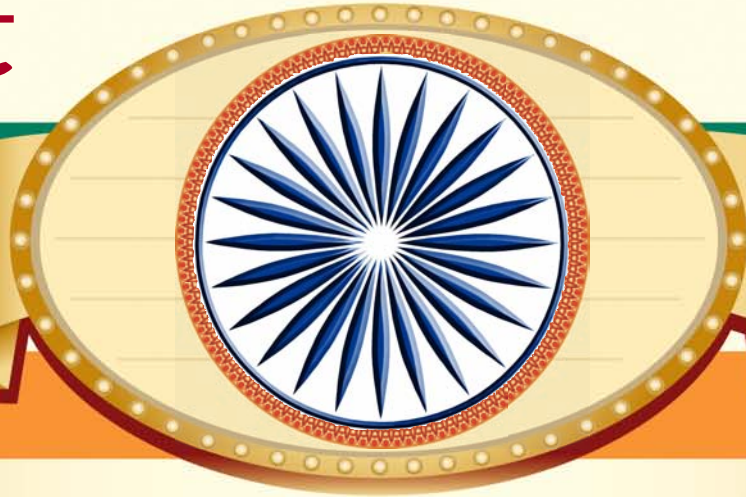


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मानक



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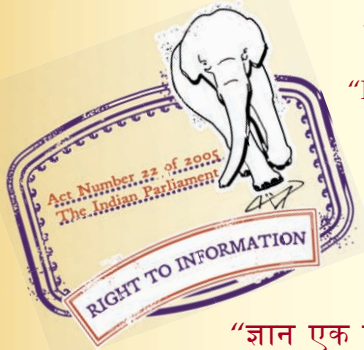
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IS 8186 (1976): Marking codes for values and tolerance of resistors and capacitors [LITD 5: Semiconductor and Other Electronic Components and Devices]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS : 8186 - 1976

(Superseding IS : 825-1956 and IS : 4114-1967)
(Reaffirmed 1982)

Indian Standard
MARKING CODES FOR
VALUES AND TOLERANCES OF
RESISTORS AND CAPACITORS

(First Reprint APRIL 1986)

UDC 621.316.8 + 621.319.4:621-777.6:621.753.1



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

MARKING CODES FOR VALUES AND TOLERANCES OF RESISTORS AND CAPACITORS

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Indian Standard

MARKING CODES FOR VALUES AND TOLERANCES OF RESISTORS AND CAPACITORS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 September 1976, after the draft finalized by the Capacitors and Resistors for Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunications Division Council.

0.2 This standard lays down uniform codes for marking of values of capacitors and resistors and tolerances thereon by means of letters and digits or by a colour code and supersedes IS : 825-1956* and IS : 4114-1967†.

0.3 A preferred series for values of capacitors and resistors used in electronic and telecommunication equipment along with their associated tolerances is given in IS : 824-1965‡. While using the values according to IS : 824-1965‡, particularly the higher values, need was felt for using a code for convenience in marking. This standard provides the necessary code and should be used in conjunction with IS : 824-1965‡.

0.4 Assistance has been derived from IEC Publication 62-1974 'Marking codes for resistors and capacitors', issued by the International Electrotechnical Commission, in preparing this standard.

1. SCOPE

1.1 This standard specifies marking codes for values and tolerances of resistors and capacitors.

2. MARKING CODES

2.1 The following codes for the marking of the resistance and capacitance values and their tolerances are covered in this standard:

a) *Coded Marking by Colour Code* — This is intended for marking the

*Colour code for fixed resistors.

†Coded markings of values, capacitance and resistance by letters and digits.

‡Preferred values for resistors and capacitors (*revised*).

values and tolerances of resistors and capacitors by means of colour bands or dots (*see* 3).

NOTE — In case of ceramic dielectric capacitors [*see* IS : 7305 (Part II) - 1975*] and (*see* IS : 2001-1968†) the colour code for coded marking is given in individual specifications because of the necessity to indicate temperature co-efficient also in coded marking. Care has been taken to adopt the code specified in this standard (*see* 3) in these cases also so far as capacitance values and their tolerance are concerned.

- b) *Coded Marking by Letters and Digits* — This is intended for marking of values and tolerances of resistors and capacitors by means of letters and digits (*see* 4).
- c) *Coded Marking of Tolerance by Means of a Letter* — This is intended for marking the tolerance on resistance and capacitance values by means of a letter (*see* 5).
- d) *Coded Marking of Date Code by Means of Letters and Digits* — This is intended for marking date code on capacitors and resistors by means of letters and digits (*see* 6).

NOTE — For preferred values for resistors and capacitors reference should be made to IS : 824-1965‡.

3. CODED MARKING OF COLOUR CODE

3.1 Marking of Values Using Two Digit Colour Code — The colour code for indicating values to two significant figures and tolerances shall be as given in 3.1.1 to 3.1.4.

3.1.1 The values and tolerances shall be indicated by means of colour bands or dots on the components and shall be in accordance with Table 1.

3.1.1.1 In order to avoid any confusion the fourth band shall be 1.5 to 2 times wider than other bands wherever necessary.

3.1.1.2 Colour band or dots may be used for marking on capacitors; colour bands only are permissible for resistors.

3.1.2 The first band/dot shall be the one nearest to one end of the component resistor and the bands/dot shall be so placed and spaced that there is no confusion in reading the coding.

3.1.3 Any additional coding on the component shall be so applied as not to confuse the coding for value and tolerance.

*Fixed capacitors used in electronic equipments: Part II Ceramic dielectric capacitors, Type I (*Superseding* IS : 1980-1967).

†Fixed silvered mica capacitors (*first revision*).

‡Preferred values for capacitors and resistors (*revised*).

3.1.4 Examples of Application of the Colour Code — Typical examples of applications of the colour code in accordance with Table 1 is illustrated in Fig. 1.

3.2 Marking of Values Using Three Digit Colour Code — The colour code for indicating values to three significant figures and tolerances shall be as given in 3.2.1 to 3.2.4.

3.2.1 The values and tolerances shall be indicated by means of colour bands or dots on the components, and shall be in accordance with Table 2.

3.2.1.1 In order to avoid any confusion, the fifth band shall be 1.5 to 2 times wider than other bands wherever necessary.

3.2.2 The first band or dot shall be the one nearest to one end of the component and the bands/dot shall be so placed and spaced that there is no confusion in reading the coding.

3.2.3 Any additional coding on the component shall be so applied as not to confuse the coding for value and tolerance.

3.2.4 Example of Application of the Colour Code — A typical example of applications of the colour code in accordance with Table 2 is illustrated in Fig. 2.

3.3 A suitable guide for the choice of colour to be used for the marking of capacitors and resistors are given in Appendix A.

4. LETTER AND DIGIT CODE FOR RESISTANCE AND CAPACITANCE VALUES

4.1 General Rule

4.1.1 The code shall use three, four or five characters consisting of two figures and a letter, three figures and 4 letters or four figures and a letter as required.

4.1.2 Where there are two significant figures in the values to be indicated [as in all the values in the coarse series E6, E12 and E24 (*see* IS : 824-1965*) and some in the fine series E48, E96 and E192 (*see* IS : 824-1965*)], the coding shall have three characters except in the decade from 100 to 999 for any given multiplier for which the four character code is employed (to avoid unfamiliar codes).

4.1.2.1 For example, 100 k is coded 100 K and 100 μ F is coded 100 μ so as to avoid the unfamiliar M 10 or m 10.

4.1.3 Where there are three or four significant figures as for majority of fine series values, it is essential to use either the four-character code or five-character code as required.

*Preferred values for resistors and capacitors (*revised*).

**TABLE 1 VALUES TO TWO SIGNIFICANT FIGURES AND TOLERANCES
CORRESPONDING TO COLOURS**

(Clauses 3.1.1 and 3.1.4)

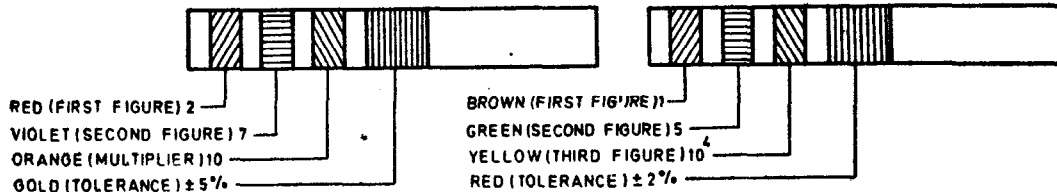
COLOUR	FIRST BAND/DOT	SECOND BAND/DOT	THIRD BAND/DOT	FOURTH BAND/DOT
	First Figure	Second Figure	Multiplier	Tolerance
Silver	—	—	10^{-2}	± 10 percent
Gold	—	—	10^{-1}	± 5 percent
Black	—	0	1	—
Brown	1	1	10	± 1 percent
Red	2	2	10^2	± 2 percent
Orange	3	3	10^3	—
Yellow	4	4	10^4	—
Green	5	5	10^5	—
Blue	6	6	10^6	—
Violet	7	7	10^7	—
Grey	8	8	10^8	—
White	9	9	10^9	—
None	—	—	—	± 20 percent

NOTE — In the case of fixed resistors, the unit shall be ohms and in the case of fixed capacitors the unit shall be picofarads.

**TABLE 2 VALUES TO THREE SIGNIFICANT FIGURES AND TOLERANCES
CORRESPONDING TO COLOURS**

(Clause 3.2.1 and 3.2.4)

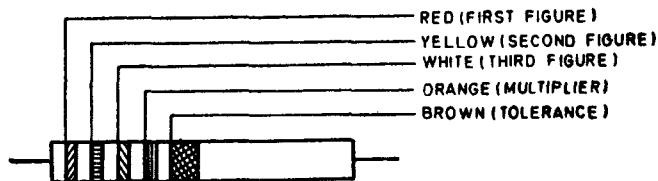
COLOUR	FIRST BAND/DOT	SECOND BAND/DOT	THIRD BAND/DOT	FOURTH BAND/DOT	FIFTH BAND/DOT
	First Figure	Second Figure	Third Figure	Multiplier	Tolerance
Silver	—	—	—	10^{-2}	± 10 percent
Gold	—	—	—	10^{-1}	± 5 percent
Black	—	0	0	1	—
Brown	1	1	1	10	± 1 percent
Red	2	2	2	10^2	± 2 percent
Orange	3	3	3	10^3	—
Yellow	4	4	4	10^4	—
Green	5	5	5	10^5	± 0.5 percent
Blue	6	6	6	10^6	± 0.25 percent
Violet	7	7	7	10^7	± 0.1 percent
Grey	8	8	8	10^8	—
White	9	9	9	10^9	—
None	—	—	—	—	—



1A Resistor of 27 000 Ω With a Tolerance of $\pm 5\%$ 1B Resistor of 150 000 Ω With a Tolerance of $\pm 2\%$

FIG. 1 COLOUR CODE ON A FIXED RESISTOR
 (TWO SIGNIFICANT FIGURES)

8



RESISTOR OF 249000 Ω WITH A TOLERANCE OF $\pm 1\%$.

FIG. 2 COLOUR CODE ON A FIXED RESISTOR
 (THREE SIGNIFICANT FIGURES)

4.1.4 The code letter shall replace the decimal point appropriate to the multiplier used.

4.1.4.1 For example, 1 200 ohms or 1·2 k Ω is coded as IK2.

4.1.5 When a letter is used for coding of the tolerance (*see* 5) it shall appear after the coding for capacitance and resistance values.

4.1.6 Any additional code letter or digit shall appear after the tolerance letter specified in 5 and shall be so applied as not to confuse the coding for value and tolerance.

4.2 Resistors

4.2.1 The letters **R**, **K**, **M**, **G** and **T** shall be used as multipliers for 1 (10^0), 10^3 , 10^6 , 10^9 , and 10^{12} respectively of the resistance value expressed in ohms.

4.2.2 Examples of code markings for resistance values derived according to the general rules laid in 4.1 are given in Table 3.

NOTE — The resistance values are chosen from IS: 824-1965*.

4.3 Capacitors

4.3.1 The letters **P**, **N**, **U**, **M** and **F** shall be used as multiplier for 10^{-12} , 10^{-9} , 10^{-6} , 10^{-3} and μ (10^0) respectively of the capacitance value expressed in farads.

4.3.2 Examples of code markings for capacitance values derived according to the general rules laid in 4.1 are given in Table 4.

NOTE — The capacitance values are chosen from IS: 824-1965*.

5. LETTER CODE FOR TOLERANCES ON RESISTANCE AND CAPACITANCE VALUES

5.1 Symmetrical Tolerances in Percent — The following letters shall be used for indicating the symmetrical tolerance (shown against them) on resistance and capacitance values:

<i>Tolerance in Percentage</i>	<i>Code Letter</i>
± 0.1	B
± 0.25	C
± 0.5	D
± 1	F
± 2	G
± 5	J
± 10	K
± 20	M
± 30	N

*Preferred values for resistors and capacitors (*revised*).

TABLE 3 EXAMPLES OF CODED MARKINGS FOR RESISTANCE VALUES

(Clause 4.2.2)

RESISTANCE VALUES (ohms)	CODED MARKING	RESISTANCE VALUES (ohms)	CODED MARKING
(1)	(2)	(1)	(2)
0.1 Ω	R10	1 M Ω	1M0
0.15 Ω	R15	1.5 M Ω	1M5
0.332 Ω	R332	3.32 M Ω	3M32
0.590 Ω	R59	5.90 M Ω	5M9
1 Ω	1R0	10 M Ω	10M
1.5 Ω	1R5	15 M Ω	15M
3.32 Ω	3R32	33.2 M Ω	33M2
5.90 Ω	5R9	59.0 M Ω	59M
10 Ω	10R	100 M Ω	100M
15 Ω	15R	150 M Ω	150M
33.2 Ω	33R2	332 M Ω	332M
59.0 Ω	59R	590 M Ω	590M
59.04 Ω	59R04		
100 Ω	100R	1 G Ω	1G0
150 Ω	150R	1.5 G Ω	1G5
332 Ω	332R	3.32 G Ω	3G32
590 Ω	590R	5.90 G Ω	5G9
590.4 Ω	590R4		
1 k Ω	1K0	10 G Ω	10G
1.5 k Ω	1K5	15 G Ω	15G
3.32 k Ω	3K32	33.2 G Ω	33G2
5.90 k Ω	5K9	59.0 G Ω	59G
5.904 k Ω	5K904		
10 k Ω	10K	100 G Ω	100G
15 k Ω	15K	150 G Ω	150G
33.2 k Ω	33K2	332 G Ω	332G
59.0 k Ω	59K	590 G Ω	590G
59.04 k Ω	59K04		
100 k Ω	100K	1 T Ω	1T0
150 k Ω	150K	1.5 T Ω	1T5
332 k Ω	332K	3.32 T Ω	3T32
590 k Ω	590K	5.90 T Ω	5T9
		10 T Ω	10T

TABLE 4 EXAMPLES OF CODE MARKINGS FOR CAPACITANCE VALUES

(Clause 4.3.2)

CAPACITANCE VALUES	CODED MARKING	CAPACITANCE VALUES	CODED MARKING
(1)	(2)	(1)	(2)
0.10 pF	p 10	100 nF	100n
0.15 pF	p 15	150 nF	150n
0.330 pF	p 330	330 nF	330n
0.680 pF	p 680	680 nF	680n
0.6801 pF	p 6801	680.1 nF	680n1
1.0 pF	1 p 0	1.0 μ F	1 μ 0
1.5 pF	1 p 5	1.5 μ F	1 μ 5
3.30 pF	3 p 30	3.30 μ F	3 μ 30
6.80 pF	6 p 80	6.80 μ F	6 μ 80
6.801 pF	6 p 801	6.801 μ F	6 μ 801
10 pF	10 p	10 μ F	10 μ
15 pF	15 p	15 μ F	15 μ
33 pF	33 p	33 μ F	33 μ
680 pF	68 p	680 μ F	680 μ
68.01 pF	68 p 01	680.1 μ F	680 μ 1
100 pF	100 p	100 μ F	100 μ
150 pF	150 p	150 μ F	150 μ
330 pF	330 p	330 μ F	330 μ
680. pF	680 p	680 μ F	680 μ
680.1 pF	680 p 1	680.1 μ F	680 μ 1
1.0 nF	1 n 0	1.0 mF	1 m 0
1.5 nF	1 n 5	1.5 mF	1 m 5
3.30 nF	3 n 30	3.30 mF	3 m 30
6.80 nF	6 n 80	6.80 mF	6 m 80
6.801 nF	6 n 801	6.81 mF	
10 nF	10 n	10 mF	10 m
15 nF	15 n	15 mF	15 m
33.0 nF	33 n 0	33.0 mF	33 m 0
68.0 nF	68 n 0	68.0 mF	68 m 0
68.01 nF	68 n 01	68.01 mF	68 m 01

IS : 8186 - 1976

5.1.1 Symmetrical Tolerances Expressed as Fixed Values— The following letters shall be used for indicating symmetrical tolerances expressed as fixed values (shown against them) on capacitance values below 10pF:

<i>Tolerance in pF</i>	<i>Code Letter</i>
± 0.1	B
± 0.25	C
± 0.5	D
± 1	F

5.2 Asymmetrical Tolerances in Percent — The following letters shall be used for indicating the asymmetrical tolerances (shown against them) on capacitance values:

<i>Tolerance in Percentage</i>	<i>Code Letter</i>
-10 +30	Q
-10 +50	T
-20 +50	S
-20 +80	Z

NOTE— These tolerances shall be specifically applicable to capacitor in general, electrolytic capacitor in particular.

5.3 Other Tolerances — For tolerances, for which no code letter has been laid down, the letter **A** may be used. The letter **A** will indicate that the tolerance is identified separately.

6. DATE CODE SYSTEM

6.1 To identify the year and week, a four character code is required. This code comprises the last two figures of the year and the number of the week in accordance with **6.1.1**.

6.1.1 *Numbering of Weeks**

6.1.1.1 For the purpose of week numbering the first day of a week shall be Monday.

6.1.1.2 Week number of a year is the first week containing four days or more of the new year.

NOTE— The first day of a week being Monday, week number one of a year is the week containing the first Thursday of January (see Table 5).

6.1.1.3 The week numbers one to nine shall be written with two digits (that is 01 to 09).

6.1.1.4 An example of numbering of week is given in Table 5.

6.1.2 *Example*

<i>Date/Week to be Marked</i>	<i>Code</i>
Fifth week of 1978	7805*

*This is based on ISO/R 2015-1971 Numbering of weeks.

TABLE 5 NUMBERING OF WEEKS

[Clauses 6.1.1.2 (Note) and 6.1.1.4]

YEAR	DAY	NO. OF WEEK
1975	Sunday 28 Dec	52
	Monday 29 Dec	
	Tuesday 30 Dec	
	Wednesday 31 Dec	
1976	Thursday 1 Jan	01
	Friday 2 Jan	
	Saturday 3 Jan	
	Sunday 4 Jan	
	Sunday 26 Dec	52
	Monday 27 Dec	
	Tuesday 28 Dec	
Wednesday 29 Dec		
Thursday 30 Dec		
Friday 31 Dec	53	
Saturday 1 Jan		
1977	Sunday 2 Jan	01
	Monday 3 Jan	
	Tuesday 4 Jan	
	Wednesday 5 Jan	
	Thursday 6 Jan	
	Friday 7 Jan	
	Saturday 8 Jan	
	Sunday 9 Jan	
	Saturday 31 Dec	
Sunday 1 Jan		
1978	Monday 2 Jan	01
	Tuesday 3 Jan	
	Wednesday 4 Jan	
	Thursday 5 Jan	
	Friday 6 Jan	
	Saturday 7 Jan	
	Sunday 8 Jan	
	Sunday 31 Dec	
Monday 1 Jan		
1979	Tuesday 2 Jan	01
	Wednesday 3 Jan	
	Thursday 4 Jan	
	Friday 5 Jan	
	Saturday 6 Jan	
	Sunday 7 Jan	

APPENDIX A

(Clause 3.3)

GUIDE FOR THE CHOICE OF COLOURS TO BE USED
FOR THE MARKING OF CAPACITORS AND
RESISTORS

A-0. GENERAL

A-0.1 This guide deals with colours to be used for coding and identification of capacitors and resistors for use in electronic equipment.

NOTE— For the time being, no detailed information is given with respect to the measurement of colours and their tolerances.

A-0.2 The object of this guide is to reduce errors or misunderstandings which may result from improper selection or interpretation of colours.

A-1. CHOICE OF COLOURS

A-1.1 The colours for the different bands shall be in conformity with the relevant shades specified in IS : 5-1961* as required in col 2 of the following table wherever applicable. The paints used in the bands shall be such that they do not fade away under normal operating conditions. The conformity to the colour shades is only by comparison:

<i>Colour</i>	<i>Shade Number as per IS : 5-1961*</i>
Silver	—
Gold	—
Black	—
Brown	411
Red	537
Orange	557
Yellow	355
Green	218
Blue	166
Violet	796
Grey	632
White	—

*Specification for colours for ready mixed paints (*second revision*).



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