2025

Winter Newsletter

spe PRODUCT DESIGN & DEVELOPMENT

Letter from the Chair

The Need for Data and the Theme for 2024-205

By: Erik Foltz

Hello Product Design and Development Division (PD3) Members!

I hope this newsletter finds you well, and you were able to enjoy some time with family over the holiday season. As we come back from the holidays many of us are setting resolutions for our own personal and professional development and how to improve over last year. We are often instructed to use the "SMART" goal-setting framework to carefully plan out and achieve these goals. While it is sometimes easy to do this type of goal setting when focused on an individual, it can be difficult to achieve when a team is involved. Additionally, many of us are tasked with leading and supporting product design tasks in our professional roles. These jobs often deal with "fuzzy" front-end work, where only an over-arching, sometimes inspiring 😊, task is laid in front of us. However, there is not really a clear solution, or obvious path in how to achieve these tasks. To compound the challenges, we often have to achieve these goals with a dynamic team of individuals coming in and out of the project at different phases. Therefore, it can be really beneficial for us as leaders and team members to implement this SMART framework when dealing with our plastic components.

S - Specific

Last year, one of our board members, Mark MacLean-Blevins, laid out a great framework for us to follow when we are tasked with making our product designs more sustainable. In his article, he states "The design engineer will begin with a set of requirements for the product or part and will proceed to create the initial design solution concepts". Building on this statement, it is also important that, relatively early on in this process, we get specific with what we want these end product metrics to be. Metrics like what markets are we targeting, what environments our products will be utilized in, what regulatory requirements need to be met, and what cost targets we are looking to achieve. Establishing these metrics can help us in tasks like material selection, manufacturing process selection, and design optimization. They can also act like an anchor for the team to reference as individuals come in and out of the project so we ensure we are moving in the correct direction. Check out our article in this newsletter, about the importance of building a product profile to help establish these specifications.

M - Measurable

Being specific, as outlined above, can help us engineers and designers understand what data we may need to help guide our design process and vet viable solutions. While there is a lot of great data out there for metals, polymers and plastics have less robust data which requires careful consideration in how our material selection may dictate our design envelope for a component or product. (cont'd)

In this Issue:

Letter from the Chair

The Need for Data and the Theme for 2024-205

The Division's mission statement is, "The continual improvement in the quality of the design and development of plastics products". In light of that, we are always trying to gather useful data and make it accessible to our membership. In fact, our mission for this year is "Getting the Right Data to Achieve The Right Design". Therefore, follow us on LinkedIn,bookmark our design guide archives, or reach out to one of our board members to see how they might help you along in your plastic part design journey!

A - Achievable

While most of us reading this newsletter are champions of plastics and how they enhance our design and experience, we must admit that plastics also do have their limitations. It is important that we utilize the materials responsibly and sustainably. Therefore, we must look at potential failure modes and the effects on our product design. Often identified as FMEA, performing this activity effectively means we are taking lessons learned from previous failures and applying them to this new product. This usually suggests we have the previous experience. However, not all designers have experience with plastics or a new market. Therefore, we encourage you to check out our column by our Board titled "Gallery of Goofs". This can be a great way for you to learn about failures our veteran board has gone through, without getting all the bumps and bruises we have gotten.

R - Relevant

An easy way to fail in setting a goal is to get overwhelmed with all the variables and potential failures we may need to address in our product design. It is important to make sure we are always focusing on the product metrics that are most important and will move the needle for our involvement in the project. Therefore, we must make sure we are bringing relevant data to the discussion to help support our direction without excessively delaying the program or team.

T - Time Bound

In the product development field, we are always managing risk. Therefore, we must balance having the perfect design and data versus having a good enough design. Delaying our product development process because of unknowns may delay the release of our product, costing us market share or anticipated profits. However, rushing through the process can result in releasing a product that delivers a poor user experience from which we may not be able to recover. Therefore, it is important we establish proper timelines to address any critical risks we deem are achievable in our product. This is always difficult for engineers, as we strive for perfection. However, we hope that through your interactions with our division you can find resources (either websites, or individuals) that can help keep your program moving along. (cont'd)

Letter from the Chair

The Need for Data and the Theme for 2024-205

If you are still reading this, I hope you feel inspired and uplifted as we begin our new year of challenges in the product design field. We look forward to hearing from you about what topics you would like to see more about in our various platforms. Feel free to reach out to myself or anyone on the Board and let us know what we should be focused on. Hopefully, we will even get to see many of you at one of our events this year!

Until we connect again, I hope you all enjoy the content of this newsletter!

Erik Foltz
PD3 Chair (2023-2025)
The Madison Group

Letter from the Editors

Dear PD3 Members,

As we step into a new year, I'm excited to share with you the latest edition of the SPE Product Design & Development Division Newsletter! This issue is packed with valuable insights, resources, and inspiration to help you tackle the challenges of product design and development in 2025.

This season's theme focuses on leveraging data to achieve better designs. From the importance of creating a robust product profile to learning from real-world design mistakes in our "Gallery of Goofs" series, this newsletter is a testament to our mission of advancing the quality of plastic product design.

We also spotlight new tools and frameworks, including an article on managing tradeoffs in the New Product Development process, and highlight upcoming events, webinars, and opportunities for collaboration. Don't miss out on the chance to connect with your peers and stay ahead in our ever-evolving industry!

I'd like to extend my gratitude to our contributors and readers for making this publication possible. If you're interested in sharing your expertise or ideas, we'd love to hear from you—just send me an email!

Here's to another year of innovation and growth for the PD3 Division. Happy reading, and best wishes for a successful 2025!

Warm regards,

Elizabeth Detampel
edetampel@sussexim.com
Web/Newsletter Editor
SPE Product Design & Development Division

Past BOD Minutes

Meeting Minutes | November 19, 2024 | PD3 Board Meeting

Call to Order and Roll Call

- Meeting started at 1:05 PM Eastern Time
- Present: Erik Foltz, Al McGovern, Jason Suess, Chris Siler, Mark MacLean-Blevins, Ed Probst, Larry Schneider, Akanksha Garg, Vik Bhargava, Mark Wolverton, Kyle Kulwicki, Eric Rose, Brandon Benvenuto, Luke Buerkley, Michael Paloian
- Excused Absence: Glenn Beall, Elizabeth Detampel, Lorena Skelly
- Absent: Pavan Valavala

Past Meeting Minutes

- The link to previous meeting minutes was distributed prior to meeting
- Minutes were approved as recorded with motion and support from Vik Bhargava and Mark Wolverton, respectively.

Treasurer Report

- Provided by Larry Schneider
- The treasurer's report and budget were approved with Motion from Al McGovern and the Second from Eric Rose.

Councilor Report

- Report was distributed prior to the meeting and reviewed by Vik in the meeting.
- The 58+ Councilors will meet quarterly (twice virtually and twice in-person). From this group, a proposal has been made to have a Councilor Leadership Team with 9 Council members that will meet monthly. 3 Council members would be elected by the Council to sit on the SPE Executive Board. This proposal will be presented to SPE Executive Committee on December 3rd.
- A question was asked regarding what the agenda would be for the regular meetings of the Council and the Council Leadership Team. Vik will follow-up.

Membership Report

- Membership report was not part of the agenda for this meeting. Therefore, no report was reviewed.

Website/Newsletter Report

- Al McGovern mentioned that another newsletter was expected to be published in January
- Website sponsorship invoices will be sent out to existing sponsors by year end with payment due by January 1st.
- Al will send an advertisement for sponsorship to Board Members for consideration of additional Sponsors
- LinkedIn followers increase by 2 to 3 per month. New followers or commentors are being added to the mailing list. (cont'd.)

Past BOD Minutes

Meeting Minutes | November 19, 2024 | PD3 Board Meeting

- Jason is working on updates to the Resources portion of the website that will be considered by the Website Committee.

Old Business

- The FAPSIG board was provided the PD3 responses from a previous meeting regarding merger into PD3
  - PD3 should expect a response back from FAPSIG board in December regarding questions about new Board member participation on the PD3 Board as well as expected magnitude of financial transfer to PD3.
- ANTEC 2025
  - Akanksha has no papers to review in the portal for our division. She is reaching out to SPE to find out if we should expect some papers to be aligned with our division.
  - There are 8 speakers planned for the Mike Sepe tribute on Wednesday during the conference.
    - There will be 6 hours of planned speaker content

New Business

- No new business was discussed at this meeting

Adjourn

- Meeting ended at 2:00 pm Eastern Time

Submitted by Chris Siler
November 22nd, 2024

How a Product Profile Can Accelerate Your Design Process?

By: Erik Foltz
The Madison Group

The excitement at the beginning of the product design process brings lots of energy and ideas. The ability to tap into a new market, or solve a lingering problem brings many groups together that must transition this idea into a physical manifestation. Industrial engineers and marketing teams are often tasked with helping define the experience and look of the solution, but many other groups are involved with making the look a reality. These different groups will have different ideas on how to best achieve this nebulous end goal, and to further complicate the task, these groups will be joining and leaving at different stages of the part design process. Taking the time to create a defined end goal can help onboard different people quickly, and ensure the project timeline is not compromised. This defined goal can be established in a document often referred to as a Product Profile. This article will help define what a Product Profile is and what information should be included.

What is a Product Profile?

A Product Profile is a document that defines what functions the component is supposed to perform, and defines the loads and constraints the component is expected to experience while in service. Requirements about appearance, expected service life, environmental exposure, and regulatory requirements are established in this document. By providing these specifications, the mechanical designer, materials engineer, and quality engineers can start to understand what materials might be compatible with the constraints and what design features might be required to achieve the end look and performance of the part. This definition can also be used to understand what material properties are required in order to move the design forward for tasks such as structural finite element analysis (FEA), injection molding simulation, and prototyping. By creating a product profile, the OEM and designers can move from designing a single sourced material, to starting to develop a “Performance Based Material Specification”, as outlined in this article.

What Should be Included in a Product Profile?

As briefly stated above, the information for creating a useful Product Profile includes:

- **Part Function:** What is the part supposed to do while in operation? Defining the part function early on allows for assessment to be made by the team about the risks involved with the design, and how much time and effort should be placed on it relative to other components in the design/assembly. If this component is deemed critical, then a Failure Modes and Effects Analysis (FMEA) can be performed to design in safety factors to mitigate those identified as most risky.
- **Operating Conditions:** Understanding the temperatures the component will experience while in service, and how long the product is expected to be in service can help define what failure modes should be considered for your design, and can help further select potential materials that might work for the application. A single-use medical device will have a very different set of operating conditions as compared to a water meter connector that is expected to last for decades. Additionally, identifying the loads expected in the assembly can help the engineer understand what structural FEA simulations they may want to perform to understand how the wall thickness or assembly features need to be designed to withstand those loads. (cont’d)

How a Product Profile Can Accelerate Your Design Process?

By: Erik Foltz
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Therefore, this document can be used to better communicate to team and ensure the design and assembly stresses are sustainable, and not just below a short-term yield stress.

- **Environmental Factors:** The designers and engineers need to understand what environmental hazards the product will encounter while over the life. Beyond just temperature, factors such as chemicals the product might encounter in the field should be documented to again mitigate risk and further define what additives will be important to incorporate into the base material to help reduce adverse material alteration. This consideration is particularly important for polymeric materials. While they are often viewed as great materials to avoid oxidation, they are still susceptible to diminished part performance in the presence of chemicals, or without the incorporation of the proper additive packages.
- **Design Requirements:** This section of the product profile helps define what design features might be required to achieve the end performance of the part. Sometimes those performance metrics are defined by a regulatory body, such as UL, ROHS, or CE. However, others are less well defined and help determine what assembly methods are required to mate this component to the other sub-assemblies, and what secondary operations will be required to achieve the end look that your consumer is looking for. This information can be used to help perform design for manufacturing and assembly analyses (DFMA).
- **Performance Testing:** Understanding how you are going to quantify and verify the performance of the part and show the company or regulatory body that the design meets the end functional requirements is critical for the Product Profile. Sometimes this testing is defined by a regulatory body, while other times it is an internal test standard. Regardless, physical testing of components is typically an expensive and time-consuming process. By defining it in the Product Profile, this testing timeline can be integrated early on. Any fixtures or coordination efforts can be completed in parallel while the design is being finalized.

When Should a Product Profile Be Created?

A Product Profile should be created as early as possible in the design process. By having it early on, it can be used as a background document for when new team members or suppliers are brought on board so they understand how their responsibilities and roles may influence the end performance of the part. Additionally, if the document is created early in the design process, all the energy and efforts can be concentrated to ensure any discussion points brought up are relevant to the end performance of the part and if those points merit any change in design direction. The Madison Group has found this last point to be one of the most critical functions of the Product Profile and ensuring the development timeline is maintained as closely as possible.

How a Product Profile Can Accelerate Your Design Process?

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The Madison Group

How Often Should the Product Profile be Reviewed?
The Product Profile is not a stagnant document. It should be reviewed and amended any time a major development milestone has been achieved, or any time a new team member/supplier is brought into the process. Again, the document can be used as a beacon for discussions if a change in design direction is needed or not to achieve the end goal of the product. This will help minimize any unnecessary design iterations or trials that would delay the release of the product to market. Additionally, the document can be used whenever there is a value-added engineering task performed. By creating the document, the team allows future cost-saving evaluations an avenue into understanding the initial design constraints and what work has been previously performed.

In conclusion, the Product Profile helps designers and OEM's create a clear focus on where they need to head and what questions they need to answer along the way. By creating this document, the time spent on discussion or trial and error methods can be minimized, thereby the confidence that they need to release their product to market!

“The Gallery of Goofs”

By: Glenn Beall
Glenn Beall Plastics Inc.

Human beings are not infallible(1). They make mistakes. Plastic product designers are human beings and can therefore be expected to make mistakes. I am reluctant to admit it, but I have made more than my fair share of plastic product design mistakes. My only excuse is that plastic technology was not taught at my university. As a result, I learned about designing with plastic on the job, in the school of hard knocks, by reading the plastics industry magazines and the few relevant books that existed back then.

I like to believe I also learned from my own frequent mistakes. However, it didn’t take very long for me to realize that it would be faster and less costly to learn from the mistakes being made by other designer engineers. I started saving stories of these mistakes in design.

In September of 1981, I had the good fortune to be named the design editor of the highly respected Plastic Design Forum (PDF) magazine. This was a wonderful job that gave me an opportunity and the freedom to promote my design philosophy to the plastics products design community.

In the normal course of events, I wrote an article about a plastic part that failed due to a lack of attention to the basic plastic part design guidelines. That mistake resulted in the death of an innocent person. This article was well-received and the PDF editors asked for more stories about why plastic parts failed and how those failures were eliminated. After a few part failure articles, the editors established a recurring PDF column entitled “The Gallery of Goofs”. They chose the word goof(2) instead of failure or mistake as those words sounded too harsh in the politically correct society we were living in at that time. For obvious reasons, the names of the people, companies, and suppliers mentioned in these articles were changed to protect the guilty. In some articles, the application was also disguised.

I have been designing plastic parts since 1957. Unfortunately, the same mistakes I made over sixty years ago are still being made today. I admit that my work as a consultant and expert witness in plastic product failure litigations brings me into contact with more plastic part failures than the average product designer. Be that as it may, there is obviously something missing in how plastic designers are being educated.

With that thought in mind, SPE’s Product Design and Development Division will be including some of the PDF Gallery of Goofs articles in future newsletters. Hopefully, those reading the newsletter will benefit by learning about these reviews of real-life plastic part failures and how these defects were resolved.

Glenn L. Beall
Glenn Beall Plastics

Webster’s Dictionary
(1) Infallible – incapable of erring.
(2) Goof – an incompetent, foolish, or stupid person.
A careless mistake or a slip.

“The Gallery of Goofs” - Part II

By: Glenn Beall
Glenn Beall Plastics Inc.

This is the second in a continuing series that reports on errors of judgment made in the design and engineering of actual plastic parts and products. In this report, Glenn L. Beall, president of Glenn Beall Plastics and former design editor of Plastics Design Forum magazine, illustrates how one person’s well-intended but excommunicated solution to a small manufacturing difficulty created a significant loss in time and money. In the real world, Beall notes, changes are often made in the manufacturing process without the designer’s knowledge; meticulous checking of the details of certain possible problems might have kept this one from happening.

Many products, including those made of plastics, fail in the marketplace because of well-intended but ill-advised action at some point in the product development process. The following case history is a typical example of how concentration on the solution of one small difficulty created a much bigger problem.

In this case, the product was a simple test-tube heater that is used in diagnostic laboratories to hold reagents and tissue samples at a slightly elevated temperature (160F) for a specific time in order to accelerate a chemical reaction. An electric cartridge heater embedded in an aluminum block provides the heat. The test tubes containing the specimens are placed in holes bored into the aluminum block. The noncritical temperature is controlled by a simple surface-mounted thermostat.

The entire assembly is mounted on a steel plate, and the unit is housed in an injection-molded modified-PPO housing. The housing is a simple shell that provides the necessary aesthetics and ensures a suitable display area for the off/on switch, indicating lights and timer. (Figure 1).

The housing was considered to be a simple problem, as it was virtually a no-load type of application. The PPO provided the necessary temperature resistance and the nonburning characteristics required for the application. Molded samples were tested and found to have sufficient impact strength to withstand being dropped or knocked off a laboratory bench. It was also determined that the modified-PPO housing material would provide the needed resistance to the chemicals most commonly used in the process, as well as common cleaning solutions employed in this type of laboratory. Figure 2 shows the interrelationships of the various components.

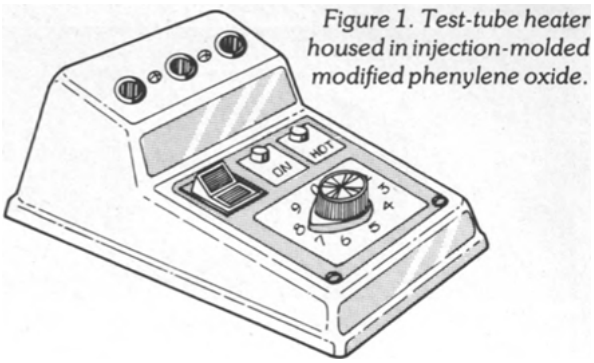

Figure 1. Test-tube heater housed in injection-molded modified phenylene oxide.

“The Gallery of Goofs” - Part II

By: Glenn Beall
Glenn Beall Plastics Inc.

The first lot of production units were produced and assembled with minimum difficulty. Sales volumes developed much as expected. Reports from the field indicated that the product was well received and that it performed as anticipated.

Shortly after the initial introduction of the product, users registered complaints about the housing’s tendency to crack between the three test-tube heating wells. These failures did not prevent the unit from performing its intended function, but the cracks did destroy the nice appearance of the housing.

Investigation into the cause of the housing failures included considerations of material substitution and pigment compatibility. Molding procedures, especially weld lines around the holes, were also studied. The tolerances that govern the fitment between the heating wells that project through the housing and the housing itself were rechecked for a possible interference fit. The possibility of a stress failure caused by the differences in thermal expansion between the plastics and the aluminum heating block were also considered. None of these investigations revealed the source of the failures.

Unused units that had been assembled at the same time were withdrawn from stock and inspected. None of these units had cracked housings, an indication that the source of the problem had to be in the actual laboratory use of the product.

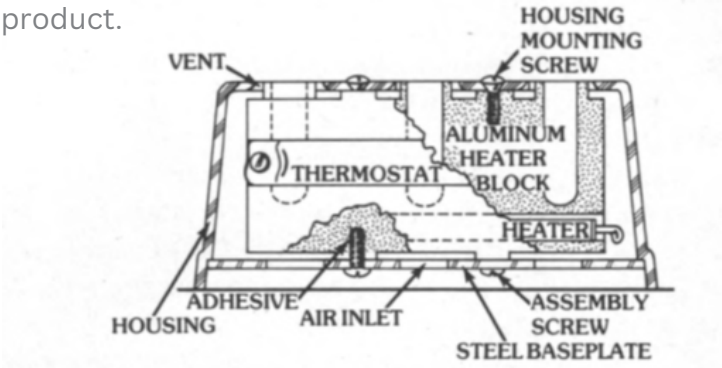

Figure 2. Schematic of test-tube-heater components.

Careful examination of the actual fracture surfaces seemed to indicate a stress-cracking pattern (Figure3) characteristic of a chemical attack.

Pre-market introduction testing had already suggested that the plastic was not adversely affected by common chemicals used in this diagnostic procedure.

"The Gallery of Goofs" - Part II

By: Glenn Beall
Glenn Beall Plastics Inc.

The possibility of other chemicals being used in specific laboratories was considered and rejected since, by then, virtually all of the housings in use had failed. Attention was then directed to the assembly procedures.

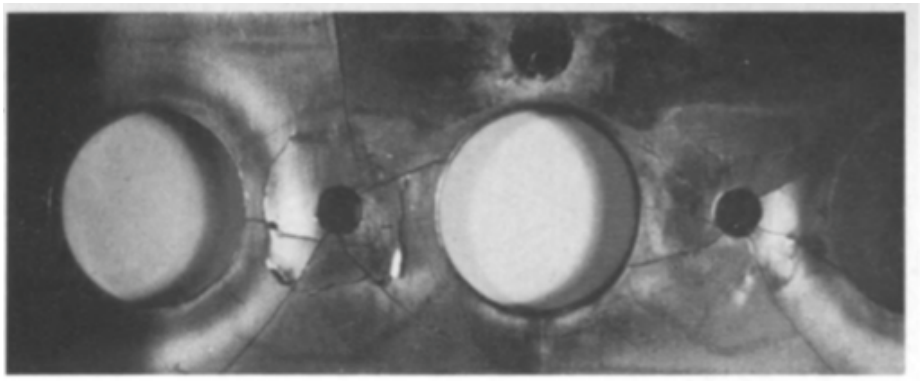

Figure 3. Stress-cracking pattern indicative of a chemical attack.

Detailed manufacturing procedures had been written, but a review of the component list did not reveal any item that could be suspected as a possible stress-cracking agent for PPO. The possibility of a residual machining fluid on the assembly screws or machined-aluminum heating block was also investigated with negative results. Heaters and thermostats were operated at the maximum temperature to determine whether or not they would disperse a volatile gas, but this did not prove to be the answer.

By this time, the product had been discontinued and the assembly line shut down. An actual inspection of the assembly line did reveal, however, a small can of adhesive of the type used to hold metal screws in place. This type of adhesive was not listed in the manufacturing instructions. A series of probing questions revealed that the adhesive had been added as an afterthought.

The logic in using the adhesive was good; however, the well-meaning person who applied it had not stopped to consider the possibility of an incompatibility between the adhesive and modified PPO. That was very understandable, as the adhesive itself never came into actual contact with the plastics housing, as can be seen in Figure 2.

The test-tube heater was designed to allow all of the components to be assembled on the metal baseplate. The plastics cover was not placed in position until after the unit was totally assembled and tested. The adhesive was added to the assembly screws on the baseplate in order to discourage anyone from inadvertently removing the baseplate instead of the plastics housing to service the unit.

“The Gallery of Goofs” - Part II

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Actual testing of full assemblies under normal usage conditions revealed that the adhesive dispersed a very small amount of volatile gas during the first few hours of operation. This gas followed the normal flow of cooling air through the assembly, which brought the volatile gas in contact with the inside surfaces of the plastics housing. These volatile gases only attacked the plastics housing in the two relatively high-stressed areas around the upper two flathead-screw holes that were used to attach the housing to the rest of the assembly. The two screw holes on the lower level were unaffected, since the volatile gas did not contact that area in the assembly.

A phone review with the adhesive supplier’s technical people revealed that they were aware of some problems associated with chemical incompatibility and indicated specific adhesives having formulations that would be compatible with PPO.

Another phone call to the plastics material supplier confirmed the adhesive manufacturer’s comments. It was interesting to note that the plastics material supplier’s excellent product bulletin listed adhesives of this type as a possible stress-cracking agent.

In accordance with the material supplier’s recommendations, a different adhesive was chosen and its use was written into the manufacturing specifications. After accelerated testing, the product was reintroduced. Those customers who had cracked housings were provided with replacements. Cracks in the test-tube heater housing are no longer a problem.

In summary, a simple addition to the manufacturing process was made in order to improve the product. Unfortunately, this well-intended action resulted in a significant loss in time and money.
The good end product could have been achieved and the problem avoided from the start if this change in the manufacturing procedures had been reviewed with the design engineer responsible for the plastics housing. He would certainly have been aware of the fact that many plastics materials can be attacked by many chemicals, including solvents and adhesives. A simple check of the plastics material supplier’s literature would have confirmed the probability of this type of failure. A compatible adhesive could have been specified and the problem would have been avoided.

As in most endeavors, the secret to a successful product-design and development project is often meticulous attention to details. In this case, that would have meant checking the chemical compatibility of all of the materials that would or might have come into contact with the product. It is also obvious that the manufacturing specifications should not have been changed or added to without prior approval.

“The Gallery of Goofs” - Part II

By: Glenn Beall
Glenn Beall Plastics Inc.

Designers must recognize, however, that in the real world, changes are often made in the manufacturing process without the manufacturer going back through the product-approval committee or specification-writing procedure. The “same” ABS from a lower-cost source or an “identical” soldering flux that is easier to use or the addition of an “insignificant” amount of lubricant to improve molding are all changes of the type that somehow or other are made without official approval. Designers investigating failures would be well advised to be skeptical of the glib phrase “We haven’t changed anything,” and should actually go and see for themselves.

UPCOMING EVENTS

JAN. 31

SPE Impact:

Injection Molding Performance Awards Entries

MARCH 3

ANTEC 2025

Philadelphia, PA

MARCH 18

PTXPO 2025

Rosemont, IL

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Minimal Commitment

- All Meetings are Virtual
- 2+ Hours Required per Month

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Email Mark MacLean-Blevins or Erik Foltz:

- Mark@maclean-blevins.com
- Erik@madisongroup.com

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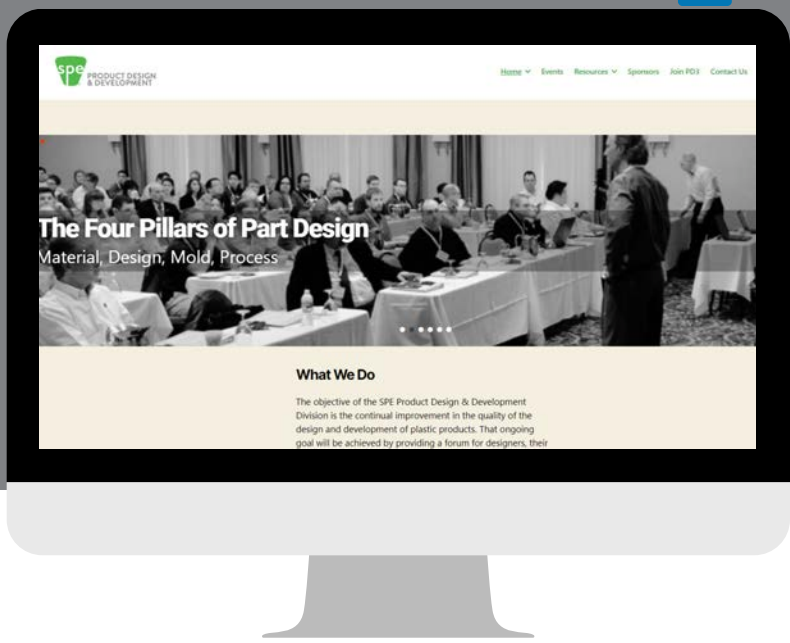

MBA CONSULTANTS & DESIGNERS MacLean-Blevins & Associates

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Sponsor Spotlight

Check out the article, "Managing the New Product Development Project Tradeoffs," written by Eric P. Rose, NPDP, MBA, and published on the cover of the Product Development and Management Association's journal, Visions. This insightful piece introduces a new framework for managing the 5 key tradeoffs encountered during the NPD process and includes illustrative real-world examples.

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