

INTERNATIONAL STANDARD

IEC
60938-2-1

QC 280101

First edition
1999-10

Fixed inductors for electromagnetic interference suppression –

Part 2-1: Blank detail specification – Inductors for which safety tests are required – Assessment level D

Inductances fixes d'antiparasitage –

*Partie 2-1:
Spécification particulière cadre –
Inductances nécessitant des tests de sécurité –
Niveau d'évaluation D*



Reference number
IEC 60938-2-1:1999(E)

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For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED INDUCTORS FOR ELECTROMAGNETIC
INTERFERENCE SUPPRESSION –****Part 2-1: Blank detail specification –
Inductors for which safety tests are required – Assessment level D**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60938-2-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

| FDIS | Report on voting |
|--------------|------------------|
| 40/1112/FDIS | 40/1138/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

The committee has decided that this publication remains valid until 2005.

At this date, in accordance with the committee's decision, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

FIXED INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

Part 2-1: Blank detail specification – Inductors for which safety tests are required – Assessment level D

INTRODUCTION

Blank detail specification

A blank detail specification is a supplementary document to the sectional specification and contains requirements for style, layout and minimum content of detail specifications. Detail specifications not complying with these requirements may not be considered as being in accordance with IEC specifications nor shall they so be described.

In the preparation of detail specifications the content of 1.4 of the sectional specification shall be taken into account.

The numbers between square brackets on the first page of the detail specification correspond to the following information which shall be inserted in the position indicated.

Identification of the detail specification

- [1] The "International Electrotechnical Commission" or the National Standards Organization under whose authority the detail specification is drafted.
- [2] The IEC or National Standards number of the detail specification, date of issue and any further information required by the national system.
- [3] The number and issue number of the IEC or national generic specification.
- [4] The IEC number of the blank detail specification.

Identification of the inductor

- [5] A short description of the type of inductor.
- [6] Information on typical construction (when applicable).
- [7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an annex to the detail specification.
- [8] Application or group of applications covered and/or assessment level.
- [9] Reference data on the most important properties, to allow comparison between the various inductor types.

| | | |
|--|---|-----|
| [1] | IEC 60938-2-1XX QC XXXXXXXXXXXXX | [2] |
| ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH: | IEC 60938-2-1 QC XXXXXX | [4] |
| [3] | FIXED INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION FOR WHICH SAFETY TESTS ARE REQUIRED | [5] |
| Outline drawing: (see table 1) (... angle projection) | | |
| [7] | | [6] |
| (Other shapes are permitted within the dimensions given) | Assessment level: D | [8] |
| NOTES [1] to [9] see page 3. | | |

[9]

Information on the availability of components qualified
to this detail specification is given in the Register of
Approvals.

1 General data

1.1 Recommended method(s) of mounting (to be inserted)

(See 1.4.3 of IEC 60938-2.)

1.2 Dimensions

Table 1 – Dimensions related to case size

| Case size reference or type | Dimensions | | | | | | |
|---|------------|----------|----------|--|--|--|--|
| | mm | | | | | | |
| | <i>L</i> | <i>W</i> | <i>H</i> | | | | |
| | | | | | | | |
| | | | | | | | |
| NOTE 1 – When there is no case size reference, the dimensions should be given per type designation. NOTE 2 – The dimensions should be given as maximum dimensions or as nominal dimensions with a tolerance. | | | | | | | |

1.3 Ratings and characteristics

| | |
|----------------------------------|---------------|
| Inductance range | (see table 2) |
| Tolerance on rated inductance | |
| Rated current (I) range | (see table 2) |
| DC resistance (R) | (see table 2) |
| Rated voltage | |
| Rated temperature | |
| Climatic category | |
| Category of passive flammability | |

Table 2 – Type designation related to values of inductance, rated current and d.c. resistance

| Type designation related to values of inductance, rated current and d.c. resistance | L_R per line mH | I_R A | R_{max} per line Ω |
|---|-------------------------|------------|-----------------------------------|
| | | | |

1.4 Related documents

| | |
|--------------------------|---|
| Generic specification: | IEC 60938-1:(1999), <i>Fixed inductors for electromagnetic interference suppression – Part 1: Generic specification</i> |
| Sectional specification: | IEC 60938-2:(1999), <i>Fixed inductors for electromagnetic interference suppression – Part 2: Sectional specification</i> |

1.5 Marking

The marking of the inductor and the package shall be in accordance with the requirements of 1.6 of IEC 60938-2.

The details of the marking of the component and packaging shall be given in full in the detail specification.

1.6 Ordering information

Orders for inductors covered by this specification shall contain, in clear or in coded form, the following minimum information:

- type designation;
- rated inductance;
- tolerance on rated inductance;
- rated voltage;
- rated current;
- number and issue reference of the detail specification and style reference.

1.7 Certified records of released lots

Required/non required.

1.8 Additional information (not for inspection purposes)**1.9 Additional or increased severities or requirements to those specified in the generic or sectional specification**

NOTE – Additions or increased requirements should be specified only when essential.

Table 3 – Other characteristics

This table is to be used for defining characteristics which are additional to or more severe than those given in the sectional specification.

2 Inspection requirements**2.1 Procedures**

2.1.1 For qualification approval, the procedure shall be in accordance with 3.4 of IEC 60938-2.

2.1.2 For quality conformance inspection, the test schedule (table 4) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.5.1 of the sectional specification.

Table 4 – Test schedule for quality conformance inspection

| Subclause number and test (see note 1) | D or ND (see note 3) | Conditions of test (see note 1) | IL (see note 2) | A Q L | Performance requirements (see note 1) |
|---|-------------------------|--|--------------------|-------|--|
| GROUP A INSPECTION (lot-by-lot) | | | | | |
| Subgroup A1 | ND | | S-4 | 2,5 % | As in 4.1 |
| 4.1 Visual examination | | | | | Legible marking and as specified in 1.5 of this specification |
| 4.1 Marking | | | | | |
| 4.1 Dimensions (gauging) | | | | | See table 1 of this specification |
| Subgroup A2 | ND | | II | 1,0 % | See 1.3 of this specification |
| 4.5 DC line resistance | | | | | |
| 4.4 Inductance | | | | | Within specified tolerance |
| 4.2 Voltage proof | | | | | |
| 4.3 Insulation resistance (test A only) | | | | | See table 2 of this specification |
| GROUP B INSPECTION (lot-by-lot) | | | | | |
| Subgroup B1 | D | | S-3 | 2,5 % | |
| 4.8 Solderability | | Method: ... Specify ageing if none or other than 16 h 155 °C dry heat | | | |
| 4.8.2 Final measurements | | Visual examination | | | Good tinning as evidenced by free flowing of the solder with wetting of the terminations, or solder shall flow within 3 s, as applicable |

| Subclause number and test (see note 1) | D or ND (see note 3) | Conditions of test (see note 1) | Sample size and acceptance criterion (see note 3) | | | Performance requirements (see note 1) |
|--|-------------------------|--|--|-------------------|---------|--|
| | | | p | n (see note 4) | c | |
| GROUP C INSPECTION (periodic) | | | | | | |
| Subgroup C1A | D | | 6 | 5/3/1/1 | 0/0/0/0 | |
| 4.1.2 Dimensions (detail) | | | | | | Table 1 of this specification |
| 4.1.2 Creepage distances and clearances | | For method and severity see detail specification | | | | Table 1 of this specification and 4.1.2 |
| 4.6 Robustness of terminations | | For method and severity: see detail specification | | | | No visible damage |
| 4.7 Resistance to soldering heat (if applicable) | | See detail specification for the method (1A or 1B) For method 1A: Immersion time: 10 s, unless otherwise specified in the detail specification | | | | |
| 4.20 Component solvent resistance (if applicable) | | | | | | |
| 4.7.2 Final measurements | | Visual examination DC line resistance | | | | No visible damage See 1.3 of this specification |
| Subgroup C1B | D | | 6 | 9/6/4/1 | 0/0/0/0 | |
| 4.21 Solvent resistance of the marking (if applicable) | | | | | | Legible marking |
| 4.9 Rapid change of temperature | | θ_A = Lower category temperature θ_B = Upper category temperature Five cycles Duration $t = \dots$ h, see 4.9.1 Visual examination | | | | No visible damage |
| 4.10 Vibration | | For mounting method, see detail specification Frequency range: from ... Hz to ... Hz Total number of sweep cycles: ... | | | | |
| 4.10.2 Intermediate inspection | | Visual examination | | | | No visible damage |
| 4.11 Bump (or shock, see 4.12) | | For mounting method, see detail specification Number of bumps: ... Acceleration: ... m/s ² Duration of pulse: ... ms Visual examination | | | | No visible damage |

| Subclause number and test (see note 1) | D or ND (see note 3) | Conditions of test (see note 1) | Sample size and acceptance criterion (see note 3) | | | Performance requirements (see note 1) |
|---|-------------------------|--|--|-------------------|---------|--|
| | | | p | n (see note 4) | c | |
| 4.12 Shock (or bump, see 4.11) | | For mounting method, see detail specification Acceleration: ... m/s ² Duration of pulse: ... ms | | | | |
| 4.11.2 Final measurements or 4.12.3 | | Visual examination DC line resistance | | | | No visible damage See 1.3 of this specification |
| Subgroup C1 | D | | 4 | 14/9/4/2 | 1/1/0/0 | |
| 4.4 Inductance | | | | | | For reference |
| 4.13 Container sealing (if required in the detail specification) | | Test Qc or Qd as prescribed in the detail specification | | | | No leakage |
| 4.14 Climatic sequence | | | | | | |
| 4.14.2 Dry heat | | Temperature: upper category temperature Duration: 16 h | | | | |
| 4.14.3 Damp heat, cyclic, test Db, first cycle | | | | | | |
| 4.14.4 Cold | | Temperature: lower category temperature Duration: 2 h | | | | |
| 4.14.5 Low air pressure (if required in the detail specification) | | Air pressure 8,0 kPa unless otherwise stated in the detail specification Duration: 1 h | | | | |
| | | Visual examination | | | | No permanent breakdown, flashover, harmful deformation of the case |
| 4.14.6 Damp heat, cyclic, test Db, remaining cycles | | | | | | |
| 4.14.7 Final measurements | | Recovery: 1 h to 26 h Visual examination DC line resistance Inductance Voltage proof Voltage: 66 % of voltage applied in group 0 Insulation resistance | | | | No visible damage Legible marking See 1.3 of this specification Within –5 %/+10 % of value measured in group 0 No breakdown or flashover ≥50 % of values in 4.3 |
| Subgroup C2 | D | | 12 | 8/5/4/2 | 0/0/0/0 | |
| 4.4 Inductance | | | | | | For reference |
| 4.15 Damp heat, steady state | | Recovery: 1 h to 26 h | | | | |

| Subclause number and test (see note 1) | D or ND (see note 3) | Conditions of test (see note 1) | Sample size and acceptance criterion (see note 3) | | | Performance requirements (see note 1) |
|--|-------------------------|---|--|-------------------|---------|--|
| | | | p | n (see note 4) | c | |
| 4.15.1 Final measurements | | Visual examination DC line resistance Inductance Voltage proof Voltage: 66 % of voltage applied in group 0 A polarizing voltage shall be applied if specified in the detail specification Insulation resistance | | | | No visible damage Legible marking See 1.3 of this specification Within –5 %/+10 % of value measured in group 0 No breakdown or flashover ≥50 % of values as measured in 4.3 |
| Subgroup C3A 4.16 Temperature rise (inductors with mass >5 g only) 4.16.1 Test conditions 4.16.2 Final measurements 4.18.1 Endurance, current (inductors with mass ≤5 g only) | D | Duration: until thermal equilibrium has been reached Current: rated current Ambient temperature: rated temperature Internal temperature Duration: 1 000 h Current: 1,1 × rated current Recovery: 1 h to 26 h | 3 | 8/4/2/1 | 0/0/0/0 | As in 4.16.2 |
| Subgroup 3B (inductors with more than one winding only) 4.17 Impulse voltage 4.18.2 Endurance, voltage between line terminations | D | 3 impulses, full wave Crest voltage: see 4.17.1 Duration: 1 000 h Voltage and temperature, see 4.18.2 | 3 | 10/6/4/2 | 0/0/0/0 | |
| Subgroup C3 4.18.3 Final measurements | | Recovery: 1 h to 26 h Visual examination DC line resistance Voltage proof Voltage: 66 % of voltage applied in group 0 Insulation resistance Inductance | | | | No visible damage Legible marking As for group 0 No breakdown or flashover See 4.18.3 Within –5 %/+10 % of value measured in group 0 |

| Subclause number and test (see note 1) | D or ND (see note 3) | Conditions of test (see note 1) | Sample size and acceptance criterion (see note 3) | | | Performance requirements (see note 1) |
|--|-------------------------|------------------------------------|--|-------------------|---|--|
| | | | p | n (see note 4) | c | |
| Subgroup 4 4.19 Passive flammability (if required in the detail specification) | D | | 12 | (see note 5) | 0 | As in 4.19 |
| <p>NOTE 1 – Subclause numbers of tests and performance requirements refer to the sectional specification, IEC 60938-2 and clause 1 of this specification.</p> <p>NOTE 2 – Inspection levels and AQL's are selected from IEC 60410.</p> <p>NOTE 3 – In this table:</p> <p>p = periodicity (in months)</p> <p>n = sample size</p> <p>c = acceptance criterion (permitted number of non-conforming items)</p> <p>D = destructive</p> <p>ND = non-destructive</p> <p>IL = inspection level</p> <p>AQL = acceptable quality level } IEC 60410</p> <p>NOTE 4 – The number of specimens indicated relate to the mass limits as follows:</p> <p>≤5 g</p> <p>>5 g and ≤250 g</p> <p>>250 g and ≤1 500 g</p> <p>>1 500 g respectively</p> <p>Where a range is qualified which contains inductors within more than one the mass classifications listed above, the number of specimens selected shall be that for the classification in which the majority of the values in the range fall.</p> <p>The numbers in group 0 exclude the numbers of specimens required for group 4.</p> <p>NOTE 5 – See 4.21 of IEC 60938-1 to determine the number of specimens to be tested.</p> | | | | | | |



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.....

Q2 Please tell us in what capacity(ies) you bought the standard (tick all that apply). I am the/a:

- purchasing agent ☐
 librarian ☐
 researcher ☐
 design engineer ☐
 safety engineer ☐
 testing engineer ☐
 marketing specialist ☐
 other.....

Q3 I work for/in/as a:
(tick all that apply)

- manufacturing ☐
 consultant ☐
 government ☐
 test/certification facility ☐
 public utility ☐
 education ☐
 military ☐
 other.....

Q4 This standard will be used for:
(tick all that apply)

- general reference ☐
 product research ☐
 product design/development ☐
 specifications ☐
 tenders ☐
 quality assessment ☐
 certification ☐
 technical documentation ☐
 thesis ☐
 manufacturing ☐
 other.....

Q5 This standard meets my needs:
(tick one)

- not at all ☐
 nearly ☐
 fairly well ☐
 exactly ☐

Q6 If you ticked NOT AT ALL in Question 5 the reason is: (tick all that apply)

- standard is out of date ☐
 standard is incomplete ☐
 standard is too academic ☐
 standard is too superficial ☐
 title is misleading ☐
 I made the wrong choice ☐
 other

Q7 Please assess the standard in the following categories, using the numbers:

- (1) unacceptable,
 (2) below average,
 (3) average,
 (4) above average,
 (5) exceptional,
 (6) not applicable

- timeliness.....
 quality of writing.....
 technical contents.....
 logic of arrangement of contents
 tables, charts, graphs, figures.....
 other

Q8 I read/use the: (tick one)

- French text only ☐
 English text only ☐
 both English and French texts ☐

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

.....





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Suisse

Q1 Veuillez ne mentionner qu'**UNE SEULE NORME** et indiquer son numéro exact:
(ex. 60601-1-1)
.....

Q2 En tant qu'acheteur de cette norme, quelle est votre fonction?
(cochez tout ce qui convient)
Je suis le/un:

- agent d'un service d'achat ☐
- bibliothécaire ☐
- chercheur ☐
- ingénieur concepteur ☐
- ingénieur sécurité ☐
- ingénieur d'essais ☐
- spécialiste en marketing ☐
- autre(s).....

Q3 Je travaille:
(cochez tout ce qui convient)

- dans l'industrie ☐
- comme consultant ☐
- pour un gouvernement ☐
- pour un organisme d'essais/ certification ☐
- dans un service public ☐
- dans l'enseignement ☐
- comme militaire ☐
- autre(s).....

Q4 Cette norme sera utilisée pour/comme
(cochez tout ce qui convient)

- ouvrage de référence ☐
- une recherche de produit ☐
- une étude/développement de produit ☐
- des spécifications ☐
- des soumissions ☐
- une évaluation de la qualité ☐
- une certification ☐
- une documentation technique ☐
- une thèse ☐
- la fabrication ☐
- autre(s).....

Q5 Cette norme répond-elle à vos besoins:
(une seule réponse)

- pas du tout ☐
- à peu près ☐
- assez bien ☐
- parfaitement ☐

Q6 Si vous avez répondu PAS DU TOUT à Q5, c'est pour la/les raison(s) suivantes:
(cochez tout ce qui convient)

- la norme a besoin d'être révisée ☐
- la norme est incomplète ☐
- la norme est trop théorique ☐
- la norme est trop superficielle ☐
- le titre est équivoque ☐
- je n'ai pas fait le bon choix ☐
- autre(s)

Q7 Veuillez évaluer chacun des critères ci-dessous en utilisant les chiffres
(1) inacceptable,
(2) au-dessous de la moyenne,
(3) moyen,
(4) au-dessus de la moyenne,
(5) exceptionnel,
(6) sans objet

- publication en temps opportun
- qualité de la rédaction.....
- contenu technique
- disposition logique du contenu
- tableaux, diagrammes, graphiques, figures
- autre(s)

Q8 Je lis/utilise: (une seule réponse)

- uniquement le texte français ☐
- uniquement le texte anglais ☐
- les textes anglais et français ☐

Q9 Veuillez nous faire part de vos observations éventuelles sur la CEI:

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