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# **NADCA Product Specification Standards for Die Casting**

**Aluminum,  
Aluminum-MMC,  
Copper,  
Magnesium,  
Zinc and  
ZA Alloys**



**NORTH AMERICAN DIE CASTING ASSOCIATION**  
**Arlington Heights, Illinois**

**Revised for 2021**  
**11<sup>th</sup> Edition**

# NADCA Product Specification Standards for Die Casting

**Dedicated  
to Continuous  
Improvement**



The North American Die Casting Association's mission is to continue as the worldwide leader in stimulating growth and improvement in the die casting industry.

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OEM product engineers and specifiers can contact NADCA for information on a range of materials and services aimed at helping designers achieve product cost reductions and performance improvements through today's advanced die casting technology. These include an OEM design, specification and sourcing website, design engineering publications and a regional and on-site OEM design seminar program.

## Product Standards Disclaimer

The standards and guidelines for the specification of products to be produced as die castings presented in this volume are generic in nature. They are offered as a convenient reference for the general direction of die casting component designers and specifiers, whose final decisions must depend on their own engineering and design judgment and predictive testing under application conditions. Use of these standards and guidelines is voluntary.

The unique characteristics and features of a specific die cast component design are the major determinants of the final specifications which can be economically achieved by the die casting process.

The OEM product engineer is urged to consult with their die caster to establish more precisely those guidelines which can be expected to apply to a particular design under consideration.

Although every effort has been made to assure accuracy of the data presented, the publisher cannot be responsible for results obtained through the use of this data.

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No warranties, expressed or implied, are given in connection with the accuracy or completeness of this publication. The data presented are subject to modification without notice.

## Revisions and Additions Schedule

NADCA Product Specifications Standards for Die Castings will be revised as needed on a yearly basis. Major revisions and additions are incorporated on a three (3) year schedule.

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# Introduction to this Manual

**T**hese specification guidelines and standards for die castings have been formulated to aid product designers and specifiers in the successful execution of their designs as die cast components. Significant advances in the capabilities of North American process technology, and the introduction of an expanded number of die casting alloys, have created new opportunities for cost-effective die cast designs. To achieve net-shape or near net-shape components, designers today are using die casting to capitalize on improved dimensional accuracy and stability, cosmetic surface quality, and more dependable product performance. To best capitalize on all of these advantages, designers and specifiers should consult the guidelines presented here at an early design stage, in collaboration with a qualified die caster.

Today's die casting process can offer significant reduction in, or elimination of, part machining costs through its ability to cast dimensions, holes and features to precision tolerances at high volumes. Such major cost reductions can also often make die castings practical in lower production volumes. Through parts consolidation, die castings can reduce finished product assembly costs and improve product integrity and operation. Selected alloys can allow bearing properties to be integrally incorporated into a part, eliminating the need for inserts. The established strength and durability of die castings can allow undamaged disassembly, refurbishing or remanufacture to extend a product's useful life. And at the end of a product's life cycle, die castings allow for optimum reclamation with eventual remelting and realloying, followed by die casting back into high-level applications — without degradation of properties.

The first section of this manual, Process & Material Selection for Product Recyclability, presents the facts on this important new product requirement for process and material selection.

The Tooling Section will familiarize engineers, especially those new to the process, with the unique characteristics of die casting tooling requirements.

The Alloy Data Section provides an updated reference to die casting materials commercially available for component design specification in North American production. These material families include the aluminum alloys; aluminum metal matrix composites; copper alloys including brass and bronze; magnesium alloys; zinc (Zamak) alloys; and zinc-aluminum (ZA) alloys. Lead and tin are rarely die cast because of relatively low mechanical properties. Ferrous-metal die casting is carried out on a limited production basis, with very high melting temperatures necessitating the use of special refractory metals for dies and other special procedures. Alloy tables provide data for comparison of chemical composition and properties for each alloy and their characteristics in die casting and post-casting operations. Poisson's Ratio, where available, is included to aid finite element analysis (FEA).

\* Different sets of properties can be achieved with alternate processes (such as high vacuum, squeeze, and semi-solid casting) and alternate alloys (such as A356, Aural 2 or 356, and Silafont 36). Information on these processes and alloys can be found in the NADCA Standards for High Integrity and Structural Die Casting Process (NADCA Publication #403) and the High Integrity Die Castings book (NADCA Publication #404).

Replacing the former ADCI/NADCA "E" Series are the comprehensive Engineering and Design Sections. These present die casting coordinate dimensioning specifications for "Standard" Tolerances and "Precision" Tolerances, with values up to 65% tighter than the former "E" Series. In addition, guidelines for Geometric Dimensioning are presented as they relate to die casting part designs.

Sections on Quality Assurance and Commercial Practices will aid the specifier and die caster in reaching agreement on the procedures and practices that should be followed to assure purchaser satisfaction.

A detailed contents page appears at the beginning of Sections 2 through 9. A listing of all numbered standards, guidelines, and checklists appears on the next page. An index and glossary of die casting terms appear in Section 10.

More than one section should be reviewed in making process decisions. The special features and geometry of an individual component to be die cast, its dimensional, functional, finishing and end-use requirements — considered in relation to production parameters — must be carefully weighed.

The appropriate tooling, engineering and quality assurance guideline information provided should be evaluated in combination with alloy data. The benefits of early consultation with an experienced die caster are obvious.

These guidelines are prepared and published by NADCA, in collaboration with OEM engineers and dedicated die casting industry technical specialists. Thanks go to the many industry members who contributed at various stages to the development, research, organization and review that resulted in this volume.

NADCA wishes to acknowledge the Product Standards Task Force for the efforts provided to establish this 11th Edition.

# Guideline & Checklist Cross Reference

Cross Reference between former ADCI Product Standards, former NADCA Volume 401 Product Guidelines and NADCA 2021 Product Specification Standards for Die Casting.

ADCI	NADCA #401	NADCA 2021	Subject
ADCI-M2	NADCA-M2	NADCA A-3-1 NADCA A-3-2	Composition & Properties of Standard Aluminum Alloy Die Castings
ADCI-M3	NADCA-M3	NADCA A-3-1 NADCA A-3-2	Composition & Properties of Special Aluminum Alloy
ADCI-M4	NADCA-M4	NADCA A-3-3	Characteristics of Aluminum Alloys
ADCI-M5	NADCA-M5	NADCA A-3-7 NADCA A-3-8	Composition & Properties of Copper Alloy Die Castings
ADCI-M6	NADCA-M6	NADCA A-3-9	Characteristics of Copper Alloys
ADCI-M7	NADCA-M7	NADCA A-3-10 NADCA A-3-11	Composition & Properties of Mg Alloy Die Castings
ADCI-M8	NADCA-M8	NADCA A-3-12	Characteristics of Mg Alloy Die Castings
ADCI-M9	NADCA-M9	NADCA A-3-13 NADCA A-3-14	Composition & Properties of Zn. & ZA Alloy Die Castings
ADCI-M10	NADCA-M10	NADCA A-3-15	Characteristics of Zn. & ZA Alloy Die Castings
ADCI-M11	NADCA-M11	(Discontinued)	Certified Zinc Alloy Plan for Die Casting
ADCI-C1-76	NADCA-C1-88	Comm'l Practices pgs. 8-8	Production Part Orders
ADCI-C2-76	NADCA-C2-88	Comm'l Practices pg. 8-3	Specifying Tolerances
ADCI-C3-76	NADCA-C3-88	Comm'l Practices pg. 8-4	Die Casting Dies & Production Tooling
ADCI-C4-79	NADCA-C4-88	Comm'l Practices pg. 8-11	Price Adjustments
ADCI-C5-76	NADCA-C3-88 NADCA-C5-88	Comm'l Practices pgs. 8-7	Insert: Gauges
ADCI-C6-76	NADCA-C6-88	Comm'l Practices pg. 8-12	Patent Obligations
ADCI-C7-76	NADCA-C7-88	Comm'l Practices pg. 8-12	Warranties
ADCI-C8-76	NADCA-C8-88	Comm'l Practices pgs. 8-10	Limitations on Inspection
ADCI-C9-76	NADCA-C9-88	NADCA C-8-1	Checklist for Die Casting Production Part Purchasing
ADCI-C10-76	NADCA-C10-88	NADCA C-8-2	Checklist for Finished Die Cast Production Part Purchasing
ADCI-Q1	NADCA-Q1	Quality Assurance pgs. 7-9	Drawing & Specifications
ADCI-Q2	NADCA-Q2	Quality Assurance pgs. 7-10	Gage, Measurements & Test Equipment
ADCI-Q3	NADCA-Q3	Quality Assurance pgs. 7-11	Statistical Quality Control

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<b>ADCI</b>	<b>NADCA #401</b>	<b>NADCA 2021</b>	<b>Subject</b>
ADCI-Q4	NADCA-Q4	Quality Assurance pg. 7-10	FAIR
ADCI-Q5	NADCA-Q5	Quality Assurance pgs.7-12	Porosity
ADCI-Q6	NADCA-Q6	Quality Assurance pg. 7-17	Pressure Tight Castings
ADCI-E1-83	NADCA-E1-83 NADCA-E1-65	NADCA S-4A-1 NADCA P-4A-1	Linear Dimension Tolerances
ADCI-E2-83	NADCA-E2-83 NADCA-E2-65	NADCA S-4A-2 NADCA P-4A-2	Parting Line Tolerances
ADCI-E3	NADCA-E3-83 NADCA-E3-65	NADCA S-4A-3 NADCA P-4A-3	Moving Die Component Tolerances
ADCI-E4	NADCA-E4-83 NADCA-E4-55T	NADCA S-4A-7 NADCA P-4A-7	Draft Tolerances
ADCI-E5	NADCA-E5-83 NADCA-E5-65	NADCA S-4A-8 NADCA P-4A-8	Flatness Tolerances
ADCI-E6	NADCA-E6-83 NADCA-E6-65	(1) (See below)	Depth of Cored Holes
ADCI-E7	NADCA-E7-83 NADCA-E7-65	(1) (See below)	Draft Requirements in Cored Holes
ADCI-E8	NADCA-E8-83 NADCA-E8-65	NADCA S-4A-9 NADCA P-4A-9 NADCA P-4A-10 NADCA S-4A-11	Cored Holes for Threads (1) The Cored Holes for Threads sections requirements include cored hole & draft requirements
ADCI-E9	NADCA-E9-83 NADCA-E9-65	NADCA G-6-4	Ejector Pin Marks
ADCI-E10	NADCA-E10-83 NADCA-E10-65	NADCA G-6-5	Flash Removal
ADCI-E11	NADCA-E11-83 NADCA-E11-65	Engrg. & Design Pg. 5-11	Location Tolerances
ADCI-E12	NADCA-E12-83 NADCA-E12-65	Engrg. & Design Pg. 5-13	Concentricity Tolerances
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ADCI-E14	NADCA-E14-83 NADCA-E14-65	NADCA S-4A-12	Die Cast Threads
ADCI-E15	NADCA-E15-83 NADCA-E15-65	NADCA G-6-2 NADCA G-6-3	Fillets, Ribs & Corners
ADCI-E16	NADCA-E16-83 NADCA-E16-65	NADCA G-6-7	Lettering & Ornamentation
ADCI-E17	NADCA-E17-83 NADCA-E17-63T	NADCA G-6-1	Pressure Tightness
ADCI-E18	NADCA-E18-83 NADCA-E18-64T	NADCA G-6-6	Surface Finish, As-Cast
ADCI-M1	NADCA-M1	Alloy Data Tables Pg. 3-42	Alloy Cross Reference Designations

# List of NADCA Standards, Guidelines & Checklists

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Guideline to Increase Die Life	T-2-2-21	Guideline	2-19
<b>Aluminum Alloys</b>			
Chemical Compositions	A-3-1-21	Standard	3-5
Properties	A-3-2-21	Standard	3-6
Die Casting Characteristics	A-3-3-21	Guideline	3-7
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Die Casting Characteristics	A-3-6-21	Guideline	3-15
<b>Copper Alloys</b>			
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<b>Coordinate Dimensioning</b>			
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Linear Dimension Tolerances	P-4A-1-21	Precision	4A-8
Parting Line Tolerances	S-4A-2-21	Standard	4A-9
Parting Line Tolerances	P-4A-2-21	Precision	4A-10
Moving Die Component Tolerances	S-4A-3-21	Standard	4A-11
Moving Die Component Tolerances	P-4A-3-21	Precision	4A-12
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Draft Tolerances	S-4A-7-21	Standard	4A-21
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Cored Holes for Cut Threads Tolerances	P-4A-9-21	Precision	4A-35
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<b>Engineering &amp; Design: Miniature Die Castings</b>			
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# Current Revisions and Additions

<b>Title</b>	<b>Page</b>	<b>Comment</b>
Process and Material Selection for Product Recyclability	1-1 to 1-6	Rewritten to focus on the life cycle of a die casting and its impact on the environment
Checklist for Die Casting Die Specifications	2-18	Additional checklist items for inherited die casting dies
Die Casting Alloy Cross Reference Designations	3-3	Zinc UNS specifications corrected
Aluminum Alloys	3-4 to 3-7	Updated alloy names to reflect names commonly associated with alloy
Aluminum Alloys	3-11 & 3-12	Additional mechanical properties for low iron aluminum alloys
Engineering & Design: Tolerancing	4A-1	Section title adjusted to accurately reflect section content
Standard and Precision Tolerances	4A-4	Paragraph added on Cpk vs. Cp
Standard and Precision Tolerances	4A-4	Paragraph added on datum placement
Production Part Technologies	4A-6	Note added on Theoretical Sharp Corners and Drafted Surfaces
Draft Requirements	4A-22 & 4A-24	Correction to draft equation constant "C" units, with updated metric conversion
Engineering & Design: Additional Specification Guidelines Introduction	6-2	Updated to accurately reflect section content
Simulation	7-4 & 7-5	Images updated with current flow simulation software
Checklist for Die, SSM and Squeeze Casting Production Part Purchasing	8-15 & 8-16	Additional blank lines to write in specifics for checklist items
Edits made throughout the book to correct typographical errors or for minor clarification to existing information		