



SPE Thermoforming Division Parts Competition 2019 Award Winners

Photos: Dallager Photography

PEOPLE'S CHOICE AWARD

**Plastics Unlimited, Preston, IA
Two-Sheet Glued Versatile Cab Roof**

Overview

This versatile tractor cab roof houses many different steel inserts as well as other thermoformed parts glued internally.

Features and Benefits

This tractor cab roof top consists of two thermoformed parts that are glued together. Inside the roof, there are many different steel and thermoformed parts.

Our customer approached us about producing a cab roof top for them that would incorporate mounting brackets and air ducts. They wanted a color matched Class "A" top side with a black textured bottom side. They also wanted to keep tooling costs low.

With everything on the customers "Wish List" we thought the two-sheet glued option would be a great process. The material on the outside is a color matched high gloss Class "A" acrylic capped ABS with a starting thickness of 0.156" and the bottom is a black acrylic capped haircell ABS starting thickness of 0.187". Some of the most difficult parts of this process include controlling the shrink and making sure the top and bottom fit correctly so the glue gap is consistent. Another difficult part is making sure everything is held correctly when gluing the top and bottom together to ensure there is proper pressure on all sides.

The two-sheet glued design was a huge tooling cost savings over other processes like Long Fiber Injection (LFI), Sheet Molding Compound (SMC), injection molded, or twin sheet molded plastics.

This part is formed from temperature controlled, single cavity production tooling.

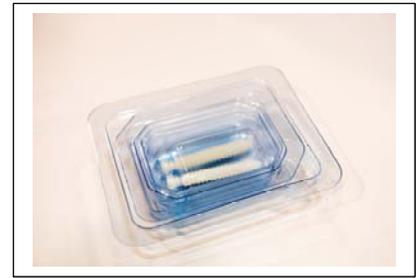


ROLL FED THIN GAUGE INDUSTRIAL – GOLD

PLACON, Madison, WI
ORTHOFIX

Overview:

Custom tray keeps medical screws suspended to prevent HA coating damage.



Features and Benefits:

The Orthofix tray package was designed to securely hold the two medical screws with HA (hydroxyapatite) coating in place until operating room usage. The HA coating is on each screw, as this compound helps reduce the screw from backing out of the bone after implantation into the patient. Once the screws are securely fastened into the retainer base, a retainer cover that goes over the tray and snaps into place to create a second secure barrier for the HA coated screws.

The tray and all packaging components are made using PETG material. This tray package design is composed of two parts (retainer tray and tray cover) that were designed and two (2) pre-validated double sterile barrier trays that go inside each other and hold the newly designed tray and tray cover. The double sterile barrier trays are parts that the customer is currently using to package about 2,000 different products they currently produce. We were able to save over \$50,000, as this is the average cost to validate a new medical package.

The customer had to find a solution that would hold the product without causing the HA coating to rub off while in the package. By creating a locking retainer for the head of the screw, while keeping the body of the screw suspended to prevent any HA coating from rubbing off. The package does prevent any damage to the product, because without it, the HA coating would be removed and cause the product to be defective.

ROLL FED THIN GAUGE INDUSTRIAL – SILVER

PLACON, Madison, WI
PACLOCK

Overview:

Bi-Fold clamshell brings 100% more marketing space for consumer information.



Features and Benefits:

The new bi-fold Pacific Lock Company (PACLOCK) clamshell package provides the consumer the ability to touch the product without risk of theft prior to purchase. The open and fold back panel design gives PACLOCK 100% more marketing and graphics space to convey important product and brand information. The package was designed to allow the consumer to open and close the back panel to read and help better understand the product.

Current packaging in the marketplace utilizes a simple front and back blister or clamshell design. The bi-fold clamshell package creates an added dimension with a back panel that can open and close. The package is able to hold each of the five (5) lock models, thus creating a SKU efficiency, only having to order one package to fit these five (5) products.

In most cases a package like this would be made using an injection molding process. However, with precision trim and tooling options, we were able to design a more lightweight package that can be thermoformed in a single piece during production. The result is a more simplified production and assembly process to create a package that gives the consumer access to touch and feel the product without risk of theft or damage.

The package is a single thermoformed piece that can be nested when placed into the shipping carton. It uses a resin code 1, as it is made from PET material and recyclable. When the assembly facility unpacks the package, they are easily removed from the shipping carton and hand packed with a simple weld to ensure the package is sealed and secure. By having a single piece package, it creates an efficiency during the production and assembly process, thus creating less labor and more efficient warehousing as the package can be neatly stacked when in shipping cartons. Once the packing process is complete, the package is able to support the heavier weight of the lock and key during shipping.

ROLL FED THIN GAUGE FOOD - GOLD

LINDAR Corporation, Baxter, MN Simply Secure Tamper Obvious Hinged Package

Overview

Our customer presented us with several unique challenges for a tamper obvious package to merchandise single serve bakery items; mini bombs or dessert squares for sale in bakeries. Criteria included a design that could utilize production automation, automated label application and a package that would hold the product in place even if tipped upside down.

The result was an innovative Simply Secure, tamper obvious hinged package, which looks great and exceeded all of our customers' requirements for a new perishable food package.



Features and Benefits

Our Simply Secure, tamper obvious, closure has been applied to this new hinged package design to ensure customers receive high quality products, safely.

The package design creates a freshness seal when closed to help ensure product freshness is maintained until customers consume the product.

The package design has a unique tapered closure from hinge to the front opening tab to display the mini bombs and dessert squares and to maximize space efficiencies to ship and/or display more mini bombs and dessert squares in less space.

The package is made from black/clear APET material to enhance the mini bomb and dessert square product presentation and provide excellent freezer performance.

Each package is also designed to receive a label that wraps around from the top of the package over the hinge area and onto the bottom of the package to accommodate USDA labeling requirements while still allowing retailers to build stable displays when stacked.

Our Simply Secure tamper obvious package design supports automation designed to de-nest, place, close and engage the Simply Secure closure.

This item is made from .015 starting thickness APET on a 10 cavity aluminum production tool. Trim registration and consistent perforations to remove the Tamper Obvious closure presented significant tooling and production challenges.

This black/clear Simply Secure tamper evident package with tapered closure, product hold feature and label placement stacking feature includes complex designs features that protect and enhance product presentation in a cost effective package.

ROLL FED THIN GAUGE FOOD – SILVER

PLACON, Madison, WI
Homefresh Entrée

Overview:

A modular stacking, polypropylene, microwavable foodservice package with superior leak resistance.



Features and Benefits:

The HomeFresh Entrée product line was designed for modular stacking and interstacking (small footprint containers stack on and under large footprint bases), leak prevention when lidded, and secure stack engagement to limit package movement when stacked during transportation from the foodservice establishment to the home or place of consumption.

A vent channel was designed and strategically located within the base of the compartmented containers to allow the steam from hot foods to evacuate the container when closed. The vent channel allows the air to circulate through the container compartments and escape through the c-vent on the compartmented lid. Incorporating the vent channel eliminated the need for more than one vent opening in the lid.

The optional vented lid was made with a steel rule trim, modular tooling. Key components such as anvils and c-cut blades could be shared saving on tooling costs and decreased tool set-up/change over time. Parts of the tooling can be changed while in the press, further saving on change-over/set up time. The c-cut vent trimming technology is unique because it is completed within the same cycle as the forming and perimeter trimming. The vent is trimmed at the end of the forming cycle inside the form tool and then opened by tooling in the stacker. Typically, two trimming stations are required to create a cleanly opened vent. This tooling advance saves money on tool cost and saves the foodservice employee time, as they do not need to manually open the vent.

The HomeFresh Entrée base was awarded three design patents: one for the lid (D830,825S) and two for the base (D831,481S and D872,427S). The top surface of the base rim reduces the amount of plastic needed in the lid as it does not overhang or wrap around the bases' outer lip. The opening tab features are on separate planes, which help with ease of opening by keeping the two tabs naturally separated.

The fact that the container is made from polypropylene and can be washed, heated, and reused again and again in the home for additional meal leftovers contributes to a circular economy. When the container has reached its useful life, it can be recycled curbside to be put back into a sustainable recycling stream.

The PET lids are made from Placon's Ecostar® material, an FDA compliant, food-grade, post-consumer recycled PET sheet made from curbside collected plastic bottles and thermoforms.

ROLL FED THIN GAUGE RECYCLED/SUSTAINABLE – GOLD

CMI Plastics, Ayden, NC
Hoppe's Black Gun Cleaning Kit

Overview

This unique tray and lid features a mix of firearm maintenance tools, totaling 15 different items. There are multiple configurations or products that can be captured in the design to allow a significant cost savings by elimination of additional covers. The kit is used to showcase the product in retail as well as at home. The benefits of the sturdy design include long-term product storage and enhanced shelf-presence.



Features and Benefits

The challenge was to design a rigid thermoformed tray that has the appearance of a heavy-duty injection molded part.

The tray is made with recycled ABS with a starting gauge of .075". The ABS contained a minimum of 70% recycled content. The ABS was manufactured by Impact Plastics of Putnam, CT.

The lid was made with recycled PETE with a starting gauge of .035". The PETE contained a minimum of 50% recycled content.

The tray design was challenging due to the small cavity diameter and the thickness of the ABS. The combination of prototype testing and high-end plug assist materials allowed us to get proper distribution into the molds to maintain the injection molded look the customer requested.

The lid design compliments the tray with a sleek and simple look. The lid system works with several product mixes and allows those products to be locked in with minimal move and rotation.

CUT SHEET HEAVY GAUGE VACUUM FORMING – GOLD

Profile Plastics, Lake Bluff, IL
Neonatal Intensive Care Unit

Overview

This part is utilized in a Neonatal Intensive Care Unit.



Features and Benefits

- The part is made using 0.236" cast acrylic sheet
- The part requires total clarity on all flat surfaces to enable nursing staff complete and unimpeded visibility of premature newborns
- Cast acrylic material was required to achieve the specified clarity. Ridge forming was chosen for the molding process
- To achieve the customer's target price point, it was determined that the part had to be molded in a rotary forming machine equipped with a quartz oven

- It was also necessary to incorporate a precisely “shaded” section on the part to hide the unit’s electronics and wiring. This was accomplished via distortion printing of each sheet of cast acrylic prior to forming.
- The repeatability of all of the formed features as well as the overall trim dimensions were critical. Five (5) axis, close tolerance, CNC trimming of the part was required to precisely fit with the numerous amounts of other, equally precise, mating parts

CUT SHEET HEAVY GAUGE VACUUM FORMING – SILVER

Say Plastics, McSherrystown, PA Door Assembly

Overview

This door assembly is a light weight highly aesthetic solution for a new generation of commercial tankless water heater systems. These systems are especially well-suited to meet demanding domestic hot water needs in applications such as hotels.



Features and Benefits

The customer was originally planning to purchase fabricated steel door structures from China, but due to urgent timing needs and a desire for light weight higher cosmetic features thermoformed assemblies produced with our Corporate Branded Tooling System proved to be a more effective solution. The tooling system provides customers the best tooling solution given number of parts required, material, timeline, budget, and application requirements. In this case, the tooling required was two (1) cavity epoxy CNC machined molds, with CNC machined trim and assembly fixtures. This production tooling system not only takes mold material into consideration but more importantly the process control and technique that will be unique to each design.

The critical elements of the design and challenges of this project involved:

- Meeting the project timeline with the in-house responsibility for the following.
 - Part re-design as conversion from metal to plastic thermoform
 - Mold design and manufacturing
 - Trim and assembly fixture design and manufacturing
 - Work cell, job instructions and quality plan design
 - Manufacturing controls and technique development
 - 3D Printing
 - FAI completion
- Ship first production in 6 weeks

The assembly consists of five thermoformed parts (1 inner, 1 outer, and 3 hinge covers) produced out of custom color matched Kydex 100. The Kydex 100 was chosen to meet the stringent UL requirements and meet project timeline. The material thicknesses used... Outer – 0.055”; Inner - 0.110”; Hinges – 0.110”

The inner panel provides a sharp color contrast to accent the customer’s name and logo through the CNC machined reliefs in the outer panel. The assembly also features the use of a 3D printed mounting bracket for the touch screen. Inhouse 3D Printing complimented our Corporate Branded tooling System as a vehicle to provide the customer a quick project turnaround. This is an excellent example of where 3D Printing provides added value to the thermoforming processor. All parts were assembled with a two-

part epoxy aided by a CNC machined assembly fixture to ensure proper component locating and bond strength.

In the end, this completed door provided the solutions sought by the end customer – providing a light weight, door with highly cosmetic design features to an expedited delivery

Recently, an aluminum mold was manufactured to produce the inner panel. The outer panel and hinge cover molds will remain in epoxy until the next phase of product design changes are completed. Also, the mounting bracket for the touch screen has been switch over to injection molding.

CUT SHEET HEAVY GAUGE PRESSURE FORMING – GOLD

Ray Products, Ontario, CA
Stratasys 3D Printer

Overview

This multi-part / multi process assembly provides highly aesthetic and repeatable enclosures for an industrial grade 3D Printer. The F Series 3D Printer is comfortable in any office environment, but is durable enough to thrive in harsh manufacturing environments.



Features and Benefits

Initial design concept was intended for reaction injection molding, but once the customer understood the values and benefits of the pressure forming process, the design shifted to a 100% molded in color pressure-formed unit. Pressure forming allowed for larger parts to be molded, decreasing the total number of parts and tools required. In addition, paint was eliminated, and all structural ribs were removed, which increased the capability of the 3D printer and the part size it could produce. The pressure-formed parts have no residual stress, no need for additional reinforcement, and allow for quick, easy and repeatable assembly.

By manufacturing the unit with the pressure-forming process and using various molded in features and undercuts, only two bonded blocks are needed for this entire multi part assembly. One of the most significant challenges that this project presented was incorporating undercuts into two drawers at the front of the unit. In fact, during design review our toolmaker voiced concerns that the undercuts were too large and too deep to form, and a re-design should be considered; we pushed ahead knowing that our processing capability would deliver the desired results. To create this undercut feature, a two motion plug assist was required to generate the double-undercut drawer handle and allow for even and consistent material distribution. One undercut has a depth of 2.5". These undercuts eliminated the need to attach injection-molded pieces, and/or secondary operations for handle grabs and significantly reduced the overall manufacturing costs and assembly time.

Once the designs were agreed upon, the components were manufactured quickly, which is a testament to the collaborative interactions and strong communication between both teams. Communication was vital as the 3D printing technology is evolving quickly and getting to market before the competition was critical.

Materials: Kydex® T – Color Matched PVC Acrylic – Various Thicknesses from .187" to .312"

Tooling: All Tooling is Female Machined Aluminum Pressure Form, Temperature Controlled and Manufactured by American Tool & Engineering, Inc., of Greene, Iowa. All tools were textured with MT 11020 Finish.

Molding: All parts are molded on a Modern Machinery Rotary Pressure Former.

Trimming: All parts are trimmed on Shape Process Automation 6 Axis Robotic Routers. Several parts utilize 7 bits for completion. Special resins were used for fixtures to eliminate scuffing and scratching.

CUT SHEET HEAVY GAUGE PRESSURE FORMING – SILVER

Profile Plastics, Lake Bluff, IL
Motor Drive Cover

Overview

This cover is made for a motor drive used for the integration of various control systems.



Features and Benefits

- Formed using 0.250" gauge KydexT, then 2-tone painted for specific cosmetic appearance
- Detailed and crisp cosmetics were required and provided by the pressure forming process
- Formed in detail highlight clean paint lines of the lower portion of the part for a unique cosmetic appearance
- Limited space for internal components required smaller than normal radii around perimeter of part which provided a challenge for the specific fastener types and to also maintain critical part thickness in consideration of the deep draw ratio
- A full-part perimeter undercut was required for proper mounting to the base unit as well as a maximum thickness in specified areas
- Isolated area for venting and a specified min/max open area, required modified vent design
- UL 94 V0 requirement on raw material used
- EMC conductive paint was required to meet C2 EMC Certification. Special masking was required for specific areas of the part for cosmetic & performance purposes.

HEAVY GAUGE TWIN SHEET – GOLD

Profile Plastics, Lake Bluff, IL
Beverage Dispensing Equipment Lid

Overview

Made for beverage dispensing equipment, this lid, when in use, is uniquely designed to distribute the beverage product in specific flow patterns to ensure consistent & continuous mixing, while also creating a visually novel experience for the end customer.



Features and Benefits

- The part is now made using 0.118" (x2) PETG, clear sheet
- The twin sheet process was selected to meet the part specifications of a 100% leak proof seal, high-temperature dishwasher safe, impact resistant and optical clarity
- The part was originally made by hot plate welding 2-injection molded parts (top & bottom). The parts ultimately failed due to crazing, therefore, diminishing the part's overall appearance and useful life (see part sample on display labeled "Original Part for Comparison Only")

- Significant cost savings were achieved due to reduced part weight, improved chemical resistance, and eliminating the secondary bonding operation

CUT SHEET HEAVY GAUGE TPO – GOLD

Kal Plastics, Vernon, CA
Cab-Over Front Cap



Overview

The vacuum formed TPO truck camper “Cab-Over Front Cap” was developed to replace fiberglass. The move to plastic was made to reduce costly field repairs/warranty claims on the fiberglass predecessor and to reduce the overall weight of the camper to achieve better fuel efficiency.

Features and Benefits

A.Schulman’s HGSR TPO was selected for the typical benefits afforded by TPO and specifically the high gloss – scratch resistant product feature.

The customer identified the front, curved, surface area to be the most critical area of the part. Structural, and aesthetically pleasing, design elements were incorporated, and several starting thicknesses were tested. Ultimately the client decided to specify 0.230” as the preferred starting thickness.

To aide in the construction of the finished tool, it was decided to make the mold in (2) cast aluminum sections; a left and a right. In such a large part (2) castings allowed flexibility to work out any imperfections in the finished mold. Additional thought was given to the thermal cooling system/placement and bracing of the mold. Void materials were added to decrease interior volume of the mold to aide in crisper detail, and better performance, when forming.

Ultimately the stated goals were not only met but were in fact exceeded. An unexpected bonus was a substantial unit cost savings over fiberglass. As of this submission, there have been ZERO warranty claims on this part. The client publishes video of taking a baseball bat to the part to show its durability. The market has responded well and the move to plastics, from fiberglass, has further elevated their brand.

CUT SHEET HEAVY GAUGE PARTS PRODUCED WITH AUTOMATION AND NEW TECHNOLOGY – GOLD

Wilbert Plastics, White Bear Lake, MN
Medical Assembly MRI



Overview

This medical equipment enclosure is thermoformed, robotically trimmed, and then assembled using vision systems and augmented work instructions to ensure a complete and correct assembly.

Features and Benefits

Completed assembly ships to end customer without additional work added by our customer so correct and complete assemblies are critical.

Main equipment component is thermoformed and robotically trimmed to customer's specifications. Main component is then moved into an assembly area for completion. This assembly has 88 components and 28 steps, which means it is critical that all components are correct, and all steps are completed correctly prior to shipment.

Assembly operators are guided by augmented work instructions which are projected on the main component part surface showing/describing assembly steps, component part numbers and locations. Multiple vision systems are used to ensure the correct component(s) are used at each step in the assembly process and that each is in the proper location.

Overall assembly process is completed ensuring all components are installed and in their correct locations, so the customer is confident the assemblies that are shipped directly to their end customer are complete.