Dr. Die Cast

"Structural Die Castings", Buzz Word or Reality?

If there was an underlying theme to the recent NADCA Congress it was "Structural Die Castings". The question we all need to ask ourselves as we look forward is, "Is this a market I should consider?" And if so, "How do I prepare to produce structural grade die castings?"

Is there a growing market for structural die castings? I think the answer to that is very clear, "Yes". As Rob McInerney so clearly quoted, the CAFÉ Standards mandate is very aggressive. A goal of 36.7 MPG for Passenger cars by 2016 increasing to 51.3 MPG by 2025 will require a significant weight reduction of the automobile fleet. Table 1 below is from page 19/578 of the Federal Register.

Aluminum and magnesium are the primary materials readily available for that type of weight reduction. Does that weight reduction translate in to a windfall of profits for die casters? Let's not delude ourselves. Somebody please tell me if you've been approached by an automotive company stating they wanted to pay a premium for a special process or material. If you need a reminder, think of the words, Semi-Solid, Squeeze Cast and Thixomolding. They are all great technologies to produce heat treatable, structural castings but the price point is not always in line with the overhead costs associated with the equipment, tooling and materials. If you need a further reminder, think of certain die casting companies that no longer exist that were locked in to unrealistic price points and/or terms.

In case you think I'm making this up take a look at Table 2 from the Federal Register page 26/578.

The risks are real, but they are not insurmountable and are worthy of discussion. What are some of the components?

1. **Existing capital equipment. Some die casting plants already possess most of the equipment used to produce structural die castings. However many have only the basic equipment.**
   a. Higher tonnage die casting machinery with high speed shot ends. The key here is high speed shot ends. For an automotive designer to get the greatest benefit from the material the castings need to be large components such as door pillars, shock towers and cross members. In addition, the casting wall sections need to be minimized to further reduce weight and material costs. Even greater benefits are possible when entire doors, tail gates and hatch backs are produced by die casting. In order to reduce the casting wall section the injection speeds must be 2 to 3 times faster than we are accustomed for the mechanical castings that are our bread and butter today. If exterior components can be die cast then paint ready surfaces must be a part of our offering.

2. **Metal melting and monitoring:**
   a. Most of the structural die casting alloys require frequent monitoring and "sweetening" with elements that burn off. This requires someone 24 hours a day to maintain the chemistry.
   b. Degassing: While this is practiced occasionally by die casters casting 380, it is essential for structural alloys. This is a requirement not only in the remelt furnace but at every step on the way to the cold chamber.

Table 1 – Minimum Standard for Domestically Manufactured Passenger Cars (MPG)

2017	2018	2019	2020	2021	2022	2023	2024	2025
36.7	38.0	39.4	40.9	42.7	44.7	46.8	49.0	51.3

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3. Heat treatment:

a. Depending on the size and volume of the castings, these could be a significant capital investment in both the heat treat furnaces, utilities and the building structure.

b. Monitoring and testing: Again this could be an area of technical expertise that doesn't currently exist within our plant. Training and special test equipment is essential to guaranteeing the quality and performance of our castings.

4. Traceability from cradle to grave:

a. Die Casting Process monitoring has been around for several decades. The ability to capture and store the data is constantly advancing.

b. Technology now exists to serialize the casting immediately after extraction. The serial number is tied to the entire die cast process data that produced that specific casting. (This is not "pie in the sky", it is already being practiced.)

5. Infrastructure:

a. The utilities of the entire plant are part of the die casting process. They include, compressed air, central die lube, tip lube, vacuum, gas, electrical, lighting, HVAC, I.T., cooling/process water and hoists/crane bays, die maintenance and storage, material handling, shipping and transportation, etc.

While this is not intended to be all inclusive I hope it will at least bring some awareness of challenges that lie ahead. Let me know what you think. Are you ready? Do you know anyone that is?

References

Federal Register/Vol. 77, No. 199/ Monday, October 15, 2012/Rules and Regulations 62641

Available for download at: www.nhtsa.gov/fuel-economy

Table 2 – Model Year 2025 CO^2 and Fuel Economy Targets for Various MY 2012 Vehicle Types

Vehicle Type	Example Models	Example model footprint (sq. ft.)	CO2 Emissions target (g/ml)[a]	Fuel Economy target (mpg)[b]
Example Passenger Cars				
Compact car	Honda Fit	40	131	61.1
Midsize car	Ford Fusion	46	147	54.9
Full size car	Chrysler 300	53	170	48.0
Example Light-duty Trucks				
Small SUV	4WD Ford Escape	43	170	47.5
Midsize crossover	Nissan Murano	49	188	43.4
Minivan	Toyota Sienna	56	209	39.2
Large pickup truck	Chevy Silverado (extended cab, 6.5 foot bed)	67	252	33.0

[a, b] Real-world CO^2 is typically 25 percent higher and real-world fuel economy is typically 20 percent lower than the CO^2 and fuel economy target values presented here.