. The NG belts allowed the line to increase product throughput up to 60% in some areas compared to the previous stainless steel products.

A United Kingdom soft drink plant switched from lubricated acetal chain to dry running NG chain on their labeler. The Line Manager noted the retrofit was relatively easy with no changes in controls or speeds when they installed the dry running NG chain. This customer had also previously installed NG material chain at the infeed of their packer with very positive results.

Non-returnable glass bottles in a brewery

Many glass plants run non-lubricated chains or belts from the de-palletizer until approximately the filler, and then again towards the packer unit. In between these two units it is standard practice to run water and soap lubricated stainless steel. The ideal solution would be to eliminate the need for the lubricated stainless steel chain sections.

A brewery in Holland chose to retrofit their lubricated stainless steel chain to dry running NG chain. The company's objectives were:

1. Cost reduction
2. Water use reduction
3. Improve accessibility for inspection (no drip trays), maintenance and hygiene.
4. Smoother bottle flow with the NG belt as compared to individual stainless steel strands of chain.
5. Improve bottle handling to reduce plant noise and provide easier transfers.

The same brewery also had a 180° curve running dry acetal chains but was extremely noisy. This curve section was converted to dry running NG chain and resulted in a noise reduction level from 91dBa to 77dBa.

Companies have also discovered dry running conveyors allow for easier cleaning in many returnable bottle applications. In some cases the water and lubricant bound particulates creating cleanliness issues.

Abrasive materials

A coffee producer in the UK was using standard acetal based chains for their application. Due to abrasive glass particles being present, the chains typically had to be replaced every 9 months. NG chains were installed in the same application and have run for several years with no wear measureable wear. The NG chain is projected to last a total of 5-6 years.

Two spirits bottlers also converted to dry running NG chains as acetal chains were damaging their expensive glass bottles. The acetal chain also produced dust that created quality control issues. The NG material was much more wear resistant and created very little dust, thus eliminating the quality control issues. In lab tests under sand blasting and abrasive dust tests, the NG chain resulted in less than half the wear rate of acetal chain.

Industry Direction

System Plast and other industry providers are continuing to seek innovative solutions in product design and material design to support the global requirement for sustainability in food and beverage production.

Sustainability Partner

System Plast is a partner in The Water Footprint Network. The Water Footprint Network is a global organization headquartered in the Netherlands whose mission is to advance knowledge and understanding of water shortages and pollution to consumers, producers, communities and governments.

Partners include food and beverage companies as well as auto manufacturers, universities, clothing suppliers and consulting companies.

About Emerson

Emerson (NYSE:EMR), based in St. Louis, Missouri (USA), is a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial, and consumer markets through its network power, process management, industrial automation, climate technologies, and tools and storage businesses. Sales in fiscal 2010 were $21 billion. For more information, visit www.Emerson.com

About Emerson Industrial Automation

Emerson Industrial Automation delivers manufacturing solutions designed with leading technologies – including mechanical, electrical and ultrasonic – to provide the most advanced industrial automation possible for numerous and diverse industries worldwide. The company's wide range of products and systems used in manufacturing processes and other equipment include motion control systems, plastics joining, precision cleaning, materials-testing equipment, fluid control valves, alternators, motors and mechanical power transmission drives and bearings. Emerson Industrial Automation's mechanical power transmission division, headquartered in Florence, Kentucky consists of Browning®, Jaure®, Kop-Flex®, McGill®, Morse®, Rollway®, Sealmaster® and System Plast™. For more information, please visit **www.EmersonIndustrialAutomation.com** and **www.Emerson-EPT.com**

###

For more information contact:
Matt Stoneburner, Director of Marketing; Material Handling
Emerson Industrial Automation - Power Transmission Solutions
Phone: 800/626-2120
Email: matt.stoneburner@emerson.com