Guide to Reducing Costs With Metal to Plastic Conversions

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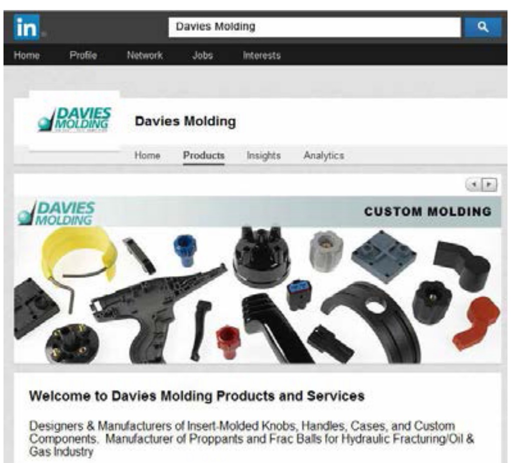
Rich Peterson is the Senior Sales Executive at Davies Molding LLC. He has worked in the plastic industry for over 40 years and specializes in working with Food Service and HVAC companies in developing metal to plastic conversion parts.



Connect with Rich on Linked In
and follow the Davies Molding company page for updates on new products, join discussions on current industry topics, and more.

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Guide Summary

How can you reduce the cost of your parts? Converting your metal parts to plastic can not only provide cost savings, but additional benefits in product design, such as rust-resistance and easy clean surfaces. This guide is designed to provide you with information to help you review which parts can be converted to plastic and save you money.

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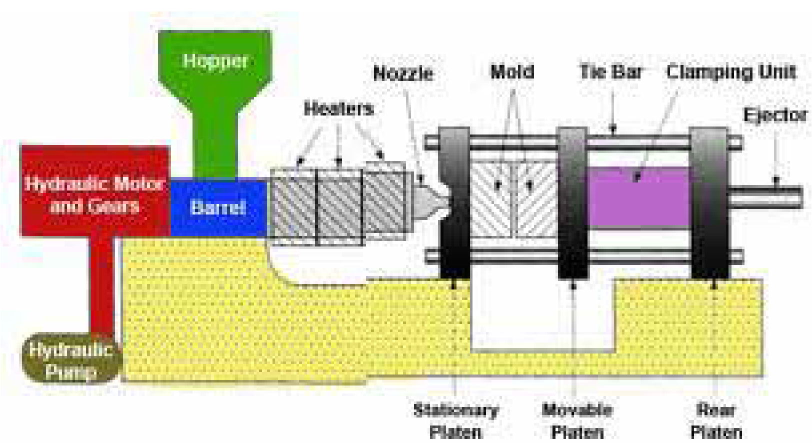
Molding Process

Converting your metal part to plastic can be done using injection or compression molding, depending on the plastic material (see pages 15-21) that works best for your part's application. Working with a molder that has experience and the capacity to use both molding processes provides more options to maximize efficiencies in your part's design and reduce costs on the overall project.

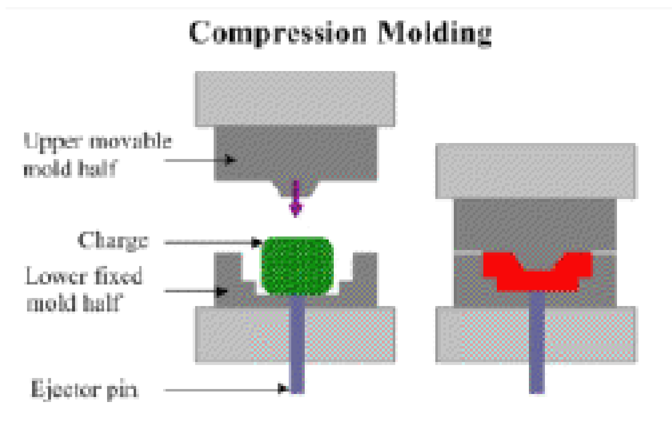
Injection Molding:
The method of forming objects from granular or powdered plastics, most often of the thermoplastic type, in which the material is fed from a hopper to a heated chamber where it is softened, after which a ram or screw forces the material into a mold. Pressure is maintained until the mass has adequately hardened for removal from the mold.



Molding Process

Compression Molding:
This method of molding requires the molding material, which is usually pre-heated, to be placed in an open mold cavity. The mold is closed with a top force or plug member, pressure is applied to force the material into contact with all mold areas, and heat and pressure are maintained until the molding material has cured. The process employs thermosetting resins in a partially cured stage, either in the form of granules, putty-like masses, or preforms. Compression molding is a high-volume, high-pressure method that is suitable for molding complex, high-strength fiberglass reinforcements. Advanced composite thermoplastics can also be compression molded with unidirectional tapes, woven fabrics, randomly orientated fiber mat or chopped strand.

The advantage of compression molding is its ability to mold large, fairly complex parts. Compression molding produces fewer knit lines and less fiber-length degradation than injection molding. Compared to thermoplastics, these materials are more dimensionally stable, which means that shrinkage doesn't change with processing or environmental conditions and is less sensitive to wall thickness variations.



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Engineering

Whether you are looking for cost savings on an existing part, or have a brand new product idea, working with an experienced engineering team will help you design the perfect plastic part. When designing your part, engineers need to look at 3 critical aspects:

- Aesthetics
- Functionality
- Moldability

At Davies, we make sure your part looks how you want it to, works how it's supposed to and will mold properly once the design process is finished. Our engineers ensure that the proper material is used for your product by reviewing the list of material available and working with you to identify the most cost effective choice. We want to be sure the material used will provide the best performance and most longevity for your product, and will provide the best cost savings for your project. Our engineers won't stop until you are happy with the design, and we are certain your product will turn our properly after it is manufactured.

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Design Review

A thorough analysis of your design will help reduce costs. When you've decided which part you want converted to plastic, Davies will review all of the information and decide on the most economical way to meet the design requirements. A 3-D model, and subsequently a 2-D drawing is generated that will not only meet the design requirements, but also adhere to best molding practices and standards..

Computer-Aided Design (CAD) is the most effective program in design manufacturing because of its ability to make changes to models/drawings. Models and drawings are associative, so changes to designs are quick and easy. Most importantly, this allows the manufacturing process to flow smoothly without potentially costly interruptions.

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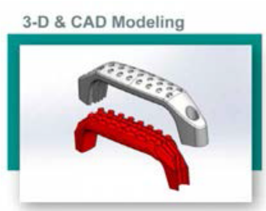
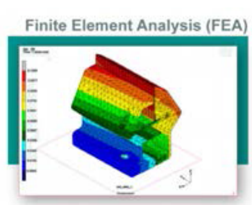
Modeling

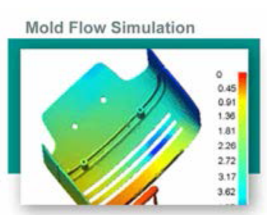
Modeling and simulation has become a "best practice" in manufacturing to help reduce costs and design the most efficient part possible. Choosing a molder that uses these best practices ensures the most cost effective part is produced.



3-D & CAD Modeling
Computer-aided design (CAD) modeling is used to develop viable, productive solutions to your performance criteria.



Finite Element Analysis (FEA)
FEA uses a computer model of a material or design that is stressed and analyzed for specific results. FEA uses a complex system of points called nodes that create a mesh and are programmed to contain the material and structural properties to define how the part will react under certain loading conditions. This allows engineers to verify whether or not a proposed design will perform to the client's specifications prior to molding the part, saving you unnecessary expense and lost time.



Mold Flow Simulation
Plastics simulation software allows engineers to determine the manufacturability of your part in the early stages of the design. This is beneficial because it helps prevent any potential problems such as air traps, weld lines, warpage, shrinkage, and sinks that can cause delays in production and also ensures that the material chosen will provide the best performance, longevity, and the highest cost savings for your project.

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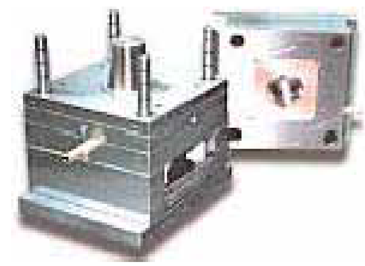
Tooling



After design, the next step is to build the mold. Before the mold is purchased, the mold manufacturer will send us a tool layout sketch, so we can be sure that the tool will be made to our exact specifications.
We review the tool sketch as part of a pre-design feasibility study so that we can eliminate tooling issues for the tool is built. This will help for more efficient production, as we can catch any problems with tooling before moving to the production phase. Tooling is an investment in the metal to plastic conversion project, and careful review of tooling requirements can minimize the investment cost and improve the part design. Check your part's design to see how small changes can simplify the tooling requiremetns and reduce tooling costs.

Recently, we were contacted by a food equipment manufacturer to convert their stainless steel drip trays to plastic. After careful review of the project part design, we chose a sheet molding compound plastic and used a cold sheet compression molding process with secondary deflashing services. The tooling investment paid for itself after just 800 pieces! Davies Molding's engineering staff is trained to review tooling requirements and have made cost saving modifications to many projects, helping save customers money on their new plastic parts.

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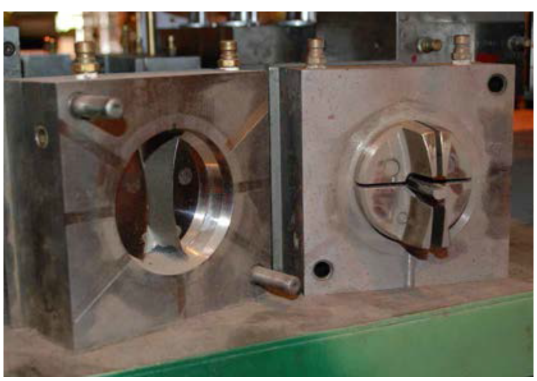
Mold Review

Working with a molding company that has experience working with number of highly qualified mold manufacturers to ensure that tools made are of the highest quality at the lowest cost possible. A variety of mold types are available to ensure that the product meets the quality and budget that the project requires.

When possible, we will use existing Davies-owned frames. This will cut down on your total cost since we will only have to purchase cores and cavities to use with our MUD units. You can rest assured knowing we will only purchase exactly what is needed for your project.

Some projects may allow the mold to be made in-house. We have a competently staffed and equipped tool room to build new molds and maintain present tooling. This allows for better control of mold quality and delivery schedules. In addition, we have complete tool room capabilities, including state-of-the-art CNC equipment.



2-Shot Mold

Drip Tray Mold

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Secondary Services

Finding a partner to supply multiple services for your part saves on shipping costs and management time. At Davies, we know that not every application is well suited or a standard part. That's why we offer "specials" where a different insert may be required or perhaps a secondary operation added. Most of our parts can be customized to meet your specific needs and requirements. Parts can be modified by color, finish, material, size, insert type, and more.

Davies offers the following secondary operation:

- Drilling
- Machining
- Turning
- Ultrasonic Welding
- Buff and Polish
- Tapping
- Sand Blasting
- 3-D CAD Imaging
- Plating
- Vacuum Metalizing
- Hot Stamping
- Pad Printing
- Engraving
- Branding
- Paint Fill
- Decorative Pointers
- Decorative Inlays
- Paint Coatings
- Silk Screen,Plating
- Custom Color Matching
- Packaging
- Bagging
- Assembly
- Kitting

Kit Example

Pad Print Example

Retail Packaging Example

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Quality Control

Performing quality checks at each stage of the part development saves money every time. Process parameter set up - First piece analysis - In-process analysis - final audit are key to keeping quality in check and costs down. Is your supplier ISO certified? Request a copy of their certificate so you can be assured that quality is an important part of the process, from material suppliers to employees, from production systems to management teams and across the entire production process.

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Project Management

Keeping your project on task and completing it on time is key to successfully converting your metal part to plastic. Employing a project management plan to help identify the necessary work at each step will move the project along and make sure it is completed on time.

Concept
Meet with team of Technical Sales, Engineering, and Production

↓

Design
Review CAD model, complete FEA, and mold flow simulation

↓

Prototype
Complete 1st piece approval, review with engineering and production for efficiencies

↓

Production
Review production schedule and meet with quality control to track new part audits

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Delivery/ Lead Time

Is your plastic molder a just in time supplier? Companies that implement JIT have an increase in product quality and in productivity. The benefits include higher inventory turnover, increased product quality and productivity, which leads to a reduction in product costs. Delivering your new part on time is crucial to the success of making the metal to plastic conversion. Choosing a supplier with a history of delivering on-time with short lead-times allows you to service your customer better.

At Davies Molding, we have 80 years of experience delivering our parts on time and with a quick turn around for large and small orders.

"Our volumes are low, but we feel we get treated with the same concern and care as those with high volumes."

-Rotha F., Production Planner at a Medical Manufacturer, August ISO Survey 2013

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Material

When considering which part might work best as a metal to plastic conversion, keep in mind there are various plastic material that you could choose from based on your part's application and industry standards.

Here is a list of popular material types with application ideas:

Name	Description	Typical Applications
Acetal	Acetal resins is produced by the polymerization of purified formaldehyde into both homopolymer and copolymer types. Acetals are extremely rigid without being brittle and have a high melting point, high strength, and good frictional properties and resistance to fatigue.	Gears, bearings, bushings, cams, housings, conveyors, plumbing fixtures, gas tank caps, automotive door handles, seat belt components, and zippers.
Acrylics	A family of thermoplastic resins of acrylic esters or methacrylic esters. This resin has exceptional resistance to long-term exposure to sunlight and weathering and is known to also have outstanding clarity and good light transmission.	Swimming pools, skylights, sinks, washbasins, room dividers, and the tail lights on automobiles.
Acrylonitrile-Butadiene-Styrene (ABS)	A copolymer made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. ABS possesses outstanding impact strength and high mechanical strength, which makes it suitable for use in tough consumer and industrial products. This material is also great as a substrate for metalizing (applying a chrome-like finish to the plastic part).	Appliances, automotive parts, pipe, business machines, telephone components, shower heads, door handles, faucet handles, and automotive front grilles.

Name	Description	Typical Applications
Alkyds	Alkyds are thermosetting unsaturated polyester resins that are produced by reacting an organic alcohol with an organic acid, dissolved in and reacted with unsaturated monomers such as styrene, diallyl phthalate, diacetone acrylamide, or vinyl toluene. Alkyds also have excellent heat resistance and are dimensionally stable under high temperatures. As a molding material for compression molding, alkyds offer excellent dielectric strength.	Electrical applications like circuit breaker insulation, switchgear components, cases, housings, capacitor and resistor encapsulation, automotive parts, and coatings.
BMC (Bulk Molding Compound)	Thermosetting plastic resins mixed with stranded reinforcement, fillers, and other additives into a viscous compound for compression or injection molding. BMC is a highly rigid and impact resistant material that possesses exceptional physical and aesthetic properties and is typically selected for its high strength-to-weight ratio at a relatively low cost.	Appliance parts, electric and electrical components, HVAC components, industrial light housings, automotive, recessed lighting baffles.
Epoxy	Epoxies are thermosetting resins that, in the uncured form, contain one or more reactive epoxide or oxirane groups and serve as cross-linking points in the subsequent curing step, in which the uncured epoxy is reacted with a curing agent or hardener. Epoxies are used by the plastics industry in several ways. Epoxies can be used in combination with glass fibers to produce high-strength composites or reinforced plastics that provide heightened strength, electrical and chemical properties, and heat resistance or can be used in the encapsulation or casting of various electrical and electronic components and in the powder coating of metal substrates.	Adhesives, protective coatings in appliances, industrial equipment, aircraft components, pipes, tanks, pressure vessels, tooling jigs, and tooling fixtures.
Melamine-Formaldehyde	Thermosetting resins formed by the condensation reaction of formaldehyde [HCHO] and melamine. Melamines offer extreme hardness, excellent colorability properties, and arc- resistant non-tracking characteristics.	Rugged dinnerware, household goods, various electrical applications, bonding, adhesives, and coatings.

Name	Description	Typical Applications
Nylon	Nylon resin or polyamide resin is a type of engineering thermoplastic synthesized from ethylenediamine for the purpose of producing a variety of products for industrial use. These resins are usually grouped together as a class of polamides that are known for their stability and adaptability when it comes to mechanical engineering applications. In the United States the majority of resin produced is nylon 66, which is typically used in the production of extruded and molded parts.	Automotive parts, electrical and electronic applications, and packaging.
Phenolic	Phenolic, also known as Bakelite, is a resin that is made from phenol and an aldehyde. There are a lot of advantages to using phenolic resins such as excellent dielectric strength, great mechanical strength, and dimensional stability, resistant to high heat, wear resistant, low moisture absorption, and can be machined easily.	Adhesives, casting resins, laminating resins, electrical and electronic Applications, automotive, appliance handles, frac balls, and knobs.
Polyamide-Imide	Thermoplastic resins that are produced by the condensation reaction of trimellitic anhydride and various aromatic diamines. These resins have exceptional mechanical, thermal and chemical resistant properties.	Aerospace, heavy equipment, and automotive.
Polyethylene	Polyethylene is a thermoplastic resin that is obtained by polymerizing the gas ethylene, a monomer that provides the ability to double bond with other carbon-based monomers to form polymers. It is available in a range of flexibilities and properties which are dependent upon the production process with high density materials being the most rigid. Great for applications where moisture resistance and low cost are required!	Packaging films, house wares, toys, containers, pipes, drums, gasoline tanks, and coatings.

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Name	Description	Typical Applications
Polyimides	Thermoset polyimides are produced in condensation polymers that possess reactive terminal groups capable of subsequent cross-linking through an addition reaction. They are known for thermal stability, good chemical resistance, excellent mechanical properties, and exhibit very low creep and high tensile strength. Polyimides are also inherently resistant to flame combustion and do not usually need to be mixed with flame retardants. Most carry a UL rating of VTM-0.	Electronics, medical tubing, adhesives, gears, covers, bushings, piston rings, and valve seats.
Polyketones	Polyketones are a family of high-performance thermoplastic polymers. The polar ketone groups in the polymer backbone of this material yields a strong attraction between polymer chains, which increases the material's melting point. This resin is resistant to solvents and has great mechanical properties.	Appliances, industrial applications, electrical and electronic applications, automotive applications, bearings, gears, hoses, and tubing.
Polyphenylene Sulfide	Polypropylene is an economical material that offers a combination of outstanding physical, chemical, mechanical, thermal and electrical properties which is not found in any other thermoplastic. It is light in weight and possesses excellent resistance to staining, organic solvents, degreasing agents and electrolytic attack and has a low moisture absorption rate. This is a tough, heat-resistant, semi-rigid material, ideal for the transfer of hot liquids or gases. It is recommended for vacuum systems and where higher heats and pressures are encountered.	Dishwashing safe food containers, packaging, automotive, and appliances.

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Name	Description	Typical Applications
Polystyrene	Today, polystyrene which is also known as Styrofoam is among the most heavily used commodity thermoplastics. This resin is a petroleum-based plastic made from the styrene monomer. Polystyrene is a light-weight material, about 95% air and has very good insulation properties. High molecular weight thermoplastic resins are generally produced by the free-radical polymerization of styrene monomer which can be initiated by heating alone but more effectively by heating in the presence of free-radical initiator (such as benzoyl peroxide). Typical processing techniques are modified mass polymerization or solution polymerization, suspension polymerization, and expandable beads for foam.	Packaging and foodservice products, automotive parts, toys, house wares, appliance parts, wall tiles, radio and TV housings, furniture, floats, and luggage.
SMC (Sheet Molding Compound)	Sheet Molding Compound (SMC) is a combination of resins, fiberglass, catalysts and fillers compounded into a sheet form and then used to manufacture compression-molded products. SMC benefits from very high volume production ability, excellent part reproducibility, and it is cost effective.	Electrical applications, corrosion resistant needs, structural components at low cost, automotive, and transit.
Styrene Acrylonitrile	Thermoplastic copolymers of styrene and acrylonitrile. SAN resins are random, amorphous copolymers produced by emulsion, suspension, or continuous mass polymerization. Styrene Acrylonitrile has good chemical resistance, high heat resistance, great clarity, good dimensional stability, and high rigidity.	Automobile instrument panels and interior trim and house wares.
Sulfone Polymers	A family of engineering thermoplastic resins characterized by the sulfone group. Polysulfone is made by the reaction of the disodium salt of bisphenol with 4,4'- dichlorodiphenyl sulfone. These resins are heat-resistant plastics can be molded to tight tolerances and exhibit low creep under a sustained load at elevated temperatures and have excellent oxidation resistance and compressive strength.	X-ray film, magnetic tape (audio, video and computer); packaging; metalized film, strapping and labels.

Name	Description	Typical Applications
Thermoplastic Polyester (Saturated)	Thermoplastic polyesters are highly crystalline, hard, strong and extremely tough. They form a family of polyesters in which the polyester backbones are saturated and hence unreactive. The most common commercial types are: PET (polyethylene terephthalate) produced by polycondensation of ethylene glycol with either dimethyl terephthalate or terephthalic acid; and PBT (polybutylene terephthalate) produced by the reaction of DMT with 1,4 butanediol.	X-ray film, magnetic tape (audio, video and computer); packaging; metalized film, strapping and labels.
Thermoset Polyester	Thermoset polyester is available in a variety of standard and custom formulations, colors, and extrusions for compression, transfer, and injection molding. This resin is usually chosen because of its low cost per cubic inch, its high strength-to-weight ratio, dimensional stability, and its retention of physical properties at high temperatures. Great to use as an alternative to metal parts!	Appliance parts, electric and electrical components, HVAC components, industrial light housings, automotive, recessed lighting baffles.
Urea-Formaldehyde	A member of the amino family, just like melamine, urea-formaldehyde is a very hard, scratch-resistant material with good chemical resistance, electrical qualities, and heat resistance. These resins are formed by the condensation reaction of formaldehyde and urea and are clear water-white syrups or white powered materials that can be dispersed in water to form colorless syrups. Molding powders are made by adding fillers to the uncured syrups and form a consistency suitable for compression and transfer molding. The liquid and dried resins find extensive Applications in laminates and chemically resistant coatings. The molding compounds are formed into rigid electrical and decorative products.	Electrical and electronic products, decorative products, laminates, and chemically resistant coatings.

Metal to Plastic Part Conversion Checklist

Molding Process

Engineering / Feasibility Study

Design Review / Feasibility Study

Modeling

Tooling

Mold Review

Secondary Services

Quality Control

Project Management

Delivery/ Lead time

Material

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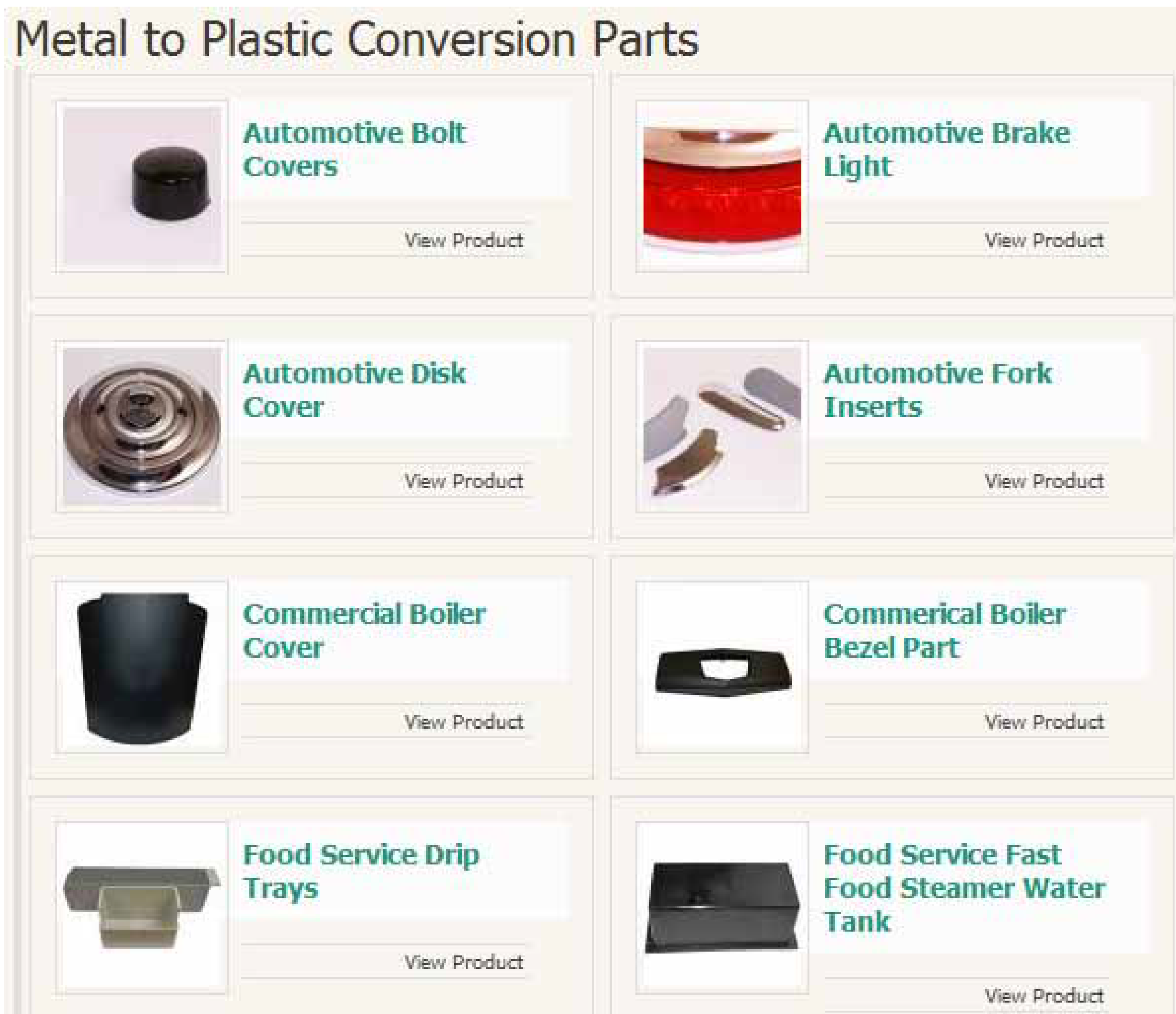
Davies' Project Portfolio

Our custom molding website lists examples of parts converted from metal to plastic in a project portfolio. Each project lists the type of plastic material and molding process, along with additional details about the project.



View our project portfolio at:
http://plastic-molding.daviesmolding.com/projects-portfolio.html

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Free Consultation

Ready to get started? Schedule a free consultation with our skilled manufacturing and design engineers to review your drawings and production plan.   We will prepare a cost-reduction plan to take your existing metal part and convert it to plastic.

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