Nordson Advances
News and Concepts from Nordson's Polymer Processing Systems

Single Cart for Downstream Components Makes Extrusion Operator's Job Easier

A simple concept plus smart design makes it faster and easier to deploy and maintain the gear pump and screen changer on an extrusion line. By combining the two components on a single movable cart, Nordson Kreyenborg has created a system that takes up less floor space than separately mounted machines, and provides easy access for replacement of filter media.

Developed at the request of one customer, the concept of a single support cart can be applied for equipment custom designed by Nordson Kreyenborg for other companies, including extrusion processors, compounders, and recyclers, replacing the standard configuration involving separate carts for the two components.

The single cart (see photo on this page) is mounted on fixed casters that permit transverse-direction movement into and out of the extrusion line, while precisely aligned movement in the extrusion direction is provided by rails installed on the floor of the cart. At the same time, linear guides on the cart permit independent extrusion-direction movement of the gear pump and screen changer. To save space *Continued on P. 5.*

Inside....

Nordson at Chinaplas: Wealth of New Melt Stream Components for Extrusion, Molding, and Compounding

Chinaplas® 国际橡塑展 2014

Nordson Corporation will present four of the world's renowned brands of melt stream component technologies, including recent innovations for extrusion and molding processors, web converters, compounders, and recyclers, at Chinaplas 2014. Featured in the company's main exhibit at ***Booth W2 J01*** will be Nordson Extrusion Dies Industries, Nordson XALOY, and two product lines acquired since the last Chinaplas: BKG and Kreyenborg. In addition, a combined Nordson BKG and Nordson Kreyenborg exhibit in the German Pavilion at ***Booth E1 F03*** will focus on equipment engineered and produced in Germany.

Nordson acquired and added these melt stream component product lines to their polymer processing portfolio during the past two years, adding their regional manufacturing, sales, and service capabilities to the company's already extensive presence in China and throughout Asia, as well as in Europe and the Americas.

"Our combined resources have increased the availability of local sales and technical service for customers and provided them with the opportunity to source components in our various product lines from a single supplier." says Peter Lambert, senior vice president for Nordson's polymer processing product lines. "Because Nordson uniquely understands all of the components in the melt stream, we can draw on this knowledge to help customers by recommending ways to optimize their overall melt stream process, increasing productivity, reducing costs, and enhancing product quality."

Current innovations are detailed in separate articles in this issue of NORDSON ADVANCES. They will also be highlighted at the Nordson booths during Chinaplas. For each of the product lines, a wide range of products will be on display:

- ***Nordson Kreyenborg***. At Booth W2 J01: screen changer K-SWE-121 and gear pump GPE 70/70-01. At Booth E1 F03: screen changer K-SWE-125-4K-75/RS and gear pumps 70/70-01, 70/70-01/MB (masterbatch), and 70/70-03. *Continued on P. 3.*

COMPACT AND OPERATOR-FRIENDLY, this single cart from Nordson Kreyenborg combines gear pump and screen changer. New design makes deployment of components on an extrusion line faster and provides easier access for replacing filter media. (See article starting at top left on this page for details.)

Innovative Heating System Works for Nozzles and Melt Pipes

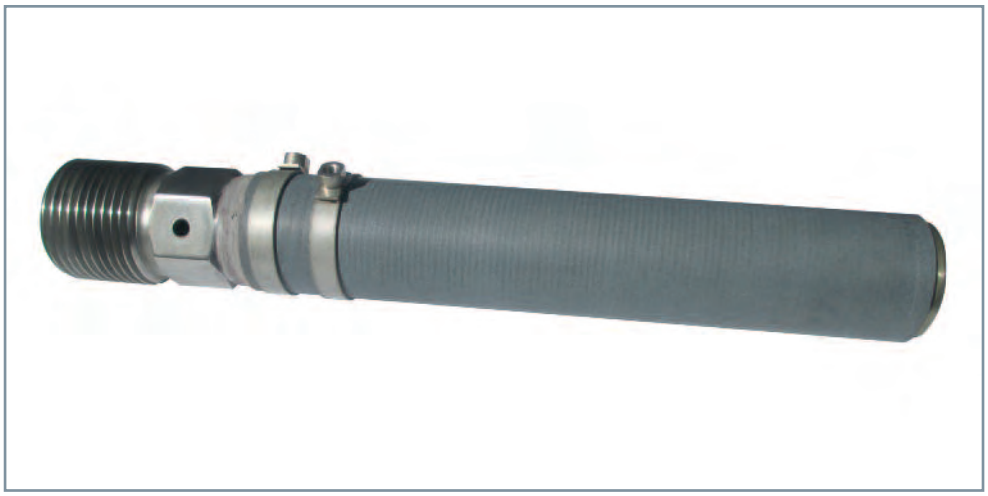
A highly energy-efficient coating first offered as a replacement for conventional heater bands on injection barrels is now proving to have important advantages on injection nozzles as well—and on melt pipes and adapters in extrusion.

Nordson XALOY's SmartHeat™ coating eliminates downtime for removing melt "blowback" from nozzles and maintains melt uniformity in melt pipes and adapters. As a result, it reduces downtime and helps enhance end-product quality, as shown by these results from successful installations:

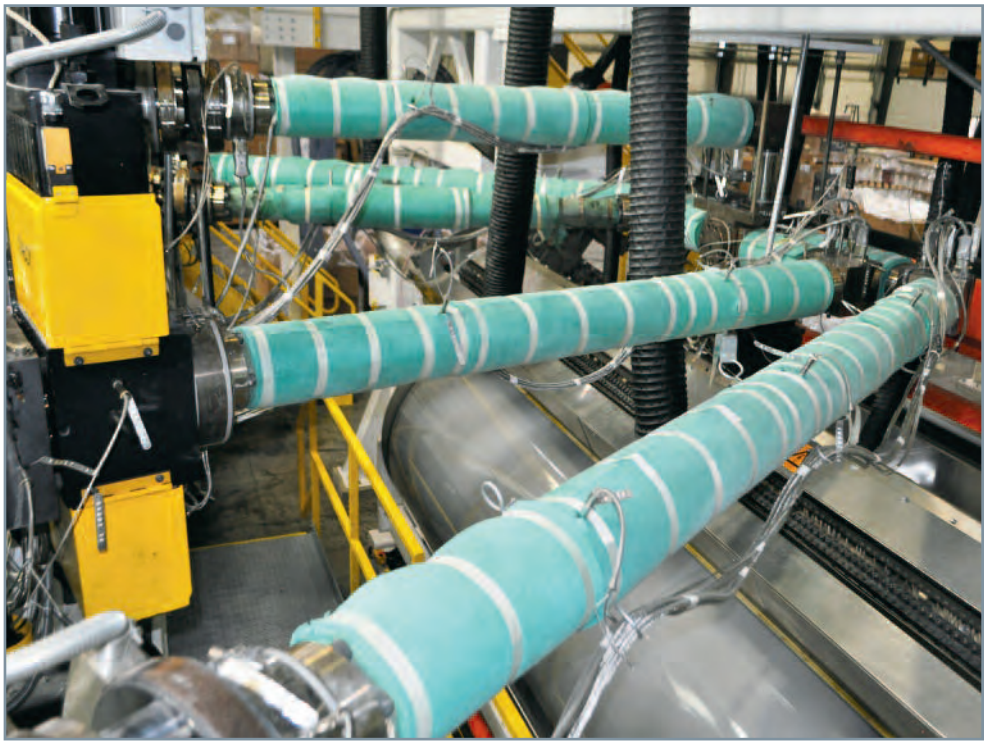
- ***Injection nozzles***. A SmartHeat coating can simplify maintenance and prevent downtime caused by blowback, the backward oozing of molten polymer (particularly when the seal is not tight) into the spaces between the heater bands and the nozzle. Available on new nozzles or as a retrofit, the coating is easily cleaned without need to stop production.
- ***Melt pipes or adapters.*** These components for transferring molten polymer from the extruder to downstream equipment can cover considerable distance, making it difficult to maintain melt uniformity. Replacing band heaters with a continuous SmartHeat coating ensures a consistent temperature over extended lengths.

For melt pipes installed at Paragon Films, Inc., Broken Arrow, Oklahoma, the company chose the SmartHeat coating mainly to ensure uniform temperature control throughout the pipes, according to Gary Greenfield, director of engineering. "Anyone utilizing band heaters knows the issues you can have with inconsistent heat transfer and the problems encountered when heater bands go bad," says Mr. Greenfield. "We believe the SmartHeat coating will eliminate these problems, not only providing a more reliable solution than band heaters but helping to reduce energy use as well."

The SmartHeat coating consists of two layers of plasma-sprayed metallized ceramic with a nichrome wire wrap sandwiched in between, plus a thermal insulation cover. Because the heat from the wires is conducted throughout the ceramic material, it raises the temperature of a machine component to target levels more quickly than with band heaters, maintains it more uniformly, and uses less energy. The tightly strapped thermal insulation wrap over the ceramic coating virtually eliminates heat losses to the workplace, saving on air conditioning costs and reducing the risk of operator injury.



SIMPLER MAINTENANCE AND MORE UPTIME. Used instead of heater bands on injection molding nozzles (as on the one shown here), SmartHeat™ coating from Nordson Xaloy prevents downtime caused by removing of resin from molten polymer 'blowback.'



CONSISTENT TEMPERATURE OVER GREAT LENGTHS. SmartHeat™ coating from Nordson Xaloy enables extrusion melt pipes and adaptors to deliver more uniform melt than in systems with conventional heater bands. (Photo courtesy of Paragon Films, Inc.)

"The SmartHeat coating is 25 to 60% more energy-efficient than band heaters, and as a continuous coating it distributes heat more uniformly—a crucial advantage for any melt pipe or barrel," says David Hotchkiss, global product manager for Nordson XALOY. "Since the wiring is run underneath the thermal insulation, it eliminates the hazard of having numerous exposed wires connected to multiple heater bands."

More information about Paragon Films, Inc., Broken Arrow, Oklahoma, USA is available at www.paragon-films.com. ◆

Tuning Inserts Keep Coextrusion Lines Up and Running

It takes time to machine the layer profiling inserts required for fixed-geometry feedblocks used in flat-die coextrusion—time in which no saleable film or sheet can be produced. To eliminate this downtime, Nordson Extrusion Dies Industries has developed "tuning inserts" that are quickly adjusted on the extrusion line so that on-specification production can take place while permanent inserts are built. Once the tuning inserts have established the targeted layer profiles, another new device duplicates their settings for use in machining the permanent inserts.

Designed for the widely used Ultraflow® I feedblock from Nordson Extrusion Dies Industries, the tuning inserts not only increase machine uptime but also reduce material waste and yield greater precision in the ultimate thickness profiles of each layer across the width of the die.

A feedblock shapes molten polymers from two or more extruders into layers in a sandwich structure that is subsequently distributed to full end-product width inside a flat die. In the Ultraflow™ I feedblock, a specially machined flow insert yields a target cross-direction thickness profile for each layer, and any job change involving significantly different layer ratios or polymer flow properties makes it necessary to design and machine different inserts. The innovative tuning inserts enable processors to maintain production while being adjusted until the target profile is achieved and a matching permanent insert can be built.

"The new tuning inserts help processors to maximize run time and minimize waste during the week or more that is required to design and machine permanent inserts," says Sam G. Iuliano, chief technologist. "Because the tuning inserts can be fine-tuned 'on the fly,' it is possible to do several iterations, making small additional changes in very little time and refining the geometry with great precision before machining a permanent insert. This process eliminates the need to do several 're-cuts' of the permanent insert before arriving at the target layer profile."

Typically about 4 inches (10 cm) wide and machined from hardened stainless steel, a flow insert is specially designed to generate a corrective layer profile for a polymer with specific flow properties. The flow-adjusting component of the new tuning insert from Nordson Extrusion Dies Industries consists of multiple and adjustable segments, each of which can be adjusted to reduce or increase layer thickness. Once the target profile has been established, a measurement tool supplied by Nordson Extrusion Dies Industries replicates the screw positions so that it can be used for producing a precisely matching permanent insert.

Ultraflow I fixed-geometry feedblocks can be designed to accommodate a flow sequencing spool that makes it possible to change the sequence of material layers without having to block off channels or disassembling the feedblock. Nordson Extrusion Dies Industries also offers the Ultraflow V adjustable-geometry feedblock, which, instead of interchangeable inserts like those on the Ultraflow I, has built-in adjustable "combining planes" located where the melt streams join the central flow channel. ◆

SPEED AND PRECISION. In generalized schematic of new tuning insert for Ultraflow™ I feedblock from Nordson Extrusion Dies Industries, polymer flow for a five-layer structure is from right to left. Core layer polymer enters flow channel from far right. Next layer enters from ports at top and bottom, and its thickness profile is determined by bronze-colored flow-adjusting components. Entry of skin layer follows, again profiled by flow adjusters. Each adjuster is made up of multiple and adjustable segments.

Nordson at Chinaplas *continued from P. 1.*

- ***Nordson BKG.*** At Booth W2 J01: BKG™ pelletizer AHD 400. At Booth E1 F03: compact BKG™ pelletizer 75.
- ***Nordson Extrusion Dies Industries.*** At Booth W2 J01: Autoflex® VI-R H40 internally deckled Contour™ die for cast film (2,921 mm); Autoflex® VI-R H100 triple manifold die for biaxially oriented film (810 mm); Ultraflex® HRC100 sheet die and melt stream assembly, including screw, barrel, screen changer, gear pump, and static mixer (800 mm) from Nordson XALOY; Ultraflex® LH40 EPC die for extrusion coating; and Ultraflow® coextrusion feedblock for film or sheet.
- ***Nordson XALOY.*** At Booth W2 J01: 4 barrels and a twin barrel section; a complete screw and barrel set, including tipset; 7 screws for extrusion; 10 screws for injection molding; X8000™ screw coating; 5 screw mixer sections (Stratablend®, Nano™, Efficient™, and Fusion™; 8 front end components (end caps, shut-off nozzles, tipsets, mixer heads); SmartHeat™ coating for barrels, nozzles, and melt pipes; 3 screen changers; 5 melt pumps; a static mixer; 2 rolls; and a complete melt stream system.

Information on Nordson's polymer processing products and capabilities is available at www.nordsonpolymerprocessing.com. ◆

PET Pelletizing System Saves Cost by Making Double Use of Melt Heat

Why take away the heat from pelletizing PET when heat is just what's needed in the crystallizing step to follow? Nordson BKG has addressed the question by developing an integrated system that uses the thermal energy of molten polymer in pelletizing for crystallization as well. The CrystallCut® pelletizing system, a patented process, not only reduces energy costs for compounding or recycling but also eliminates problems caused by the agglomeration of amorphous material.

As an integrated network that incorporates underwater pelletizing, drying, and crystallizing, the CrystallCut system avoids the need to cool PET after pelletizing, then reheat it for crystallization. It is designed for precise control of material temperatures throughout the process, preventing production and quality problems caused by insufficient crystallization and excess levels of amorphous material. The energy efficiency of the CrystallCut system can save more than €3,000,000 in annual energy costs for a typical PET resin plant and nearly € 200,000 for an extrusion line recycling PET bottle flakes, according to calculations based on actual commercial installations (see graph for an example relating to polymerization).

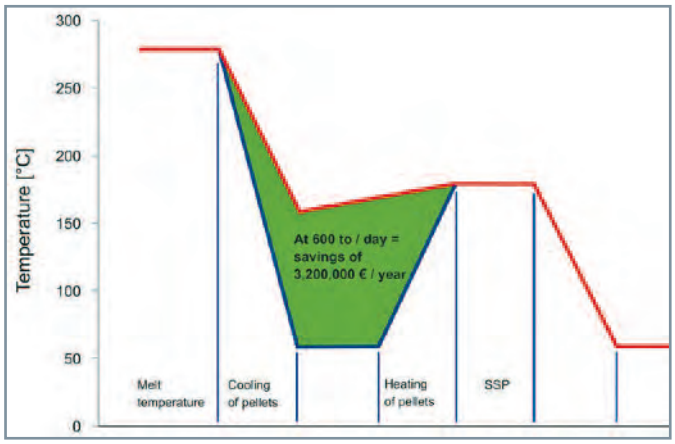
"The CrystallCut system provides substantial relief to the cost pressure on PET polymerization and recycling, particularly as prices for PET fall," says Ralf Simon, managing director of Nordson BKG™. "In addition, because the system utilizes residual thermal energy within the material to crystallize pellets from the inside out, it yields an enhanced crystalline structure that results in lower energy costs for re-melting the material."

In the CrystallCut system, the hot PET granulate produced by the face cutter of the underwater pelletizer is transported rapidly to the pellet dryer in hot water (up to 95 °C) through closed conveying pipes, where pellet cooling and solidifying takes place. This conveying medium and the short distance between die head and dryer are keys to conserving the heat from melt processing. The pellets are at a temperature in the 150 to 160 °C range when they exit the dryer onto a vibrating conveyor. This keeps the pellets in constant motion, generates a uniform distribution of thermal energy, and prevents pellets from sticking together. At the completion of the process, the pellets have a temperature of approximately 180 °C, have achieved up to 40% crystallinity, and may be transferred directly to solid state polycondensation (SSP).

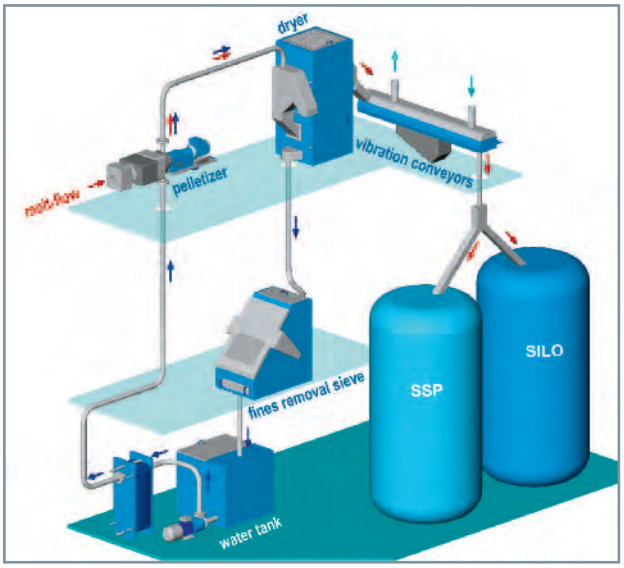
In addition to saving energy costs and preventing amorphous PET clumping, the CrystallCut system yields an almost dust-free product and increases bulk density by 8% in comparison with a conventional process.

Big Savings in Energy Costs with CrystallCut® System

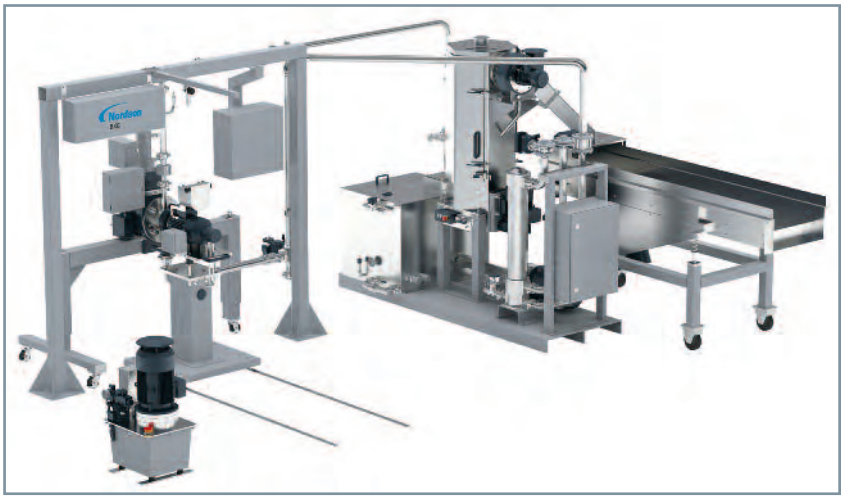
Assuming an average energy cost of 12 cents/kWh, Nordson BKG estimates that the CrystallCut system yields energy savings of up to 125 kWh or €15 per ton of PET in a modern PET polymerization plant. Since such a plant can achieve a production capacity of 600 tons per day, these savings amount to *Continued on P. 5.*



ENERGY SAVINGS IN A PET RESIN PLANT. At an energy cost of 12 cents/kWh, the CrystallCut® system from BKG saves up to 125 kWh or € 15 per ton of PET in a modern PET polymerization plant. With production at 600 tons per day, these savings amount to € 9,000 daily and € 3,200,000 per year—an annual energy saving of more than 26 gigawatt hours.



ENERGY-SAVING CRYSTALLCUT® SYSTEM FOR PET, developed by Nordson BKG, re-uses heat from underwater pelletizing to crystallize the polymer. The system delivers finished resin directly to storage or to solid state polycondensation (SSP).



CRYSTALLCUT® SYSTEM rapidly transfers hot PET granulate in hot water from the face cutter of the underwater pelletizer to the pellet dryer through closed conveying pipes, where pellet cooling and solidifying takes place. This conveying medium and the short distance between die head and dryer are keys to conserving the heat from melt processing. The pellets exit the dryer onto a vibrating conveyor, which keeps the pellets in constant motion, generates a uniform distribution of thermal energy, and prevents pellets from sticking together.

A Closer Look *continued from P. 6.*

increasingly frequent with changes in material formulation and the appearance of new, more challenging compounds. Typical glass-reinforced formulations used to run in the 15 to 20% glass loading range, but now levels of 50 and 60% are not uncommon. In high-volume applications like automotive under-hood components, compounds heavily filled with glass and minerals are now widely used. Yet another recent challenge results from market demand for halogen-free flame retardant (HFFR) compounds, which are heavily filled. Nordson XALOY is a leader in dealing with issues of wear and corrosion, offering diverse options in alloys, claddings, coatings, and linings. In a system designed to address the challenge posed by HFFR compounds, for example, our company offers a complete wear-resistance system, including a fused nickel-tungsten carbide coating for screw root surfaces, carbide hard facing on screw flight ODs, tungsten carbide bimetallic barrel lining, and a combination of wear resistant materials for screw tip sets.

5. ***Adjusting plasticizing capacity to improve melt quality.*** The rule of thumb for shot utilization as a percentage of maximum shot capacity is that utilizing between 25 and 75% delivers acceptable melt quality as exhibited in shot to shot repeatability and proper dispersive and distributing mixing. As jobs change and plasticizing capacity becomes either too little or too great in proportion to required shot size, Nordson XALOY addresses the issue through upsizing or downsizing the injection unit, whenever possible by keeping the overall external dimensions of the unit the same. While smaller or larger screws and check valves can be employed, barrel IDs can be modified to accommodate them.

ONE WAY TO REDUCE CYCLE TIME is to replace a standard screw with a barrier screw such as Nordson Xaloy's Efficient™ screw. Introducing an auxiliary flight that splits the solid channel from the newly formed melt channel helps o deliver a better quality melt at a faster rate.

In addressing these and other challenges, Nordson XALOY draws on a worldwide network of manufacturing and assembly sites—Pennsylvania, Ohio, Virginia, and North Carolina in the U.S.; Germany and Austria in Europe; and Thailand in Asia. In addition, with the acquisition of Xaloy Incorporated by Nordson Corporation in 2012, our company became part of a worldwide group focusing on melt stream technologies, further expanding our capabilities as a resource for processors. For example, customers can now send their materials for rheological testing to our affiliates Nordson KREYENBORG and Nordson EXTRUSION DIES INDUSTRIES, both of which maintain laboratories in Europe and Asia, as well as the U.S.

During the past ten years, Xaloy Incorporated acquired several related component businesses and then was itself acquired by Nordson. At the same time, a new generation of molding process engineers and purchasing managers has emerged. Many in the injection molding community may now be unaware that Nordson XALOY can work with them to help solve problems and enhance production. Drawing on decades of experience in injection molding, extensive technical resources, and the manufacturing capabilities and global reach of the Nordson organization, Nordson XALOY is better prepared than ever to serve as a valuable partner for injection molders looking to enhance their molding process. ◆

PET Pelletizing *continued from P. 4.*

€9,000 daily and €3,200,000 per year. This represents an annual energy saving of more than 26 gigawatt hours, or 26,000 megawatt hours.

Another example is that of an extrusion line which recycles PET bottle flakes at a rate of 1,500 kg/h. The savings achievable with the CrystallCut system exceed 180 kWh, or more than 1.4 cents/kg. In a 365/24 operation this equates to €190,000 per year.

Nordson BKG has been awarded U.S. Patent No. 8,324,339 B2 for the process used in the CrystallCut system. ◆

Single Cart *continued from P. 1.*

and facilitate access for changing screens, Nordson Kreyenborg has in effect turned the gear pump onto its side so that its drive can be mounted below the pump.

"Our use of a common cart for gear pump and screen changer simplifies deployment of these components in the extrusion line and permits faster and easier maintenance," says Markus Walbersmann, research and applications engineer. "The gear pump in this system incorporates the same features as our traditionally configured equipment, including a cooling system that enhances the effectiveness of the thread shaft seal, which is particularly important for low-viscosity materials."

The rate of coolant flow is adjustable, and the coolant may be either air or de-mineralized water. Customers are asked to specify the coolant in advance so that Nordson Kreyenborg can design the gear pump for optimal performance. If the material to be processed is shear-sensitive, Nordson Kreyenborg recommends its Type 03 gear pump to minimize residence time. ◆

A Closer Look at Your Injection Unit Could Enhance Your Molding Process

by Mark Colella, *Director of Engineering, Nordson XALOY*

Often overlooked as keys to meeting injection molding challenges are the basic components in the injection unit—screws, barrels, valves, and nozzles. A closer look at this equipment could point the way for molders looking to solve processing problems, boost output, or enhance product quality. Variables that can help or hinder efforts to achieve these goals include component size, design, metallic makeup, coatings, degree of corrosion or wear, and presence of degraded resin.

While Nordson XALOY regularly works with injection molders to help solve problems or improve production, others are unaware that our company can be such a resource. We draw on decades of experience in designing components for injection molding systems and addressing processing issues.

Founded in 1929, our company has pioneered many of the molding industry's workhorse screws, barrels, coatings, and front end components, and today Nordson XALOY manufactures in the U.S., Europe, and Asia. Our database of screw designs for injection applications goes back 35 years, and our library of rheological data on resins includes thousands of entries. At our two rheology laboratories, customers can have materials characterized at no charge by sending us tiny samples. Our two processing laboratories enable us to test out component designs on commercial molding equipment.

When customers come to Nordson XALOY for help in addressing challenges, we start by trying to get a complete understanding of their current process—cycle time, shot weight, screw design, screw rpm, barrel temperature, backpressure, scrap rate, and other factors. Among the many injection molding challenges for which customers come to Nordson XALOY for support, five are particularly common:

1. ***Reducing screw recovery time.*** One way to reduce overall cycle time is to increase the plasticizing rate so that a shot is ready for injection by the time the previous part has cooled. Often the plasticizing step is carried out inefficiently as a result of wear to the screw and barrel, and the solution is to replace them with new components. Alternatively, if the current screw is a general-purpose (GP) type, it can be replaced by a higher-performance screw, such as a barrier design, which delivers a better-quality melt at a faster rate than a GP screw. In cases where the current screw is found to be inappropriate for the material it is now being asked to process, a different screw design can increase output.
2. ***Addressing the problem of resin degradation.*** There are many causes of resin degradation in the injection unit. One is wear at the interface between the OD of the screw flights and the barrel ID, making replacement or refurbishment necessary. Resin can also degrade when the residence time in the injection unit is too long, such as when the unit is too large in proportion to the size of the parts being molded; in this case, the unit can be downsized. A screw design that is inappropriate for the resin being processed can create too much shear, resulting in resin "burning." Still another possible cause of resin degradation is material sticking to the root of the screw.
3. ***Improving additive or color mixing performance.*** In view of the fact that a GP screw has little if any mixing capability, Nordson XALOY supplies a range of proprietary mixing screw designs. Mixing is particularly challenging in fast-cycling systems such as those in the high-volume packaging industry. The importance of efficient mixing also arises when molders seek to save on raw material costs by minimizing addition levels of masterbatch. Glass-reinforced and other highly filled compounds also pose a challenge to effective mixing, as in maximizing fiber length retention and filler distribution for improved integrity and part strength.
4. ***Improving component wear performance.*** Wear problems have become *Continued on P. 5.*

INSPECTION OF NEW COMPONENTS is the final stage in Nordson XALOY's process for the design, engineering, and production of precision screws and barrels. Nordson XALOY draws on huge databases of screw designs and resin rheologies and operates two rheological laboratories for customers.

NORDSON ON THE WEB
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For information on specific Nordson Polymer Processing Systems products, readers are invited to visit www.nordson.com. At the home page, click on "Polymer Processing" for information on Nordson Kreyenborg, Nordson BKG, Nordson Extrusion Dies Industries, and Nordson XALOY.

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