The Journal

Summer 2014
Volume 5
Issue 3

Product Design and Development Division

Newsletter

Editor's Desk

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ANTEC 2014

Brandon Lee

DIRECTION

I had the wonderful opportunity to finally meet my fellow Board members at this year's ANTEC. I was awestruck by the amount of plastic knowledge in the room. Glenn Beall eloquently reminded us the goal of our division, "To educate designers and engineers to be better plastic designers." This got me thinking, all the members of PD3 are experts in specific plastics and processes, and it is our duty to share that knowledge not only with each other, but with our fellow design colleagues. We are the PD3 ambassadors. We need to get the word out- evangelize as it were- to the design community that the SPE- and PD3 in particular- are a resource to help them make better, more effective plastic products.

The Journal is not only a document to get the latest on what's happening in our division, but a technical journal. The Journal is meant to be shared with non-members in the design community.

With this in mind, The Journal is a great way to share your experience and knowledge with regards to plastics. So please contribute an article or two. If you're not good at writing, make a verbal dissertation and send your mp3 recording to pd3.quarterly.editor@live.com. I will transcribe your talk. As another suggestion, we can have a conversation regarding your views. I will be glad to setup a time to interview you. Whichever method you choose to share your knowledge will be appreciated.

Okay, I'll get off my soapbox now.

ANTEC

The purpose of ANTEC is education, but everyone knows it's really a chance to get reacquainted with old colleagues and make new ones. I hope you had a chance to partake in all your chosen events and enjoyed the company of your fellow plastics professionals.

Have a great summer and I look forward to hearing from you.

Brandon Lee
Editor-in-Chief
pd3.quarterly.editor@live.com

PD3

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President's Desk

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A Call to Arms

Al McGovern

Greetings to all PD3 Members—and to plastic part designers everywhere!

It is my honor to address you as the incoming President of the SPE Product Development and Design Division, affectionately referred to as PD3. I have just one goal for this rejuvenated division:

> To make PD3 the destination for plastic part designers to reliably obtain the answers to their questions, and the solutions to their problems.

This goal continues the great work done by our outgoing President, Michael Paloian, whose inspirational leadership the past two years has generated enthusiasm amongst the PD3 Board of Directors (BOD) that we intend to pass along as we involve YOU in achieving this goal—there is no better way to meaningfully achieve this goal. Thanks, Michael, for putting the spark back into this great division!

The PD3 has an awesome BOD, all of whom are ready and willing to make this goal a reality. Although we are volunteers, with "day jobs", we are all passionate about this because we believe Product Development and Design is at the core of all we do as engineers and designers. And, to steal the US Marines' recruiting slogan: "We're looking for a few good men", and women of course, to join our ranks.

So, what are you waiting for?! This is your opportunity to share your passion for plastic part design with the rest of the world! We have great

plans to build a PD3 website, to increase our presence at ANTEC in the form of Product Development and Design papers and case studies, and to build upon the wildly successful rebirth of PD3 TOPCONs—the one just held in Gurnee, IL, had over 140 attendees and sponsors! And, we'd love to take our enthusiasm outside the US—I have heard that plastic part design is happening all over this great globe! And a special shout-out to Millenials—you are the future of this world, so make a difference by getting involved! You will be enriched and will grow your network to include some of the best plastic part designers in the world.

Don't let another week go by without giving me a call, or sending me a text or an e-mail. I don't bite, but I will try to inspire you to join us in this great adventure!

Wishing you peace and happiness in all you do,

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Board Meeting, April 30, 2014, ANTEC

Ed Probst, Notetaker

Called to order 12:50 PM
Quorum established: Mike Lacey, Al McGovern, Glenn Beall, Mike Paloian, Lance Neward, Mark MacLean-Blevins, Ed Probst, Brandon Lee, Eric Larson (guest), Dave Tucker (guest) and Kathy Schacht as SPE HQ Gov. Liaison.

Retiring Chair Paloian handed the proverbial gavel to incoming Chair McGovern, after his last official act of presenting a certificate of appreciation to Ed Probst for a job well done as Conference Chair of the recent PD3 TopCon in Gurnee, IL.

Presentation of an informal Certificate of Appreciation from McGovern to Paloian, printed on the back of a coffee cup stained recipe: Guiness Cupcakes w/Bailey's Cheesecake frosting and a very formal, handsomely engraved acrylic momento. The sentiment read:

Presented to
Michael Paloian
For His Inspired Leadership as
President of the PD3 for the Past Two Years
Board of Directors
April 29, 2014

After McGovern provided a brief perspective of his leadership style, he laid out his goals for PD3 for the next 2 years.

"To make PD3 the destination for plastic part designers to reliably obtain the answers to their questions, and the solutions to their problems."

Goals

1) Create a website – by 12/31/14
    a. This could / should be a micro-site from the newly improved SPE website.
2) Education – Consistent, sustainable, relevant, reliable and affordable design education
    a. Newsletter—3X per year goal. Maybe limit to 20 pages to make it more readable on mobile devices.
    b. TOPCONS—2X per year goal, one per year minimum, with a small speaker count, seminar style format focusing on fundamental process education for designers
    c. ANTEC papers—more part design related content and perhaps case studies.
3) Membership—growth goal 5% but would like to set a stretch goal of 10%
    a. Target demographics – younger professionals
    b. International participation – China is a large, untapped market in need of what PD3 has to offer.
4) Other
    a. Fill all open slots on BOD, especially Secretary
    b. Add support people for committees, especially Newsletter and TopCon
    c. Bi-monthly Board Meetings via GoToMeeting
    d. Board Meeting face to face at ANTEC and/ or TOPCON

Kathy Schacht Report

1) Website – micro-sites by end of year 2014

2) SPE membership info available to McGovern (as Div. Chair) and Membership Chair for real time PD3 membership info
3) Gail Bristol retiring in August, 2014
4) Encouraged the BOD to reach out to her as a resource (kschacht@4spe.org)

Website

1) Al asked Brandon to participate in Web Content committee to make sure PD3 Newsletter is properly incorporated
2) Mike Lacey had strong opinions on website
3) Website Committee: Lacey, Mark M-B, Lee, McGovern
    a. Website format
    b. Website content
    c. Coordinate with SPE (Tom Conklin, per Kathy)
    d. Define ongoing Webmaster role—will reach out to general PD3 membership for interested members (aka, "volunteers")

Education

1) Ability to put on a TOPCON every 6 to 9 months—Ed felt he had the time to commit to this ambitious goal.
2) Ed felt success for a TOPCON would be financial breakeven.
3) TOPCON Committee: Probst, Lacey, Neward, Larson, and Paloian; Beall to be a resource
    a. Determine next 3 potential TOPCON locations and report back to PD3 Board by next meeting
4) ANTEC Committee: Lacey (Chair), McGovern, Tucker; Larson as a resource
    a. Discussion regarding panel format focusing on design "how to"
        i. Approach CAD software vendors and Regional

User Groups

ii. Approach plastic resin suppliers

b. Include Additive Manufacturing as appropriate

Membership

1) McGovern to provide action items after discussion with Jeremy Braaten, Membership Committee Chair (unable to attend this meeting).

Committee Reports

1) ANTEC-Mike Lacey
    a. 14 papers, with 1 no-show; 1 Student Poster
    b. Need 2 moderators/ session—Mark M-B strongly recommended this after his experience this year.
2) Newsletter-Brandon Lee
    a. Brandon considering Topical Newsletters (e.g., Bioplastics)
    b. How to get more content?
    c. Probst to supply Gallery of Goofs disk to Brandon
    d. Probst to supply Brandon Thermoforming articles
    e. Probst to provide newsletter advertising contact in Thermoforming Division
    f. Need committee to be formed
    g. Committee to come back with schedule of rates that will be used
3) TOPCON-Ed Probst
    a. 141 total attendees, 103 of which were solely attendees; 18 sponsors
    b. Probst to send link to pictures
    c. Tucker to supply HP info for reduced printing costs for future

   d. Probst to include report to HQ for minutes

4) Councilor-Mark MacLean-Blevins
   a. MacLean-Blevins will supply notes from ANTEC Council Meeting for these PD3 minutes
   b. Future discussion topics will include considering Finance Committee instead of singular Treasurer for Divisions, and Part Design Competition at ANTEC—should be led by PD3 (it is not so currently).
   c. Discussion of SPE micro-site and cost to digitize past content
   d. McGovern to supply updated PD3 committee information to HQ
   e. Motion to supply $1,000 to Student Activities Committee. All Aye – approved

Old Business

1) None discussed

New Business

1) New SIG for additive manufacturing

3:18 PM Motion to adjourn – no objections

Councilor's Desk

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Spring 2014 Council Meeting, Apr 26-27 2014, Summary

Mark MacLean-Blevins

Division Committee and CCOW – Saturday April 26th, 2014

- Discussions regarding the purpose and scope of the current committee format and the possibilities of combining the three committees into one working committee for a more comprehensive, and hopefully more efficient, approach.

Council I and II – Sunday April 27th, 2014

- Recap of the accomplishments in the 2013-2014 year by outgoing President Jon Ratzlaff; including new branding of SPE, new SPE image, new SPE website, and global outreach.
- New website and Avectra platform are up and working well. 5,000 + papers now uploaded and available, 15-20K will be up and available by the end of 2014.
- New APPs are up and functioning, including the SPE events App and the Plastics Engineering App.
- Global outreach has resulted in many new international groups; including, ASEAN Section, Ireland Section, China Section, China Injection Molding Division, China Rotational Molding Division, and India Thermoforming Division.
- Expanded services from SPE HQ to; TopCon agreement now in place, online registration for TopCons through the Avectra platform, and TopCon advertising in Plastics Engineering.
- New Global Parts competition will be held at ANTEC each year moving forward – bringing winning parts and assemblies from the past year's TopCons to ANTEC for display and review.

- SPE HQ is requesting that all member groups make short, dynamic videos of features relative to their specialty – for PD3, this would mean short videos relating to plastic product design. Videos posted will drive users to the new SPE website and should help to increase membership and enhance member value.
- Advertising on the new SPE website has already generated around $45K and will continue to be a revenue source for SPE. Cost of the website was around $125K.
- A social networking site called "the Chain" will be launched by SPE this fall through next spring, in stages. This will be similar to Facebook or LinkedIn but it will be specific to SPE.
- Student Activities at ANTEC 2014
    - Student and Professional posters will now be published as part of the proceedings at each ANTEC.
    - 89 Student Posters and 24 Student Podium Presentations at ANTEC 2014.
    - PD3 was recognized as a Bronze Level sponsor of the student activities committee at ANTEC.
- Incoming President Vijay Boolani presented his action items and goals for the coming 2014-2015 year – calling for everyone to "walk the talk with Team SPE" encouraging us to work together as a team to further move SPE into relevancy for our members and others.

Respectfully Submitted
19MAY2014
Mark MacLean-Blevins
PD3 Councilor

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PD3 Receives Pinnacle Silver Award, ANTEC

The PD3 received the Pinnacle Silver Award this year from SPE. PD3 President Michael Paloian accepted the award from SPE President John Ratzlaff on behalf of the division. In an unusual coincidence, both Michael and John were outgoing Presidents, with this meeting being among their last official acts. Joining Michael at the Awards luncheon were PD3 Board of Directors members Al McGovern, Mike Lacey, Barbara Arnold-Feret, Ed Probst, Glenn Beall, Mark Wolverton and Mark MacLean-Blevins.

The SPE Pinnacle Award recognizes Sections and Divisions that work to create and deliver member value in four categories of achievement:

- **Organization** – Maintaining compliance with Section/ Division organizational guidelines and policies.
- **Technical Programming** – Providing quality technical programming to members.
- **Membership** – Developing and implementing plans that result in annual membership growth.
- **Communication** – Communicating effectively with members about SPE offerings and events to foster a sense of community and allow members to respond.

Pinnacle – Silver is awarded to Sections and Divisions who demonstrate required activities in all four categories.

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Michael Paloian (l), PD3 President (Outgoing)
accepting the SPE Pinnacle Silver Award
from John Ratzlaff (r), SPE President (Outgoing)

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Plastic Hall of Fame Inductees

Plastics Hall of Fame Inducts New Members at ANTEC 2014
One with close ties to PD3!

During the SPE Celebrates Banquet held at ANTEC 2014, the Plastics Academy, in conjunction with the SPI and SPE, held a Plastics Hall of Fame Posthumous Induction Ceremony. Six new Hall of Fame members were inducted during this ceremony, one of which was the father of our long-term board member and volunteer, Anne Bernhardt.

The Plastics Hall of Fame was established in October of 1972 to honor the countless individuals that have made important contributions to the growth of the plastics industry. It was endorsed by the SPI, SPE, the Plastics Pioneers, and the National Plastics Council in 1988; the American Plastics Council followed with an endorsement in 1999. Membership in the Hall of Fame is to be considered the crowning achievement of any life spent in the plastic industry. It is a distinct honor that sets the recipient apart from his or her peers. Based strictly on accomplishments, the award recognizes the absolute best in the industry.

The presentation for Dr. Bernhardt was as follows:

Dr. Ernest C. Bernhardt (1923-2013)

"A champion for the use and application to all areas of plastics engineering and an Army veteran of WWII, Bernhardt contributed to a number of globally known companies, the likes of which include Monsanto and DuPont.

Dr. Bernhardt has been widely recognized for his ability to bridge the

gap between theory and practice, and the dissemination of theory to industry practitioners. As the leading liaison for DuPont to the European plastics industry, he guided the development of the first reciprocating screw injection molding machine in Germany, which was later introduced to the U.S. His time at DuPont also led to the introduction of materials such as Delrin®, Zytel® and Teflon®, and the design and development of new plastics applications such as the Bic lighter and countless automotive components.

Outside of his professional career, Dr. Bernhardt has also been published and cited in at least 16 other works in 25 publications, and can be found in more than 630 library holdings, including translations of seminal works."

Receiving the Award on behalf of their father were Russ and Anne Bernhardt (former PD3 board volunteer); also attending was Dr. Bernhardt's wife Betty Bernhardt, close family friend Mark Wolverton (also a long-term PD3 board volunteer), and close family friend Barbara Arnold-Feret (another long-term PD3 board volunteer). Russ Bernhardt gave an inspiring speech describing his father the man, his father the parent, and his father the professional; and shared his family's gratitude to the academy for the honor bestowed upon Dr. Bernhardt.

The Plastics Academy President, Jay Gardiner, and SPI President, Bill Carteaux, present Russ and Anne Bernhardt with the Hall of Fame Award honoring their father, Dr. Ernest C. Bernhardt, at the SPE Celebrates Banquet,
held during ANTEC 2014 in Las Vegas, Nevada

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Spring 2014 Plastic Part Design Topcon Report

Ed Probst

On March 25 & 26, 2014 PD3 held it's first TOPCON in over a decade! Injection molding experts John Bozzelli and Mike Sepe ran an intensive two days seminar titled "Successful Plastic Part Design – The Fundamentals Revealed!" This seminar, at the newly remodeled Gurnee Holiday Inn in the northern suburbs of Chicago, attracted over 120 part designers, design managers, process technicians, sales engineers and mold designers. In addition, we had 18 tabletop exhibitors eager to meet the attendees and explain their products and services.

The first day started with a 7:30 AM continental breakfast for those that were commuting in from around the northern Illinois and southern Wisconsin region. John started the program with a scorching criticism of non-uniform wall thickness and it's resulting effect on molded parts. Designers beware - if you want to maximize your design success you need to pay attention to wall thickness! Once the tone had been set, John and Mike proceeded to alternate back and forth in their presentation, with lots of time for questions and answers from the attendees. Sample parts illustrating the design rules were given out to each attendee, along with a binder containing all the PowerPoint slides with room for notes on each page.

The day ended with some attitude adjustment at a reception in the exhibit area that featured an open bar and tables of appetizers. The attendees took the opportunity to network, compare notes and spend some time with the exhibitors.

The second day was filled with more information on plastic and it's importance on part design. The presenters dove head first into the importance of wall thickness, boss design, venting and flow considerations. The material was presented in a fashion that allowed for beginners and experts to become better designers.

The last hour and a half was spent reviewing problem parts supplied by the audience. Information learned over the previous two days was used to determine how the parts could be changed to improve performance and reduce reject rates.

Many thanks to the SPE Chicago and Milwaukee Sections that hosted this event and helped with all the big and small details that goes along with a TOPCON. Specifically, we would like to thank Kim Rush with Polyform Products, Matt Bennett with InPro Corporation, and Al McGovern with Shure Incorporated for all their help.

Due to the success of this TOPCON the PD3 Board of Directors has approved plans for three more design conferences that are aimed at plastic professionals just like you – stay tuned!

Ed Probst
PD3 TOPCON Chair

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Cost Effective Material Selection

Eric R. Larson, PE

Some thoughts on selecting plastic materials for the lowest possible manufacturing cost

Everyone is concerned about costs these days. Whether its labor rates, tooling costs, machine prices, utility rates, real estate taxes, it's all about cost. When it comes to manufacturing plastic parts, all these costs affect the final part cost. The basic equation is simple:

Part Cost = Material Cost + Processing Cost

Some companies pursue cost reduction by buying materials at the lowest possible price. They will negotiate global supply contracts, conduct blind auctions, and basically do everything they can to hammer their suppliers for the lowest possible price.

Other companies pursue cost reduction through implementation of a set of processes called Lean Manufacturing. There are some basic ideas that govern these processes: reduce the number of parts, make each part easier to manufacture, simplify the assembly steps, integrate discrete parts into robust sub-assemblies, reduce waste at each and every opportunity, etc. They often go by names such as Design for Assembly, Design for Manufacture, or some other type of Design for X (sometimes designated DFX). Most Lean Manufacturing methods focus on processing costs, which is a key aspect of mass production.

Process Cost	=	Cost of Process	x	Process Time
(per part)		(per unit of time)		(per part)

For plastic parts, the process steps typically include molding, handling, and assembly, but can also involve printing, painting, plating, sterilizing, etc. The cost of each step depends on a number of factors, including many of the items mentioned above.

As design engineers, we are often constrained in our choice of materials by the specific requirements of the project. (Did I say often? I meant to say almost always). But we usually do have a say about what material(s) can be used in the design. And if we can recommend a material that reduces the time involved in any given process – effectively reducing the cost of the parts – we can save our client a lot of money.

To help with this, I find it useful to translate abstract numbers about processing costs into simple, common sense things I can relate to – usuallly involving dollars and cents (or as my mother used to say, dollars and sense).

As an example, the following hourly rates as translated into common cents:

$3.60 / hr = a penny every ten seconds

$36 / hr = a penny per second

$360 / hr = a dime a second

$60 / hr = a dollar per minute

$120 / hr = 2 dollars a minute

Using the above numbers, if I can choose a material for my design that processes a total of three seconds faster – saving three cents per part (or more, depending on the number of parts per cycle) – I will save my client money – even if the raw material costs two cents more.

So, the next time you are about to choose a material, consider the processing costs.

Just my two cents worth.

This article is a condensed extract from http://plasticsguy.com/material-selection-cost/

Eric R. Larson, PE

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Article

Case Study

David Hunt, PE

Choosing Plastics: Case Study (LEGO toy truck)

I had been downsized out of one full-time job in 2003, and it was before being hired full-time at another company – so I was doing contract work to "put beans on the table" and was working at Mack Molding as a project manager for a Lego toy truck. This was a fun project, and I'll give credit to Mack Molding for letting me do the project plan the right way rather than throwing together a Gantt Chart *a prion* and then having that become holy writ. (In January, when I mapped out all the tasks to create the project's critical path, I said we would be building the first production pieces the first week of July; right on schedule, the first week of July, the first production pieces rolled off the assembly line.)

Since this was a consumer product both safety and cost were critical concerns and I, as the project manager, had to choose the materials with that in mind… but child safety was paramount, not only for the materials but for the colors. So the very first criterion was to use FDA-approved resins and masterbatch colorants. Second was the resin cost, and we went with a polypropylene material for cost and because similar applications had also used this material – so there was some prior familiarity with it; as I recall, it was a co-polymer polypropylene for better impact resistance (see #6 at the link). Since Mack Molding had long-standing relationships with several resin suppliers, I leveraged their – and Lego's – knowledge of prior resin and colorant use.

Plastics Lesson One: Leverage the experience of your suppliers to help you choose a suitable material. If you view them as a partner who has a

stake in the success of your product, and make sure they know they have a stake in its success, they will be vested in making sure you get what you need to be successful.

Polypropylene is a polyolefin, and one of the characteristics of this kind of resin is that it has a wide range for shrinkage. Shrink is the term used for the fact that the part is designed to have specific dimensions; the mold then has to be cut to account for the fact that plastic – injected as a liquid, solidified, and cooled – shrinks some percentage. This shrinkage needs to be accounted for when cutting the steel for the mold. In the case of polypropylene, parts can shrink several percent (e.g., from 1%-3%) depending on any number of factors. So my first responsibility in dealing with the material selection, after selecting the material itself, was to choose the shrink rate to be used to scale the mold so that the parts come out right to the design dimensions.

So what did I choose? A low shrink rate at about 25% of the way from the low end of the window to the higher. Why? Because it's easier to process a part to shrink more, rather than shrink less. For example, to have a part shrink more, you can reduce the force packing the plastic into the mold during injection, reducing the part density slightly – which increases shrink. One can also eject the part a little earlier from the mold, allowing it to cool in the air instead of in a hard fixture (the mold itself) which would hold it in place… in-air cooling allows the part to move more.

Conversely, to make the part shrink less, one can pack the part harder (increasing the material usage and cycle time) and hold the part in the mold longer (increasing cycle time). Both of these increase the part cost.

Plastics Lesson Two: When faced with a shrink rate window, choose towards the lower end rather than the higher; if the shrink rate needs to be massaged during trials to meet dimensional targets, it's easier and cheaper

to get the part to shrink more than to get it to shrink less. But don't go hard-up against the low end of the range either as you want to leave a little wiggle room "just in case".

But there was another layer to choosing the materials for the toy – the wheels needed to spin freely. And they needed to not only spin freely all the time, but after sitting on a shelf a potentially-extended period. Also, the majority of drops would be onto the wheels, and while the main body components were made from a modified polypropylene, specifically for impact resistance, the wheels would undoubtedly bear the brunt of any impacts.

Something that people unfamiliar with plastics might not know is that similar-chemistry plastics sliding on each other have higher friction than two dissimilar plastics. Another datum for consideration is that like plastics can micro-weld to each other over time, though admittedly at room-temperature this is not likely. This immediately triggered my decision to make the wheels from a different resin type than the base product which, as stated above, was made from polypropylene.

I selected polyethylene as the material for the wheels (FDA approved, of course). First and foremost was the fact that it, too, is an inexpensive resin. It also has excellent impact resistance – better than polypropylene. And although still a polyolefin, its different chemistry would mean that the wheels would rotate freely and would not micro-weld to the body axles. The one wrinkle was that this would mildly complicate regrinding scrapped parts as the wheels would need to be segregated; however, since the colors would need to be segregated anyway, this was not an overly-burdensome hurdle.

Plastics Lesson Three: If products need to slide on each other reliably and with low friction, consider choosing dissimilar chemistries for the parts that need to move against another.

As I said early on, I did the project plan where we launched right on time. Part-and-parcel with that was the fact that in any project where parts have to be injection-molded, there really need to be at least three mold trials:

1. Initial shots. Can plastic be put in, does the part come out close?
2. Testing parts. Parts made for initial product testing, form-and-fit checks.
3. Final verification before shipping. All changes made correctly?

Plastics Lesson Four: Budget time in the project plan for at least three mold trials. If there are critical aspects of form, fit, or function that are exacting in their requirements, you may need additional trials.

A project manager should not only be skilled in project management, but have a deep and instinctive understanding of the materials being used and the tasks required to bring the product to fruition. Just as a conductor is not just waving a wand to coordinate the orchestra, they must be a skilled musician in their own right to know the capabilities and limitations of the musicians, and instruments, under their direction.

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Designers' Corner, Rotational Molding, Part 10

Glenn L. Beall

Draft Angles

Molding draft angles are tapers that are provided on those surfaces of a part that are perpendicular to the parting line of the mold. The function of draft angles is to improve the release of the part from the mold. The liberal use of draft angles can result in a reduced molding cycle and a lower part cost.

Rotational molding is an open-molding process. As a hollow plastic part cools and shrinks it pulls away from the cavity. This allows some parts in some materials to be molded without draft angles. Design engineers sometimes choose rotational molding over other processes because of its ability to produce parts with straight-side walls. Eliminating draft angles can be a distinct advantage in some applications.

The body portion of the refuse container (Fig. 16) is free to pull away from the cavity as it cools and shrinks. The draft angle on these outside surfaces can be minimized.

The plastic material in the wall between the handle support and the handle supports themselves, as shown in Section X-X, are not free to shrink as much as the rest of the body of the container. These inside surfaces are restricted from shrinking by the metal core of the mold between the two handle supports. These surfaces require larger draft angles.

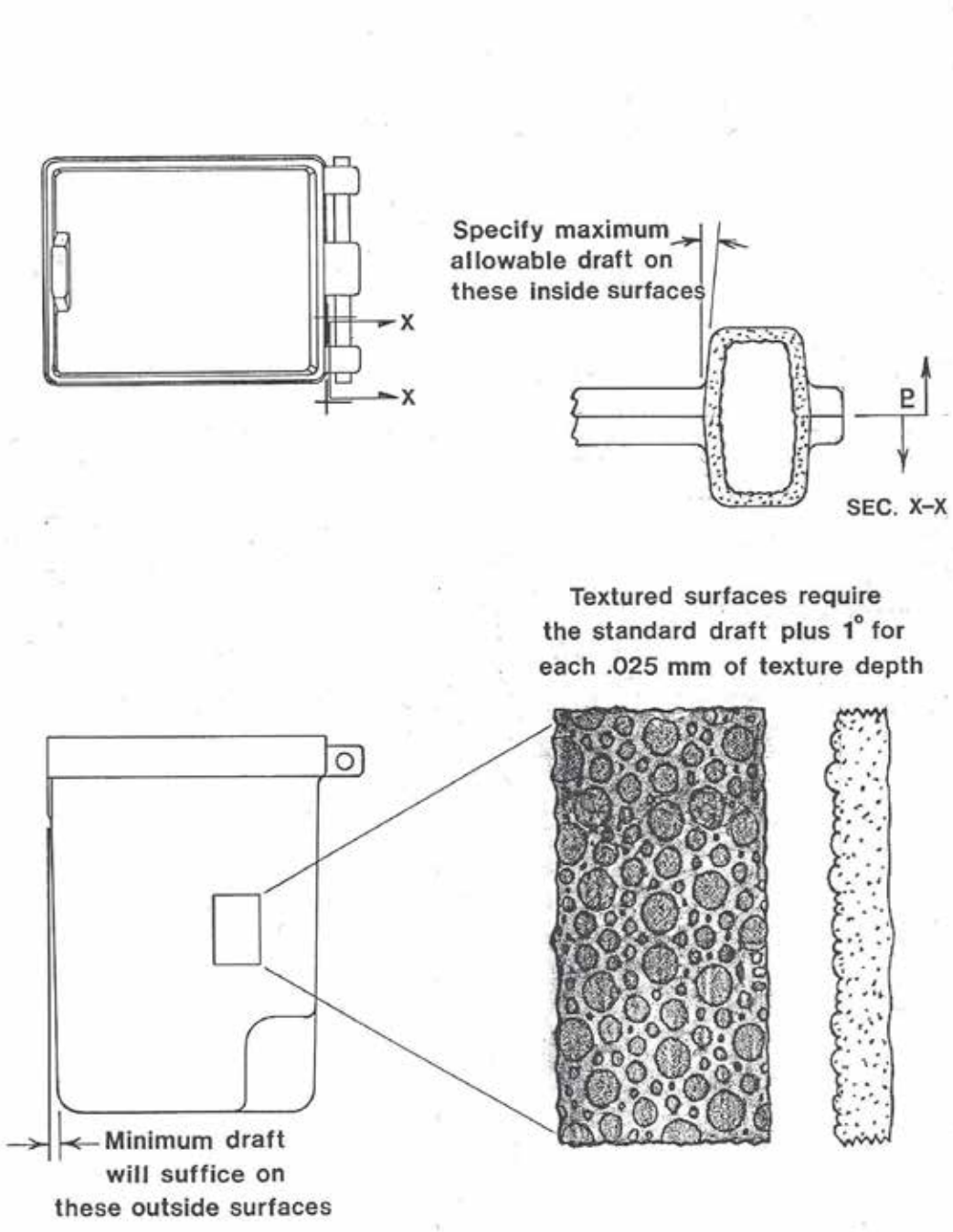

Figure 16 - Molding-draft angle considerations on inside, outside, and textured surfaces. See Table 4

Specifying the optimum draft on a rotationally molded part requires careful consideration. Each plastic material has its own unique requirements. The soft PEs and PVCs can be easily demolded from cavities containing shallow undercuts, which are negative draft angles. The rigid PPs, nylon, and PCs cannot accommodate undercuts. It is only logical that plastic materials with low mold-shrinkage factors will require larger draft angles than the softer materials with higher shrinkage factors. Parts molded in rigid plastic materials will be easier to demold from cavities with large draft angles and smoothly polished surfaces.

The recommended inside and outside surface draft angles for the commonly molded plastic materials are shown in Table 4. These draft angles have been found to be acceptable in the majority of cases, but bigger is better, and there are always exceptions. All other things being equal, the ideal draft angle is the largest angle that will not distract from the customer's acceptance of the product.

Table 4
Recommended Draft Angles for Commonly Molded Materials in Degrees per Side

Plastic Materials	Inside surfaces		Outside surfaces	
	Min	Better	Min.	Better
PE	1.0°	2.0°	0.0°	1.0°
PP	1.5°	3.0°	1.0°	1.5°
PVC	1.0°	3.0°	0.0°	1.5°
Nylon	1.5°	3.0°	1.0°	1.5°
PC	2.0°	4.0°	1.5°	2.0°

The size and shape of a part and the material being molded can combine to require special draft angle considerations. Special cases of this type should be reviewed with an experienced molder and/ or mold maker prior to finalizing the design of such a part.

This article is a condensed extract from G. L. Beall's Hanser Publishers book entitled Rotational Molding Design, Materials, Tooling, & Processing available from the SPE.

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Announcements

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PD3 Calendar

June 10, 2014

Decorating and Assembly Conference

Location: Ann Arbor Marriott Ypsilanti at Eagle Crest, Ypsilanti, MI, USA

June 24, 2014

Commercial Impact of Olefins and Polyolefins Technologies: Cost Competitiveness, Market Dynamics and Trade

Location: Swissôtel Zürich, Zürich, Switzerland

June 25, 2014

PePP 2014:22nd Annual Polyethylene-Polypropylene Chanin Global Technology & Business Forum

Location: Swissôtel Zürich, Zürich, Switzerland

September 8, 2014

FOAMS® 2014

Location: Renaissance Woodbridge Hotel, Iselin, NJ, USA

September 9, 2014

Automotive Composites Conference & Exhibition 2014

Location: The Diamond Banquet & Conference Center, Novi, MI, USA

September 9, 2014

Bio-Base Global Summit

Location: Thon EU Hotel Rue de la Loi/Wetstraat, Brussels

September 14, 2014

CAD RETEC 2014 'What a Colorful World"

Location: New Orleans Marriott, New Orleans, LA, USA

September 15, 2014

Thermoforming Conference

Location: Renaissance Schaumburg Convention Center Hotel, Schaumburg, IL, USA

September 16, 2014

Thermoplastic Elastomers Conference

Location: Hilton Akron-Fairlawn, Akron, Ohio, USA

September 17, 2014

Plastic & Polymers Innovation Awards

Location: Movenpick Hotel-Amsterdam, Amsterdam, Netherlands

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