2010 International Die Casting Design Competition Winners

Look Inside! What’s New with Aluminum
Each year since 1973, NADCA has sponsored its International Die Casting Design Competition to showcase outstanding die cast designs while acknowledging the continuous contribution die casters provide to the manufacturing industry.

Submitted castings are reviewed by a panel of independent judges from which winners are selected. Categories are grouped by material and include aluminum, zinc and magnesium. For each category, a die casting is evaluated based on ingenuity of casting and product design, overall quality, cost savings and contribution to expanding the market for die casting.

This year, NADCA honored its 29th International Die Casting Design Competition award winners at CastExpo’10 in Orlando, FL. Seven winners received awards, and two honorable mentions were given.

“This year, surprisingly, the competition was most fierce in the magnesium over one half pound category, possibly indicating that we will see more innovations in the application of large magnesium die castings in the future,” said NADCA design engineer Dan Meyer. “The largest dimension individual die casting ever submitted to the competition was a large magnesium lift gate die casting. Other surprising innovations such as die casting over other die castings of a different alloy were also demonstrated.”

NADCA wishes to thank all the die casters who submitted their entries in the 2010 competition, while congratulating the winners.
Aluminum Die Casting under One lb. & Magnesium Die Casting under .5 lb.

Part: Tablet PC Housing Heat Sink Material: 384
Weight: 0.8 lb.
End Market: Computer/Electronics

Caster: Twin City Die Castings Co. – Monticello
520 Chelsea Rd., Monticello, MN 55362 USA

Caster Award Nominees: Engineering/Monticello Teams

Customer: DRS Tactical Systems Inc.

Customer Award Nominees: ARMOR Design Engineering Team & Solutions Design Team

Comments: The back housing for this rugged tablet PC for military and industrial markets contains an aluminum die cast heat sink embedded in another magnesium die casting. After being cast separately, the die cast aluminum heat sink is used as an insert in another die and subsequently die cast over with a magnesium alloy, creating an aluminum/magnesium composite housing. This composite construction allowed the customers dual criteria of minimum weight and maximum heat dissipation to be met. The die caster used a combination of flow simulation and a unique die design to accomplish a good seal between the two different alloys.
Aluminum Die Casting One to 10 lb.

Part: Power Conditioning Module Chassis
Material: 380
Weight: 2.3 lb.
End Market: Computer/Electronics

Caster: Twin City Die Castings Co. – Minneapolis
1070 33rd Ave. SE, Minneapolis, MN 55414 USA

Caster Award Nominees: Prototype Engineering/Minneapolis Team

Customer: Crane Aerospace and Electronics

Customer Award Nominees: Pete Gilderoy – project manager; Jim Price – mechanical engineer

Comments: Originally machined from a roughly shaped ingot, this chassis gained significant cost savings after being converted to an aluminum die casting. Using flow simulation, a gating system was developed that allowed proper filling of the many fins and tall bosses in the part design. By using rapid tooling techniques, the three slide die casting die was completed in just more than eight weeks.
Aluminum Die Casting over 10 lb.

**Part:** Military Radio Power Amplifier Body  
**Material:** G-AlSi12 Cu0.05 Max (413)  
**Weight:** 13 lb.  
**End Market:** Computer/Electronics

**Caster:** ASELSAN Elektronik Sanayi ve Ticaret A.Ş.  
P.K. 1, 06172, Yenimahalle/Ankara, Türkiye

**Caster Award Nominees:** Mechanical Design Department

**Customer:** ASELSAN Elektronik Sanayi ve Ticaret A.Ş.

**Customer Award Nominees:** Communication and Information Technologies Division

**Comments:** At first, investment casting and extrusion were considered for manufacturing this amplifier body. However, these processes required extensive machining to provide sufficient detail for fine functional geometry and efficient heat dissipation. In addition, extrusions were not cost effective to meet water proofing requirements. Die casting met all the product requirements with minimal machining and at a large cost savings over these other processes. The part fin details with openings passing through the entire part presented a technical risk to successfully die cast, but with a well-planned four slide die design, a high quality die casting was produced.
Aluminum Die Casting Squeeze/Semi-Solid

Part: Automotive AWD Clutch Housing
Material: ADC12-T5
Weight: 2.4 lb.
End Market: Automotive

Caster: Contech Castings LLC
Caster Award Nominees: Rockey Wilson, Rick Seaman, Greg Myers, Joe Bowen, Shannon Daley, Rob Steinhaus, Todd Mullard, Dustin McDonald, Grant Wesson

Customer: Borg Warner TTS, PTC
Customer Award Nominees: Donn Niffenegger, Glenn Harris, Garret Gage, Chris Blair, Larry Pritchard

Comments: Originally produced as a multi-step forged steel housing, the die caster working closely with the customer was able to successfully convert this part to an aluminum squeeze casting. The new squeeze cast design incorporated 33 spline teeth with 0.1 degree draft. The squeeze casting process also allowed for optimized solidification and part density to achieve the required material properties. The new housing also allowed for less processing and assembly steps. A significant mass reduction was obtained resulting in better fuel efficiency, reduced inertia for improved all wheel drive engagement response time, and this resulted in enhanced road performance. An innovative die design, casting and heat treatment processes resulted in passing the stringent requirements of zero porosity and 100% leak testing after secondary operations. All these features were obtained while reducing the overall cost of the assembly for the customer.
Magnesium over .5 lb.

**Part:** Crossover Vehicle Lift Gate Inner Panel  
**Material:** AM60  
**Weight:** 18 lb.  
**End Market:** Automotive

**Caster:** Meridian Lightweight Technologies  
2001 Industrial Drive, Eaton Rapids, MI 48827

**Caster Award Nominees:** Jim Kennedy – plant manager

**Customer:** Ford Motor Co.

**Customer Award Nominees:** Cindy Wetzel – design engineer

**Comments:** Replacing a stamped steel assembly, this large die cast magnesium lift gate reduced weight, added design flexibility and reduced assembly time through the integration of various components. The die cast lift gate is the largest size single casting ever submitted to the competition at 54 x 52 inches (1380 x1315 mm) and is believed to be the largest magnesium automotive closure panel currently produced. Switching to a die casting allowed six parts to be integrated into one part and allows for a two-piece outer panel. Design improvements included deep draws, variable wall thickness, ribs, pockets, and nesting features, all as cast. The weight of the lift gate was reduced, allowing the downsizing of the gas struts and opening motors. In addition, narrower pillars allowing for more daylight opening was achieved while maintaining stiffness requirements. One final benefit was a 15mm increase in headroom over the previous design.
Zinc under Six oz. Non-Electroplated

Part: Pinless Tag Clip  
Material: ZA-8  
Weight: 0.35 oz.  
End Market: Computer/Electronics

Caster: Caudle Manufacturing Co. Inc.  
7545 NW 26th Ave., Miami, FL 33147

Caster Award Nominees: Gilmar Barbosa – design engineer, Frank Caudle – VP operations, John Slingerland – Toolmaker

Customer: TYCO Safety Products

Customer Award Nominees: Luis Anderson – design engineering

Comments: This zinc die cast clip allows secure attachment to the merchandise it protects from theft without piercing it with a pin. The strength of the ZA-8 alloy coupled with die casting’s ability to cast fine details allowed a series of functional teeth and ratchet serrations to be created as cast. The die caster provided prototype parts early in the project by using a single-cavity prototype die. Later, the single-cavity prototype die was replaced by a more advanced production die which was built and put into production casting more than 100,000 pieces in four weeks time. This more advanced die allowed the ratchet serrations to be cast without flash further improving product performance.
Part: Base Flange for Flat Panel TV Mount  
Material: Zinc 3  
Weight: 2 lb.  
End Market: Building/Construction/Hardware

Caster: Cast Products Inc.  
4200 N Nordica Ave., Norridge, IL 60706

Caster Award Nominees: Cast Products Engineering Group

Customer: Peerless Industries Inc.

Customer Award Nominees: John Gillespie – senior design engineer

Comments: This die cast flange is used as the base of a flat panel TV swivel mount for the use in hotels and other hospitality applications. The flange allows the mount to be attached to a table top allowing selectable ranges of swivel as well as preventing theft of the entire assembly. In addition, the flange must support the accidental application of weight to the TV without failing. Originally made from machined hot roll steel, the base flange was redesigned as a zinc die casting. Working closely together, the die caster and customer developed a new 3D model optimized for end use and taking full advantage of what the die casting process has to offer. Once the 3D model was developed, a rapid prototype part was printed in plastic and used as pattern for sand cast prototypes. After preliminary testing of the sand cast prototypes and Finite Element Analysis of the 3D model were completed, a production die casting die was approved to be built. The final die casting passed all the customers destructive tests and easily accepted the customer-applied powder coating without discoloration or blistering. Zero draft pads were incorporated in the inner bore of the flange to allow the central bore to be cast to size without additional machining. The tapping of numerous holes on the bottom of flange is also provided by the die caster. The final die casting allowed for a significant cost savings over the machined steel part and allowed the die caster to win additional projects originally slated to be produced overseas.
Honorable Mention Aluminum over 10 lb.

Part: Outboard Marine Engine Drive Shaft Housing  
Material: AA 367  
Weight: 25 lb.  
End Market: Sports/Recreation

Caster: Mercury Marine  
Caster Award Nominees: Mark Potratz  
Customer: Mercury Marine  
Customer Award Nominees: Bob Stuber

Comments: The drive shaft housing pictured here serves as the structural support between the engine power head, transom mount and gear case housing (where propeller is attached) for a 300 to 350 horse power marine engine. The drive shaft housing must be strong and ductile enough to prevent catastrophic failure when hitting an unmoving underwater object. As horsepower and speed increases, preventing these types of failures exceeded the capabilities of existing die casting alloys. Working together the product designer, metallurgists and the die casting department developed and die cast the large drive shaft housing using a new AA 367 alloy that they invented. The invented alloy allowed the drive shaft housing to exceed requirements for use in the highest output outboard engines the customer has ever produced. Impressively, the new die casting alloy demonstrated it could absorb 3X more energy than the previously used alloys.
Honorable Mention Magnesium over .5 lb.

Part: Motorcycle Tail Section  
Material: AM60  
Weight: 2.7 lb.  
End Market: Automotive

Caster: Twin City Die Castings Co. – Monticello  
520 Chelsea Rd., Monticello, MN 55362 USA

Caster Award Nominees: Engineering/Monticello Teams

Customer: Buell Motorcycle Co.

Comments: This single die cast magnesium tail section replaced a four-pound aluminum weldment consisting of more than 25 parts. After talking with their customer, the die caster developed a mock 3D model with suggested die castable geometry. The customer then modified the model to meet detail, functional and aesthetic needs of the final product. The final design resulted in a one-piece die casting design with no secondary machining required and a reduced part weight even though the new design is larger than its predecessor. In addition, the die cast part provided a 70% cost reduction over the aluminum weldment. The part design required a relatively complex die casting die with extreme steps in the parting line as well as two very large slides to create the truss sections of the part. In addition, the unsupported truss sections are surprisingly released without distortion from the slides.