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IS 742 (1981): Zinc base alloy die castings [MTD 9: Lead, Zinc, Cadmium, Tin, Antimony and their Alloys]



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*Indian Standard*  
SPECIFICATION FOR  
ZINC BASE ALLOY DIE CASTINGS  
( *Second Revision* )

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BUREAU OF INDIAN STANDARDS  
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**AMENDMENT NO. 1 APRIL 2011  
TO  
IS 742 : 1981 SPECIFICATION FOR ZINC BASE  
ALLOY DIE CASTINGS**

*(Second Revision)*

*(Page 4, clause 1.1)* — Insert '(see Table 1)' at the end.

*(Page 5, Table 1)* — Substitute the following for the existing:

**Table 1 Chemical Composition of Zinc Base Alloy  
Die Castings  
(Clauses 1.1 and 4.1)**

SI No.	Constituent	Zn Al 4 Percent	Zn Al 4 Cu 1 Percent
(1)	(2)	(3)	(4)
i)	Aluminium	3.8 to 4.2	3.8 to 4.2
ii)	Copper	—	0.7 to 1.1
iii)	Magnesium	0.035 to 0.06	0.035 to 0.06
iv)	Impurities:		
a)	Copper, <i>Max</i>	0.10	—
b)	Iron, <i>Max</i>	0.10	0.1
c)	Lead, <i>Max</i>	0.005	0.005
d)	Cadmium, <i>Max</i>	0.005	0.005
e)	Tin, <i>Max</i>	0.002	0.002
f)	Thallium and Indium, <i>Max</i>	0.001 5	0.001 5
g)	Nickel, <i>Max</i>	0.006	0.006
v)	Zinc	Remainder	Remainder

NOTE — In case of Indium and Thallium, the supplier shall undertake that the material does not contain impurities in limits excess of those laid down above

(MTD 9)

Reprography Unit, BIS, New Delhi, India

# *Indian Standard*

## SPECIFICATION FOR ZINC BASE ALLOY DIE CASTINGS

### ( *Second Revision* )

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( *Continued on page 2* )

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*Indian Standard*  
SPECIFICATION FOR  
ZINC BASE ALLOY DIE CASTINGS  
( *Second Revision* )

**0. FOREWORD**

**0.1** This Indian Standard ( Second Revision ) was adopted by the Indian Standards Institution on 12 February 1981, after the draft finalized by the Lead, Zinc, Tin, Antimony and Their Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** This standard was first published in 1955 and subsequently revised in 1966. In this revision, maximum limits for nickel and chromium have been specified for zinc alloy die castings as nickel and chromium may enter the alloys from remelting plated casting.

**0.2.1** The alloy designation adopted in the standard is same as used in ISO/R 301, and replaces the former nomenclature of Alloy 1 and Alloy 2. The alloys Zn Al 4 and Zn Al 4 Cu 1 are almost identical in composition with Alloys 1 and 2 respectively. The properties of these alloys are given in Appendix A. Alloy Zn Al 4 die castings find application where a high degree of stability is desired. Zn Al 4 Cu 1 die castings are used where a slightly lower stability but better castability and greater hardness are required.

**0.3** This Indian Standard is based on the manufacturing and trade practices followed in the country in this field. Assistance has also been derived from the following standards:

BS 1004 : 1972 Zinc alloys for die casting and zinc alloy die castings.  
British Standards Institution.

ASTM B 86-1976 Specification for zinc alloy die castings. American Society for Testing and Materials.

AS 1881-1977 Zinc alloy ingots ( for pressure die casting ) and zinc alloy pressure die castings. Australian Standards Association.



**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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## **1. SCOPE**

**1.1** This standard covers the requirements for two grades of zinc base alloy die castings, namely, Alloys Zn Al 4 and Zn Al 4 Cu 1.

## **2. SUPPLY OF MATERIAL**

**2.1** General requirements relating to the supply of zinc base alloy die castings shall conform to IS : 1387-1967†.

## **3. MANUFACTURE**

**3.1** Castings shall be manufactured from ingots which comply with the requirements of zinc base alloys specified in IS : 713-1981‡. The manufacturer shall, if so desired by the purchaser, shall furnish a certificate to this effect.

**3.2** No scrap shall be used in the manufacture of alloy Zn Al 4 and Zn Al 4 Cu 1 die castings unless otherwise agreed to between the manufacturer and the purchaser.

**3.3** In the manufacture of die castings no scrap shall be used other than sprues, gates, rejected die castings, overflow wells, etc, of the particular alloy that are produced in the manufacturer's own plant conforming to IS : 713-1981‡. The rejected die castings shall be free from finishes, solder or inserts which may contaminate the alloys.

**3.3.1** Castings with inserts may be used provided the scrap is pigged and analyzed for purity conforming to this standard.

**3.4** When the purchaser so desires, the proportion of scrap of reclaimed metal to virgin alloy ingots shall be subject to agreement between the purchaser and the manufacturer.

## **4. CHEMICAL COMPOSITION**

**4.1** The material, when tested in accordance with the methods given in IS : 2600-1964§, shall have the chemical composition given in Table 1.

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\*Rules for rounding off numerical values ( *revised* ).

†General requirements for the supply of metallurgical materials ( *first revision* ).

‡Specification for zinc base alloy ingots for die castings ( *second revision* ).

§Methods of chemical analysis of high purity zinc and zinc base alloys for die castings.

**TABLE 1 CHEMICAL COMPOSITION OF ZINC BASE ALLOY  
DIE CASTINGS**

( Clause 4.1 )

Sl No.	CONSTITUENT	ALLOY Zn Al 4 percent	ALLOY Zn Al 4 Cu 1 percent
(1)	(2)	(3)	(4)
i)	Aluminium	3·8-4·3	3·8-4·3
ii)	Copper	—	0·75-1·25
iii)	Magnesium	0·03-0·06	0·03-0·06
iv)	Impurities:		
	a) Copper, <i>Max</i>	0·10	—
	b) Iron, <i>Max</i>	0·10	0·10
	c) Lead, <i>Max</i>	0·005	0·005
	d) Cadmium, <i>Max</i>	0·005	0·005
	e) Tin, <i>Max</i>	0·002	0·002
	f) Thallium and Indium, <i>Max</i>	0·001 5	0·001 5
	g) Nickel, <i>Max</i>	0·006	0·006
	h) Chromium, <i>Max</i>	0·02	0·02
v)	Zinc	Remainder	Remainder

NOTE 1 — In case of Indium and Thallium, the supplier shall undertake that the material does not contain impurities in limits excess of those laid down above.

NOTE 2 — When ingots are required for rerolling, the limit for Indium and Thallium shall be subject to the agreement between the supplier and the purchaser.

**4.1.1** Spectrographic methods of analysis as specified in IS : 2599-1963\* may be adopted as an alternative.

## 5. DIMENSIONS

**5.1** The dimensions of the die castings shall be as shown on the drawings supplied by the purchaser and within the tolerances to be agreed to between the purchaser and the manufacturer.

## 6. FREEDOM FROM DEFECTS

**6.1** The castings shall be clean and free from cracks and undue porosity. The permissible extent of porosity shall be mutually agreed in each case between the purchaser and the manufacturer.

\*Method for spectrographic analysis of high purity zinc base alloys for die castings.

**6.2** No patching, plugging or welding of casting shall be allowed.

**6.3** Die castings which show injurious defects on machining due to faulty manufacture may be rejected, notwithstanding the fact that they had complied with other requirements.

**6.4** When specified in the contract or purchase order, the pressure tightness of die castings shall conform to standards agreed to between the purchaser and the manufacturer.

## **7. CONDITION OF SUPPLY**

**7.1** Unless otherwise specified, the die castings shall be supplied in as cast condition.

**7.2** If required, castings may be supplied in the dimensionally stabilized condition. They shall then be designated as alloy Zn Al 4 (S) die casting and alloy Zn Al 4 Cu 1 (S) die casting. The stabilizing treatment shall be as given in Appendix B.

## **8. SAMPLING**

**8.1** One sample for chemical analysis shall be taken from each batch consisting of a product of one die from one shift. The method of preparing the sample for chemical analysis shall be as given in IS : 1817-1961\*.

**8.2** The batch under test for chemical analysis shall not exceed the product of one die from one shift.

## **9. RE-TEST**

**9.1** If the sample prepared under **8.1** fails to meet the requirements specified under **4.1**, two more tests shall be conducted on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements, the lot shall be accepted. Should either of the re-test fail, the lot represented shall be deemed as not complying with this standard.

## **10. WEIGHT TEST**

**10.1** When required by the purchaser, the manufacturer shall weigh each casting after trimming and discard any casting whose weight is below the minimum weight as determined by the method given in Appendix C.

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\*Methods of sampling non-ferrous metals for chemical analysis.

## 11. STEAM TEST

11.1 When required by the purchaser, the manufacturer shall carry out steam test on one sample casting from each batch in the manner specified in Appendix D.

## 12. MARKING

12.1 If required, each casting shall be distinguished with such marks of identification and in such positions as may be agreed to between the purchaser and the manufacturer.

### 12.2 BIS Certification Marking

The product may also be marked with Standard Mark.

12.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## A P P E N D I X A

( Clause 0.2.1 )

### PROPERTIES OF DIE CAST ZINC BASE ALLOYS Zn Al 4 and Zn Al 4 Cu 1

#### A-1. DIMENSIONAL CHANGES

A-1.1 Die casting of Alloys Zn Al 4 and Zn Al 4 Cu 1 undergo a very small shrinkage at a progressively diminishing rate during ageing at normal temperature. The shrinkage is given in Table 2.

TABLE 2 DIMENSIONAL CHANGES OF DIE CASTINGS

SHRINKAGE MEASURED AFTER	ALLOY Zn Al 4	ALLOY Zn Al 4 Cu 1
	mm/mm	mm/mm
5 weeks	0.000 32	0.000 69
6 months	0.000 56	0.001 03
5 years	0.000 73	0.001 36
8 years	0.000 79	0.001 41

**A-1.2** The changes shown in Table 2 are insignificant for most practical purposes, but if greater dimensional stability is desired, this shrinkage may be accelerated, with little change in mechanical properties, by carrying out stabilizing treatment given in Appendix B ( *see also* Table 3 ).

**TABLE 3 DIMENSIONAL CHANGES OF STABILIZED DIE CASTINGS**

SHRINKAGE MEASURED AFTER	ALLOY Zn Al 4 (S)	ALLOY Zn Al 4 Cu 1 (S)
	mm/mm	mm/mm
5 weeks	0.000 20	0.000 22
3 months	0.000 30	0.000 26
2 years	0.000 30	0.000 37

**A-2. MECHANICAL PROPERTIES**

**A-2.1** The mechanical properties obtainable from sound pressure cast specimens of Alloy Zn Al 4 and Alloy Zn Al 4 Cu 1, in as cast and stabilized conditions, before and after different ageing treatments, are given in Table 4 for information.

**TABLE 4 MECHANICAL PROPERTIES OF PRESSURE DIE CAST SPECIMENS**

Sl. No.	MECHANICAL PROPERTY	ALLOY	ORIGINAL VALUE 5 WEEKS AFTER CASTING
i)	Tensile strength* in MPa ( Strain rates 6.3 mm/minute crosshead speed )	Zn Al 4	286
		Zn Al 4 (S)	273
		Zn Al 4 Cu 1	335
		Zn Al 4 Cu 1 (S)	312
ii)	Elongation percent on 50.8 mm × 6.35 mm diameter	Zn Al 4	15
		Zn Al 4 (S)	17
		Zn Al 4 Cu 1	9
		Zn Al 4 Cu 1 (S)	10
iii)	Impact strength in joules on un-notched charpy test piece of 6.35 × 6.35 mm section	Zn Al 4	57
		Zn Al 4 (S)	61
		Zn Al 4 Cu 1	58
		Zn Al 4 Cu 1 (S)	60
iv)	Brinell Hardness number HB 10/500/30	Zn Al 4	83
		Zn Al 4 (S)	69
		Zn Al 4 Cu 1	92
		Zn Al 4 Cu 1 (S)	83

NOTE — These figures indicate to designer the properties that may be expected from tensile and impact specimen cast in a test bar die. These figures shall not represent values obtained on specimens cut from commercial die castings.

\*For the effects of prolonged high stresses, creep curves shall be consulted.

## APPENDIX B

( Clauses 7.2 and A-1.2 )

### STABILIZING TREATMENT

**B-1.** The castings shall be heated in air to a temperature of  $100 \pm 5^{\circ}\text{C}$  and maintained at this temperature for six hours. They shall then be allowed to cool freely in air at room temperature.

## APPENDIX C

( Clause 10.1 )

### DETERMINATION OF MINIMUM WEIGHT FOR CASTINGS

#### C-1. PROCEDURE

**C-1.1** Ten finish-trimmed sample castings shall be taken from each die impression and weighed separately in the presence of representatives of the purchaser and the manufacturer.

**C-1.2** The representative of the purchaser shall then be entitled to fracture each of the castings. Any casting showing harmful porosity shall, by agreement between the two parties, be rejected and replaced by a further sample which shall also be weighed and fractured as before.

**C-1.3** When 10 satisfactory castings from each impression have been selected, the weight of the lightest casting shall be taken as the minimum weight for the bulk production from all impressions, and this shall be as agreed to between the purchaser and the manufacturer.

**C-1.4** Wherever practicable, each die impression shall be marked for easy identification and the purchaser shall be entitled at any time to have the weight test repeated in respect of any die impression.

**C-1.5** It is important that castings subjected to this test should be examined for their accuracy of dimensions, especially at right angles to the parting plane of the die. Variation in dimensions nullifies the value of the weight test as a check on density.

## APPENDIX D

( Clause 11.1 )

### STEAM TEST FOR ZINC BASE ALLOY DIE CASTINGS

#### D-1. GENERAL

**D-1.1** This test is intended as a practical inspection or acceptance test for castings to supplement analytical procedure in detecting the presence of excessive amounts of noxious impurities particularly lead, cadmium or tin. Contamination with one or more of these elements gives rise to inter-crystalline corrosion which causes cracking, swelling or distortion of casting in service, and this test accelerates such effect and thereby makes them evident in a reasonably short time.

#### D-2. APPARATUS

**D-2.1** The apparatus for the steam test shall consist of a vented humidity cabinet of suitable size fitted with thermostatic control to maintain the required temperature in the cabinet. The cabinet shall not be made of wood or any other organic matter.

#### D-3. PROCEDURE

**D-3.1** The sample castings shall be immersed in water vapour and the temperature maintained at  $95^{\circ} \pm 2^{\circ}\text{C}$  for 10 days continuously.

**D-3.2** The castings under test in the cabinet may be supported on racks or suspended by wires, but the supports or suspensions shall consist of one or the other of the following materials, namely, glass, porcelain, zinc or zinc-coated metal. Castings under test shall not be supported or suspended in such a way as to cause strain in thinner sections.

**D-4.** After the steam test, the sample castings shall not exhibit cracking, swelling or undue warping.

**D-5.** The average expansion of any casting of the two grades measured over a solid dimension shall not exceed 0.001 0 mm per mm.

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