BKG® Systems Support PET ‘Bottle-2-Fiber’ Recycling

The growing trend toward recycling PET bottles into fiber has benefitted from BKG® pelleting and melt filtration systems from Nordson. In recycling operations around the world, the BKG systems have extended the working life of pelletizer die plates and screen-changer filter screens compared with older machines and reduced purging losses by nearly one-half. In addition, they have contributed to extending the working lives of spin packs, thus reducing downtime.

Many recycling companies have switched from “bottle-2-film” recycling to “bottle-2-fiber” processes because of automotive demand for PET fiber for applications such as carpeting, interior trim, headliners, and safety belts, notes Oliver Brandt, BKG market development manager. In global markets like the U.S., this changeover has also been driven by OEM specifications switching from polypropylene to PET.

“In fiber extrusion, the polymer is spun and then stretched to form the finished product, says Brandt. “It is necessary to minimize the

Customers Use Worldwide Nordson Labs to Run Trials and Explore Technologies While Their Plants Stay Fully Productive

Nordson has invested heavily in laboratories on three continents to enable current and prospective customers to investigate new processes, run equipment trials, develop new applications, and train workers—all while keeping their own production lines up and running.

New laboratories in support of Nordson Polymer Processing Systems (PPS) products are now operating in Europe at Münster, Germany; in the USA at Chippewa Falls, Wisconsin and Hickory, North Carolina; and in Asia at Shanghai, China and Chonburi, Thailand. A sixth laboratory is in preparation at Austintown, Ohio. These six sites also serve as regional manufacturing hubs for PPS brands, including BKG® pelletizers and melt delivery components; EDI® polymer extrusion dies and Premier™ fluid coating dies; and Xaloy® screws, barrels, and front end components.

Each laboratory is extensively equipped with primary processing machinery, tooling, melt delivery components like gear pumps and screen changers, and ancillary equipment, along with facilities for raw material analysis and characterization. A dedicated staff provides engineering and process know-how acquired through decades of experience in the marketplace. Depending on the laboratory, potential users include extrusion and molding processors, resin companies, compounders, and recyclers.

“Because Nordson supplies numerous equipment systems that play critical roles in melt processing, our technical experts take a systems approach, examining the whole process and the many factors that contribute to a successful lab project,” says John J. Keane, Nordson Corp. executive vice president. “This enables them to make customized recommendations, identifying the equipment that best meets the customer’s cost-performance requirements.”

Four Fully Equipped BKG® Labs
In Europe, USA, and Asia

BKG pelletizers are used worldwide in resin production, compounding, and recycling, while BKG gear pumps and screen changers are applied in these processes and in all types of polymer extrusion. Laboratories supporting BKG customers are located in Münster, Hickory, Shanghai, and Chonburi. The Münster lab is part of an extensive new sales and manufacturing facility that serves as the global headquarter for all BKG products. The BKG labs at the three other locations are all new, and like the Münster lab are equipped with twin screw extruders, pelletizers, melt delivery components, and related equipment installed within the past year.

The combined experience of the full-time staff at the Münster laboratory totals 96 years, notes Ralf Simon, managing director of Nordson BKG GmbH. “Our laboratory provides a full-scale production environment,” Mr. Simon says. “We also have an extensive data storage system, making possible detailed final

Inside...

- Many BKG® filtration options for recyclers
- EDI® Die Boosts BOPP Output by 25%
- Xaloy® Screw Ends Screw-Recovery Problems
- Leading PET Maker Uses BKG® Pelletizers
- Shrink Film Tolerances Improved by 30%
- EDI® Die Helps First-Time Sheet Processor
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reports, including process and equipment recommendations.

“While competitors that do have labs equip them with some basic devices, ours includes a full range of underwater and water ring pelletizers, melt pumps, and screen changers. In addition to all of our manual and continuous screen changers, for example, customers can run trials on an altogether new type of melt filtration system, our HiCon R-Type.”

Similarly, all types of pelletizing applications can be trialed at the BKG lab, including high-temperature polymers, low-viscosity materials like hot melts, and specialties such as micropellets impregnated with blowing agent for EPS. In addition, the lab can demonstrate Nordson’s proprietary patented process, called CrystallCut®, which substantially reduces energy consumption in PET pelletizing by using the thermal energy of the molten polymer for subsequent crystallization.

Like the laboratory in Münster, the new BKG lab in Hickory includes both underwater and water ring pelletizing systems.

BKG laboratories also includes jet cleaners, which reduce the time between trial runs by rapidly cleaning parts such as breaker plates.

**Die System Labs for Polymer Extrusion and Fluid Coating**

Enhanced laboratory capabilities are part of an ongoing project to build a new global headquarters in Chippewa Falls for EDI® polymer extrusion dies and Premier™ fluid coating dies. Due for completion in 2020, the facility will relocate all sales, engineering, production, and laboratory operations currently at three other sites in Chippewa Falls. The project will add new, advanced equipment and completely integrate people and resources previously deployed in separate locations. The resulting enhancement of collaboration and synergy will benefit users of the EDI and Premier laboratories.

Also new is a laboratory line for fluid coating at Nordson’s Shanghai facility, designed to support fast-growing Asian markets for applications such as batteries and optical displays.

“While not all die manufacturers host a laboratory, our Technology Center at Chippewa Falls has operated laboratories for customers from around the world for many years, providing complete production and converting lines for cast film and sheet, extrusion coating and laminating, and slot die coating,” says Scott Smith, business unit director. “In addition, we have used the Center to fulfill multiple U.S. government contracts for development of barrier packaging for the military and components for lithium-ion batteries.”

Some key capabilities of the Technical Center are:

- **Multi-process extrusion line for cast film, sheet, coating, or lamination**, equipped for single- or multi-layer production and including web-converting equipment.
- **Six-extruder pilot line** for multi-layer sheet.
- **Multi-layer fluid coating line**, including various fluid-delivery systems and equipment for laminating, UV-curing, adhesive melting, and drying.
- **Numerous tooling options**. For polymer processing these include extrusion dies, coextrusion feedblocks, and layer multiplier tooling for micro layer production. Fluid coating tooling includes Premier fixed lip slot dies and Ultracoat™ flexible lip slot dies.
- **Rheological analysis** to determine the optimum processing parameters for a customer’s application and the system design that will provide them.

The heart of the new Shanghai fluid coating lab is a Premier™ slot die system, die positioner, and fluid delivery equipment, along with web-handling and UV-curing systems. In addition, the Shanghai lab operates a machine for measuring flatness—a critical property of fluid coating dies.

**New Laboratory to Support Xaloy® Plasticating Systems**

The newly built Americas hub in Austintown for manufacturing Xaloy screws, barrels, and front-end components will include a Technology Center that combines laboratory capabilities relocated from New Castle, Pennsylvania, along with new, advanced equipment for process optimization.

“Our laboratory staff consists of expert engineers who draw on nine decades of experience in plastics processing technology,” says Steve Purcell, vice president, Americas. “We will be fully equipped to test our customers’ extrusion and injection molding applications under real-world conditions.”

Some Xaloy laboratory capabilities will be:

- **Primary process equipment**, including various sizes of extruders and an injection molding line that can be outfitted to demonstrate Nordson’s Twinshot® technology. The Twinshot single screw, single barrel equipment package provides the cost savings and versatility of two-component molding while requiring substantially less investment than coinjection systems that use separate injection units.

- **Ancillary equipment**, including BKG screen changers and melt pumps, sheet die, roll stack, winder, blender, feeder, chiller, and dryer.

Nordson laboratories are available on a rental basis and are open to existing and prospective customers. Companies can use these facilities to test new technologies in the strictest confidence. Nordson will sign nondisclosure agreements when required.
drop in intrinsic viscosity (IV) that normally occurs in recycling, since a reduction in IV correlates with loss of tensile properties.”

BKG underwater pelletizers are widely used for pelletizing post-consumer PET flakes. Because the melt residence time in the pelletizers is very short, the IV drop is almost completely avoided. Another advantage of the BKG pelletizers is their flexibility, because different die plates can be used depending on the IV level. Combined with suitable materials for die plate and cutters, this flexibility results in a long working life for the cutting system.

Upstream of the pelletizer, in melt filtration, the filter design and flow channel geometry are critical for minimizing IV drop, as well as temperature control. To meet these requirements, the BKG HiCon™ V-Type 3G screen changer is designed to be free of “dead” zones and to provide constant shear and flow rates. It makes possible a longer filter life and easy handling during production and filter change.

The new FlexDisc™ filtration device, for use with the HiCon V-Type 3G and Nordson’s other piston-activated screen changers, provides a larger filtration area than standard screen packs, achieving finer filtration, higher throughputs, and longer filter service life. Due to the larger filtration area, it might be possible to use a smaller screen changer.

The FlexDisc also contributes to reduced “backflush” volume. Backflushing is a self-cleaning feature of many BKG screen changers. It is a hydraulically powered process which automatically removes contaminant while maintaining throughput and keeping flow and pressure constant.

“The high production volumes in the fiber market place a premium on melt filtration systems with maximum efficiency and minimum material loss,” says Brandt. “Nordson has achieved these goals through the enhanced flow properties of our screen changers and the increased capacity of our filtration devices.”

**EDI® Die Helps Automotive Supplier Take Sheet Extrusion In-House**

A manufacturer which for more than 35 years has helped owners of classic cars restore their vehicle’s interior to as-new condition is making its first venture in extrusion processing, with support from Nordson’s EDI® team.

Since its founding in 1983 by owner Martin Beckenbach, Legendary Auto Interiors Ltd. has produced hundreds of thousands of soft trim components designed for retrofitting hundreds of vintage models, including many American “muscle cars” from the 1960s through the 1990s. Ranging from door panels and sun visors to upholstery and carpets, many of these components are cut, sewn, and thermoformed in-house at Legendary’s Newark, NY headquarters. For years the company relied on outside vendors to supply flexible PVC sheet for its floor mat lines, but now it has purchased its first extrusion line, including a sheet die from Nordson.

“We have had thirty-plus years of experience in cutting, sewing, and thermoforming, but none in sheet extrusion until now,” says Mr. Beckenbach. “The Nordson team played a critical role in helping us get up to speed and manufacture vinyl sheet that perfectly meets our requirements.”

While the extrusion line is refurbished, the EDI Ultraflex™ sheet die is new and is equipped with a restrictor bar to enhance control of sheet uniformity. Nordson dispatched an EDI team to provide start-up service, including hands-on training for how to operate the die, make adjustments, perform maintenance, and ensure operator safety.

**Everything There Is to Know About Screws and Barrels**

A wide-ranging new resource for extrusion and injection molding processors covers all aspects of plasticating systems, with explanations of every type of screw, barrel, and front end component, including details on related Xaloy® products from Nordson Corporation.


Visit These Nordson Stands at K 2019

- **BKG®**: Hall 9, Stand A44/48
- **EDI®**: Hall 1, Stand E91
- **Xaloy®**: Hall 11, Stand A26
**EDI® Die Enables Shrink Sleeve Maker To Improve Tolerances by 30%**

When an automatic die used by Innovia Shrinkfilms GmbH for making shrink sleeve film yielded product that was often out of tolerance, the company switched to an EDI® Autoflex™ VI-RE die from Nordson Corporation that improved tolerances by 30% and reduced start-up times.

Innovia is a specialty film manufacturer and a division of CCL Industries Inc., the world’s largest producer of labels. To supply the fast-growing shrink sleeve segment of the label market, Innovia produces transparent film that is subsequently printed on the inside surface, slipped over a container, and made to conform to the container surface by means of heat shrinking. On the cast film line in which the EDI die has been installed, Innovia processes a polystyrene blend into monoaxially-oriented film.

The new die replaces one from another supplier. Like the previous die, the Autoflex die is an automatic one, using data from a computerized downstream gauging system to adjust the transverse thickness profile by making changes to the flexible upper lip of the die.

“In comparison with our previous die, the EDI Autoflex die from Nordson produces more uniform film with 30% better tolerances,” says Giuseppe Ronzoni, Innovia plant manager. “The automatic control of the flexible lip is faster and more accurate and start-ups are faster than before.”

The flexible lip of an Autoflex die is made up of thermally-actuated adjuster blocks that expand or contract to adjust the lip gap in areas of the film that are thicker or thinner than the target dimension. “The upper lip of the Autoflex die is more flexible in that the adjustments to the lip gap take place more rapidly,” says Patrick Meinen, polymer dies product manager for Nordson.

Another critical factor for ensuring product quality is the length of the lip land—the lip surface just before the die exit. “The lip land can be made longer or shorter to optimize product thickness, flatness, and surface finish,” says Meinen. “Besides having a stiff upper lip, the older die had a lip land that was too short. In our Autoflex die, we optimized the lip land to control the product profile and manage die pressure.”

At start-ups, the rapid gauge profile adjustment provided by the Autoflex system reduces the time before saleable product is produced. Also helping to shorten start-ups is the design of the flow channel, or manifold, inside the die.

“The greater uniformity of the film produced with the EDI die reduces the potential for gauge bands on the product roll,” says Mr. Ronzoni. “This leads to less stretching of the final product and better printing results.”

Innovia Shrinkfilms GmbH is in Schkopau, Germany. info@innoviafilms.de.

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**Screw-Recovery Problems Call for Special Screw Design**

In injection molding, the penalty for using a general-purpose screw in an application that has special requirements often takes the form of longer cycle times. This is particularly the case in packaging and other applications where high outputs or thin-wall parts are essential. For one Nordson Corporation customer producing large thin-wall parts, making the switch from a standard screw to an Xaloy® screw custom-designed by Nordson has resolved a cycle-time issue, increasing their productivity and profitability.

In one of its North American plants, this customer was using a general-purpose screw to process 100% recycled HDPE on a 1,000-ton Ube machine. Shot size was 3750 g. Their problem was a screw recovery phase that was too long. It was an issue that is all too common in the world of injection molding, often involving processing of virgin or recycled PP or HDPE.

Recovery time is the amount of time it takes for the screw to rotate back into its set position. It takes place during the cooling phase. A common rule of thumb is that recovery time should be 1 or 2 seconds less than the set cooling time. If recovery time exceeds this cooling time, the overall machine cycle increases.

Nordson custom designs screws to help with recovery issues. The Xaloy® MeltPro™ barrier screw melts more efficiently than a

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Switch to EDI® Film Die Reduced Gauge Variation and Increased Output by 25%

Asia Poly Films Industries, a versatile producer of biaxially oriented polypropylene (BOPP) films for packaging, has substantially reduced downtime and increased throughput on a lamination-grade film line by switching from a relatively new competing supplier’s die to a brand-new EDI® Autoflex™ die from Nordson Corporation.

Since it began producing BOPP film at Morbi, Gujarat, India, in 2017, Asia Poly Films frequently encountered gauge bands and film sagging with the previous die, making it impossible to achieve the degree of flatness required by customers. It was necessary to clean the die every two or three months—a process that meant 48 to 60 hours of production downtime for each cleaning. The die also exhibited gauge variation that could be held within acceptable limits only if the line speed were limited to no more than 2,800 kg/hr.

Since installing the EDI die in February 2019, Asia Poly Films has been running the film line continuously at 3,500 kg/hr with gauge variation maintained “well within acceptable levels,” according to Dipesh Patel, director. “In addition, while our old die needed about two hours after line start-up to stabilize and start producing film with an acceptable level of gauge variation, the new EDI die stabilizes within only 15 or 20 minutes.”

Using the new EDI die with the same extruder, controls, and polymer recipe as in the past, Asia Poly Films has produced film with lower haze and better gloss, Mr. Patel says.

The EDI die is an Autoflex VI-R triple-manifold unit. Like the die previously used by Asia Poly Films, the Autoflex die is an automatic one, using data from a computerized downstream gauging system to adjust the transverse thickness profile by making changes to the flexible upper lip of the die.

“The Autoflex system responds more rapidly to gauge variations than other automatic dies,” says Mrunal Sanghvi, general sales manager in India for Nordson’s Polymer Processing Systems business. “In addition, Nordson custom-designed the flow channel, or manifold, inside the die to optimize the flow of the specific polymers used by Asia Poly Films. These are two reasons why the EDI die has enabled Asia Poly Films to achieve saleable product in a shorter time after start-up, hold to tighter tolerances during the production run, and increase throughput while maintaining product uniformity and quality.”


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EDI® DIE INCREASED BOPP FILM OUTPUT BY 25% for Asia Poly Films Industries, based in India. The Autoflex™ automatic die also reduced gauge variation.

SAMPLE FILM PRODUCTS from Asia Poly Films
the pressure differential—up to 200 bar—encountered during filtration. One such failure is "screen dimpling," in which the mechanical stress forces screen layers into the holes of the breaker plate that supports the screen in the cavity. This distorts the screen, breaking the peripheral seal and causing contaminants to bypass the screen and become part of the end product.

Nordson precisely tailors the size of the screen pack to the dimensions of the cavity, eliminating the common problem of contaminant passing the screen pack at the edges. Nordson can supply the Nordson screen packs with various combinations of coarse- and fine-weave layers. The Nordson screen pack provides the optimum ratio of solid material and free volume, so that the polymer melt can use as many flow paths as possible to make its way through the filtration medium. This minimizes melt build-up and significant increases in pressure, which can lead to premature and costly screen changes and endangers the quality of the end product.

For bottle-to-bottle PET recycling, PET fiber production and battery separator film production, Nordson has developed the BKG FlexDisc™ for use in HiCon V-Type 3G, HiCon K-SWE-4K-75/RS and D-SWE screen changers. Each cavity contains a filter stack comprised of two to four FlexDiscs, depending on machine size. Each FlexDisc is equipped with two Nordson screen packs. As a result, there is two to 4.5 times more filtration area available for each cavity with the new FlexDisc than with conventional standard round screens, and 25% additional area (on average) when compared to the former FlexDisc version. Recyclers achieve finer filtration, higher throughputs, longer filter service life, and reduced specific backflush volume, all without need for a larger screen changer.
**Online Savings Calculators Compute ROI from Nordson Products**

A new capability on the Nordson Polymer Processing Systems (PPS) website enables prospective users of BKG®, EDI®, and Xaloy® components to calculate the savings that they make possible versus alternate equipment and the time before the PPS equipment pays for itself. Often the payback on investment calculated by these online tools can be shown to take only a matter of months.


Currently calculators are available for BKG BlueFlow™ gear pumps, BKG screen changers, EDI SmartGap™ sheet dies, EDI Premier™ fluid coating dies, and Xaloy® injection molding screws.

The Savings Calculator for the BlueFlow gear pump, for example, calculates resin cost savings and investment payback time on the basis of resin price, output rate, pressure variation with and without the gear pump, and capital investment. These inputs can be made by the site visitor in either pounds or kilograms and in many of the world’s currencies.

Users of the SmartGap Savings Calculator enter two types of information: 1) the one-time costs of equipment investment for a standard sheet die with removable lower lip and for a new SmartGap system; and 2) process data including die length, output rate, number of die gap and die lip changes, number of working days, raw material cost, approximate product selling price, and burden cost of sheet line per hour.

Using these inputs, the SmartGap online tool calculates the daily output values of the two systems, including downtime, missed production output, downtime cost, missed product gross profit, and total downtime cost; compares the time required for changing die lips versus that needed for changing the die gap in the SmartGap system; and estimates how long it would take for a complete return on an investment in the SmartGap system.

**Prospective Customers Can Compute Payback from Investment in Nordson Products**

Prospective customers can compute payback from investment in Nordson products by using online “Savings Calculators” like this one for gear pumps. Other calculators for Nordson products are available.
Nordson Corporation has developed a broad range of BKG® melt filtration systems for plastics recycling. BKG screen changers include continuous types, which permit processing to continue through one or more filter screens while others are being changed; and discontinuous types, with which production must stop during changes. Many hydraulic piston-actuated screen changers are available, as well as manual systems.

Many BKG screen changers have a self-cleaning feature based on a hydraulically powered process called “backflushing,” which automatically removes contaminants while maintaining throughput and keeping flow and pressure constant. As an example, consider the HiCon™ V-Type 3G screen changer, which has four screen cavities. Melt flow from the extruder is split at the entry side and guided to the four cavities, two of which are located on each piston. Each pair of cavities is positioned so that they can filter their respective melt streams, until the piston removes one of the cavities from the process to remove contaminant buildup by means of backflushing.

The backflushing sequence starts automatically when the pressure differential caused by contaminant build-up increases to a pre-set level. For each cavity, a displacement piston retracts, creating a reservoir of filtered molten polymer. This material is hydraulically compressed and discharged in reverse direction, back through the screen, carrying away contaminant for removal from the system. The sequence is performed for each cavity one after the other. In normal operation, polymer is flowing through all four cavities. While one of the cavities is changed, the other three remain in the process.

A quite different method for automatically removing contaminant is that of the HiCon™ R-Type filtration system for recycling highly contaminated plastics. This fundamentally new system uses a cylindrical “separating head” with knives arranged on its surface in a helical pattern designed to move contaminant particles forward as the head rotates. Enclosing the head is a stationary filter element called a “strainer tube.” When contaminated melt from an entry port flows into the cylindrical space between the rotating head and the strainer tube, the knives capture the contaminant while the contaminant-free melt moves through the strainer into flow channels that lead to an exit port. At the same time, the rotating head turns a screw which guides the contaminated material through cooling sections and finally to where it is discharged into collecting bins.

The HiCon R-Type filtration system cleans much more efficiently than commercially available systems for highly contaminated polymers. The special design makes possible a uniform load on the strainer tube during the cleaning process, providing an extended lifetime for the filter and scrapers and increasing the overall efficiency of the system at far less melt loss.

For piston-actuated BKG systems, Nordson has developed different filter media that can be used with these systems.

The robust multi-layer structure of new BKG screen packs prevents failures caused by

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**NORDSON ON THE WEB**

For information on all Nordson Polymer Processing Systems brands, readers are invited to visit www.nordsonpolymerprocessing.com.

Nordson Corporation (Nasdaq: NDSN) engineers, manufactures and markets differentiated products and systems used for the precision dispensing and processing of adhesives, coatings, polymers and plastics, sealants, biomaterials and other materials and for fluid management, test and inspection, UV curing and plasma surface treatment, all supported by application expertise and direct global sales and service. Nordson serves a wide variety of consumer non-durable, durable and technology end markets including packaging, nonwovens, electronics, medical, appliances, energy, transportation, construction, and general product assembly and finishing. Founded in 1954 and headquartered in Westlake, Ohio, the company has operations and support offices in more than 35 countries. Visit Nordson on the web at www.nordson.com, www.twitter.com/Nordson_Corp or www.facebook.com/nordson.