
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 2015
9th 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.

For complete information on NADCA corporate or individual membership, contact:

North American Die Casting Association
3250 N. Arlington Heights Rd., Ste. 101
Arlington Heights, IL 60004
Phone: **847.279.0001**
Fax: **847.279.0002**
Email: **membership@diecasting.org**
Website: **www.diecasting.org**
Design Website: **www.diecastingdesign.org**

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.

The North American Die Casting Association, and its members expressly disclaim any liability arising out of the use of this material.

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.

Published by:
North American Die Casting Association
3250 N. Arlington Heights Rd., Ste. 101
Arlington Heights, IL 60004

© Copyright 1994, 1995, 1997, 2000, 2003, 2006, 2009, 2012, 2015

All rights reserved. Printed in the United States of America

Library of Congress Catalog Card Number 94-70763

ISBN 1-885271-00-x

NADCA Product Specification Standards for Die Casting

Section Number	Content
iv	Introduction
v	Cross Reference to NADCA Standards, Guidelines & Checklists
vii	List of NADCA Standards, Guidelines and Checklists
viii	Current Revisions and Additions
1	Process and Material Selection for Product Recyclability
2	Tooling for Die Casting
3	Alloy Data
4A	Engineering & Design: Coordinate Dimensioning
4B	Engineering & Design: Miniature Die Casting
5	Engineering & Design: Geometric Dimensioning
6	Engineering & Design: Additional Specification Guidelines
7	Quality Assurance
8	Commercial Practices
9	Casting Examples
10	Index/ Glossary of Die Casting Terms

1

2

3

4A

4B

5

6

7

8

9

10

Introduction to this Manual

These 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 Product Specification Standards for Die castings produced by Semi-Solid and Squeeze Cast Processes (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 8th Edition.

Guideline & Checklist Cross Reference

Cross Reference between former ADCI Product Standards, former NADCA Volume 401 Product Guidelines and NADCA 2012 Product Specification Standards for Die Casting.

ADCI	NADCA #401	NADCA 2015	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

Guideline & Checklist

Cross Reference

Cross Reference between former ADCI Product Standards, former NADCA Volume 401 Product Guidelines and NADCA 2015 Product Specification Standards for Die Casting.

ADCI	NADCA #401	NADCA 2015	Subject
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
ADCI-E13	NADCA-E13-83 NADCA-E13-65	NADCA S/P4A-13	Machining Stock Allowance
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

Title	NADCA No.	Format	Page
Tooling			
New Die Casting Die/Inherited Die Specifications	T-2-1-15	Checklist	2-17
Guideline to Increase Die Life	T-2-2-15	Guideline	2-19
Aluminum Alloys			
Chemical Compositions	A-3-1-15	Standard	3-5
Properties	A-3-2-15	Standard	3-6
Die Casting Characteristics	A-3-3-15	Guideline	3-7
Aluminum Matrix Composites			
Chemical Compositions	A-3-4-15	Standard	3-13
Properties	A-3-5-15	Standard	3-14
Die Casting Characteristics	A-3-6-15	Guideline	3-15
Copper Alloys			
Chemical Compositions	A-3-7-15	Standard	3-17
Properties	A-3-8-15	Standard	3-18
Die Casting Characteristics	A-3-9-15	Guideline	3-19
Magnesium Alloys			
Chemical Compositions	A-3-10-15	Standard	3-21
Properties	A-3-11-15	Standard	3-22
Die Casting Characteristics	A-3-12-15	Guideline	3-23
Zinc and ZA Alloys			
Chemical Compositions	A-3-13-15	Standard	3-27
Properties	A-3-14-15	Standard	3-28
Die Casting Characteristics	A-3-15-15	Guideline	3-29
Coordinate Dimensioning			
Linear Dimension Tolerances	S-4A-1-15	Standard	4A-7
Linear Dimension Tolerances	P-4A-1-15	Precision	4A-8
Parting Line Tolerances	S-4A-2-15	Standard	4A-9
Parting Line Tolerances	P-4A-2-15	Precision	4A-10
Moving Die Component Tolerances	S-4A-3-15	Standard	4A-11
Moving Die Component Tolerances	P-4A-3-15	Precision	4A-12
Angularity	S/P-4A-4-15	Standard/Precision	4A-13
Concentricity	S-4A-5-15	Standard	4A-17
Parting Line Shift	S-4A-6-15	Standard	4A-19
Draft Tolerances	S-4A-7-15	Standard	4A-21
Draft Tolerances	P-4A-7-15	Precision	4A-23
Flatness Tolerances	S-4A-8-15	Standard	4A-29
Flatness Tolerances	P-4A-8-15	Precision	4A-30
Cored Holes for Cut Threads Tolerances	S-4A-9-15	Standard	4A-34
Cored Holes for Cut Threads Tolerances	P-4A-9-15	Precision	4A-35
Cored Holes for Formed Threads Tolerances	P-4A-10-15	Precision	4A-36
Cored Holes for Pipe Threads Tolerances	S-4A-11-15	Standard	4A-38
Cast Threads	S-4A-12-15	Standard	4A-39
Machining Stock Allowance	S/P-4A-13-15	Standard/Precision	4A-40
Engineering & Design: Miniature Die Castings			
Tolerances	S-4B-1-15	Standard	4B-3
Additional Specification Guidelines			
Pressure Tightness	G-6-1-15	Guideline	6-3
Fillets	G-6-2-15	Guideline	6-4
Ribs & Corners	G-6-3-15	Guideline	6-5
Ejector Pins, Pin Marks & Pin Flash	G-6-4-15	Guideline	6-6
Casting Flash Removal	G-6-5-15	Guideline	6-7
Surface Finish, As Cast	G-6-6-15	Guideline	6-8
Die Cast Lettering & Ornamentation	G-6-7-15	Guideline	6-10
Specification Checklists			
Die Cast Production Specifications	C-8-1-15	Checklist	8-14
Die Cast Surface Finishing Specifications	C-8-2-15	Checklist	8-15

Current Revisions and Additions

Title	Page	Comment
Die Casting Die Specification Checklist	2-17	Checklist updated to allow specific alloy to be written in
Guidelines to Increase Die Life	2-19	Guidelines 8 and 9 added
Alloy Data	3-11	Tables 7 and 8 added for chemical composition and properties of suggested and company specific alloys
Zinc Alloy Properties at Temperature	3-37	Alloy 2 added More data points and modulus added for other alloys
Aluminum Alloy Data	3-42 & 3-43	EN specifications and chemical composition added for aluminum alloys
Zinc Alloy Data	3-45	Expanded zinc cross reference specifications and added chemical compositions
Parting Line	4A-9 to 4A-12	Clarified terminology for calculating parting line tolerance and parting line shift tolerance
Miniature Die Casting Dies	4B-6	M-2 and H-13 added as die material options in table
Primary, Secondary, and Tertiary Features & Datums	5-4	Rewritten to explain more clearly
Material Conditions	5-8 & 5-9	Rewritten to explain more clearly
Ribs and Corners in Die Cast Parts	6-5	Section on Small Metal Savers added
Ejector Pins, Pin Marks and Pin Flash	6-6	Section on Bumping Ejector Pins added
JIT Delivery	8-9 & 8-10	Just In Time Delivery section removed
Compliance with Laws	8-11	Section on Compliance with Laws added
Intellectual Property	8-13	Section on Intellectual Property added
Edits Made Throughout New photographs and revised line drawings added throughout		
