



## K-ALLOY™

The corrosion resistant structural aluminum alloy for electrification

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9/7/2022

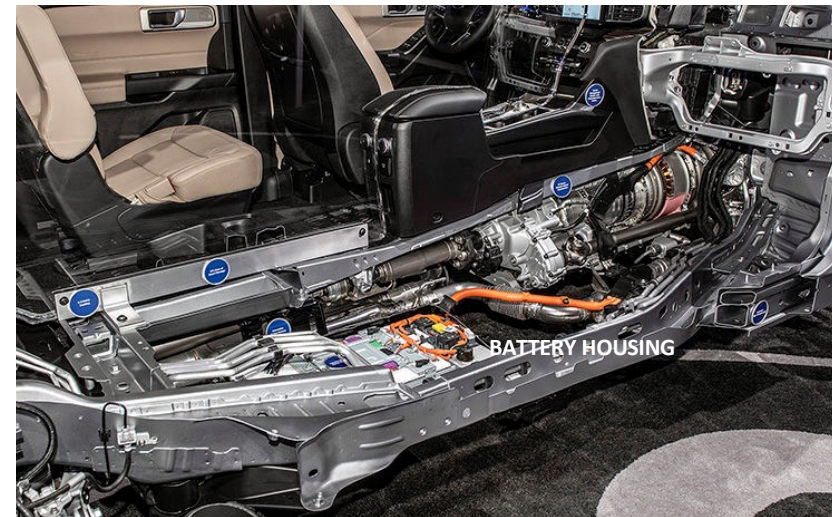


# K-ALLOY™ / A304

## Why Use K-Alloy™?

Aluminum alloy that provides unexpected levels of corrosion resistance when compared to traditional aluminum alloys.

- Eliminates water intrusion due to corrosion.
- Enables components to be placed lower in the vehicle.
- Protects costly electronic components.
- Reduces the mass over steel housings.
- Ductile metal as-cast, and heat treatable.
- Eliminates coating.
- Longer die life.



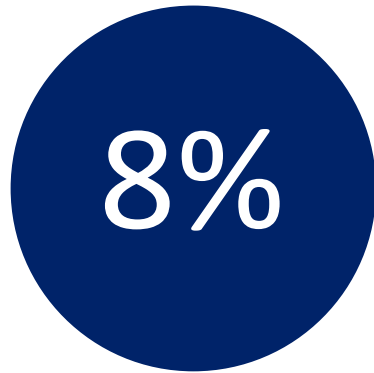
# K-ALLOY™ / A304

## Material Properties

PROPERTY	K-ALLOY AS CAST	K-ALLOY HEAT TREATED	AURAL-2 SILAFONT (365)	A360	A380 ADC12	A413
Tensile Strength PSI (MPa)	43,000 (296)	42,000 (289)	41,000 (283)	46,000 (317)	47,000 (324)	42,000 (290)
Yield Strength PSI (MPa)	25,000 (172)	23,000 (159)	21,000 (145)	25,000 (172)	23,000 (159)	19,000 (131)
Elongation	5.0%	8-14%	4.5 – 6.5% as cast 8-11% HT	3.5% as cast	3.5% as cast	3.5%
Thermal Conductivity (W/m.k. @77°F)	120	120	120	113	96	121
Electrical Conductivity (% of AICS)	32	-	-	27	25	31
Density (gms cm-3)	2.63	2.63	2.64	2.63	2.71	2.66
Corrosion Resistance (1=worst, 10=best)	10	10	10	6	3	6
Die Life % of A380	100%	100%	40%	100%	100%	100%
Castability (1=worst, 10=best)	10	10	6	6	10	5

# K-ALLOY™ / A304

## Benefits



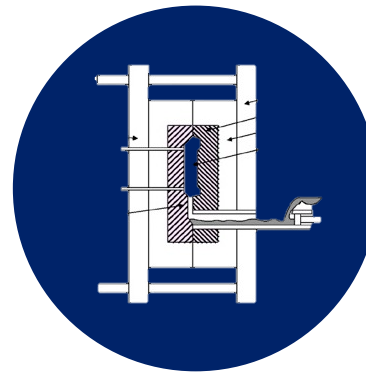
### HIGH ELONGATION

5% as cast  
8%-14% heat treated



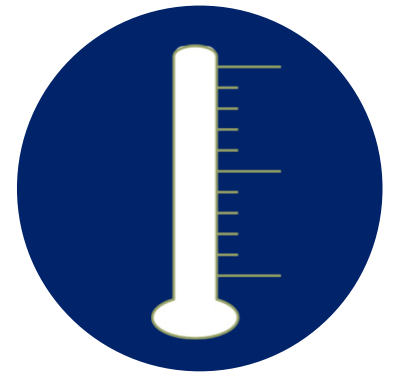
### CORROSION RESISTANT

Offers unique engineering  
solutions, no paint or  
coatings required.



### LONGER DIE LIFE

Equal to A380. Die life  
is 2-3x longer than alloys  
with low Fe



### THERMAL CONDUCTIVITY

15% better than A380



# K-ALLOY™ / A304

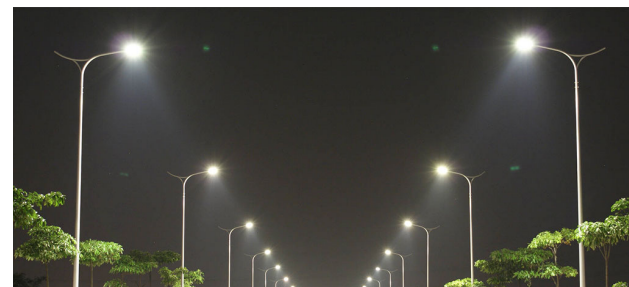
## Typical Applications



Automotive



Marine



Lighting and Telecommunications



Construction / Agriculture



Furniture



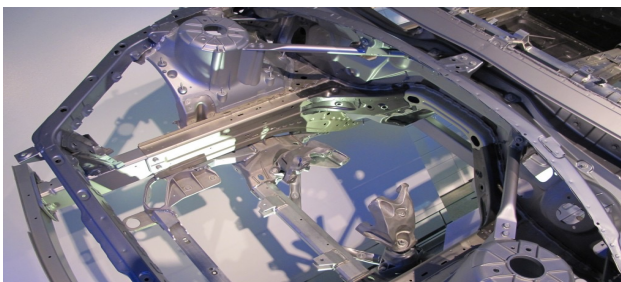
Military

# K-ALLOY™ / A304

## Typical Automotive Applications



Electronics Housings



Structural Castings



LED Lighting Housings



e-Steering Gear Housings



Roof Rack & Exterior



Powertrain and E-Powertrain

# K-ALLOY™ / A304 FOR ELECTRONIC HOUSINGS

Corrosion Resistance (30 cycles of ASTM B117)



## A360 Alloy

The housing shows signs of material loss, pitting, and raised perimeter completely missing.



## K-Alloy / A304

The housing shows no visual corrosion, nor metal loss due to chemical reaction.



## A360 Alloy

Housing shows signs of water intrusion. Corrosion to the edge of the housing is pronounced. Severe surface pitting is evident.



## K-Alloy / A304

The same housing shows the top cover removed. The sealed surface remains intact and shows no signs of water intrusion nor surface corrosion.



# K-ALLOY™ / COMPARED TO OTHER ALLOYS IN CORROSION TESTS

## Superior Performance



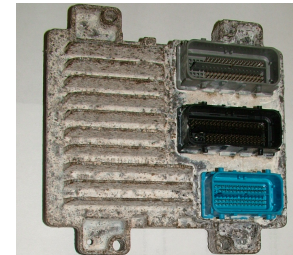
### A360 Alloy

The housing shows signs of material loss, and pitting. The raised perimeter is completely missing. Water intrusion will be the result.



### A413 Alloy

The surface pitting from corrosion is extreme. The corrosion growth under the electrical connector pushes the seal open. Water intrusion will result.



### A383 Alloy

The connectors are surrounded by severe crevice corrosion and the surface is heavily pitted from general corrosion. Parts fail leak testing.



### K-ALLOY™ / A304

The same housing shows with the top cover removed. The seal surface remains intact and shows no signs of surface corrosion. The housing will be sealed.

30 Cycles

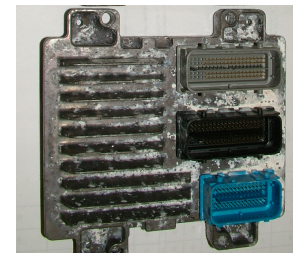
1 Cycle = 1 Day



### K-ALLOY™ / A304

The housing is watertight, and corrosion is not evident under the connector.

30 Cycles



### K-ALLOY™ / A304

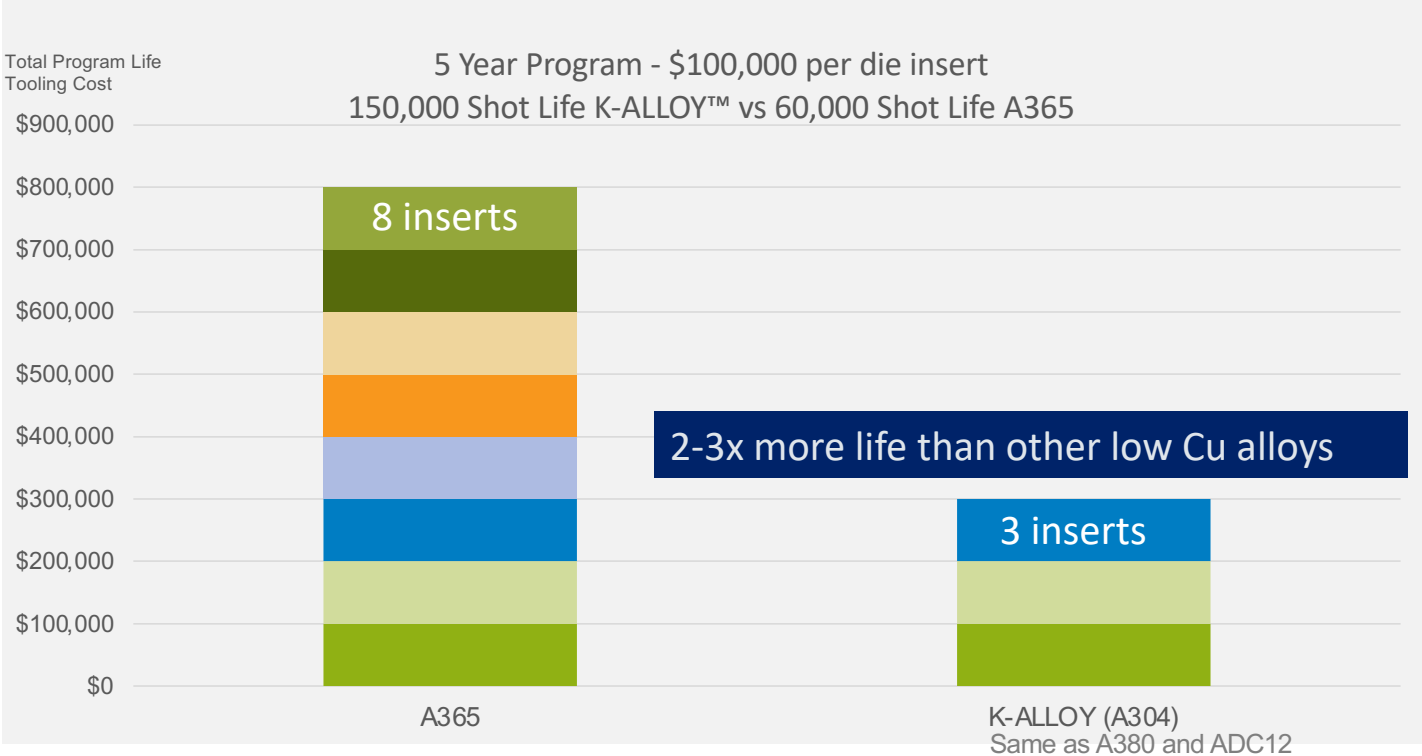
The heatsink is clean and free from corrosion. The area around the connectors has some salt product (in white) but has no material loss or pitting. Parts pass leak testing.

40 Cycles



# DIE LIFE SAVINGS

K-ALLOY™ A304 Die Life is equivalent to ADC12 and A380 Alloy, and 2-3x more than A365



# MATERIAL SPECIFICATION

K-ALLOY™ is a registered alloy with The Aluminum Association, as A304.0 as from a die casting and A304.1, as from ingot

The Aluminum Association keeps track of all of the available alloys and designations, globally. For high pressure die casting, the alloys' standard compositions are found on the "Pink Sheets", which can be found at this link; <https://www.aluminum.org/pink-sheets>

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1525 Wilson Blvd  
Arlington VA 22209  
www.aluminum.org

The Aluminum Association 

**ALLOY REGISTRATION ACCEPTANCE FORM  
(CASTINGS & INGOT)**

**DATE:** May 23, 2012

**TO:** Technical Committee on Product Standards

**FROM:** Parvaneh Shafiee 

**ALLOY DESIGNATIONS:** 304.0, 304.1

**REGISTRANT:** Delphi Corporation

**REGISTRATION DATE:** April 17, 2012

**REGISTERED COMPOSITION LIMITS:**

Alloy Desig.	Former Desig.	Product Form	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Sn	Others <sup>3†</sup>		Aluminum
													Each	Total <sup>3</sup>	
304.0	K-Alloy	Die Casting	9.0-11.5	0.8-1.2	0.05-0.08	0.30-0.50	0.30-0.50	0.05	0.03	0.20	0.03-0.18	0.03	0.03	0.15	Remainder
304.1 <sup>1‡</sup>	K-Alloy	Ingot	9.0-11.5	0.8-1.0	0.05-0.08	0.30-0.50	0.35-0.50	0.05	0.03	0.20	0.03-0.18	0.03	0.03	0.15	Remainder

Unless specified below for referenced footnotes refer to the pink sheets

cc: SC on Alloy and Temper Registration Mailing List  
Casting Standards Distribution List  
Kurt O'Connor, Delphi Corporation  
Michael Skillingberg  
Revisions to the 2009 Edition of Pink Sheets  
PN12-54 Project File  
Project Completion File

# K-ALLOY™ / A304

## Material Properties

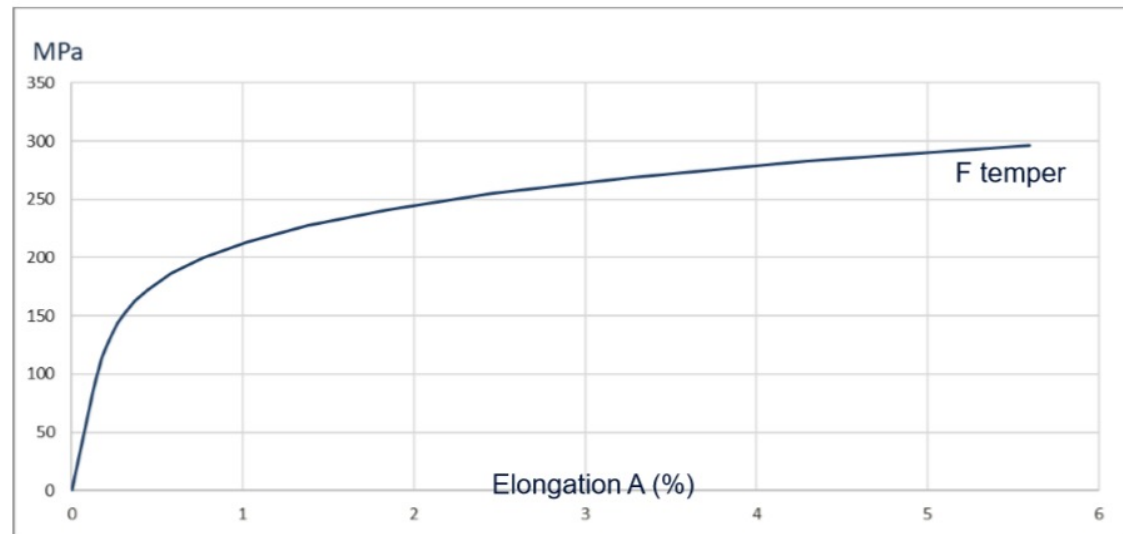
### Pure Al, and Balanced Fe, for Higher %e

K-ALLOY™ parts have higher elongation and energy absorbing characteristics.

>5% elongation can be expected, which makes self threading fasteners, and the elimination of extra tapping operations, possible.

The combination of high elongation and high yield strength, makes K-ALLOY™ a suitable candidate for replacement of gravity cast A356-T6 castings.

The structural performance of a K-ALLOY™ part is suitable for replacement of any application using high pressure die cast A380, ADC12, or high pressure, vacuum die cast A365 alloy.



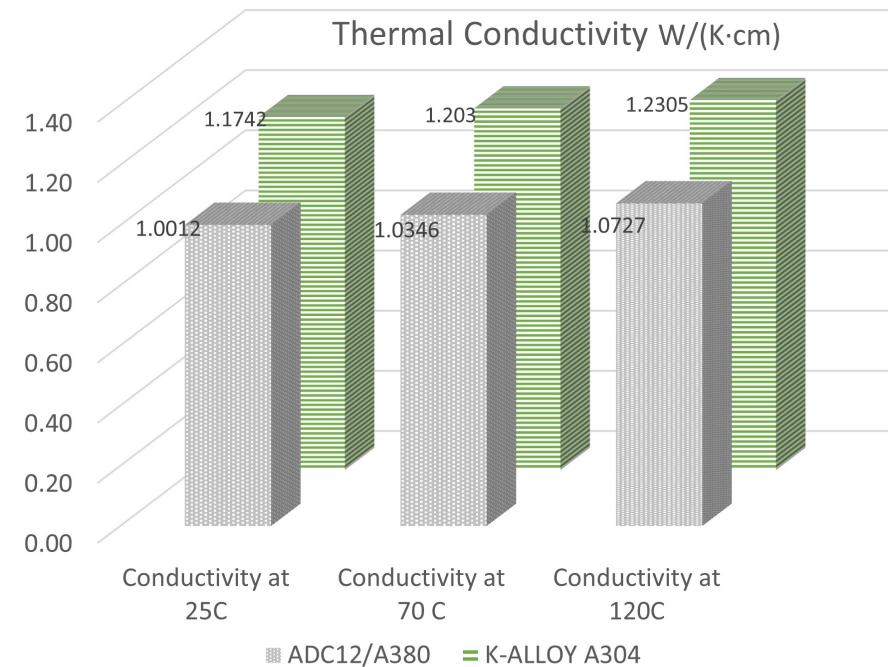


# K-ALLOY™ / A304

## Thermal Conductivity

Curated specifically as an electronics housing alloy, K-ALLOY™ (A304) was developed to have a 15% better thermal conductivity than A380 die casting alloy.

In the eV market, this benefit is key to the designers that need to dissipate heat from electronic components.



# K-ALLOY™ / A304

Where to buy K-ALLOY™

## > NORTH AMERICA

### **Custom Alloy Light Metals**

Kenneth Cox– Custom Alloy Sales  
13329 Ector St  
City of Industry, CA 01746  
Office. 626-369-3641  
Cell. 213-705-1811  
[ken.cox@customalloysales.com](mailto:ken.cox@customalloysales.com)

### **Rio Tinto – Global Sales**

200 E Randolph St. Ste 7100  
Chicago, IL 60601  
PH: 847-915-1674  
[dave.roggenbuck@riotinto.com](mailto:dave.roggenbuck@riotinto.com)

### **Borg Warner – K-ALLOY™**

#### **Technical Support**

[k.f.oconnor@sbcglobal.net](mailto:k.f.oconnor@sbcglobal.net)  
[david@dgimgmt.com](mailto:david@dgimgmt.com)

## > CHINA

### **Shanghai Sigma Metals, Inc.**

Zhejiang Sigma Metals, Inc.  
111 Huangpu Road, ETDZ,  
Jiashan County, Jiaxing City,  
Zhejiang 314100, China  
Contact: David Huang  
[david\\_huang@sigmacorp.com](mailto:david_huang@sigmacorp.com)  
Office: +86-573-8466-1818 ext.6551  
Fax: +86-573-8468-1818

- Borg Warner certifies its licensees for capability in manufacturing
- License holders have many locations globally
- Contact Eric Gottschling at  
[eric.gottschling@borgwarner.com](mailto:eric.gottschling@borgwarner.com)

## > ASIA

### **Aluminium Alloy Smelter Ind Sdn Bhd**

#### **Malaysia**

Attn: Miss Chin Guek Lim  
Lot 6076, Jalan Haji Abdul Manan,  
Off Jalan Meru, KM3, 41050 Klang, Selangor D.  
[cglim@alloy.com.my](mailto:cglim@alloy.com.my)  
Phone : +603-3393 6855

### **Rio Tinto – Asia/Pacific Sales**

#### **Singapore**

[ira.tanadi@riotinto.com](mailto:ira.tanadi@riotinto.com)  
Phone: +65 66799216

### **Wooshin Metal Co., Ltd.**

#### **South Korea**

<http://www.wsmetal.co.kr/eng>  
17, Cheoyongsaneop 2-gil, Onsan-eup, Ulju-gun  
Ulsan, Korea  
Contact: Mr. Sang-Jin Han  
[mirue5374@hanmail.net](mailto:mirue5374@hanmail.net)  
Phone: 82.52.238.3113

# Thank you!



Combustion



Hybrid



Electric