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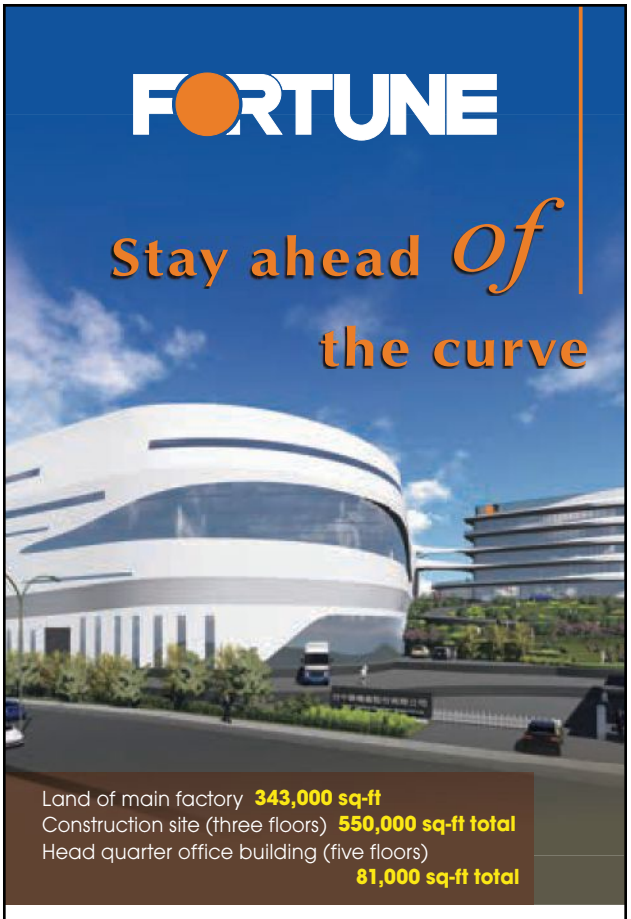
BLOG: Enter Your Molded Part in 'Hot Shots' Competition

Challenging parts have long been used as a calling card for injection molders, whether they're displayed in the company's lobby or brought to trade shows. *Plastics Technology* and its annual Molding Conference are now offering injection molders a higher-profile venue to show off those parts—and their own capabilities: the Hot Shots part competition. Using a "People's Choice" model, all attendees at Molding 2020 will be eligible to cast a ballot. One winner will be chosen for Technical Sophistication and one for Achievement in Molding Efficiency/Economics, as well as an overall winner. **Enter your part by Dec. 16 at:** ***moldingconference.com/parts-competition.html***



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Of Bans, Taxes … and Good Publicity

It's time for processors to be more involved in telling their story to the public.

I had an occasion recently to chat with Matt Seaholm, executive director of the American Progressive Bag Alliance (APBA), an association that represents the U.S. plastic bag manufacturing and recycling industries. The APBA (***bagalliance.org; bagtheban.com***) has been around since 2005 as a self-funded, special-purpose group within the Plastics Industry Association (PLASTICS), and as its website indicates, "proactively promotes product lines and leads numerous public policy initiatives that serve as the frontline defense against plastic bag bans and taxes nationwide."

Jim Callari
Editorial Director

As you can imagine, Matt has been busy lately, with state and local governments imposing or weighing bans or taxes of various shapes and sizes on retail bags, or what the industry calls t-shirt sacks. His task has become more frenetic as some states impose bag restrictions while municipal governments *within* these same states attempt to enact bans of their own—quite often, with different standards on bag thickness, recycled content, etc.

To be sure, Seaholm has the facts on his side. Banning bags, he points out, "will have no meaningful environmental impact." He elaborates, "Bags represent less than 1% of litter and 0.3% of the waste stream. What we are dealing with here are symbolic moves that often have unintended consequences: They make trips to the grocery store more expensive. They also threaten thousands of U.S. manufacturing jobs. The anti-bag sentiment is largely "emotional, driven by those who feel 'we have to do something.'"

Seaholm and the APBA also spend countless hours trying to refute the endless stream of misinformation churned out on a regular basis: "One local lawmaker recently put in the record that '12 million barrels of oil a year are used in the production of plastic bags.' The truth is, not a drop of oil goes into bag making. But this kind of misinformation spreads quickly from jurisdiction to jurisdiction. I have also heard lawmakers say that a very high percentage of bags are imported from Asia. Again, not so."

Of course, the problems the industry faces are not just about bags. Polystyrene foam has been a target for years, PET bottles/clamshells and plastic straws more recently. Suffice to say, if it's single-use packaging, expect it to be scrutinized by someone, somewhere, at some time.

I don't want this column to veer into a discussion of who "owns" this problem and is responsible for a solution: litterbugs, bag makers, supermarkets, resin companies, recyclers, MRFs? Let's just agree—for now at least—that the problem is complex, the solution will cost money and be multi-faceted, and no one in this supply chain (consumers included) can afford to say, "Not my problem."

To be sure, the solution will not happen overnight, but there are steps I think *all* plastics processors can take to shine a more positive—and accurate—light on our industry. For starters, be proud of what you do, and brag about it. Seaholm put it like this, "We need to do better at raising the level of awareness as to the contribution our industry makes to the economy. When the APBA and its members have brought elected officials into bagmaking plants, it's been a tremendous learning experience for them."

One of the things that has confounded and frustrated me throughout my editorial career in plastics is why you, the plastics processor, remain a bit gunshy about telling your story. Of course there are exceptions, but while we publish monthly plant-tour articles that we call On-Site (such as the one on p. 34 of this issue), we sometimes find while pursuing story ideas that processors aren't all comfortable about letting us into their plants. Perhaps they don't want their competitors knowing what they are doing. Maybe they are just plain bashful.

Whatever the reason, I think it's time to ban this way of thinking. Finally, a ban I can get behind. PT

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PET Blow Molding Tech Services for Small & Mid-Size Molders

Proplastic Solutions, Scottsdale, Ariz., a technical services provider for PET bottle makers, has launched a new program tailored to be affordable to small to mid-size stretch-blow molders using either two-stage or single-stage machines. Proplastic Solutions (***pro-plastic.com***) was started in 2012 by Harold Bailey, who has 20 years' experience in PET stretch-blow molding, to fill a niche in the market caused by "a serious lack of technical personnel," as he puts it. He now has 16 field-service engineers in nine locations. Up to now, they have served mainly large beverage-industry firms like Coca-Cola, Ocean Spray, Nestle Waters, Cargill, Niagara Bottling, Cott Beverages, Serac Inc., and Sonoco Plastics. His firm provides overhauls, maintenance, machine installations, startups, and technicians for day or night shift support to fill voids left by seasonal fluctuations, vacation absences and attrition. These services also cover palletizers, case packers and other product-handling equipment. Proplastic also offers help with project management, product development, process engineering, and training. The company recently installed an APF-3002 two-stage stretch-blow machine from PET Engineering of Austria, which is available for training. Says Bailey, "We are the largest third-party technical-support provider for PET blow molding, and one of very few companies in this field."

To expand its market to small and mid-sized molders, Proplastic will focus on companies within 60 miles of its technicians' nine locations. That will eliminate most travel expenses, which often deters smaller companies, Bailey notes. Proplastic will also lower charges for overtime and weekends, and add other payment options.

Wittmann Battenfeld Partners with Moldex 3D on LSR Injection Molding Simulation

Wittmann Battenfeld and CoreTech System Co. of Taiwan, provider of Moldex 3D injection molding simulation software, have agreed to collaborate on advancing the role of simulation in LSR injection molding. CoreTech has installed a Wittmann Battenfeld SmartPower 90 press with an LSR dosing system from Elmet. Goals of the joint effort include validating simulation predictions of LSR molding and exploring the possibility of incorporating LSR molding simulation in the machine's Unilog B8 controller. Wittmann Battenfeld is also working on integrating thermoplastic flow simulation with its machine controller, based on software from Simcon of Germany.

Arburg & Dieffenbacher Collaborate on Molding Thermoplastic Composites

Based on favorable results of a joint research project, Arburg and Dieffenbacher will cooperate in supplying systems for molding hybrid composite components. The companies were two of 14 partners participating in the MoPaHyb project (short for modular production plant for economical manufacturing of high-performance hybrid structures), funded by the German Federal Ministry of Education and Research (BMBF).

A production system incorporating an Arburg modular injection unit equipped for fiber direct compounding (FDC), a Dieffenbacher 3600-metric-ton vertical press, Dieffenbacher Fiberforge thermoplastic unidirectional tape-laying system, Kuka six-axis robot, Siemens controller, and other components was tested at Fraunhofer ICT. Test parts for the project were an automotive seat backrest and underbody segment.

Arburg's FDC technology feeds continuous fiber rovings into an injection barrel, allowing direct control of fiber length and concentration. A vertical press allows easy insertion of UD tapes or geometric reinforcements such as ribbed structures for local reinforcement.

Based on the results of the MoPaHyb project, Dieffenbacher will offer its vertical transfer molding presses in combination with an Arburg FDC unit.

Lanxess Adds Capacity for Tepex Composite Materials

Bond-Laminates, a German subsidiary of Lanxess, has added two new production lines for Tepex continuous-fiber thermoplastic composites. This expansion by around 50% is in response to strong demand for structural materials for lightweight vehicles and consumer electronics.

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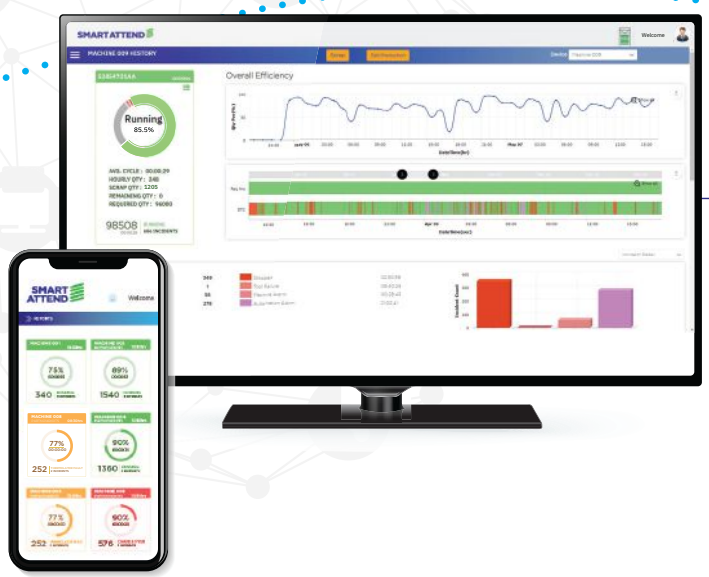

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Boser Gets SPE Thermoforming Lifetime Achievement Award

The Society of Plastics Engineers (SPE) Thermoforming Div. presented its Lifetime Achievement Award to Leroy (Lee) Boser, an expert in thermoforming technology who worked for Spartech and other companies for nearly four decades and authored two well-known thermoforming manuals. The Division's Executive Committee presented the award to him on Sept. 10, during SPE's Thermoforming Awards Dinner in Milwaukee.

Boser began his career in 1967 as a plant supervisor with Uniroyal. After 11 years, he left to become general manager at Riblet Plastics, where he worked for six years until returning to Uniroyal in 1985. Fifteen years later, Uniroyal's sheet business was acquired by Spartech Corp., and Boser became the chief sales engineer until he retired in 2005. He now serves as a thermoforming engineer consultant to many of Spartech's customers.

Boser played an instrumental role in the introduction of Spartech's Royalite and Royalex sheet materials. He published *Pressure Forming Manual* in the early 1990s and *Thermoforming Manual and Troubleshooting Guide* a decade later.

"I had the privilege of seeing Lee Boser in action during my resin-selling days, and I was always amazed at how he could show a customer how to troubleshoot an issue (which quite often was not a material issue), and do it in a way where the customer was grateful," said Eric Short, SPE Thermoforming Div. Chair. "While processors are the core of our industry, there is an often unsung supporting cast of resin producers, sheet extruders, tool makers, and other suppliers who have partnered with the processor to help accomplish great things. Lee Boser's career epitomizes that partnership."

Modern Dispersions Expanding in Engineered Compounds, Polyolefin Black Masterbatches

Modern Dispersions has announced capacity expansions at Leominster, Mass., and Fitzgerald, Ga. A new 133-mm twin-screw extruder will significantly increase production capacity for engineered compounds and masterbatches in Georgia in first-quarter 2020. The company also announced additional capacity for black polyolefin masterbatches at the Georgia plant to come online in 2020.

Modern Dispersions will also install a 50-mm Steer twin-screw extruder for a new pilot line at Leominster, Mass. This R&D line will help develop new formulations for nylon, PC, and PET resins and support initial scale-up and pre-production needs. The twin-screw extruder will have a capacity of 3000 lb/hr.

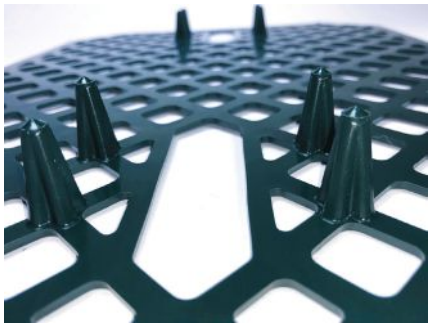
Maag to Expand Virginia Plant

Maag Group Americas is making a multi-million-dollar investment to expand manufacturing capabilities for the Gala product line in Eagle Rock, Va. Gala makes underwater pelletizers, centrifugal dryers and other machines. The 20,000 ft^2 addition will house optimized assembly that will permit shorter lead times and assembly and testing of larger systems, like high-capacity centrifugal dryers. The additional space also will allow Gala to centralize and optimize laboratory operations, including customer or product trials, toll runs and product development.

The project is to be completed in the fourth quarter of 2020. The addition will represent a 20% increase to Gala's current 100,000 ft^2 manufacturing facility in Eagle Rock. Gala began operations in 1959 and since 2015 has been part of the Maag Group of Switzerland, which is owned by Illinois-based Dover Corp.

Injection Molding Keeps Golf Greens Pristine

This challenging LDPE part measures 14 × 16 × 0.175 in. thick and weighs around 0.65 lb. You might call it a Duffer's Delight: It's a mat designed to protect golf greens and other grass surfaces from damaging "divots." Just hitting the market last month, it's called "Terfy" and comes from inventor Philip Vala and his firm, Innovation Equity Group Ltd. in Oakville, Ont. (***terfy.com***). It was custom molded by Omachron Technologies in Pontypool, Ont. (***omachrontechnologies.com***). Omachron developed a tabletop injection machine that uses intrusion molding to mold parts weighing up to 140 lb with a screw no larger than 1.25 in., as well as low-cost aluminum molds (see March '19 Close-Up). This system can mold large parts, comparable to the capabilities of a 500-ton injection press, at low pressures (up to 900 psi) and low temperatures, with resulting low internal stresses, according to the company. The Terfy part was molded in 20 min for development purposes, but Omachron is confident that it can be done in 6 min for commercial production.



The inventor first tried producing the product from HDPE sheet via water-jet or die cutting, neither of which proved cost-effective. Injection molding was the only way to go but was lacking in "design flexibility for an early-stage product where design could still undergo changes," Vala says. "Upfront mold costs were extremely high and the moldmaking process was slow, so small production runs were prohibitively expensive." Then the inventor came across Omachron. "Six weeks after the first discussion, and at a fraction of the previous price, we had a finished prototype to show to prospective clients and a viable, flexible manufacturing process than can scale with expected demand." Omachron says this and many other parts can be molded on its machine from 100% post-consumer recycle, which will be the next major thrust in marketing its machines and custom-molding services.

Steve Gerth and Steve Upton

Dri-Air Drying and Conveying System

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Schmit Prototypes installed the Dri-Air Industries Hopper Bank Drying System, which has simplified and improved their processing. ***"Being a custom molder we tend to do a lot of changeovers, having resin dry and available to any press is crucial to our success in meeting customers' demands."***

— Steve Upton, President

Schmit did a cost study on the savings the Dri-Air Hopper Bank System has provided, and determined that they made a complete return on investment within 14 months of installing the system.

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Tension-Indicating 'Smart' Bolts Make Mold Mounting Safer, More Efficient

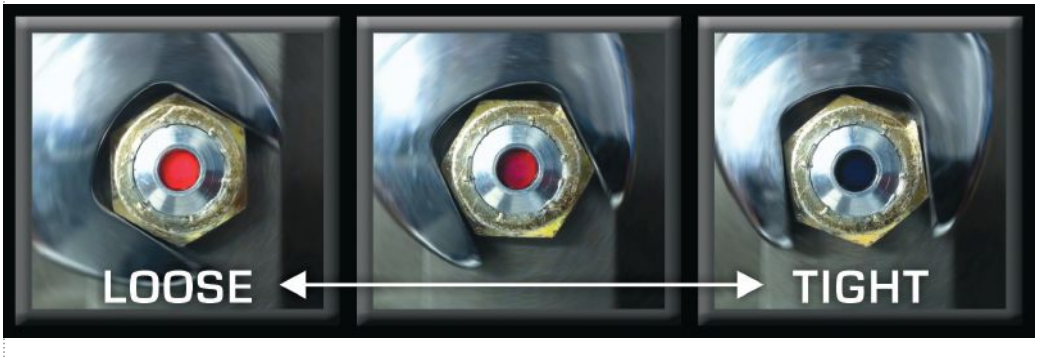
No more guessing about whether mold-mounting bolts are tightened properly, with an alternative to unreliable torque measurements.

By Matthew Naitove
Executive Editor

The bigger the machine, the heavier the mold and the greater the stripping forces when the clamp opens—all of which add up to ongoing safety concerns for injection molders about secure mounting of molds to machine platens. Some injection molders have addressed this by adding more bolts or clamps to secure their molds and scheduling redundant bolt-tightening checks, which is potentially wasteful and, in some circumstances, can even lead to mold damage.

John Bozzelli, a well known injection molding trainer and consultant (and long-time contributor to this magazine), says, "I have had a number of clients request a seminar on how to mount molds. Clients were tired of having molds drop out of the platens—literally fall out. Can you imagine the cost and safety concerns? evidently, this has become a major issue in our industry, and it needs attention."

One company that is giving this issue serious attention is Industrial Indicators (aka Stress Indicators Inc.) in Gaithersburg, Md. (*industrialindicators.com*). Over 20 years ago, the firm developed a "direct tension indicating" (DTI) bolt with an indicator that changes color in response to the degree of "stretch" of the bolt as a result of tension. In the past 12 years, the company has refined the technology for injection molding with the help of some early adopters in automotive molding with large presses. "The molding market is growing rapidly now," says account manager Matthew Hallwig.



Direct Tension Indicating (DTI) SmartBolts provide easy visual indication of tightness or looseness in real time.

WHY NOT RELY ON TORQUE WRENCHES?

According to Industrial Indicators, "There is no clear industry standard on how to properly secure injection molds." Notes Hallwig, "We have seen incredible variation among molders in the type of bolts and type of tools used to tighten them." Some molders reportedly have developed complex spreadsheets full of notes to calculate the number of bolts that would be required to secure different molds to platens. Others have struggled to control the torque applied by operators, which is made even more difficult as bolt sizes get larger and the torqueing forces required to tighten them increase exponentially.

Some molders use wrenches that can be set to apply a certain amount of torque ("torque wrenches") as a standard test of adequate bolt tightening. But Industrial Indicators engineers point out that torque is a rotational force, not a compressive force, and thus is commonly mistaken for a measure of joint security. One reason is the unknown and variable friction factors that can alter the clamping force of bolted joints, even when operators maintain a consistent torque specification. Even more serious is the phenomenon of "bottoming out," when a bolt is too long for the hole in which it is inserted and reaches the end—or bottoms out—before the head of the bolt can clamp onto a surface. The bolt seems tight, and if checked with a torque wrench there would be no warning of a problem, even though the bolt has no tension is not clamping anything together. This is a dangerously deceptive occurrence, which can be easily overlooked unless tension-indicating bolts are used, according to Industrial Indicators. What's more, applying too much torque to hardened bolts can damage threads in softer platen steels.

A better answer, according to Industrial Indicators, is its DTI SmartBolt line, which applies strain-gauge technology in a ►

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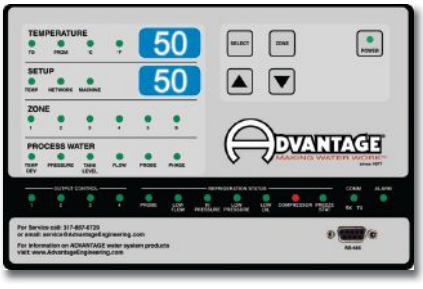

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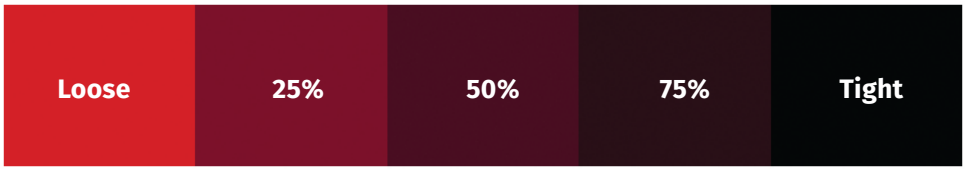

Verification chart for DTI SmartBolts shows the gradual change in color from "Loose" to "Tight," graduated in percentages of maximum Design Tension.

unique way. They are ordinary fasteners rerofitted with a gage pin installed in the bolt shank. This gage pin is fixed at the base of a machined hole and serves to measure elongtion of the shank under tension. As tension is applied to the bolt, a built-in visual indicator in the head of the bolt gradually darkens from bright red to black when the bolt is properly tightened to its Design Tension. The Design Tension is selectable by the customer, in consultation with Industrial Indicators. According to Hallwig, SmartBolts for injection molds typically have a Design Tension set at 35% to 45% of fastener proof strength, measured in kilopounds, though that figure sometimes has been as high as 60%. A lower Design Tension allows for longer bolt life and reduced platen thread wear, Hallwig notes.

DTI SmartBolts can be tightened with conventional tools; they have a one-year warranty; and the indicator is certified to function at -4 F (-20 C) to 168 F (75 C). SmartBolts are supplied with a Verification Guide that shows the indicator color from 0% to 100% (fully tight) of Design Tension at intervals of 25%. The color indicator is said to be accurate within 10% of Design Tension. The indicator reportedly cannot be damaged by over-tightening, provided that the bolt is not tightened beyond its elastic limit (proof load).

SmartBolts are available in sizes from 7/16 in. up to 2½ in. diam. They are more expensive than standard bolts, but Hallwig says the price difference is more than compensated by increased safety, resulting in lower risk of worker injuries or damage to expensive molds. SmartBolts reportedly also help users improve operational efficiency by potentially reducing time spent on mold changes in removing and installing excessive numbers of bolts and confirming bolt tightness with wrenches. Reduced damage to platen threads from over-torqueing bolts is another claimed benefit.

AUTOMOTIVE PENETRATION

Hallwig estimates that DTI SmartBolts are being used to varying degrees in around 15 injection molding plants, mainly among automotive molders with large machines. In 2018, one automotive molder with 36 big machines (up to 4000 tons) installed SmartBolts on all its presses. The facility averages over a dozen mold changes per day. Prior to installing SmartBolts, the facility had experienced almost weekly mold slips—warning events when bolts loosen enough to allow the mold to slip down the platen though it still hangs in place—and even occasions of a full mold drop. In six months after installation of SmartBolts, the plant reportedly experienced zero mold slips or falls, and on three separate occasions identified SmartBolts that "felt" tight but had bottomed out in the bolted joint. A manufacturing manager at this plant told Industrial Indicators, "I've been in this business for 31 years, and the thing I'm most proud of in my career is implementing SmartBolts."

NOW MORE THAN EVER

Conditions in the plastics industry would seem propitious to the introduction of a product like SmartBolts. As consultant Bozzelli told *Plastics Technology*, "In my decades of going into shops, I have seen a few molds come loose—not fall, but come close. In more recent years, it has gotten worse and is something I check before I start working on a press. Most processors in the earlier years had some background with tools. We worked on cars or farm equipment, etc. Today, far fewer processors have any mechanical background or experience. So something as simple as tightening a bolt is not done properly. Nobody trains how to do it. It is assumed everybody knows how to use bolts, but they do not. Plus, most shops do not like to buy tools, as they disappear. Torque wrenches are a bit pricey, so they are not often purchased for the workers; and if they are, they do not last long on the shop floor. Sometimes, workers do not even know how to use them properly."

Torque applied by a wrench is a poor indicator of how much force a bolt is applying to its working surface.

Industrial Indicators is beta testing new lines of products for injection molders. One is the Chroma series of SmartBolts, which will have color indication for "Loose, Tight, and Over-Tight" conditions. They will also offer digital remote load monitoring and closed-loop tension control. A new line of tools—the company's first—will convert the sensed load into a digital value. What's more, in tightening mode, the tool will cut off when it senses the right tension.

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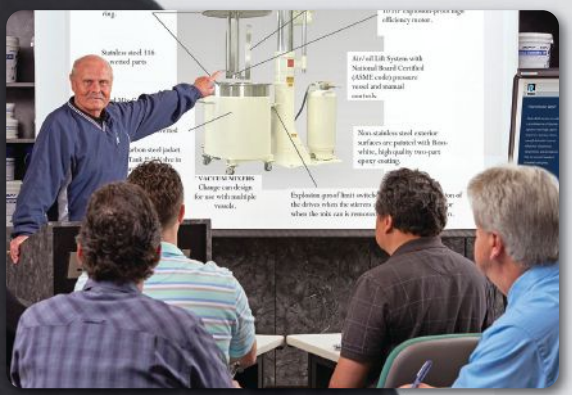

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MATERIALS

PART 3

Fundamentals of Polyethylene

PE parts can fail when an inappropriate density is selected. Let's look at some examples and examine what happened and why.

By Mike Sepe

The importance of the density of polyethylene materials can be understood by reviewing applications where parts fail when an inappropriate density is selected. In this installment we will begin to look at some of these. Interestingly, all these field failures are related to the selection of grades of polyethylene that have a density higher than what ends up being appropriate.

The first of these is a relatively mundane application, a molded brush that is a component in a cup dispenser. While it may seem quaint now, in the 1970s this was a big deal, especially for the company that designed and patented the part and particularly since it was designed by the founder and chairman of the company.

Even small differences in density can have a major effect on the performance properties of PE. For example, the small amount of carrier resin in a color concentrate, of a different density than the base resin, can affect the overall properties. (Photo: ExxonMobil)

The part was molded in an eight-cavity tool. The part came out of the mold as a flat strip with brush bristles protruding from the base at regular intervals. During assembly the part was simply bent into a circular shape that fit into the lower portion of the cup dispenser. The claim to fame of this part was that the brush bristles guaranteed that only one cup would be dispensed at a time. Consumers were easily impressed in the '70s.

The mold was moved to a different supplier, and the part drawing simply called out "polyethylene." When the molder inquired about the desired density, the buyer at the cup company had no idea and did not seem to care much about anything but the price of the item. At that time, this particular supplier was molding a lot of 5- and 2-gal pails and they were getting a very favorable price on the material. So, samples were molded in this material, which was an HDPE with a melt flow rate of 7 g/10 min and a density of 0.952 g/cm³. The parts molded well and fit the assembly properly, the buyer and the quality people at the plant to which the parts were being shipped signed off, and production began.

HDPE has a higher degree of crystallinity than LDPE. This results in improved load-bearing properties such as strength and stiffness, but it reduces ductility.

Several months later one of the assemblies made its way to headquarters, where the company founder had a chance to try it out. He was not pleased. The brush bristles were too stiff, making it more difficult to pull the cup out of the dispenser. Worse yet, it was possible to pull on the stack of cups in such a way that *two* cups might come out at the same time instead of the desired one. Shock waves reverberated through the organization and eventually reached the molding facility.

Given the feedback, it was quite simple to correct the problem. An LDPE was purchased and peace returned to the realm, although not without a spirited discussion about what to do regarding the hundreds of thousands of cup dispensers that had been shipped with the HDPE brushes. It was discovered subsequently that the HDPE brushes exhibited a more troubling behavior over time. With repeated use, the bristles began to break off of the base strip. This obviously affected the functionality of the part and created the potential for pieces of PE to fall into the dispensed cup. I never heard of any reports of consumers ingesting pieces of PE, but one can imagine how this would have played in today's world of online reviews and instant customer feedback.

The change in the behavior of the molded part as the density of the material was altered provides an instructive illustration of the effect that density has on mechanical performance. HDPE has ►

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a higher degree of crystallinity than LDPE. This results in improved load-bearing properties such as strength and stiffness, but it reduces ductility. In addition, HDPE provides a harder surface and has higher opacity than LDPE for any given wall thickness. And while this particular part was always used at ambient conditions, the temperature-dependent behavior of HDPE and LDPE also reflect the differences in molecular structure. HDPE maintains a higher percentage of its room-temperature performance at elevated temperatures, and the melting point of HDPE is approximately 30° C (54° F) higher than that of LDPE. However, LDPE can be used at lower temperatures without becoming brittle.

Differences in performance can be observed even when relatively small changes in density are made. Often these changes are made unwittingly. Several years ago, we worked with a client on a PE part made of a grade with a density of 0.962 g/cm³. This is at the upper end of the density spectrum for polyethylene. In this case the part was under constant stress in an assembly and a small percentage of the parts developed cracks over time, causing a valve to leak. An examination of fractures showed that the mechanism was environmental stress cracking (ESC). It was discovered that the cracking process could be accelerated by exposing the assembly to certain types of soap solutions, which act as stress-crack agents for polyethylene. When this was done to unassembled parts, the level of failure was less than 1%. But once in the assembly and under the influence of the associated stresses, the failure rate increased to over 25%.

ESC is a mechanism that is typically observed in amorphous polymers, and we learn from observation that amorphous polymers are much more susceptible to this failure mechanism than semi-crystalline polymers. Given this knowledge, it is counter-intuitive that higher-density PEs, which are of higher crystallinity, are more susceptible to ESC failure than lower-density grades. But that is, in fact, what we observe. In this case, a customer demand led indirectly to a solution. The parts had always been molded from the natural, unpigmented material. A customer of my client requested that a select number of the polyethylene parts be colored. Molded-in color is often considered to be something that requires no real thought process beyond matching the color. Once everyone has agreed on the color, a concentrate is manufactured and added at a particular letdown ratio. But the carrier resin used to make the concentrate can alter the properties of the base resin—for better or worse.

The carrier resin used to make the concentrate can alter the properties of the base resin for better or worse.

In this case, it turned out to be for the better. It was noted that colored parts never came back from the field exhibiting cracks, and when the soap solution test was performed on these parts, no cracking was observed. When the density of the colored parts was measured, the result was 0.953 g/cm³. At first it was thought that the base resin being provided was not within specification. Polyethylene suppliers can typically hold the density of any given grade to ±0.002 g/cm³ of the nominal specification. In this case the culprit was the concentrate.

The carrier resin for the concentrate was an LLDPE with a density of 0.920 g/cm³. When added at the prescribed letdown ratio, it reduced the density of the base resin and coincidentally solved the ESC problem. Realizing that the part still functioned mechanically even with the associated reduction in strength and stiffness, the solution to the cracking problem was obvious.

In our next column we will look at a case study from almost 20 years ago where a historically successful grade of PE was phased out and replaced with a higher-density grade that unleashed a significant field problem. PT

ABOUT THE AUTHOR Mike Sepe is an independent, global materials and processing consultant whose company, Michael P. Sepe, LLC, is based in Sedona, Ariz. He has more than 40 years of experience in the plastics industry and assists clients with material selection, designing for manufacturability, process optimization, troubleshooting, and failure analysis. Contact: *(928) 203-0408 • mike@thematerialanalyst.com.*

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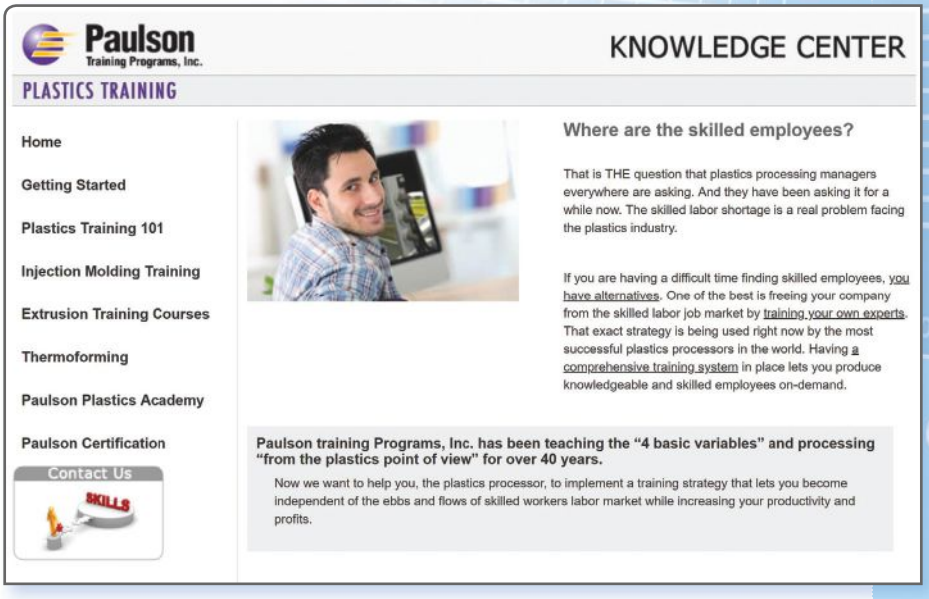

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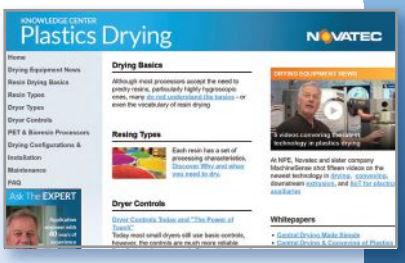

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INJECTION MOLDING

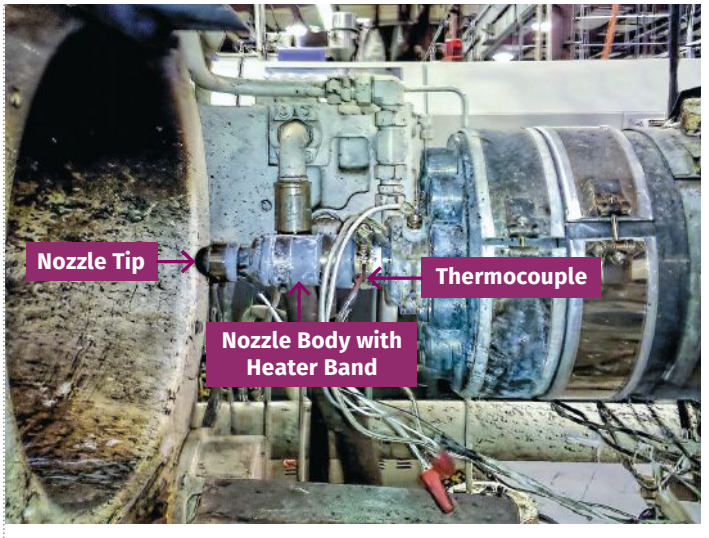
Checking and Controlling Nozzle Body Temperature

Temperature control is critical from feedthroat to nozzle tip. Yet despite advances in machinery, this continues to be an issue for molders. Here's what to do about it.

By John Bozzelli

Injection molding machines continue to evolve in the electric, hydraulic and hybrid categories. Certainly, real improvements have been made. New presses are more energy efficient, faster and loaded with sophisticated software and controllers. Good news on efficiency and speed; not so sure there is such good news on controllers.

The bad news is some basic problem areas still seem to be ignored, such as on-stream melt-temperature sensing and the topic of this column, temperature control of the nozzle body. On-stream temperature sensing is no easy chore and I do not have an answer yet, but temperature control of the nozzle body is something else. Temperature control is critical from feedthroat to nozzle tip. Most machines control the heating zones nicely, but not the nozzle body. This is a major pet peeve of mine.



Typical nozzle tip, nozzle body, heater band, and thermocouple.

The nozzle body is often at a vastly different temperature than what the screen reports on the controller. What I am seeing lately for temperature control in the nozzle body is simply unacceptable. In checking six machines over the last two months, the difference between setpoint and actual has been near 40° C (85° F) for all of them. To make matters worse, the screen temperature agrees with the setpoint. The nozzle body is on *every* machine and is a critical element of *every* machine, yet it is apparently neglected by the industry.

First let's make sure we are on the same page as to what a nozzle body is. Figure 1 shows a nozzle body (with heater band), nozzle tip, and thermocouple, which is common to nearly all injection molding machines.

Why take time to make sure the nozzle body is controlling temperature? Here are my reasons:

1. Blush;
2. Gloss gradients;
3. Degradation;
4. Halos;
5. Color variation;
6. Texture variation;
7. Inconsistent properties;
8. Marbling;
9. Cold slug in the nozzle tip;
10. Drooling or stringing;
11. Burn marks/streaks;
12. Asymmetrical filling;
13. Shot-to-shot variations;
14. Swirls;
15. Bubbles;
16. Splay;
17. Black specks.

Bottom line: This significant problem costs molders thousands of dollars a month. Adjusting the process does not fix incorrect or broken equipment. Few pay attention to it, though it is easy to check or test out.

First, to convince yourself you may have a problem, take a walk through the production floor. Check where the thermocouple is ►

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located on the nozzle body and/or tip on your machines. I bet you will notice there is no consistency. Sometimes the thermocouple is on the heater band, sometimes in the hex nut or in a drilled hole in the hex nut, or on a clamp or the nut of the heater band. With no consistency in placement. you have no chance of obtaining accurate melt temperature. The next step is to get some data. How do you get an actual reading of the melt temperature in the nozzle body?

It is not that difficult or time consuming. It may not be fun, but good temperature control will make your life easier on the shop floor and improve your profit margin. To check the actual melt temperature in the nozzle body and compare it with the setpoint on the controller, all you need is a common pyrometer and appropriate thermocouple. So, find your shop's trusty pyrometer and an appropriate wire or probe thermocouple, type J or K, preferably one long enough to go all the way into the end cap.

Next, check a couple of machines. If you have any presses with the thermocouple on the outside of the hex nut or on the clamp or heater band, they should be your first targets. Use the proper safety equipment—heat-protective gloves and goggles—and get a sense of the plastic temperature and pressure you will be dealing with. Once ready, push the probe slowly into the nozzle tip through the nozzle body as far as you can get it, ideally all the way to the end cap. Wait until the temperature on the readout of the pyrometer stabilizes (stops climbing). It will take longer than you expect and you will learn why these types of probes do not provide correct melt temperatures of purges.

After the temperature stabilizes, pull the probe out 50 mm (2 in.) and take another reading, but wait until it stops trending. Continue until you measure the temperature of only the nozzle tip. (Send me the results—setpoint vs. actual temperatures—and I will follow up with another article summarizing the results.)

If your nozzle-body temperature is within 10º C (20º F) of setpoint, that is acceptable. Controlling the nozzle-body temperature is not easy to do, so if it is within this range, compensate by changing the set temperature. If it is off by more than the above range, replace the thermocouple with a spade type. Location is critical. Measure the length of the nozzle body and tip. Put a spade-type thermocouple one-third the total distance of the nozzle body and tip, measuring from the nozzle tip. Use some thermal paste underneath it. Hold it in place with one full-round wrap of a high-quality glass tape, then add three to four short pieces of glass tape over the thermocouple to insulate it. Now carefully put the heater band back on and make sure the thermocouple is in the gap of the heater band.

If your nozzle-body temperature is within 10° C (20° F) of setpoint, that is acceptable.

Once back up to appropriate melt temperature, check the actual temperature in the nozzle body as mentioned above. It will rarely be exactly at setpoint but it should be within 10º C (20º F) of setpoint.

In short, you cannot trust your machine for proper nozzle-body temperature control. Here's some data for two recent nozzle-body checks I conducted on brand-new machines:

Machine 1: setpoint 210 C (410 F); actual 257 C (495 F).

Machine 2: setpoint 304 C (580 F); actual 355 C (670 F).

Do not just believe me—check a couple of your machines. Save yourself some time and aggravation by reconfiguring the nozzle-body thermocouple. It will provide better melt-temperature control and consistency. This in turn will provide "Murphy" some naptime, and keep him from visiting you.

ABOUT THE AUTHOR: John Bozzelli is the founder of Injection Molding Solutions (Scientific Molding) in Midland, Mich., a provider of training and consulting services to injection molders, including LIMS, and other specialties. Contact *john@scientificmolding.com*; *scientificmolding.com*.

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EXTRUSION

Try This Approach to Clean Up Your Recycled Material

CO_2 can be used as a totally "green" solvent to remove many kinds of contamination in recycled plastics without the need for toxic solvents.

By Jim Frankland

Recycling is getting lots of attention these days due to public and media outcries about plastic in the environment. About half of all the plastics produced go into single-service food packaging of some type. Food packaging usually contains various oils, printed surfaces, surface treatments and adhesives that are difficult to remove, even by very aggressive washing, and require the use of toxic solvents that often make the reclaim unusable for further food-packaging applications. This makes it hard for processors running reclaim to produce the clean products the application may demand.

However, supercritical CO_2 can be used as a totally "green" solvent to remove many kinds of contamination in recycled plastics without need for toxic solvents. CO_2 is naturally occurring in the atmosphere, and when stripped of residual contamination after processing it can either be reclaimed or simply vented back into the atmosphere. The use of supercritical CO_2 is a well-established technology in food and drug processing. For many years it has been used to decaffeinate coffee and tea, for example.

CO_2 treatment has very little effect on the polymer morphology, making the recycled polymer useful for the original performance requirements.

CO_2 exists naturally as a gas in the atmosphere; at reduced temperatures it is a solid (dry ice). However under certain conditions CO_2 can exist as a liquid if the pressure and temperature are increased above a certain point. The phase diagram shows the pressures and temperatures necessary for CO_2 to exist in the liquid phase.

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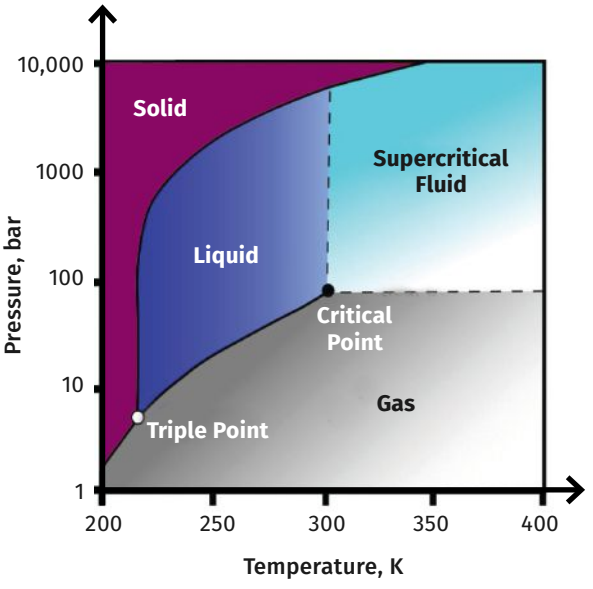
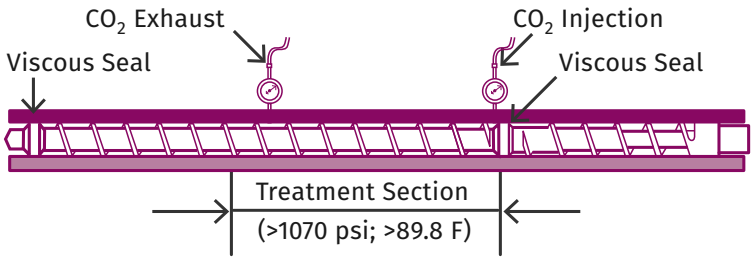


Shown here are the pressures and temperatures necessary for CO_2 to exist in the liquid phase. At the triple point all three phases can exist, but as the temperature and pressure are increased the CO_2 becomes a liquid. (Source: Wikipedia)

At the triple point (TP) all three phases can exist, but as the temperature and pressure are increased the CO_2 becomes a liquid. At a pressure of 1070 psi and 89.8 F the liquid enters a supercritical phase (CP) and remains in that phase with increasing pressure and temperature. That is important because in that phase it has some unusual properties—between a gas and a liquid—that allow it to more easily penetrate through many solids (like polymers) and act as a strong solvent to dissolve many materials. Its solvent properties are so strong, in fact, that when the supercritical phase exists it must be contained in highly corrosion-resistant materials.

Although the technology of decontamination with supercritical CO_2 is old and well understood, this is typically a batch process because of the difficulty in controlling pressure from the treatment phase, where the CO_2 solvent absorbs the contaminants, to the

Extruder Setup to Inject & Exhaust CO_2



Viscous seals isolate the treatment area to maintain the pressure and temperature necessary to keep the CO_2 in supercritical condition without elaborate pressure chambers and transfer valves.

solvent-cleaning phase, where the pressure is reduced and the contaminants drop out of solution. If the pressure is released during the treatment phase, the residual contamination simply drops out of the supercritical CO_2 and right back into the polymer. The use of an extruder simplifies that by allowing the pressures to be easily segregated by use of viscous seals between the treatment and solvent-cleaning phase.

The use of a viscous seal before and after the area to be cleaned by the supercritical CO_2 isolates the "treatment area" so that the pressure and temperature necessary to maintain the CO_2 in the supercritical condition can easily be maintained without elaborate pressure chambers and transfer valves. The CO_2 can be simply exhausted into a container at a lower pressure, allowing the residuals to drop out, and then return to the atmosphere with no net environmental effect. However, in the interest of economics the "clean" CO_2 can be recompressed and reused.

Fluropolymers are the only common polymers that are dissolved by the supercritical CO_2 so this treatment has broad applicability. Amorphous polymers seem to be more effectively cleaned using this technique, but crystalline polymers apparently can be cleaned with longer treatment times and additional mixing in the treatment section.

The CO_2 treatment has very little effect on the polymer morphology, making the recycled polymer useful for the original performance requirements. Although somewhat of a change from typical decontamination processes used in recycling, it offers the potential to greatly expand the amount of recycle that can be reused for its original purposes.

ABOUT THE AUTHOR: Jim Frankland is a mechanical engineer who has been involved in all types of extrusion processing for more than 40 years. He is now president of Frankland Plastics Consulting, LLC. Contact *jim.frankland@comcast.net* or *(724) 651-9196*.

TOOLING

PART 2

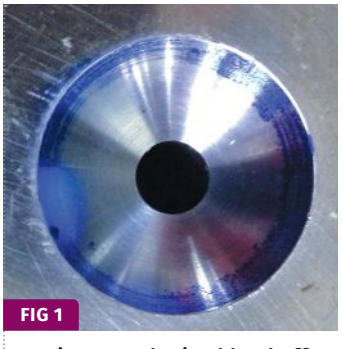
How to Prevent Nozzle Tip Leaks

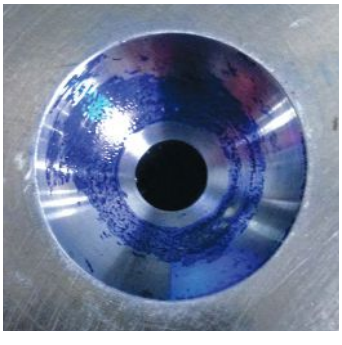
Your very costly mold in that very expensive press is relying on the performance of a $20 nozzle tip that no one ever checks, and has a high probability of not doing its job. Stop learning from your mistakes and start learning how not to make them.

By Jim Fattori

A common cause of leakage between the machine nozzle tip and the sprue bushing is incompatible radii. I took a brand-new sprue bushing from a reputable mold-component supplier and three brand-new machine nozzle tips from three different mold-component suppliers and blued them off, as shown in Fig. 1. One of the nozzle tips seated on the outer perimeter of the sprue bushing; one seated in the middle; and the third seated in the center.

The one that seated on the outer perimeter has a very good chance of blowing the carriage back and allowing material to leak out. The level of precision on machine nozzle tips is not just highly suspect—it's a flat-out crap shoot. Maybe that's why they are so inexpensive. Now think about that for a second. Your very expensive mold, in that very expensive machine, is relying on the performance of a $20 nozzle tip that no one ever checks to see if it is any good, and has a high probability that it's not.





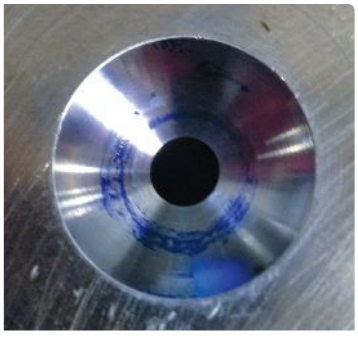


FIG 1

Various nozzle tips blued off against a sprue bushing.

Some molders have experienced this common radius mismatch problem. To overcome it, they use a ¾-in. radius on the sprue bushing and mate it with a ½-in. radius on the machine nozzle tip. That's way too aggressive, and a bit dangerous for my liking. As shown seen in Fig. 2, all of the carriage pressure is applied to the sharp edge of the sprue-bushing orifice, which can cause it to hob or roll over. That can create several other molding problems.

A more precise method to correct a radius mismatch is to either grind the machine nozzle tip to a 0.496-in. spherical radius, or EDM the sprue-bushing nozzle seat to a 0.505-in. radius. EDM-ing the sprue-bushing nozzle seat is the preferred method because the EDM, or stipple finish, improves the shutoff between the two components. However, the same result can be obtained with a light sand blast of the machine nozzle tip.

A rough surface finish improves the nozzle shutoff.

Whichever method you choose, having a rough finish will give you another benefit. Bring the carriage forward until the two components meet. Then retract the carriage and inspect the textured surface. The rough finish gives you an excellent visual indicator of the alignment or misalignment of the carriage to the mold when under pressure, as shown in Fig. 3.

The rule of thumb in our industry is to use a machine nozzle tip orifice 1/32 in. smaller than the sprue bushing orifice to prevent any sticking of the sprue in a cold-runner mold. That's fine for most cold-runner molds, but ►

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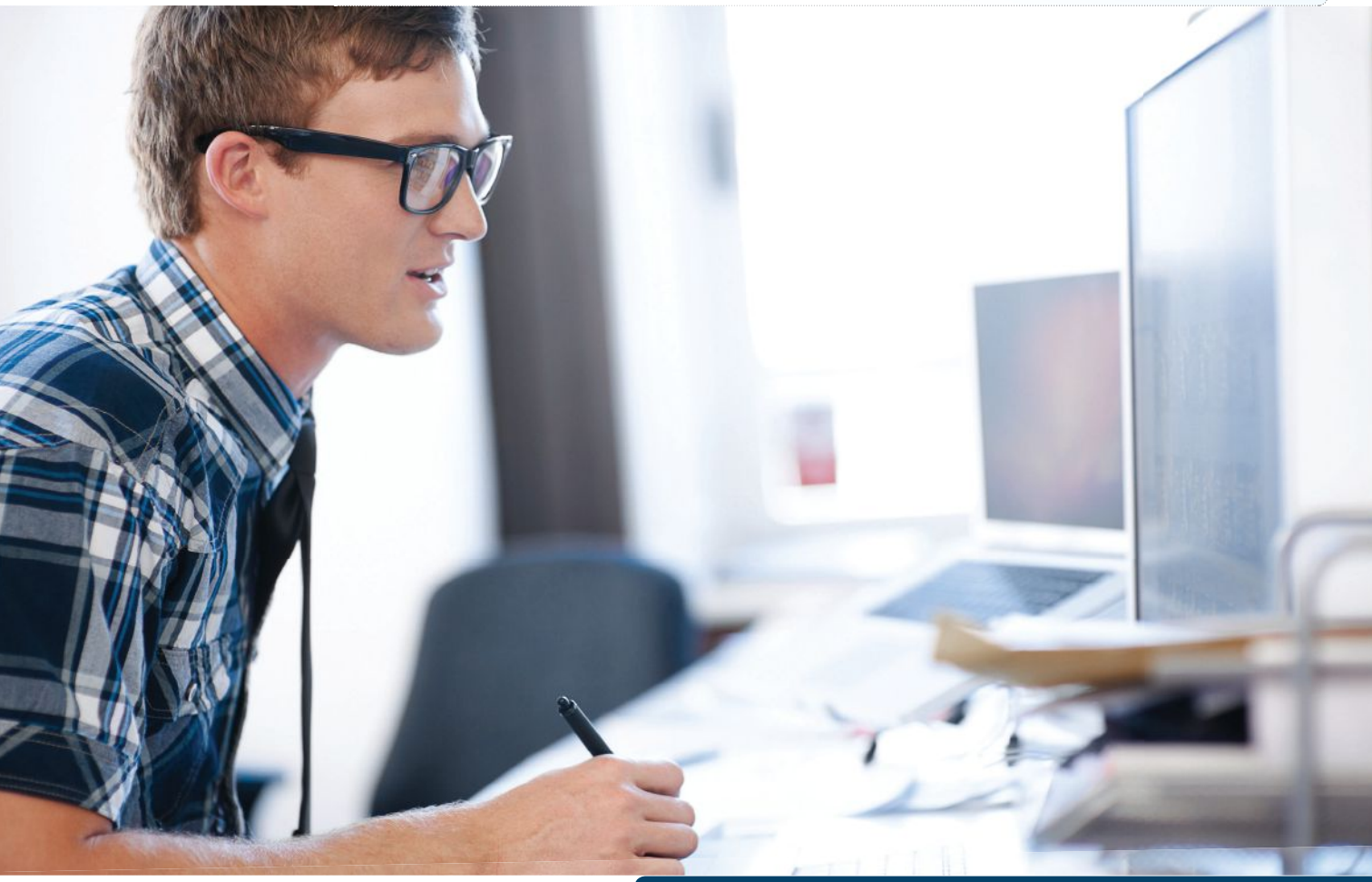

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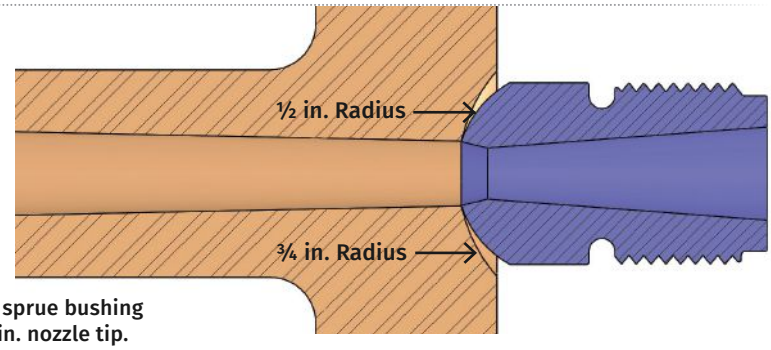
PRESENTER

Christoph Pielen
Lab Manager,
Chemical Division

Brabender CWB

Christoph Pielen studied Mechanical Engineering specializing in plastics processing engineering at the RWTH Aachen University, Germany. From 2002-08 he was part of the scientific team that developed, tested and produced new formulations in rubber compounds and rubber foam extrusion at RWTH Aachen. He joined Brabender GmbH, Germany in 2002 to support international technical sales and service. In 2014, he became lab manager in the chemical division of Brabender CWB, USA. He is an active member of ASTM.

FIG 2



A ¾-in. sprue bushing and ½-in. nozzle tip.

it's terrible for hot-runner molds. For hot-runner molds, the orifice size should be no more than 0.010 to 0.015 in. smaller than the orifice of the sprue bushing. All it takes is a drill bit and a reamer to fix this problem. The drill bit gives you the preferred diameter. The reamer is used from the back of the nozzle tip, to reduce the straight land length, which ideally is no more than one-third the orifice diameter. When reaming the tip, just be careful not to enlarge the critical ½- in. opening in the back, where it seats against the nozzle body.

Engrave the modified tip with the mold number. Buy a ⅞-in.-14 nut and tack weld it to the top of the mold. At the end of the production run, remove the nozzle tip from the barrel and screw it into the nut. Now the perfectly sized tip will stay with the mold for the next production run. Nozzle tips are cheap. Why we don't assign a particular tip to every mold is beyond me. If you want

Assign a particular nozzle tip to every mold.

FIG 3

Rough surface finishes on a nozzle tip and sprue bushing.

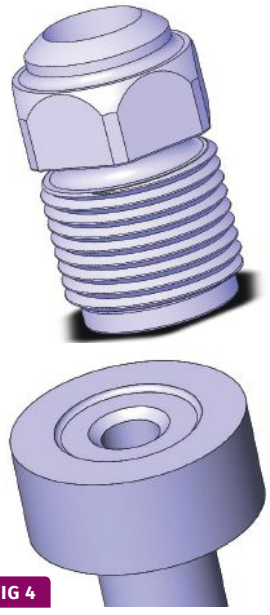


FIG 4

A relieved nozzle tip and sprue bushing.

the same results run after run, you have to use the exact same type and size of nozzle tip.

I weigh about 200 lb and have a 9½ shoe size. If I asked you to lay face down on the ground, and I stood on your back, you would probably have some choice words to say to me. If a petite woman, who weighs half as much as I do soaking wet, got on your back, it might actually relieve some of your back pain. Now if she stood on one foot wearing a ¼-in.-square high heel, despite her much lighter weight, you are going to the hospital. Why? Because P = F/A or Pressure = Force/Area.

An easy way to remember this mathematical formula is PSI = P/SI, which obviously stands for pounds per square inch, equals pounds divided by square inches. Simple enough. Now let's do the math: The woman's weight of 100 lb / (¼ × ¼ in. heel size) = a whopping 1600 psi.

So what does this have to do with material leaking? Most molding machines use either a hydraulic cylinder or a spring pack (a stack of Bellville washers) to push the injection carriage up against the sprue bushing. This is called the nozzle touch force. Kudos to those of you who know what the nozzle touch force is on your various machines.

But what really upsets me is that machine manufactures seem to provide a nozzle touch force relative to the weight of the machine's injection carriage. They should provide a nozzle touch force relative to the machine's maximum injection pressure. Smaller machines typically have higher injection-pressure capabilities, yet they have some of the lowest nozzle touch forces—especially on electric machines. If there is not enough nozzle touch force to resist the injection pressure of the material, it will cause the machine carriage to blow back, which causes material leakage and creates that hog's head we all know and don't love.

If your shot size is too large, or if a gate gets blocked or freezes off due to a contaminant or failed heater, the screw is still going to do everything it can to keep going until it reaches the transfer position. When it hits that brick wall prior to the transfer position, the peak pressure will spike—often exceeding the forces trying to prevent bad things from happening. While you don't want to have a pressure-limited process, you also don't want to max out the available injection pressure. It will only make the probability of a leak that much more likely. The extra material will either compress or find someplace else to go. It can flash the parting line, leak out of any of the hot-runner shut-off surfaces, or push the carriage back and ooze out of the sprue bushing.

There's not much you can do about flashing the parting line, or leaking in the manifold, but you can easily reduce the odds of the material pushing the carriage back. The machine's nozzle touch force is typically a fixed number. You can't increase it or decrease it. But you can reduce the amount of contact area between the machine nozzle tip and the sprue bushing. As in the previous example, reducing the contact area increases the holding pressure. It's the same premise as relieving a mold's parting line to increase clamp pressure and thereby prevent flash.

Reducing the contact area increases the holding pressure.

If any of your molds have a sprue orifice (hot or cold) less than or equal to ½ in., there is no need to use a ¾-in. radius on either the sprue bushing or the nozzle tip. Contrary to what you might think, it will actually increase the chance of material leaking out. If you are using one of those oversized "mushroom" tips, you are really looking for trouble.

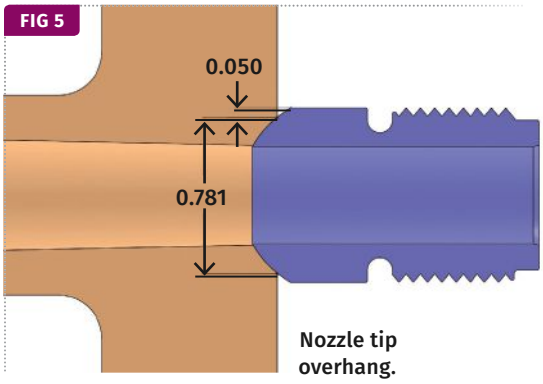


FIG 5

Nozzle tip overhang.

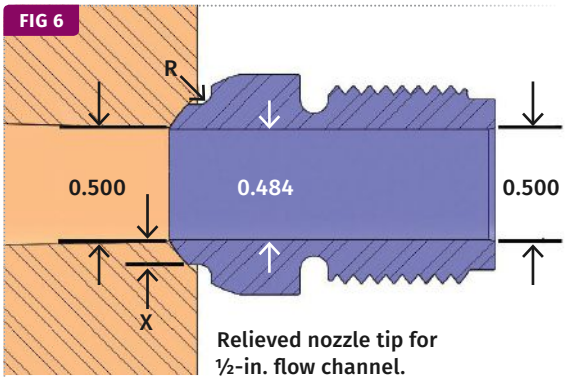


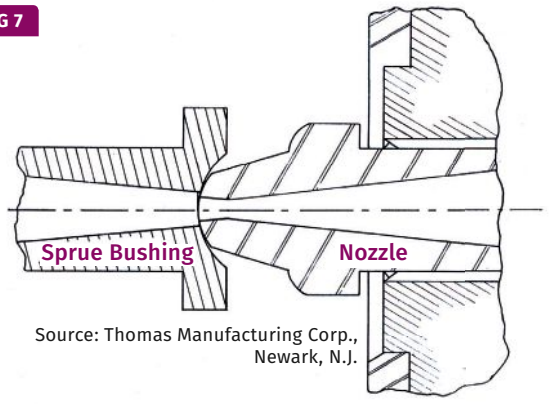
FIG 6

Relieved nozzle tip for ½-in. flow channel.

There are two equally effective ways to reduce the amount of contact area between the nozzle tip and the sprue bushing. You can either reduce the outside diameter of a small section of the nozzle tip, or decrease the 3/16-in. (0.1875-in.) depth of the sprue-bushing nozzle seat, as shown in Fig. 4. I prefer to reduce the nozzle-tip diameter, assuming the nozzle tip will be staying with the mold. If you reduce the depth of the sprue bushing, it will only increase again if the nozzle seat is ever re-faced.

The hex flats on a typical machine nozzle tip are ⅞ in. (0.875 in.) apart. The chord length, which is the largest diameter of the ►

FIG 7



Source: Thomas Manufacturing Corp., Newark, N.J.

A 1947 nozzle tip.

nozzle seat on the end of a sprue bushing with a ½-in. radius is 0.781 in. wide. Therefore, a standard nozzle tip is already extending beyond the nozzle seat by about 0.050 in. per side, as seen in Fig. 5. If you have a problem with blowback, reduce the diameter of the nozzle tip below this 0.781-in. diam.

Let's say your hot-runner sprue bushing has a ½-in. diam. orifice and you have issues with blowback. The standard size of the opening on the back of a machine nozzle tip is also ½ in. Drill out a general-purpose nozzle tip to 31⁄64 in. (0.484 in.), and stone the bore to "break" the small step you just created inside. Be careful not to increase the ½-in. opening in the back of the nozzle tip. Now relieve the outside diameter of the front of the nozzle tip, which will decrease the contact area and increase the resulting nozzle touch force, as shown in Fig. 6. How much you decrease the diameter below the 0.781-in. chord length is a compromise between how much more force you need to overcome the blowback and how weak are you safely willing to make the remaining wall section, shown as "X." Just remember to add a radius, R, at the transition, so as not to create a stress riser on the inside corner.

If you think my suggestions in this article are relatively new or novel, look at Fig. 7. That is a drawing of a machine nozzle tip used in 1947. It has a smaller spherical radius and a relieved outer diameter, to prevent blowback and hog's heads. It is over seven decades old and yet is a better design than every type of nozzle tip available to molders today. Let's stop learning from our mistakes, and start learning from those who have already solved them. PT

ABOUT THE AUTHOR: Jim Fattori is a third-generation injection molder with more than 40 years of molding experience. He is the founder of Injection Mold Consulting LLC, and is also a project engineer for a large, multi-plant molder in New Jersey. Contact *jim@injectionmoldconsulting.com*; *injectionmoldconsulting.com*.

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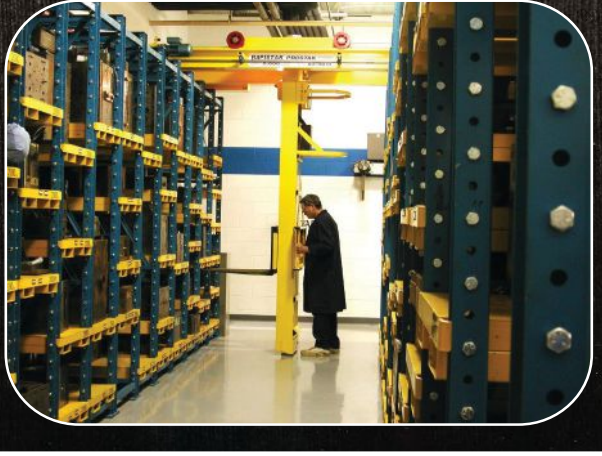

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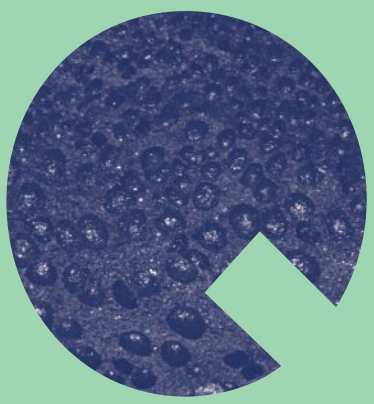

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Recyclable All-PE Pouches:
Sustainable Opportunity for Film Extruders

Sustainability and the circular economy are both a challenge and an opportunity for flexible packaging producers. Recyclable pouches based on all-PE multilayer structures, utilizing new resins and perhaps techniques like MDO or biaxial orientation, appear to be major contenders against glass, metal, and multi-material film structures.

By Lilli Manolis Sherman
Senior Editor

Plastic film-based pouches are fast evolving in both variety of design and breadth of applications in packaging of dry and frozen foods, liquid foods, pet foods and non-food household products. Due to growing demand for sustainable packaging options from consumers and brand owners, all-PE structures have already gained a lead simply because of their potential recyclability advantage over multilayer, multi-material film structures. What's more, manufacture of plastic pouches boasts 70% lower emissions than production of aluminum containers; and the pouches take up far less space than rigid containers, are very damage resistant, lightweight, and cheaper and more energy-efficient to transport.

All-PE structures have already gained a lead in both food and non-food applications. (Photo: Dow Packaging and Specialty Plastics)

A handful of leading polyolefin suppliers have made significant commercial strides in all-PE pouches within the last half-decade, and their specialty, high-performance PE polymers, including metallocene-catalyzed LLDPE (mLLDPE), allow processors to further downgauge films. There are also advances in HDPE, polyolefin elastomers and plastomers, and specialty coatings that allow replacement of film structures that contain PET or nylon for barrier properties and increased stiffness.

Pioneers Dow, ExxonMobil and Nova Chemicals, with SABIC a more recent contender, highlighted their advances in such sustainable packaging at last month's K 2019 show in Düsseldorf.

Are there any specific machinery requirements for film extrusion to make all-PE pouches? Suppliers agree that most all-PE structures can be run on standard film equipment. However, they believe that alternative film processing technologies may offer advantages. For example, they note that all-PE films produced on machine-direction orientation (MDO) lines have exceptional stiffness and clarity.

How many film layers are typical for all-PE pouches? Holly Dunnill, director of Dow Packaging and Specialty Plastics' North America Food & Specialty Packaging, says the majority of today's packaging films have three to 12 layers depending on application. "With our RecycleReady technologies, including PE resins and compatibilizers, our goal is to make multiple layers compatible with PE so they can be recycled through existing PE recycling streams."

Nova Chemicals' food-packaging market manager Eric Vignola says recyclable coextruded PE pouches have at least five layers and up to nine layers or more, while laminates may have a minimum of two or three layers. For example, pouches requiring only moisture barrier could be a one-ply five-layer, surface-printed, coextruded film. For laminated structures, including an outer print layer and inner sealant layer, at least two or three layers are generally required for general-purpose and moisture-barrier pouches. If higher barrier is required, the sealant web will need five or more layers.

SABIC sources suggest two basic alternatives: For non-barrier pouches, a maximum three-layer coextrusion and an additional lamination layer; for barrier pouches, starting with at least five layers because of required barrier and tie layers.

THE NEW LIGHTWEIGHT HEAVYWEIGHT

Nova's Vignola notes that with the American Chemistry Council's commitment that all plastic packaging will be recyclable or reusable by 2030, and many brand owners committing to 100% recyclable packaging by 2025, all-PE structures have become a major trend. "Current commercial food-packaging applications for recyclable PE pouches include dry and frozen foods, and we also see non-food household applications, like liquid and powder detergents." He believes that as technology and materials evolve, recyclable PE pouches will find their way into most applications, from products with no barrier requirement, to moisture-barrier only, and ultimately to pouches with oxygen and aroma barrier.

Says Vignola**, "**For applications that don't require barrier, replacement of multi-material laminates with recyclable PE laminates and coextrusions is well underway. Machinery suppliers are optimizing their equipment to enable smooth processing of these film structures, which have different machinability requirements."

Moisture barrier in a recyclable PE structure requires a more specialized HDPE *and* expertise in how to run these products and structures optimally on both film and packaging lines, says Vignola.

Dow's Dunnill says her company continues to advance its RecycleReady technology, which Dow is bringing to converters early in the packaging design process, so they can collaborate to create mono-material packaging that will qualify for the How2Recycle label and the Store Drop-off Program in North America. "Last year, we launched an innovative formulation of PE resins to create a new sustainable all-PE laminate solution for flexible packaging. This mono-material, all-PE laminate packaging solution does not compromise on aesthetics and performance and will remain 100% recyclable at the end of its lifecycle."

Dunnill also cites Dow's ongoing collaboration to develop a fully recyclable plastic package for Bear Naked's granola products, which came to fruition through value-chain collaboration in just over 18 months: "This included the PE zipper closure by Fresh-Lock, the inks used for on-pack aesthetics by Colormasters, and converting by Berry Global of Bear Naked's recyclable package."

Nova Chemicals expects recyclable PE pouches to find their way into most applications—from products with no barrier requirement to moisture barrier only, and ultimately to pouches with oxygen and aroma barrier.

Noting a clear trend towards mono-material structures for multilayer pouches, SABIC sources cite the broad opportunity in dried foods, drinks, and retorted food products (precooked rice, soups, sauces, ready meals, meat and fish); wet pet food; and the growing non-food sector such as liquid household cleaners and personal-care items. They also note that retortable applications require a full PP structure, while for non-retortable products, convertors are moving towards full-PE solutions. ►

Vignola sees a significant challenge to meet the performance requirements of oxygen and aroma barrier, where products like nylon and EVOH are typically used. One way of making those barrier structures recyclable is to reduce the amount of nylon and EVOH, such that mechanical recycling may become feasible. Working closely together with organizations like the Association of Plastic Recyclers (APR) and the Sustainable Packaging Coalition will help the industry to leverage its collective expertise and insights to find solutions, he adds.

SABIC sources see plenty of potential to replace traditional packaging formats such as glass, metal, and rigid plastic packaging. They agree that the biggest challenge is being able to provide similar high barrier to oxygen and convenience with mono-material pouches.

Many pouches for liquids, viscous products and powders have fitments for dispensing. Typically molded of PE, fitments are easily sealed to multi-material pouches, but there have been challenges in sealing PE fitments to all-PE pouches, says Vignola. "There's a lot of R&D focused on new PE resins and new technologies, and at Nova we are close to overcoming those challenges."

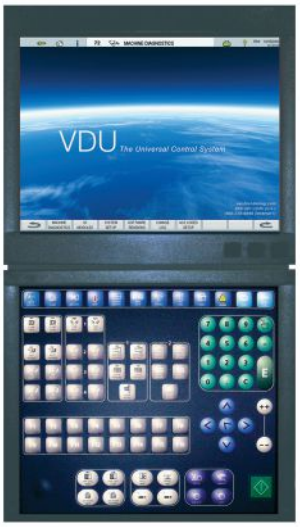
Suppliers concede that recyclable packaging structures require a combination of processability, barrier and sealant performance, clarity and aesthetics. Here are examples of some key materials contending for this market:

• **Nova:** Moderate moisture barrier, for applications like dry foods, can be achieved with medium-barrier Sclair 19C HDPE homopolymer. For products requiring a high level of moisture protection and longer shelf life, Surpass barrier HDPE resins HPs167-AB or HPs667-AB are ideal, says Vignola. All these resins also provide heat resistance and additional stiffness that enables the elimination of non-PE laminates.

A best-in-class sealant is required in all-PE structures to ensure seal integrity without damage from excessive sealing temperature. "Our VPsK914 series and VPs412-A offer the broad seal and hot-tack windows needed for faster sealing, along with improved production rates and high caulkability," says Vignola.

All-PE print webs can be customized with MDPE or HDPE, such as Nova's TF-Y534-IP, for desired aesthetics, which can include high clarity and matte to satin finish, while maintaining the heat resistance critical for printing and conversion processes.

• **Dow:** Says Dunnill, "Our RecycleReady portfolio incorporates various PE technologies and compatibilizers to create a mono-polyolefin structure that can be recycled through existing Store Drop-off PE recycling streams in the U.S." She notes that with use of Dow's Retain modifiers the RecycleReady standup pouch became the first package of its kind with barrier film that can be recycled in existing PE recycling streams. Dow's Affinity



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plastomers are designed to deliver enhanced caulkability and hot-tack strength. These properties enable hermetic sealing at higher speed, weight, or stress on the seal areas.

Dow also just launched Opulux HGT Optical Finishes to provide high gloss and high heat resistance, enabling production of full-PE pouches. This varnish is applied to surface-printed PE films. It broadens the film's processing window and helps expand the range of PE film performance.

- **SABIC:** For all-PE structures, Cohere S100 mLLDPE boasts very good heat-seal performance, sealing through contamination at low seal-initiation temperature. Supeer C6 and C8 mLLDPE resins offer high puncture resistance and toughness, while SABIC HDPE resins are said to offer high stiffness.

SABIC says its new BX202 LLDPE for biaxially oriented PE (BOPE) films on BOPP tenter-frame lines supports recyclability by using mono-material PE structures in multilayer films. Resultant films boast very good printability, high mechanical properties and toughness. This resin boasts one of the highest levels of sealing integrity compared with BOPP. Resultant pouches are used for confectionary products, snacks and dried foodstuffs, as well as for non-food personal-care products.

- **ExxonMobil:** At K 2019, the firm highlighted its Exceed, Exceed XP and Enable performance PE polymers, which help overcome recycling issues typically associated with conventional laminated structures. These new full-PE laminated solutions can easily be recycled where programs and facilities to collect and recycle plastic films exist. Also discussed were new technological advancements using recycled PE in combination with performance PE polymers to produce a range of sustainable flexible films.

TECHNICAL COMPETENCY NEEDS & MATERIALS KNOW-HOW

What do flexible packaging processors that want to enter this all-PE pouch arena need in technical competency to avoid running into problems such as quality control? Nova's Vignola says film processors will need accurate gauge control to be able to run thin layers, and layer-ratio control in a barrier structure is key. Once the film is made, the next challenge is winding thin and stiff films. Wrinkling can occur, with a negative effect on printing and lamination.

Standard laminates that contain multiple polymers typically are more forgiving on the packaging line than all-PE structures. The seal window is not as wide in all-PE structures, so managing heat exposure to limit stretching while sealing is essential.

What mistakes might new entrants might make in material selection? Nova's Vignola sees two main missteps that can hurt the chances of success. One is focusing only on recyclable options that are cost-neutral relative to mixed-material laminates. "Performance must be the first consideration. The most successful projects first establish a working film structure, and then tweak for cost savings later. For example, it can be tempting to reduce HDPE content to simplify production and reduce cost, but it also reduces stiffness and heat resistance, resulting in poorer form/fill/seal performance."

Dow's new Opolux HGT Optical Finishes provide high gloss and heat resistance to all-PE pouches.

The other potential pitfall Vignola sees is choosing resins solely based on data-sheet specs, and putting a film together based on principles that work for multi-material laminates. Depending on the size, shape and what is packaged, as well as line conditions, a recyclable PE pouch structure must be optimized for the specific use. "Our experts have the knowledge and experience to help customers design recyclable films that work," Vignola says. "Our Bonfire film-development platform, a proprietary web application, helps customers speed development of multilayer films."

Dow's Dunnill says a critical error is "bringing in recyclability and sustainability too late in the package design process. Our brand-owner customers recognize that considering recyclability as an add-on can be a major roadblock. We advise companies entering into all-PE packaging structures to work with a company like Dow that has successfully navigated designing for recyclability with all-polyolefin structures from start to finish."

Lack of proper package testing is yet another pitfall, says Dunnill, noting that it is crucial to test for shipping durability, handling, and product protection before launching a new package. She suggests new entrants invest in automation technology but remember that "the human touch is crucial throughout the process—from deciding which process automation technology is best for their company, through taking software-engineered packaging designs through a user experience and QC process." PT

By Tony Deligio
Senior Editor

Data Driven, Employee Owned

Approaching its seventh decade in business, PTA Plastics has shifted its location and remade its customer base since its founding in 1953, but many things have not changed in the intervening years, including an emphasis on people and leading-edge technologies.

Founded in 1953 in Connecticut, custom injection molder and moldmaker PTA Plastics now operates in Oxford, Conn., and Longmont, Colo. (pictured).

Founded in 1953 in Bridgeport, Conn., custom injection molder and moldmaker PTA Plastics currently operates out of facilities in Oxford, Conn., and Longmont, Colo. But back in 1999, workers at a third site in Des Plaines, Ill. faced a decision. The Illinois plant would be closing, and while PTA would offer jobs to its workers at the two remaining sites, they would still have to decide whether to pick up and move to the East Coast or Rocky Mountains, or stay put and find a new job.

The move had split the company, literally, but could have done so figuratively as well. In the end, all but one employee found a new PTA home, and Colorado received a healthy influx of Illinoians. *Plastics Technology* visited PTA's facility in Longmont, which is 30 minutes northwest of Denver, the day after a narrow loss by the Chicago Bears, and more than a few of those transplants lamented the state of their long-distance "home" team with Rich Dorans, PTA's president and *PT*'s tour guide.

Dorans, an Illinois native who started with PTA in 1984, faced the stay-or-go decision himself 20 years ago. He made the move, and in March 2019, was named PTA's president, taking over for Ray Seeley, who stepped aside after 40 years leading the company. When *PT* visited, Dorans—who had spent the previous week at an industry conference—was prepping to head to the K Show in Germany. A taxing schedule, but one that serves a core tenet.

In a bid to go paperless, PTA Plastics created a digital "Job Book" replacing the three-ring binders that follow molds around at most shops with a digital program on a press-side laptop.

PTA Plastics' quality-control department creates a variety of testing fixtures and programs for CMM equipment, shipping both with parts to its customers.

Secondary and value-added operations are a big part of PTA's value proposition.

"We just stay on top of the shows," Dorans says. "Whether it's IMTS (the International Manufacturing Technology Show) on the tooling side, or NPE and K on the plastics side." Technology has long been a focus for the company, and that didn't change when Dorans took over. In fact, that concentration might have sharpened. The company is in the midst of a strategic planning initiative—PTA 2030-Envision the Future—that emphasizes where the industry and the market are headed and what the company would have to look like to continue to thrive. Making that determination is a cross-sectional team of 10 employees.

"We take a look at where we are today, what the disruptors are going to be out in the future, and really how can we be a disruptor rather than getting disrupted," Dorans says. "I don't want to be 'Amazoned' or 'Uberized.' We're just trying to stay ahead of the curve from the technology standpoint."

KEEPING COMPETITIVE IN MOLDBUILDING

One way PTA has kept ahead of that curve has been to find, defend and grow a niche in the market. That has meant a greater emphasis on medical clients and dedication to in-house mold building, design-for-manufacture know-how, and value-added services.

In the early 2000s, as many molding shops de-emphasized their tool rooms and customers sought low-cost offshore molds, PTA did the opposite and invested in mold building in Connecticut and Colorado. "We were very aggressive towards growing the tooling business when many others were running away, pulling everything offshore," Dorans says. "We just tried to understand what we needed to do." Dorans admits that PTA wasn't trying to compete with offshore moldmakers on cost, but it hoped to make a big-picture financial and long-term service case to its customers. "If your customer is looking at the total landed costs," Dorans says, "at times, it still makes sense to do the work domestically, and you have control over that."

Occupying more than 10,000 ft², PTA's toolroom in Longmont runs 24 hr a day with two shifts. Between the two facilities, PTA has 18 tool makers and produces up to 150 molds annually. Dorans estimates that 95% of the jobs it's molding are run in tools made in-house. Some mold components are outsourced, but the most important parts of the tool are cut by PTA. "Anything that touches plastics, we keep in-house," Dorans says. Even for a component like a mold base, many of which PTA purchases from DME, Dorans notes that it is customized to the company's specs.

The toolroom, like the rest of the plant, is paperless, pulling CAD and CAM data from Cimatron software and feeding work progress into PTA's ERP system supplied by InFor Syteline. The tool room is bookended by a Makino SNC 64 making electrodes from graphite for EDM on one side and a 5-axis Monoblock 65 Deckel Maho cutting steel on the other, with a variety of metalworking equipment in between. Dorans says PTA makes "purpose-built tooling". That is, molds fabricated in a manner and from materials that are commensurate with what their ultimate job will be—satisfying the task to come while not being over-engineered.

> ***"I don't want to be 'Amazoned' or 'Uberized.' We're just trying to stay ahead from the technology standpoint."***

Because PTA can involve itself upfront in the design process—Dorans calls its capabilities here a "known strength"—it can put a project on the path toward a well-designed tool and a robust molding process while it's still a 3D model. "We do not design parts, but we can help our customers design a part that's manufacturable and cost-effective," Dorans explains. "In some cases, it could be just eliminating a detail, which will save them money; or from a quality standpoint, refining a design we could all be much more successful with."

Always seeking to stay on the leading edge of technology, one of PTA's most recent additions to its toolroom is a 5-axis Monoblock 65 Deckel Maho CNC milling machine.

MOLDING AND MORE

Molding operations are split between two rooms. The first, adjacent to the tool room, is filled by two rows of presses, while the other features a mix of presses and an assembly/secondary-operations area. Many value-added operations are mobile and can be wheeled into position adjacent to the press during molding runs. PTA has 34 injection machines companywide, with 18 in Longmont ranging up to 1375 tons. Most of the presses in Colorado are newer Toshiba's, with an older Newbury and a Battenfeld (its largest machine) mixed in. Subtracting those two, the average press age comes in at just under eight years.

In addition to straight injection molding, the company can do structural foam and gas assist. As *PT* visited, a Bauer compressor for gas assist was being wheeled into place next to one of the Toshiba machines. Keeping with its efforts to stay on technology's cutting edge, PTA added gas assist when it was just getting started. Dorans notes that gas assist allows customers to break some design rules while also offering cosmetic and dimensional-stability benefits.

Layout of the Longmont building, constructed in 1984, is not conducive to central drying, so PTA uses mobile dryers there. Recent additions include four new Matsui dryers. Dorans notes that PTA relies on a low-volume/high-mix business, which requires some agility, as the number of setups per month can range from 550 to 600.

The burden of managing those setups is eased by the company's PTA Job Book software, created in-house about 13 years ago to help remove paper from the shop floor. At many other molding shops, a three-ring binder follows a job around, containing key specs and parameters for a part and mold. PTA's Job Book makes this all-digital, allowing process and setup technicians to pull up everything from process parameters to water-line drawings on a press-side laptop. Step-by-step setup and assembly instructions are laid out with pictures and captions; and the system, which ties into the plant's ERP software, provides real-time scrap data.

Robert Berg, director of information technology, says that since its inception, the Job Book has been improved with direct feedback from the operators. Eventually, the company wants to tie in other equipment in the cell, including dryers. To make this and other initiatives possible, PTA is currently in the midst of a building-wide IT overhaul, replacing older wire infrastructure with new fiber-optic cables.

MAKING ROOM TO GROW

The company has taken on a 5000-ft² offsite storage facility, which opens up some space in its warehouse. New racks were recently installed in the warehouse, and eventually most of the assembly and decoration work will be moved into that space, freeing up room for more injection machines. The wall currently occupied by secondary operations is already plumbed for another three presses, which could range up to 180 tons in clamp force.

Value-added work has become a key and growing business for PTA, with Dorans noting, "It is very rare for us to mold a part and ship it without doing anything to it." It is also rare for the company, which generates 70% of its business from medical, to take on simpler jobs. In the assembly area, Dorans picks up a housing with TPE overmolding and multiple screw inserts in different sides and along various planes. "This is a typical PTA part," Dorans says, adding, "We don't get poker chips."

PTA Plastics is in the midst of reconfiguring its warehouse, with its extensive tool inventory, which is regularly reviewed to prune obsolete molds.

Dorans estimates that the company has 700 active tools in Longmont, with probably 1200 company wide. A strict preventive-maintenance schedule keeps these molds running, according to Brian Zutman, general manager. He notes that the ERP system will not allow a job to start up if the PM hasn't been completed. The system works—PTA has tools from 1967 that are still running. Longevity is a particular benefit for medical tools—Dorans compares a good medical tool to an annuity, paying dividends for years after an initial investment. The downside, especially when you make

upwards of 150 tools/year, is that mold inventory can build up. To avoid this, PTA performs a monthly review of the tool inventory, sending tools back to customers as they go out of service.

EQUAL SHARES

In business, it has become a platitude to call on employees to "take ownership" of their jobs; but PTA has taken that principle literally. In 2012, when Ray Seeley was seeking to wind down his role with the company, he balked at selling the company. "All the sales options could have made him a lot of money," Dorans says, "but he knew at the end of the day that PTA would not have remained what PTA has always been, and he really cares about the employees."

Seeley's solution was to create an Employee Stock Ownership Plan (ESOP), whereby he sold his stock to the company, creating a trust that holds the stock on the employees' behalf, with the share value determined by the success of the company—which, of course, is ultimately driven by its workers.

"Our share value continues to grow year after year," Dorans says, "and the employees are all given shares—they don't buy them—so it's an added benefit. It really makes you part of the team, and at the end of the day, your actions can actually improve the share value, and you can see those numbers continue to grow every year." Since the inception of the ESOP, PTA reports that its stock performance has beaten the S&P every year, displaying the competitive strength of ESOP companies.

Rich Dorans, who became president of PTA Plastics in March 2019, has been with the company since 1984 and was among those who chose to make the move in 1999 from Des Plaines, Ill., to Longmont, Colo.

PTA's share value started at $3.95 in 2012, and came in at $12.90 in 2018. In October, PTA celebrates Employee Ownership Month, along with hundreds of ESOP companies around the country. Among other festivities, PTA will hold a raffle with prizes for workers who can make the closest guess at 2019's share price. On a shelf in his office, Dorans has a row of mugs and cups commemorating the share price for each year, with steady increases all along. A new mug will soon be on Dorans' shelf, but he says he can't yet tell what number will be on it.

"I've already put my number in," says Don Williams, director of manufacturing.

"What'd you put in," Dorans asks. "$14.20," Williams responds. Dorans just smiles. PT

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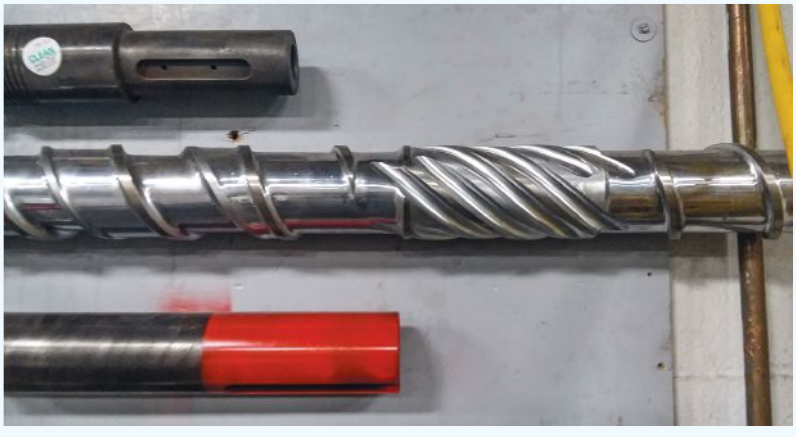
Follow These Steps to Purge Accumulator-Head Blow Molders

Preventive purging with a commercial product between resins or colors and during normal shutdown and startup cycles can prevent excessive loss of resin and production time.

Natural HDPE blow molded vessels made by ThermoFisher Scientific shown here are finished with injection molded closures.

By Peter Miller
Delta Blow Mold Consulting and Repair

If you operate accumulator-head blow molders, most likely you have tried to reduce the loss of time and material created by color changes, material changes, streaks and contamination. Success and efficiency of purging your machine depends on the proper care of your machinery and following the purging procedures for a product that is designed for your needs.



Large blow molding machines at ThermoFisher Scientific's Rochester, N.Y., facility routinely use Dyna-Purge F2 product for cleaning heads and extruder screws. ThermoFisher molding personnel say this practice reduces black-speck contamination after the machine comes out of a scheduled shutdown. Recommended purging procedures outlined in this article deliver significant time savings and reduce resin waste during startup, says ThermoFisher.

There are a number of considerations worth mentioning that are necessary for a positive purging outcome on any blow molding machine with accumulator heads. Let's review them now:

- **Temperature:** The first thing you have to ensure is that your heating and cooling functions are working properly on your barrel, screw and accumulator head. Issues in this area are commonly overlooked. One of the inspections you should conduct to ensure that the temperature readings are accurate is a planned maintenance inspection using a hand-held, quick-response probe. These devices are a good option to check and ensure your machines' temperature controls are performing properly.

- **Startup and shutdown purging:** In addition to color and material changes, shutdown purging is a good practice to follow. Using a commercial purging compound when shutting down is the best way to give your machine a thorough internal cleaning, even if you will continue running the same color. A very important step to purging an accumulator head is making sure you are following machine-manufacturer and commercial purging-compound instructions while overfilling your machine to accumulator-head capacity.

• **Purging procedure best practices:** In addition to the machine manufacturer's procedures and purge-compound instructions, here are some "best purging practices" made simple.

1. Ensure that your machine's temperature controls are working correctly and are set to the purging compound's specified temperatures. Helpful hints: Your product may have a "sweet-spot"—say, in the middle of the temperature range. Increasing temperatures on the head/die by 50° F (28° C) may improve purging results.

2. Confirm that your system is clean, with no chance of further contamination. Helpful hint: Have a checklist to ensure proper techniques are used to thoroughly clean the feed system.

3. Set your die gap open enough to let material flow out as you fill the head with purging compound. When you see the purging compound begin to appear, you can slowly close your tooling while filling, until you seal enough to be able to achieve 100% head fill. Helpful hint: Keeping die gap restricted during purging increases head backpressure, allowing for more aggressive cleaning.

Using a commercial purging compound when shutting down is the best way to give your machine a thorough internal cleaning, even if you will run the same color.

4. Put enough purging compound in your machine to fill your head and extruder. Helpful hint: Measure the amount it takes to fill the machine and keep that posted for other operators.

5. Reduce the extruder speed from its normal operating speed. Helpful hint: Start your extruder at around 20% or lower each time you restart and slowly increase while monitoring pressure indicators during all steps.

6. Fill with purging compound until your head and barrel are full. Wait the suggested amount of time at the suggested temperatures for the purge compound.

7. Follow with a virgin resin chaser or your normal production resin to remove the purging compound (post-purge) from the machine. Verify you are clean with quality-assurance first-article approval and begin your production. Helpful hint: Have a clean part that will pass inspection for comparison.

8. Depending upon machine age and condition prior to purging, more than one fill (or full cycle) of purge compound may be necessary to achieve a clean state. Helpful hint: Pre-measure the standard amount plus one additional barrel capacity so you have extra available and ready to repeat.

The value of purging is especially beneficial when shutting down for an extended amount of time, like a weekend. Thermo Fisher fills the barrel with Dyna-Purge to prevent oxidation, a major cause of degradation. As the machine cools, Dyna-Purge will solidify and shrink, pulling residue away from the barrel walls.

• **Tool-Less Purge:** In preparing to use a compound due to ongoing contamination, try pulling the seal ring when the die ring and pin are pulled. Because it's a restricted area, large chunks of contamination or previous color can hang up there. After pulling and then cleaning the tooling and seal ring, run the extruder slowly to push out any large contaminants before putting the tooling back in the head and using your compound.

• **Accumulator-head care:** Did you correctly check everything outlined here? Did you purge and remove the previous color, additives or contamination from the system? Are you still getting streaks or specks in your parison? Helpful hint: It may be time to inspect the internals of your screw/barrel and accumulator head for any wear or grooves that can trap contamination. PT

ABOUT THE AUTHOR: Peter Miller has been in blow molding for 28 years. He started as an operator, then moved up to mechanical operations leader and then plant manager at a facility with 19 accumulator-head machines. He started Delta Blow Mold Consulting and Repair, North Tonawanda, N.Y., in May 2019, in response to the shortage of dedicated mechanical ability in manufacturing. Contact: *716-512-4458*; *blowmoldpro@gmail.com*.

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PT Keeping Up With Technology

PRODUCT FOCUS **Injection Molding**

INJECTION MOLDING

Mobile Wireless Terminal For Injection Press Control

At October's K 2019 show in Dusseldorf, the German parent of Boy Machines presented for the first time a portable wireless terminal embodying the Boy Procan Alpha machine control system. It reportedly offers almost the same functionality as the fixed controls on the injection press. The IP address of the mobile terminal is permanently assigned to one particular machine, so it offers remote monitoring and control of only that one press via secure Ethernet communication. If the terminal is too far away from the machine, the press stops automatically.

The mobile control terminal is said to be particularly advantageous for complex systems or machines with multiple injection units, because it allows control screens and input values to be visible from both the fixed control screen and the mobile terminal in a different location by the machine. In the next phase of development, Boy says the WLAN version of the Procan controller will also allow setup and control of Boy LR 5 linear robots.

INJECTION MOLDING

Hot-Runner Companies Combine Technologies at K 2019

Evidence of integration of hot-runner technologies from different members of the Barnes Group was evident in their joint display at K 2019. FOBOHA, Männer, Thermoplay, Synventive, Gammaflux and Priamus all shared the same booth at the show.

As a sign of cross-fertilization among the group, Gammaflux presented several upgrades to its G24 temperature controller, including an integrated hydraulic power unit that can control hydraulic valve-gate systems with Synventive's integrated cascade control (SVGC). Männer e-control (servo control) for valve gates can also be integrated into the G24. In addition, Gammaflux has integrated the Priamus Quality Monitor software into the G24.

INJECTION MOLDING

Making Melt Temperature Useful for Process Control

At October's K 2019 show in Dusseldorf, Md Plastics introduced two new products that are meant to take the mystery out of melt temperature in the injection barrel and make it a useful parameter for process control. Both these introductions are based on the unique Temp-Sense melt sensor marketed exclusively by Md Plastics. This bimetallic micro-bead sensor reads the total "work" energy imparted to the melt by temperature and pressure during processing. This data is said to be far more accurate and consistent than any previous method of measuring melt temperature in injection molding (see Oct. '15 Close-Up for details).

One new product is the Temp-Sense Melt-Profiler II system, which eliminates the laptop required in the first version, replacing it with a handheld, standalone data-acquisition unit (pictured). This industrially designed unit plugs into the Temp-Sense sensor in the nozzle or end cap, and a magnet on the back allows it to be mounted on the press. Built-in software provides the same graphical displays of sensor readings throughout the process as were available on a laptop previously. Alarms can be set for peaks and integral areas of portions of the cycle curve. The unit is said to store weeks or months of operating data, which can be downloaded to a laptop or other computer system.

The second new introduction (ready for beta testing) is the Melt-IQ system for process control based on Temp-Sense readings. The sensor is hooked up to a small box with a 5 × 7 in. display in an industrial case, which also contains a microprocessor and analog-digital conversion unit. This unit calculates peak values and integrals of areas under the "work" curve for the molding cycle at a rate >2000 times/sec, which is faster than most injection machine controls.

The user sets up the unit by performing a brief trial run of a part, so that the unit "learns" the shape of the curve as the "fingerprint" of a good part. The software uses the total fill integral and the peak reading during injection to signal the transfer from fill to pack/hold. No screw-position sensor is necessary, and the new system is not affected by variances in the closing of the nonreturn valve or in decompression, since it measures only the thermodynamic output of the process. (It does, however, measure injection time as a safety factor and can signal an alarm if injection time is extended beyond the "learned" limit.) In most cases, data taken from the nozzle or end cap is good enough to control the machine, but sensors can also be placed into the mold's last cavity to fill for a closer look at sensitive tooling.

The system is designed to be competitively priced and easy to use. "It's a unique use of temperature data," says Md Plastics founder and president Michael Durina. "Make a good part, and the system will make sure to do it over and over again."

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INJECTION MOLDING

New Robots at K 2019

At October's K 2019 show in Düsseldorf, Wittmann Battenfeld showed off a brand-new range of high-speed robots and expansions of its WX servo robots and Primus economical linear series. Few details were available before the show on the Sonic high-speed line, other than it comes initially in three models—131, 142 and 143.

The newest model in the WX series is the WX138, which is said to have a "fundamentally new design." Wittmann describes it as "the first robot with a rigid X-axis," which is available from 620 to 920 mm and is driven in a novel way by an internal belt. Thus, the drive is concealed completely inside the profile of the X (demolding) axis, and the moving loads are reduced by 30%. The same is true of the main horizontal (Z) axis.

In addition, the vertical stroke (800 to 1200 mm) suits it to machines up to 300 metric tons. Payload capacity is 12 kg (26.4 lb). The vertical profile boasts "dramatically increased rigidity," now 50% higher in the direction of the main demolding stroke and 100% higher in the direction of the Z axis.

Wittmann also expanded the range of its economical Primus servo robots for pick-and-place operations. The new Primus 48/48T models are suited to injection machines up to 900 m.t., vs. 400 m.t. for the Primus 26/26T. Horizontal stroke can reach to 6 m, so that several pallet bays can be arranged beside the press, or parts can be deposited behind the clamp. Demolding stroke is up to 1200 mm, and vertical axis is 1600 to 2000 mm for the telescoping 48T model. Both Primus 48 and 48T models have a payload capacity of 20 kg (44 lb). Vertical tube rigidity is said to be comparable to WX models, and vacuum and air hoses are concealed inside.

Wittmann Battenfeld also added a new Primus 16T model with telescoping arm that suits it to low overheads. Vertical stroke is 800 to 1000 mm and payload capacity is 5 kg (11 lb), the same as the earlier Primus 16.

INJECTION MOLDING

News in Automation at K 2019

Three units of the Hahn Group showed new automation solutions at October's K 2019 show in Dusseldorf. First, Waldorf Technik demonstrated an enhancement to its Vario TIP System for demolding and cavity sorting of syringe barrels. Now it's possible to apply digital printing to the parts right after demolding. After cavity sorting and at least two QC checks, the cylinders are plasma treated, printed, and dried with UV radiation.

Waldorf also presented the new EVE Suite of digital services from Hahn Digital. For example, EVE Analytics allows remote monitoring of system status on a PC, smartphone or tablet. And EVE Support offers guided remote maintenance through use of augmented reality and smart glasses for video calls.

Hahn's Wemo unit, which supplies linear (Cartesian) robots, showed off its new WIPS 4.0 control software and lightweight handheld pendant, W-Hp12, with a 10.1-in. color touchscreen. The screen has a customized start page, integrated touch pen, and swipe functionality for faster navigation. Hardware buttons are provided for most-used functions, like activation of axis movement and main operation buttons for start, stop and reset. Three levels of safety buttons include a "dead-man's grip."

Wemo also showed off two sizes of its new xPacker fast palletizing robot (pictured), which appeared at Fakuma 2018 (see March '19 Keeping Up). A unique vacuum gripper detects the object's size and activates only the needed vacuum channels.

Hahn's third automation unit, GeKu, showed its latest acquisition, the Sawyer one-armed collaborative robot from the former Rethink Robotics (see March '19 Starting Up).

INJECTION MOLDING

Compact Valve Gates Debut at K 2019

At K 2019, HRSflow showcased its recently expanded line of compact valve-gate cylinders that require limited installation space. These include pneumatic cylinders that can be installed without removing the hot runner from the mold plate. Featuring good thermal insulation, the cylinders do not require cooling for a wide range of polymers. Modular design reduces the number of parts and maintenance; and the cylinders are available with or without end stroke, in a damped version, or with end stroke and pressure sensor.

Also featured at K were compact hydraulic valve-gate cylinders that require only small cutouts in the tool and minimize heat transfer from the manifold. In addition to the basic design, a dampened version is available. Further variants offer a microswitch for end-position detection, as well as an adjustable version to compensate the position of the needle by ±1 mm without mechanical reworking.

HRSflow also presented the SA Series, its smallest screw-in nozzles for very low shot weights. They feature a compact cutout and ability to process engineering polymers, including ones with high fiber loadings or high viscosities.

EXTRUSION

Two-Stage Screw Offers Dual Mixing Action

The new DS-Blend feedscrew from Davis-Standard (D-S) provides distributive and dissipative melt mixing. The two-stage design reportedly achieves outputs similar to those provided by barrier screws, but at lower melt temperatures and reduced energy requirements. It can be installed on new or existing single-screw extruders from D-S and other suppliers. John Christiano, D-S' v.p. of technology, calls the new design "one of our most versatile and energy-efficient feedscrews to date." He adds, "As with all our feedscrew designs, we are focused on improved outputs, material homogeneity and feedscrew longevity."

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EXTRUSION

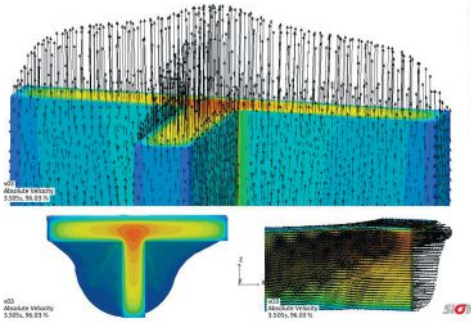
Simulation Software Permits Die Optimization

Known primarily for simulation software to optimize injection mold and runner design, Sigma Engineering gave attendees at the K 2019 show a look at its developments in simulation software for extrusion die design.

As Sigma explains, melt inside an extrusion die is a lot like flow inside a hot runner. In an extrusion die, moreover, the temperature distribution in the die steel, as well as the geometry of the flow channel, have significant influence on the flow behavior.

Simulation helps identify dead spots, excessively long dwell times in the die, or high pressure losses—all before the die is built. In this way, tool modification costs and trial-and-error runs to find the optimum configuration are reduced.

Sigma says that with its Sigmasoft Autonomous Optimization, flow channels of the extrusion die are automatically optimized within hours, dramatically improving the quality of the extrudate. To achieve this goal, geometrical degrees of freedom for the die's flow channel are defined by the user. The software then autonomously determines the ideal geometry for a dimensionally stable extrudate.



According to Sigma, software currently available on the market helps to calculate the temperature distribution inside extrusion dies. However, their new software with its "Virtual DoE" can automatically find a die geometry that allows for extrusion with homogenous velocities. An optimized velocity profile inside the die helps minimizes deformation of the extruded profile.

THERMOFORMING

Flexible Steel-Rule Die Former

WM Thermoforming Machines rolled out the Flex 92 at K 2019 last month, billing it as a steel-rule-die machine designed for maximum flexibility. Features include:

- Ability to use one machine for a wide range of molds without the need for major mold modifications.
- Movable clamping frame, plug assist and electrically driven ejector.
- New steel-rule die technology improving parallelism stability, cutting resolution, and increasing die life.
- Remote Machine Viewer interface, which allows real-time remote monitoring of the machine's functions via smartphone, tablet or PC.

As a result of an agreement earlier this year, WM machines are available in North America from SencorpWhite.

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EXTRUSION

Seven-Layer Line for All-Polyolefin Films

At K 2019 Macchi showed its next generation POD (polyolefin-dedicated) blown film line, a seven-layer line with a net width of 106 in. Enhancements to the line, called the POD Flex series, include:

- New fully automatic, integrated continuous gravimetric feeding ensures rapid material changes and drastic reductions in production waste.
- New screw designs allow greater flexibility in processing different materials while improving output.
- New TE572 series extrusion head can handle both polyolefin and barrier film formulations on the same line.
- New fully automatic, integrated high-flow air ring is able to guarantee faster and more repeatable setups.
- Non-contact thickness-control system, capacitive and optical, is suitable for real-time detection of barrier layers.
- New takeoff unit, series ST426R, with reduced height, enables more rapid response to production changes.
- Updated BO Plus winding system, comes with reel unloading and handling units with telescopic connecting rods and innovative cutting system. The new reinforced structure allows perfect winding of reels up to 47-in. diam.
- New "Macchi 4.0" software release generates complete data on recipes, setpoints, materials consumption, and production output, which can be integrated into customer's management systems.
- "Complete digitalization" of the line guarantees "clean" data exchange between the various components with zero interference in the system network.
- New Macchi-MDO technology is able to meet growing demand for thinner films with high mechanical properties.

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BLOW MOLDING

Entry-Level Injection-Blow Machine

At October's K 2019 show in Düsseldorf, Jomar Corp. introduced an injection-blow machine at an "entry-level" price for first-time users of this type of equipment. The new Model 25 replaces the Jomar Model 20, now discontinued. "We found that customers wanted a Jomar, but they didn't have the capital required for our larger machines or couldn't meet their annual volume requirements with our Model 20," said Carlos Castro, president of Jomar.

The Model 25 has the same compact footprint as the Model 20 but with greater clamp force—21 tons on the preform clamp (up from 18 tons on the Model 20) and 5 tons on the blow clamp (up from 4.5 tons). It can mold bottles up to 6 in. high and almost 4 in. diam. Previously, bottles of that size had to run on larger, more expensive machines. Based on 6000 hr of annual production, the Model 25 can make 10-ml eye-dropper vials at 16 million/yr or 500-ml pill bottles at 1.2 million/yr.

BLOW MOLDING

Three-Layer Drum Machine Performs at K 2019

The biggest blow molder running at October's K 2019 show in Düsseldorf was said to be the ECT 880 CoEx3 from ST BlowMoulding of Italy. This three-layer continuous-extrusion machine is designed to produce 220-liter L-ring drums and open-head drums at up 50 drums/hr. Compared with accumulator-head machines, this unit reportedly provides a 10% faster cycle, improved wall-thickness control and major energy savings. The machine is equipped with high-efficiency HEX extruders, a ReCo3 extrusion head from W. Müller, and the PWDS/SFDR radial-control unit from Feuertherm. The machine also incorporates safety devices for head tooling changeovers: an electric hoist to raise the core and die; an adjustable swivel arm to align them to the extrusion head; and a movable catwalk extending from the machine mezzanine to permit work under the extrusion head.

As reported in our September show preview, another new machine from ST BlowMoulding will be displayed offsite: an ASPI 200 suction blow molder. It incorporates such recent developments as a brand-new control interface said to be "as user-friendly as a smartphone"; the W-Print system to mark data directly on the parison; and parison-swell monitoring for process control.

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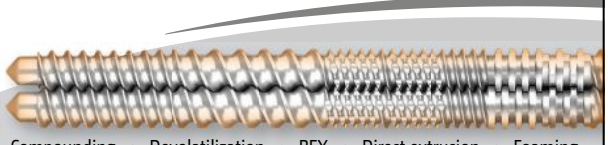

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COMPOUNDING

Two-Extruder Setup for Glass or Carbon Fibers

At K 2019, MAS displayed a conical twin-screw extruder as a side feeder for a single-screw extruder. The single-screw extruder meters the main polymer, while the twin feeds additives such as glass or carbon fiber.

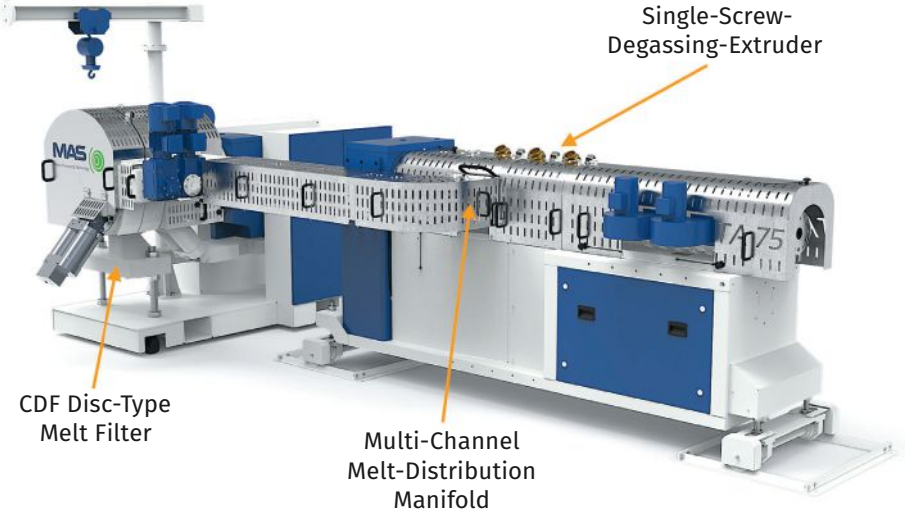
This type of setup provides high-quality mixing earlier in the process and ultimately a higher compound homogeneity, according to MAS. The MAS conical twin, moreover, offers very gentle plastication, so glass or carbon fibers are subjected to only minimal mechanical stress. This maximizes their length and reinforcing effect.

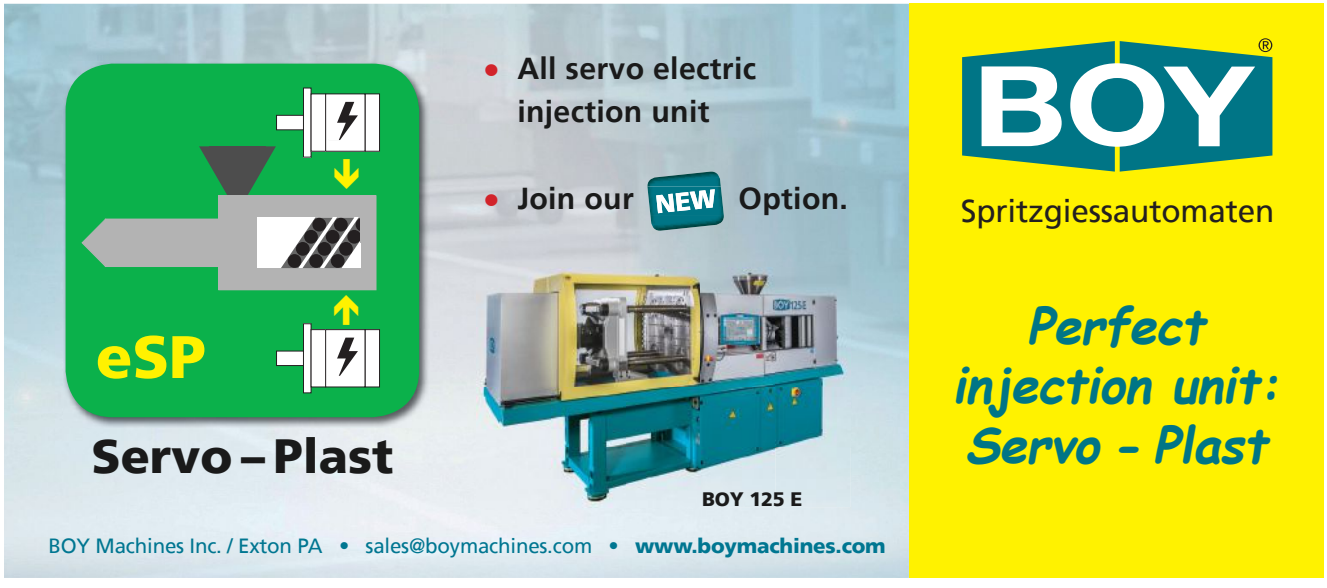
RECYCLING

Cascade Retrofit Package for Extruders

During K 2019, MAS introduced a retrofit package for recycling lines to increase process performance and quality, such as for processing PE film flakes. It featured a combination of the MAS-CDF disc filter and a special MAS single-screw degassing extruder. This allows existing single- or twin-screw extruders to be upgraded to a cascade extrusion line.

The company says that the MAS cascade package is more than just a retrofit option. The melt stream from the initial extruder exits the filter in a series of individual streams in a multi-channel melt-distribution manifold. The melt then feeds into the degassing zone of the single-screw extruder. The division into individual streams means that the melt can be degassed more efficiently and has a more homogeneous density. Several production applications with PE and PP materials have shown that after retrofitting the cascade package, throughput of the recycling line rises 40-50%, according to MAS. Also, the more homogeneous extrudate increases the bulk density of the regenerated material by up to 15%.





HEATING/COOLING

Advanced Mold-Temperature Control at K 2019 Show

Engel showed two enhancements of its program to digitalize mold-temperature control at October's K 2019 show in Düsseldorf. One exhibit was the new e-temp XL model, a larger version of its TCU with variable-speed pump, built for Engel by HB-Therm of Switzerland. The new unit has pump capacity up to 32 kW, double the previous maximum size.

The e-temp TCUs can be integrated with an Engel injection machine's CC300 control via Engel's iQ flow control software, which dynamically regulates the volume flow rate to match the process conditions. To make this possible, another key element of the system is Engel's e-flomo electronic water manifold (pictured), which can monitor and control flow and temperature in individual water channels.

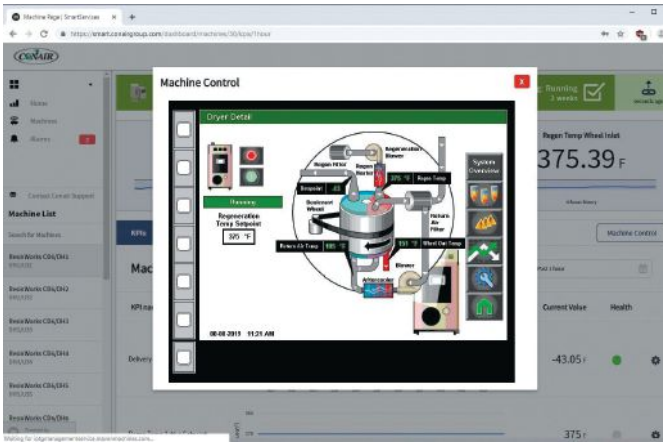
A new e-flomo feaure introduced at K 2019 is automated, sequential air-purging (blow-out) of the manifold circuits in the injection mold when changing molds or mold inserts. This is normally a manual process that is time-consuming and not always reliable, as compressed air often does not flow evenly through the circuits. The new optional feature for the premium version of e-flomo is said to speed mold setup and minimize the risk of residual water remaining in the cooling channels.

AUXILIARY EQUIPMENT

Monitoring Platform Expands Capabilities

Conair says its SmartServices platform, which it describes as an Industry 4.0 program for auxiliary equipment monitoring, management, and analysis, has been expanded following user feedback from six-month customer trials that started after its launch at NPE 2018.

The web-based portal supported by cloud-based data processing helps processors convert volumes of data generated by plant equipment into actionable information. The system collects machine data through a network of data hubs that transmit it into the secure, cloud-based SmartServices database for processing and presentation to the user in a dashboard format.



With the new additions, the SmartServices portal gives authorized users access to the complete control system of individual auxiliary machines, with the ability to execute functions from a remote location. Conair says this capability is not only useful to a manager monitoring processing operations, but is of particular value to maintenance and service personnel.

With the new capability, the system can page a maintenance supervisor anywhere, even at home, and that supervisor can then launch the portal, open the machine control, clear the alarm, and correct it on the spot. Additionally, Conair service personnel can use this feature for remote maintenance and faster repairs.

Users can now also customize and program Key Performance Indicators (KPIs) that can alert them to anomalies. Users now can choose a specific KPI, set performance thresholds, and ask the portal to notify them and report only when a machine moves outside that threshold.

At present, SmartServices can monitor and control Conair blending, drying, temperature-control, and extrusion downstream equipment. However, the program has the flexibility to monitor customized KPIs on non-Conair auxiliaries and other equipment types as well. SmartServices software is web-based so there is no need for manual updates.

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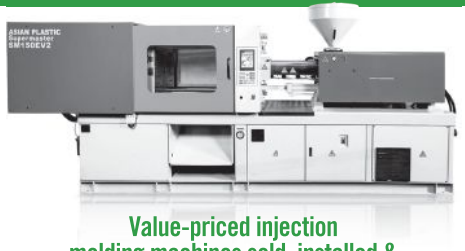

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Lower or Flat Prices Ahead

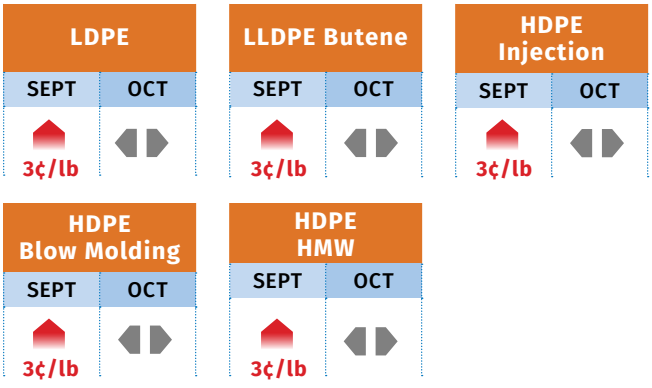
Slowed demand, sufficient supplies, and lower global prices could serve to push down U.S. prices of most commodity resins.

By Lilli Manolis Sherman
Senior Editor

The year's last quarter started with signals that prices of PE, PP, PS, PVC, and possibly PET would drop or remain flat, despite suppliers' attempts to hike prices. Among the main drivers are ample supplies, falling global prices and, in some cases, slack demand. PET could be the exception, as higher prices are projected for its key feedstocks.

These are the views of purchasing consultants from Resin Technology, Inc. (RTi), senior editors from Houston-based *PetroChemWire* (*PCW*); and CEO Michael Greenberg of The Plastics Exchange.

Polyethylene Price Trends



Market Prices Effective Mid-October 2019

Resin Grade	¢/lb
POLYETHYLENE (railcar)	
LDPE, LINER	95-97
LLDPE BUTENE, FILM	78-80
NYMEX 'FINANCIAL' FUTURES	33
OCTOBER	33
HDPE, G-P INJECTION	100-102
HDPE, BLOW MOLDING	93-95
NYMEX 'FINANCIAL' FUTURES	33.5
OCTOBER	33.5
HDPE, HMW FILM	107-109
POLYPROPYLENE (railcar)	
G-P HOMOPOLYMER, INJECTION	70-72
NYMEX 'FINANCIAL' FUTURES	45
OCTOBER	45
IMPACT COPOLYMER	72-74
POLYSTYRENE (railcar)	
G-P CRYSTAL	108-110
HIPS	112-114
PVC RESIN (railcar)	
G-P HOMOPOLYMER	82-84
PIPE GRADE	81-83
PET (truckload)	
U.S. BOTTLE GRADE	47-51

PE PRICES UP FOR SHORT TERM

Polyethylene prices moved up 3¢/lb in September as suppliers pushed to reclaim at least part of the 6¢/lb loss of previous months. They attributed the move to a weather event in the Texas Gulf Coast; but no *force majeure* declarations were reported, and transportation and production infrastructure in the PE segment was restored quickly after the heavy rains and flooding, according to Mike Burns, RTi, v.p. of PE markets, and *PCW*'s senior editor David Barry. There were also reports of a new 8¢/lb increase, effective Oct. 1, though one supplier posted a 4¢/lb hike. The Plastic Exchange's Greenberg noted that while there might be some valid reasons behind the September hike, implementation of the additional October increases was very unlikely, barring another major storm or escalating hostilities in the Middle East.

Both Burns and Barry ventured that the 3¢/lb increase would most likely be reversed in October-November, barring a major disruption. Said Burns, "Processors are in the best position in years to negotiate new-year contracts." He characterized PE demand as very active in August due to low prices. He saw September demand as sluggish due to pre-buying when prices fell. He noted that Southeast Asian PE prices could have a significant impact on late fourth-quarter prices. He explained that low regional prices are stalling exports, which will then swell domestic suppliers' inventories and can translate into lower U.S. prices. Barry noted that while more new capacity is slated to come on stream, startup of most projects was being delayed.

PP PRICES RISE SLIGHTLY

Polypropylene prices were likely to move up by 1¢/lb in step with propylene monomer after remaining flat in August. The slight increase was attributed partially to a fire at an ExxonMobil propylene cracker and the Saudi Arabian oil-fields attack. Prices were expected to be relatively stable in October-November, give or take a penny, according to both *PCW*'s Barry and Scott Newell, RTi's v.p. of PP markets. "There's a slight downward potential for that time frame," Newell said. "PP prices for secondary markets and exports have been heavily discounted."

Polypropylene Price Trends

Homopolymer	
SEPT	OCT
▲ 1¢/lb	◀▶

Copolymer	
SEPT	OCT
▲ 1¢/lb	◀▶

He characterized demand as stagnant, with many key markets showing negative growth compared with 2018, including automotive, consumer goods, and film sectors. Newell said PP suppliers' inventories increased by 55 million lb and days of supply were at 38, which translates into a very well-supplied market. While both LyondellBasell and Braskem had planned maintenance outages in September-October, Newell doubted that there would be any tightness. Both Newell and Barry see PP processors as having more of an edge on 2020 contract negotiations as a result of the supply/demand imbalance.

Greenberg described spot PP trading as very strong by September's end, with ample supply. He reported that while PP contract prices would likely settle 1¢/lb higher, following monomer costs, "Good resin availability remained and supply risks appeared benign." As September ended, spot prices for both homopolymer and copolymer PP grades ticked lower by a full cent.

PS PRICES FLAT-TO-DOWN

Polystyrene prices were flat in September, following a 1¢/lb drop in August. One supplier called for a 3¢/lb increase on Oct. 1, while another indicated flat pricing. According to both *PCW*'s Barry and Robin Chesshier, RTi's v.p. of PE, PS and nylon 6 markets, a slight increase in September benzene contract prices (5¢/gal) to $2.60/gal. was lower than the year's previous low of $2.66/gal in July. Moreover, low spot styrene monomer and butadiene prices (41¢/lb and 37.5¢/lb, respectively) did not support a price increase.

Polystyrene Price Trends

GPPS	
SEPT	OCT
◀▶	◀▶

HIPS	
SEPT	OCT
◀▶	◀▶

Both industry sources noted that prices in Asia for monomer and PS have been dropping, and that barring a major global disruption, prices in October were likely to remain flat with some potential for further PS price erosion this month and next. Said Chesshier, "Benzene will be the main driver."

PVC PRICES FLAT

PVC prices in September were flat after the August 1¢/lb decrease. *PCW*'s senior editor Donna Todd reported that while buyers were glad to see the predicted August decrease, they were disappointed that another expected 1¢/lb drop did not occur in September. Meanwhile, suppliers issued a 3¢/lb increase for Oct. 1.

PVC Price Trends

Pipe	
SEPT	OCT
◀▶	◀▶

Gen. Purpose	
SEPT	OCT
◀▶	◀▶

Both Todd and Mark Kallman, RTi's v.p. of PVC and engineering resins, were skeptical about the move, due to both a weak export market and a domestic market that never quite recovered from its early season delay. Said Kallman, "While demand has been steady, the market has not seen the boost that was expected." Both sources noted that suppliers were hanging their price moves on higher spot ethylene prices due to some production disruptions. Late-settling ethylene contract prices for August and September were expected to end up rising more than 2¢/lb. RTi's Kallman ventured that PVC prices in October would be at most 1¢/lb higher, followed by flat pricing this month. *PCW*'s Todd also ventured that there is potential for a further 1¢/lb decline before year end. He reported, "Export prices have been falling in concert with Asian prices, which is expected to put pressure on the domestic market and make a domestic price increase difficult to achieve."

PET PRICES DROP

PET prices ended September at 47-51¢, down from 50-53¢/lb at the end of August. This price is for most imported resin from around the world, as well as domestically produced PET, according to *PCW* senior editor Xavier Cronin. Meanwhile, offgrade PET and "penciled-down" prime PET (resin sold as offgrade when a seller needs to get rid of prime inventory) was a few cents lower.

PET Price Trends

Bottle Grade	
SEPT	OCT
▼ 3¢/lb	▲

Cronin noted that PET prices for October started out steady. However, some market sources project that prime PET prices could rise in October and for the rest of the year, due to higher global costs expected for PET feedstocks, including PTA and MEG. PET could possibly go up 4¢lb or more, according to one domestic PET resin seller. Demand remains weak due to the end of the heavy PET seasonal consumption period. PT

Contraction Extended Through September

Plastics business activity contracted in September for a third consecutive month.

By Michael Guckes
Chief Economist/Director of Analytics

At 47.5, the Gardner Business Index for Plastics Processing contracted further in September compared with the prior month. (Readings above 50 indicate expanding activity while values below 50 indicate contracting activity. The further away a reading is from 50, the greater the change in activity as compared with the prior month.) Over the last three months, the Index has reported a generally consistent level of contracting business activity for processors.

An analysis of the underlying components of the September Index reveals that while supplier deliveries expanded, this was more than offset by accelerating contraction in backlogs and exports. The remaining components had only a marginal impact on the Index's monthly result.

The accelerating contraction in export orders over the last 12 months has decelerated both backlogs and total new orders. September experienced an accelerating contraction in exports while total new orders activity was nearly unchanged, implying that domestic orders approximately offset the decline in exports. Production activity has fallen sharply in response to contracting new orders. In the three months ending with September, the production reading averaged 49.1, down from a reading of over 60 during January 2019. The index is based on surveys conducted monthly of subscribers of *Plastics Technology* Magazine.

Michael Guckes is chief economist and director of analytics for Gardner Intelligence, a division of Gardner Business Media, Cincinnati. He has performed economic analysis, modeling, and forecasting work for more than 20 years among a wide range of industries. He received his BA in political science and economics from Kenyon College and his MBA from Ohio State University. Contact: *(513) 527-8800; mguckes@gardnerweb.com*. Learn more about the plastics processing Index at *gardnerintelligence.com*.

Gardner Business Index: Plastics Processing

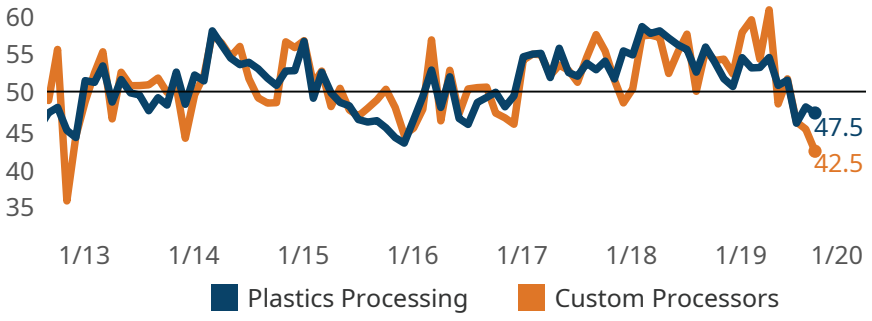


FIG 1

Total plastics business activity contracted in September for a third consecutive month. Custom processors, however, indicated a far steeper contraction in business activity in September.

Plastics Processing: New Orders & Exports

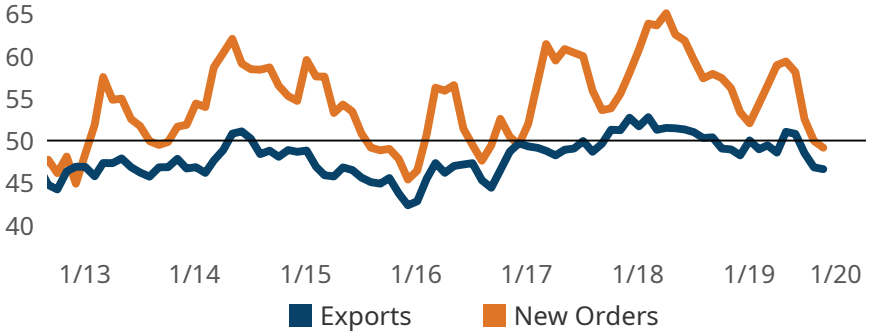


FIG 2

Export orders have contracted at an accelerating rate over the last year, putting pressure on other components of the Plastics Processing Index.

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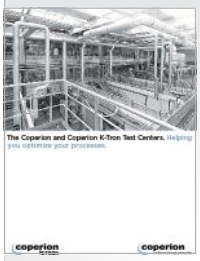

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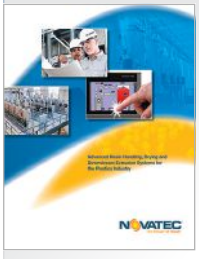

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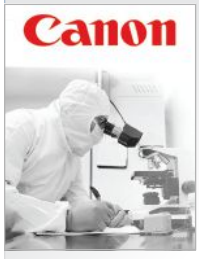

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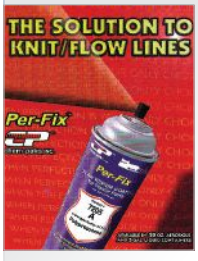

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SUPPLYONE PLASTICS — READING, PA.

Thermoformer Sees Business Bump From New Machine Installation

Addition of fast-cycling form/cut/stack unit leads to new business over $1 million.

By Jim Callari
Editorial Director

Thermoformer SupplyOne Plastics has expanded its manufacturing capabilities and increased output with the installation of a new high-speed form/cut/stack thermoformer from GN Thermoforming Equipment for production of food, industrial and electronics packaging. The increased output of the new GN800 machine has directly resulted in the acquisition of between $1 million and $1.5 million in new business for the Reading, Pa.-based custom former.

"The new GN800 thermoformer opens the door for larger food accounts that have high-volume requirements," states David Morris, president of SupplyOne Plastics. "This equipment will help us meet growing demand and further support our customers' need for speed to market by complementing our quick-turn tooling, design and production capabilities."

New GN800 at SupplyOne Plastics has helped boost the thermoformer's sales by more than $1 million.

The purchase of the GN800 was an integral part of SupplyOne Plastics' $1.5 million expansion plan, which included several new plant upgrades and the addition of 59,000 ft^2 of warehouse space to accommodate the company's growing business. The company increased its fleet of machinery to eight with its first purchase of a GN thermoformer. "We were looking to differentiate from the competition and vie for more high-volume accounts that demand a high level of market responsiveness," Morris notes. "Our leadership was impressed with GN's leading-edge technology, support and service."

The GN800 runs at 40-50 cycles/min versus SupplyOne's current production rate of 11 cycles/min. One of the machine's first production jobs is a PET food tray that is currently running at 30 cycles/min. This application previously required two shifts a day and two machines to produce the required 67 million packages per year. The GN800 eliminates one machine and one shift, cutting production time by more than 50%.

> ***This equipment will help us meet growing demand, and further support our customers need for speed to market."***

For high-volume food packaging, the new GN800 enables SupplyOne Plastics to install and run more complex tools. The new thermoformer also helps the company become leaner, according to Morris.

SupplyOne Plastics is a thin-gauge packaging manufacturer that utilizes PET, OPS, HIPS, PLA, PP, and PVC at thicknesses from 7.5 to 0.080 mil. The plant is a Safe Quality Food (SQF) certified facility, which ensures that packaging meets all food-safety best practices and established regulatory requirements. PT

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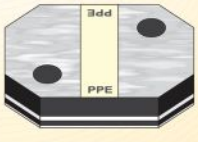

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