

Luminaires —

Part 1: General requirements and tests

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ICS 29.140.40

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National foreword

This British Standard is the official English language version of EN 60598-1:2000 including amendment A11:2000 and corrigendum April 2001. It was derived by CENELEC from IEC 60598-1:1999. It supersedes BS EN 60598-1:1997 which will be withdrawn on 2007-04-01.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a sideline in the margin. The common modification introduced by amendment A11 modifies annex C by replacing item 2b) and Figure C.3.

A vertical line in the margin containing either a 1 or 2 indicates where the fourth edition of IEC 60598-1:1996 was modified by its amendments 1 and 2 and in so doing became edition 5.0:1999. A vertical line in the margin containing the letters "IS" indicates where the text has been improved by an interpretation sheet.

The UK participation in its preparation was entrusted to Technical Committee CPL/34/4, Luminaires, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 186, an inside back cover and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments
13039 Corrigendum No.1	March 2001	Correction to pages 76, 118, 119.
13092	June 2001	See national foreword.
13308 Corrigendum No.2	September 2001	Correction of latest date of withdrawal of conflicting national standards. Correction of copyright date.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 November 2000

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ISBN 0 580 36568 9

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60598-1

June 2000

+ A11

December 2000

ICS 29.140.40

Supersedes EN 60598-1:1997 + A1:1998 + A12:1998 + A13:1999
Incorporating corrigendum April 2001

English version

Luminaires

Part 1: General requirements and tests

(includes amendment A11:2000)

(IEC 60598-1:1999, modified)

Luminaires

Partie 1: Prescriptions générales et essais
(inclut l'amendement A11:2000)
(CEI 60598-1:1999, modifiée)

Leuchten

Teil 1: Allgemeine Anforderungen und
Prüfungen
(enthält Änderung A11:2000)
(IEC 60598-1:1999, modifiziert)

This European Standard was approved by CENELEC on 2000-04-01. Amendment A11 was approved by CENELEC on 2000-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Annex ZC (informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.

This European Standard falls under Directive 73/23/EEC.

NOTE (from CEN/CENELEC IR Part 2, 3.1.9) Where standards fall under EC Directives, it is the view of the Commission of the European Communities (OJ No C 59; 1982-03-09) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA-country are **valid instead** of the relevant provisions of the European Standard in that country until they have been removed.

<u>Clause</u>	<u>Deviation</u>
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13.3	Denmark (Stærkstrømsbekendtgørelsen - Elektriske Installationer 1993, § 716.4)
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For luminaires installed in access routes, including staircases, and escape routes of public and communal buildings, luminaire enclosures shall comply with the needle flame test of 13.3.1, but with the flame applied for 30 s, or the glow-wire test of 13.3.2, but with the glow-wire heated to 750 °C.

United Kingdom (Approved document B of the United Kingdom Building Regulations)

Particular fire protection requirements are listed in the above regulations.

13.3.2	France (Regulation on the safety against fire hazards in premises open to public and workers (clause EC4, subclause 2))
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For luminaires installed in closed horizontal routes and stairs, a temperature of the glow-wire of 850 °C and an extinguishing time of 5 s are required.

In the other cases, if the area of the ceiling covered by luminaires is not too large, a temperature of the glow-wire of 750 °C and an extinguishing time of 5 s are required.

Foreword

The text of the International Standard IEC 60598-1:1999, prepared by SC 34D, Luminaires, of IEC TC 34, Lamps and related equipment, together with common modifications prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment, was approved by CENELEC as EN 60598-1 on 2000-04-01.

This European Standard supersedes EN 60598-1:1997 + corrigendum June 1999 and its amendments A1:1998 + corrigendum December 1998, A12:1998 and A13:1999.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-04-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B, C, D, E, F, P, S, T, ZA and ZB are normative and annexes J, K, L, M, N, Q, R and ZC are informative.

Annexes ZA, ZB and ZC have been added by CENELEC.

Foreword to amendment A11

This amendment was prepared by the Technical Committee CENELEC TC 34Z, Luminaires and associated equipment.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A11 to EN 60598-1:2000 on 2000-11-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-09-01
 - latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2002-09-01
-

5.2.1
(cont'd)

EXEMPTION:

If single-phased fixed class I luminaires, intended for use in homes, and for which protection against indirect contact is required according to Section 10 of the Heavy Current Regulations, are provided with a plug, this plug may, until further notice, be in accordance with Standard Sheet DKA 2-1a, DKA 2-1b, C 1b, C 2b, C 3b or C 4, provided that the cord close to the plug is marked as required in § 3.3.

If multi-phase luminaires and single-phase luminaires having a rated current exceeding 10 A are provided with a supply cord with a plug, the plug shall comply with the following table:

Class of luminaire	Plug	
	Section 107-2-D1 Standard Sheet	Section 117 Standard Sheet
I	DK 6-1a	II
II	DK7-1a*	II*
* Earthing contact not connected.		

Finland and Sweden

For luminaires provided with non-detachable flexible cables and cords and a plug, the plug shall comply with the requirements of CEE Publication 7 and EN 50075, the Standard Sheets to be applied being as follows:

- Class I luminaires CEE 7, sheet IV or VII
- Class II luminaires CEE 7, sheet XVI (alt I only) or CEE 7, sheet XVII or EN 50075, sheet I

United Kingdom

Domestic luminaires intended for connection to a standard United Kingdom 13 A socket must be pre-fitted with an approved plug complying with BS 1363.

Cord sets for domestic luminaires for connection with an appliance inlet must be pre-fitted with an approved plug complying with BS 1363.

Plugs must be fitted with the correct fuse.

CONTENTS

Clause	Page
SECTION 0: GENERAL INTRODUCTION	
0.1 Scope and object.....	7
0.2 Normative references	8
0.3 General requirements	11
0.4 General test requirements and verification	11
0.5 Components of luminaires	12
0.6 List of sections of part 2	13
SECTION 1: DEFINITIONS	
1.1 General.....	14
1.2 Definitions.....	14
SECTION 2: CLASSIFICATION OF LUMINAIRES	
2.1 General.....	24
2.2 Classification according to type of protection against electric shock	24
2.3 Classification according to degree of protection against ingress of dust, solid objects and moisture	25
2.4 Classification according to material of supporting surface for which the luminaire is designed.....	25
2.5 Classification according to the circumstances of use.....	25
SECTION 3: MARKING	
3.1 General.....	26
3.2 Marking on luminaires	26
3.3 Additional information.....	29
3.4 Test of marking	31
SECTION 4: CONSTRUCTION	
4.1 General.....	32
4.2 Replaceable components	32
4.3 Wireways	32
4.4 Lampholders	32
4.5 Starter holders	34
4.6 Terminal blocks.....	34
4.7 Terminals and supply connections	35
4.8 Switches	36
4.9 Insulating linings and sleeves	37
4.10 Double and reinforced insulation.....	37
4.11 Electrical connections and current-carrying parts	39

4.5.1 Denmark

Socket-outlets intended for providing power to other appliances shall be in compliance with Section 107-2-D1, the Standard Sheets being applied as follows:

Class I Standard Sheet DK 1-3a

For class I luminaires, the earthing contact of the socket-outlet shall be electrically connected to the earthing terminal of the appliance.

Class II luminaires shall not be fitted with socket-outlets for providing power to other appliances.

EXEMPTION:

Socket-outlets supplied from isolation transformers (shaver supply units) and socket-outlets on outdoor luminaires may be in accordance with the requirement of Section 107-2-D1 for fixed socket-outlets.

France

Socket-outlets 10/16 A intended for providing power to other appliances except those supplied by an isolating transformer shall be shuttered in accordance with standard sheet V of CEE Publication 7 and with clauses 9 and 20 of IEC 60884-1.


5.2.1 Denmark

Supply cords on single-phase portable luminaires having a rated current not exceeding 10 A shall be provided with a plug according to the following table:

		Plug	
Class of luminaire		Section 107-2-D1 Standard Sheet	EN 50075 Standard Sheet
I	Protection against indirect contact required	DK 2-1a*	
	Earthing connection not required	DK 2-1a, DKA 2-1a, DKA 2-1b, C 1b, C 2b, C 3b, C 4	
II		DKA 2-1a, DKA 2-1b, C 1b, C 5, C 6	I
* Luminaires fitted with a socket-outlet for providing power to other appliances.			

For luminaires which are mainly used in locations where protection against indirect contact is required, see Section 10, § 17.

For luminaires having an appliance inlet, the plug on the supply cord shall comply with the above requirements. If other single-phase luminaires having a rated current not exceeding 10 A are provided with a supply cord with a plug, the plug shall comply with the above requirements.

Clause	Page
4.12 Screws and connections (mechanical) and glands	40
4.13 Mechanical strength	43
4.14 Suspensions and adjusting devices	47
4.15 Flammable materials	50
4.16 Luminaires marked with  symbol	51
4.17 Drain holes.....	53
4.18 Resistance to corrosion	53
4.19 Igniters.....	54
4.20 Rough service luminaires – Vibration requirements	54
4.21 Protective shield (tungsten halogen lamps)	54
4.22 Attachments to lamps	55
4.23 Semi-luminaires	55
4.24 UV radiation	55
4.25 Mechanical hazard	56
4.26 Short-circuit protection	56
SECTION 5: EXTERNAL AND INTERNAL WIRING	
5.1 General.....	57
5.2 Supply connection and other external wiring	57
5.3 Internal wiring.....	63
<i>SECTION 6: Not used</i>	
SECTION 7: PROVISION FOR EARTHING	
7.1 General.....	65
7.2 Provision for earthing	65
SECTION 8: PROTECTION AGAINST ELECTRIC SHOCK	
8.1 General.....	68
8.2 Protection against electric shock	68
SECTION 9: RESISTANCE TO DUST, SOLID OBJECTS AND MOISTURE	
9.1 General.....	70
9.2 Tests for ingress of dust, solid objects and moisture	70
9.3 Humidity test	74
SECTION 10: INSULATION RESISTANCE AND ELECTRIC STRENGTH	
10.1 General.....	75
10.2 Insulation resistance and electric strength	75
10.3 Leakage current	79
SECTION 11: CREEPAGE DISTANCES AND CLEARANCES	
11.1 General.....	79
11.2 Creepage distances and clearances	79

Annex ZB (normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions. If it affects harmonization, it forms part of the European Standard or Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

<u>Clause</u>	<u>Special national condition</u>
2.2	If in the CENELEC countries the wiring rules do not allow luminaires of class 0, then luminaires shall not be classified according to the type of protection against electric shock provided, as class 0.

NOTE In Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Norway, Sweden and the United Kingdom, wiring rules do not allow any luminaire to be class 0. In Italy, wiring rules do not allow any luminaire to be class 0 except in special installations called "insulated installations".

3.3	Denmark Supply cords of class I luminaires, which are delivered without a plug, shall be provided with a visible tag with the following text:
-----	---

Vigtigt !
Lederen med grøn/gul isolation
må kun tilsluttes en klemme mærket



If essential for the safety of the luminaire, the tag shall in addition be provided with a diagram, which shows the connection of the other conductors, or be provided with the following text:

Fir tilslutning af the øvrige ledere,
se medfølgende vejledning.

Class I luminaires which, according to the exemption for Denmark in subclause 5.2.1, are delivered with a supply cord with a plug in accordance with Standard Sheets DKA 2-1a, DKA 2-1b, C 1b, C 2b, C 3b or C 4, shall either be provided with the above tag or the same information shall be given in an enclosed instruction. The text concerning conductors having green/yellow insulation shall be quoted word-for-word.

NOTE "ø" may be replaced by "oe"; "æ" may be replaced by "ae".

Italy


For luminaires of class 0, the manufacturer's instructions shall include the following warning:

"ATTENZIONE - QUESTO APPARECHIO E' IDONEO SOLO PER AMBIENTI ISOLATI"

Clause	Page
SECTION 12: ENDURANCE TEST AND THERMAL TEST	
12.1 General	82
12.2 Selection of lamps and ballasts	82
12.3 Endurance test	83
12.4 Thermal test (normal operation).....	84
12.5 Thermal test (abnormal operation).....	91
12.6 Thermal test (failed lamp controlgear conditions)	95
12.7 Thermal test in regard to fault conditions in lamp controlgear or electronic devices in plastic luminaires.....	97
SECTION 13: RESISTANCE TO HEAT, FIRE AND TRACKING	
13.1 General	99
13.2 Resistance to heat.....	99
13.3 Resistance to flame and ignition	99
13.4 Resistance to tracking	100
SECTION 14: SCREW TERMINALS	
14.1 General	101
14.2 Definitions	101
14.3 General requirements and basic principles	102
14.4 Mechanical tests	104
SECTION 15: SCREWLESS TERMINALS AND ELECTRICAL CONNECTIONS	
15.1 General	109
15.2 Definitions	109
15.3 General requirements.....	110
15.4 General instructions on tests	111
TERMINALS AND CONNECTIONS FOR INTERNAL WIRING	
15.5 Mechanical tests	112
15.6 Electrical tests.....	113
TERMINALS AND CONNECTIONS FOR EXTERNAL WIRING	
15.7 Conductors.....	114
15.8 Mechanical tests	115
15.9 Electrical tests.....	116
Figures.....	118

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61199	1993	Single-capped fluorescent lamps - Safety specifications	EN 61199 ¹⁸⁾	1994
ISO 75-2	1993	Plastics - Determination of temperature of deflection under load Part 2: Plastics and ebonite	EN ISO 75-2	1996
ISO 1891	1979	Bolts, screws, nuts and accessories - Terminology and nomenclature	-	-
ISO 4046	1978	Paper, board, pulp and related terms - Vocabulary	-	-

18) EN 61199 is superseded by EN 61199:1999, which is based on IEC 61199:1999.

	Page
Annex A (normative) Test to establish whether a conductive part may cause an electric shock	141
Annex B (normative) Test lamps	142
Annex C (normative) Abnormal circuit conditions	145
Annex D (normative) Draught-proof enclosure	148
Annex E (normative) Determination of winding temperature rises by the increase-in-resistance method	152
Annex F (normative) Test for resistance to stress corrosion of copper and copper alloys...	154
Annex G (<i>deleted</i>)	156
Annex H (<i>deleted</i>)	157
Annex J (informative) Explanation of IP numbers for degrees of protection	158
Annex K (informative) Temperature measurement	160
Annex L (informative) Guide to good practice in luminaire design	163
Annex M (informative) Conversion guide for table IX of IEC 60598-1 (2nd edition) to table 11.1 – Determination of creepage distances and clearances	167
Annex N (informative) Explanation to luminaire  marking	168
Annex P (normative) Requirements for the protective shield to be fitted to luminaires using metal halide lamps for protective measures against UV radiation	171
Annex Q (informative) Conformity testing during manufacture	173
Annex R (informative) Bibliography	175
Annex S (normative) Schedule of amended clauses containing more serious/critical requirements which require products to be retested	176
Annex T (normative) Requirements for the identification of a family or range of luminaires for type testing	177
Annex ZA (normative) Normative references to international publications with their corresponding European publication	178
Annex ZB (normative) Special national conditions	183
Annex ZC (informative) A- deviations	186

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60901	1987	Single-capped fluorescent lamps - Safety and performance requirements	EN 60901 ¹³⁾	1990
A1	1989		A1	1990
A2	1992		A2	1993
IEC 60920	1990	Ballasts for tubular fluorescent lamps - General and safety requirements	EN 60920	1991
A1	1993		A1	1993
A2	1995		A2	1996
IEC 60922	1989	Ballasts for discharge lamps (excluding tubular fluorescent lamps) - General and safety requirements	EN 60922 ¹⁴⁾	1991
A2	1992		A2	1993
IEC 60924	1990	D.C. supplied electronic ballasts for tubular fluorescent lamps - General and safety requirements	EN 60924	1991
A1	1993		A1	1994
IEC 60972	1989	Classification and interpretation of new lighting products	-	-
A1	1991	Classification and interpretation of new lighting products	-	-
IEC 60989	1991	Separating transformers, autotransformers, variable transformers and reactors	-	-
IEC 60990	1990	Methods of measurement of touch-current and protective conductor current	-	-
IEC 61032	1990	Test probes to verify protection by enclosures	HD 601 S1 ¹⁵⁾	1991
IEC 61046	1993	D.C. or a.c. supplied electronic step-down converters for filament lamps - General and safety requirements	EN 61046	1994
A1	1995		A1	1996
IEC 61058-1	1990	Switches for appliances Part 1: General requirements	EN 61058-1	1992
A1	1993		A1	1993
A2	1994		-	-
IEC 61167	1992	Metal halide lamps	EN 61167	1994
A1	1995		A1	1995
IEC 61184 (mod)	1993	Bayonet lampholders	EN 61184 ¹⁶⁾	1994
IEC 61195	1993	Double-capped fluorescent lamps - Safety specifications	EN 61195 ¹⁷⁾	1994

13) EN 60901 and its amendments are superseded by EN 60901:1996; which is based on IEC 60901:1996.

14) EN 60922 and its amendment are superseded by EN 60922:1997; which is based on IEC 60922:1997.

15) HD 601 is superseded by EN 61032:1998, which is based on IEC 61032:1997.

16) EN 61184 is superseded by EN 61184:1997, which is based on IEC 61184:1997.

17) EN 61195 is superseded by EN 61195:1999, which is based on IEC 61195:1999.

LUMINAIRES –

Part 1: General requirements and tests

SECTION 0: GENERAL INTRODUCTION

0.1 Scope and object

This part 1 of International Standard IEC 60598 specifies general requirements for luminaires, incorporating electric light sources for operation from supply voltages up to 1 000 V. The requirements and related tests of this standard cover: classification, marking, mechanical construction and electrical construction. ②

Each section of this part 1 should be read in conjunction with this section 0 and with other relevant sections to which reference is made. ①

Each section of IEC 60598-2 details requirements for a particular type of luminaire or group of luminaires on supply voltages not exceeding 1 000 V. These sections are published separately for ease of revision and additional sections will be added as and when a need for them is recognized.

Attention is drawn to the fact that this part 1 covers all aspects of safety (electrical, thermal and mechanical).

The presentation of photometric data for luminaires is under consideration by the International Commission on Illumination (CIE) and is not, therefore, included in this part 1.

Requirements are included in this part 1 for luminaires incorporating ignitors with nominal peak values of the voltage pulse not exceeding those of table 11.2. The requirements apply to luminaires with ignitors built into ballasts and to luminaires with ignitors separate from ballasts. For luminaires with ignitors built into lamps, the requirements are under consideration.

Requirements for semi-luminaires are included in this part 1.

In general this part 1 covers safety requirements for luminaires. The object of this part 1 is to provide a set of requirements and tests which are considered to be generally applicable to most types of luminaires and which can be called up as required by the detail specifications of IEC 60598-2. This part 1 is thus not to be regarded as a specification in itself for any type of luminaire, and its provisions apply only to particular types of luminaires to the extent determined by the appropriate section of part 2.

The sections of part 2, in making reference to any of the sections of part 1, specify the extent to which that section is applicable and the order in which the tests are to be performed; they also include additional requirements as necessary.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60432-1 (mod)	1993	Safety specifications for incandescent lamps Part 1: Tungsten filament lamps for domestic and similar general lighting purposes	EN 60432-1 ⁸⁾ + corr. April	1994 1995
A1	1995		A1	1997
IEC 60432-2 (mod)	1994	Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes	EN 60432-2 ⁹⁾ + corr. March	1994 1995
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 1993
IEC 60570	1995	Electrical supply track systems for luminaires	EN 60570	1996
IEC 60598-2 (mod)	Series	Luminaires Part 2: Particular requirements	EN 60598-2	Series
IEC 60598-2-4 (mod)	1979	Part 2: Particular requirements – Section 4: Portable general purpose luminaires	EN 60598-2-4 ¹⁰⁾	1989
A3	1990		A3	1993
IEC 60630 (mod)	1994	Maximum lamp outlines for incandescent lamps	EN 60630 ¹¹⁾	1998
IEC 60634	1993	Heat test source (H.T.S.) lamps for carrying out heating tests on luminaires	EN 60634	1995
IEC 60662 + A2 + A3 A4 A5 A6 A7 A8	1980 1987 1990 1992 1993 1994 1995 1995	High-pressure sodium vapour lamps	EN 60662 A4 A5 A6 A7 -	1993 1994 1994 1994 1995 -
IEC 60664-1 (mod)	1992	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests	HD 625.1 S1 + corr. November	1996 1996
IEC 60684	Series	Flexible insulating sleeving	EN 60684/HD 523	Series
IEC 60695-2-2	1991	Fire hazard testing Part 2: Test methods Section 2: Needle-flame test	EN 60695-2-2	1994
IEC 60742 (mod)	1983	Isolating transformers and safety isolating transformers - Requirements	EN 60742 ¹²⁾	1995
IEC 60838	Series	Miscellaneous lampholders	EN 60838	Series

8) EN 60432-1 and its amendments are superseded by EN 60432-1:2000, which is based on IEC 60432-1:1999, mod.

9) EN 60432-2 and its amendments are superseded by EN 60432-2:2000, which is based on IEC 60432-2:1999, mod.

10) EN 60598-2-4, which includes A1:1983 + A2:1987 to IEC 60598-2-4:1979 and its amendment A3:1993 are superseded by EN 60598-2-4:1997, which is based on IEC 60598-2-4:1997.

11) EN 60630 includes A1:1997 + A2:1998 to IEC 60630.

12) EN 60742 includes A1:1992 to IEC 60742.

The order in which the sections of part 1 are numbered has no particular significance as the order in which their provisions apply is determined for each type of luminaire or group of luminaires by the appropriate section of part 2. All sections of part 2 are self-contained and therefore do not contain references to other sections of part 2.

Where the requirements of any of the sections of part 1 are referred to in the sections of part 2 by the phrase "The requirements of section ... of IEC 60598-1 apply", this phrase is to be interpreted as meaning that all the requirements of that section of part 1 apply except those which are clearly inapplicable to the particular type of luminaire covered by that section of part 2.

In accordance with IEC guidelines, new IEC standards are divided into those covering either safety or performance. In the lamp safety standards, "information for luminaire design" is given for the safe operation of lamps; this should be regarded as normative when testing luminaires to this standard.

Attention is drawn to lamp performance standards which contain "information for luminaire design"; this should be followed for proper lamp operation; however, this standard does not require the testing of lamps performance as part of the type test approval for luminaires.

Improvements in safety to take account of the state of the art technology are incorporated in the standards with revisions and amendments on an ongoing basis. Regional standardisation bodies may include statements in their derived standards to cover products which have complied with the previous document as shown by the manufacturer or standardization body. The statements may require that for such products the previous standard may continue to apply to production until a defined date after which the new standard shall apply.

0.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60598. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60598 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60061-2:1969, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 2: Lampholders*
Consolidated edition (1995)

IEC 60061-3:1969, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 3: Gauges*
Consolidated edition (1995)

IEC 60065:1985, *Safety requirements for mains operated electronic and related apparatus for household and similar general use*

IEC 60068-2-63:1991, *Environmental testing – Part 2: Test methods – Test Eg: Impact, spring hammer*

IEC 60083:1975, *Plugs and socket-outlets for domestic and similar general use – Standards*
Amendment No. 1 (1979)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60238 (mod)	1991	Edison screw lampholders	EN 60238 ³⁾	1992
A1	1993		A1	1995
A2	1995		A2	1995
IEC 60245 (mod)	Series	Rubber insulated cables - rated voltages up to and including 450/750 V	HD 22 ⁴⁾	Series
IEC 60320 (mod)	Series	Appliance couplers for household and similar general purposes	EN 60320	Series
IEC 60357 (mod)	1982	Tungsten halogen lamps (non-vehicle)		
+ A1 (mod)	1984		EN 60357	1988
A2 (mod)	1985			
+ A3 (mod)	1987			
+ A4 (mod)	1989		A4	1991
A5	1992			
+ corr. June	1992			
+ corr. November	1992			
A6	1993		A6	1994
A7	1994		A7	1994
A8	1995		A8	1995
IEC 60360	1987	Standard method of measurement of lamp cap temperature rise	EN 60360 ⁵⁾	1989
IEC 60364-3 (mod)	1993	Electrical installations of buildings Part 3: Assessment of general characteristics	HD 384.3 S2	1995
A1	1994		-	-
A2	1995		-	-
IEC 60364-7-702 (mod)	1983	Part 7: Requirements for special installations or locations – Section 702: Swimming pools	HD 384.7.702 S1	1991
IEC 60384-14	1993	Fixed capacitors for use in electronic equipment - Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	-	-
IEC 60400 (mod)	1991	Lampholders for tubular fluorescent lamps and starterholders	EN 60400 ⁶⁾	1992
A1	1993		+ corr. March	1992
A2	1994		A1	1994
			A2	1995
IEC 60416	1988	General principles for the creation of graphical symbols for use on equipment	HD 571 S1	1990
IEC 60417	1973	Graphical symbols for use on equipment - Index, survey and compilation of the single sheets	HD 243 S12 ⁷⁾	1995

3) EN 60238 and its amendments are superseded by EN 60238:1998 + corrigendum February 1999, which is based on IEC 60238:1998.

4) The HD 22 series is related to, but not directly equivalent with the IEC 60245 series.

5) EN 60360 is superseded by EN 60360:1998, which is based on IEC 60360:1998.

6) EN 60400 and its amendments are superseded by EN 60400:2000, which is based on IEC 60400:1999, mod.

7) HD 243 S12 is superseded by EN 60417-1:1999 and EN 60417-2:1999, which are based on IEC 60417-1:1998 and IEC 60417-2:1998.

- IEC 60085:1984, *Thermal evaluation and classification of electrical insulation* ②
- IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*
- IEC 60155:1993, *Glow-starters for fluorescent lamps*
- IEC 60216: *Guide for the determination of thermal endurance properties of electrical insulating materials* ②
- IEC 60227: *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*
- IEC 60238:1991, *Edison screw lampholders*
Amendment 1 (1993), Amendment 2 (1995)
- IEC 60245: *Rubber insulated cables of rated voltages up to and including 450/750 V*
- IEC 60320: *Appliance couplers for household and similar general purposes*
- IEC 60357:1982, *Tungsten halogen lamps (non-vehicle)*
Amendments: 1 (1984), 2 (1985), 3 (1987), 4 (1989), 5 (1992), 6 (1993), 7 (1994), 8 (1995)
- IEC 60360:1987, *Standard method of measurement of lamp cap temperature rise*
- IEC 60364-3:1993, *Electrical installations of buildings – Part 3: Assessment of general characteristics*
Amendment 1 (1993), Amendment 2 (1995)
- IEC 60364-7-702:1983, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 702: Swimming pools*
- IEC 60384-14:1993, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*
- IEC 60400:1991, *Lampholders for tubular fluorescent lamps and starter-holders*
Amendment 1 (1993), Amendment 2 (1994)
- IEC 60416:1988, *General principles for the creation of graphical symbols for use on equipment*
- IEC 60417:1973, *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets*
- IEC 60432-1:1993, *Safety specifications for incandescent lamps – Part 1: Tungsten filament lamps for domestic and similar general lighting purposes*
Amendment 1 (1995)
- IEC 60432-2:1994, *Safety specifications for incandescent lamps – Part 2: Tungsten halogen lamps for domestic and similar lighting purposes*
- IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
- IEC 60570:1995, *Electrical supply track systems for luminaires*
- IEC 60598-2: *Luminaires – Part 2: Particular requirements*
- IEC 60598-2-4:1979, *Portable general purpose luminaires*
Amendment 3 (1990)
- IEC 60630:1994, *Maximum lamp outlines for general lighting lamps*

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60061-2 + supplements + amendments (mod)	1969	Part 2: Lampholders	EN 60061-2 + amendments	1993
IEC 60061-3 + supplements + amendments (mod)	1969	Part 3: Gauges	EN 60061-3 + amendments	1993
IEC 60065 (mod)	1985	Safety requirements for mains operated electronic and related apparatus for household and similar general use	EN 60065 ¹⁾	1993
IEC 60068-2-63	1991	Environmental testing Part 2: Test methods - Test Eg: Impact, spring hammer	EN 60068-2-63	1994
IEC 60083 A1	1975 1979	Plugs and socket-outlets for domestic and similar general use - Standards	-	-
IEC 60085	1984	Thermal evaluation and classification of electrical insulation	HD 566 S1	1990
IEC 60112	1979	Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions	HD 214 S2	1980
IEC 60155	1993	Glow-starters for fluorescent lamps	EN 60155	1995
IEC 60216	Series	Guide for the determination of thermal endurance properties of electrical insulating materials	EN 60216/HD 611	Series
IEC 60227 (mod)	Series	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V	HD 21 ²⁾	Series

1) EN 60065 is superseded by EN 60065:1998 + corrigendum June 1999, which is based on IEC 60065:1998, mod.

2) The HD 21 series is related to, but not directly equivalent with the IEC 60227 series.

IEC 60634:1993, *Heat test source (H.T.S.) lamps for carrying out heating tests on luminaires*

IEC 60662:1980, *High pressure sodium vapour lamps*

Amendments: 2 (1987), 3 (1990), 4 (1992), 5 (1993), 6 (1994), 7 and 8 (1995)

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60684: *Specification for flexible insulating sleeving*

IEC 60695-2-2:1991, *Fire hazard testing – Section 2: Needle-flame test*

IEC 60742:1983, *Isolating transformers and safety isolating transformers – Requirements*

IEC 60838: *Miscellaneous lampholders*

IEC 60901:1987, *Single-capped fluorescent lamps – Safety and performance requirements*

Amendment 1 (1989), Amendment 2 (1992)

IEC 60920:1990, *Ballasts for tubular fluorescent lamps – General and safety requirements*

Amendment 1 (1993), Amendment 2 (1995)

IEC 60922:1989, *Ballasts for discharge lamps (excluding tubular fluorescent lamps) – General and safety requirements*

Amendment 2 (1992)

IEC 60924:1990, *D.C. supplied electronic ballasts for tubular fluorescent lamps – General and safety requirements*

Amendment 1 (1993)

IEC 60972:1989, *Classification and interpretation of new lighting products*

Amendment 1 (1991)

IEC 60989:1991, *Separating transformers, autotransformers, variable transformers and reactors*

IEC 60990:1990, *Methods of measurement of touch-current and protective conductor current*

IEC 61032:1990, *Test probes to verify protection by enclosures*

IEC 61046:1993, *D.C. or a.c. supplied electronic step-down convertors for filament lamps – General and safety requirements*

Amendment 1 (1995)

IEC 61058-1:1990, *Switches for appliances – Part 1: General requirements*

Amendment 1 (1993), Amendment 2 (1994)

IEC 61167:1992, *Metal halide lamps*

Amendment 1 (1995)

IEC 61184:1993, *Bayonet lampholders*

IEC 61195:1993, *Double-capped fluorescent lamps – Safety specifications*

IEC 61199:1993, *Single-capped fluorescent lamps – Safety specifications*



Annex T
(normative)

**Requirements for the identification of a family or range of luminaires
for type testing**

T.1 General

When selecting type test sample(s) from a range of luminaires of similar construction for type test verification, the luminaire(s) chosen shall be those which represent the most unfavourable combination of components and housing.

T.2 Range or family of luminaires

A range or family of luminaires of similar construction shall be considered to be:

- a) in compliance with the same Part 2 of the applicable standard;
- b) equipped with lamps of the same nature as;
 - 1) tungsten including tungsten halogen lamps;
 - 2) fluorescent lamps;
 - 3) discharge lamps.
- c) within the same class of protection against electrical shocks;
- d) within the same IP classification.

Compliance shall be established by conformity with T.2.

NOTE – Each range of luminaires requires a case-by-case consideration. The range of luminaires should be manufactured by the same manufacturer, under the same quality assurance system. The type variants of the range should be essentially identical in respect of materials used, components and technology applied. Type test sample(s) should be selected with the cooperation of the manufacturer and the testing station.

2

ISO 75-2:1993, *Plastics – Determination of temperature of deflection under load – Part 2: Plastics and ebonite*

ISO 1891:1979, *Bolts, screws, nuts and accessories – Terminology and nomenclature*

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

0.3 General requirements

Luminaires shall be so designed and constructed that in normal use they function safely and cause no danger to persons or surroundings. In general, compliance is checked by carrying out all the tests specified.

0.3.1 A luminaire shall comply with a section of part 2. If, however, an appropriate section of part 2 does not exist for a particular luminaire or group of luminaires, the nearest applicable section of part 2 may be used as a guide to the requirements and tests.

Where the design of a luminaire is such that two or more sections of part 2 are applicable, the luminaire shall comply with both or all of the appropriate sections.

0.3.2 Semi-luminaires should be regarded as luminaires for test purposes.

0.4 General test requirements and verification

0.4.1 Tests according to this standard are type tests. For the definition of a "type test", see section 1 of this part 1.

NOTE – The requirements and tolerances permitted by this standard are related to testing of a type test sample submitted for that purpose. Compliance of the type test sample does not ensure compliance of the whole production of a manufacturer. Compliance for production is the responsibility of the manufacturer and may include routine tests and quality assurance in addition to type testing.

0.4.2 Except where otherwise specified in the sections of part 1 or part 2, luminaires shall be tested in an ambient temperature of between 10 °C and 30 °C. Luminaires shall be tested as delivered, and installed as in normal use, having regard to the manufacturer's installation instructions. The lamp (or lamps) is (are) not included except where essential for the test.

Luminaires cannot be regarded as meeting the requirements of this part 1 unless all internal wiring is complete.

In general, the tests are made on a single sample luminaire or, where a range of similar luminaires is involved, on a single luminaire of each rated wattage in the range or on a representative selection from the range as agreed with the manufacturer (see annex T). This selection shall include the luminaire, together with any attachments, which represents the most unfavourable combination from a testing point of view.

Each sample luminaire shall comply with all the relevant tests. In order to reduce the time of testing and to allow for any tests which may be destructive, the manufacturer may submit additional luminaires or parts of luminaires provided that these are of the same materials and design as the original luminaire and that the results of the test are the same as if carried out on an identical luminaire. Where the test for compliance is shown as being "by inspection" this shall include any necessary handling.

Annex S
(normative)

Schedule of amended clauses containing more serious/critical requirements which require products to be retested

2

NOTE – Clauses marked 'R' and scheduled in this annex will be included in future amendments/editions.

For track-mounted luminaires the manufacturer shall provide, together with the luminaire, a sample of the appropriate track, connector and adaptors for the luminaire to be connected.

Combination luminaires are tested for safety requirements with that assemblage of parts which gives the most unfavourable result.

Certain parts of luminaires, such as joints, raising and lowering devices, may be tested separately provided that the design of these parts is such that their performance is not dependent upon the other parts of the luminaires.

Luminaires intended to be used with non-detachable flexible cables or cords are tested with the flexible cable or cord connected to the luminaire.

For luminaires intended to be used with but not normally supplied with a shade, the luminaire manufacturer shall provide a shade, typical of the type that might be used with the luminaire.

0.4.3 Verification and tests

Luminaires for testing to the requirements of this standard may have earlier test reports updated in accordance with this edition by submitting a new sample for test together with the previous test reports.

Full type testing need not generally be necessary and the product and the previous test results shall be reviewed only against any amended clauses marked 'R' and scheduled in annex S.

NOTE – Clauses marked 'R' and scheduled in annex S will be included in future amendments/editions.

0.5 Components of luminaires

0.5.1 Components, other than integral components, shall comply with the requirements of the relevant IEC standards, if any.

Components which comply with the requirements of the relevant IEC standard and are marked with individual ratings are checked to establish that they suit the conditions which may occur in use. Aspects of use not covered by the respective standard shall require them to satisfy the additional relevant requirements of this standard.

Compliance is checked by inspection and the relevant tests.

Integral components shall comply as far as is reasonable with the IEC component standards, as part of the luminaire.

NOTE – This does not imply that components need to be separately tested before approval of the luminaire.

Internal wiring of a luminaire shall comply with the requirements in 5.3.

NOTE – This does not exclude the use of standardized cables.

0.5.2 Components complying with the requirements of their own standard and used in accordance with their intended use, shall only be tested to the requirements of this standard where there are no requirements in the component standard (covering the requirement heading of this standard).

NOTE – A valid test report should be considered adequate to show compliance.

Annex R
(informative)

Bibliography

The following informative documents refer to publications that provide information or guidance and are either not quoted in the text of this part or are quoted in Part 2 of this standard. At the time of publication the editions indicated were valid and readers are encouraged to investigate the possibility of applying the most recent editions.

IEC 60079: *Electrical apparatus for explosive gas atmospheres*

IEC 60081:1984, *Tubular fluorescent lamps for general lighting service*

IEC 60249: *Base materials for printed circuits*

IEC 60364: *Electrical installations of buildings*

IEC 60364-7-702:1983, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 702: Swimming pools*

IEC 60682:1980, *Standard method of measuring the pinch temperature of quartz-tungsten-halogen lamps*

IEC 60695-2-1/1:1994, *Fire hazard testing – Part 2: Test methods – Section 1/sheet 1: Glow-wire end-product test and guidance*

IEC 60750:1983, *Item designation in electrotechnology*

IEC 60811-3-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section 1: Pressure test at high temperature – Tests for resistance to cracking*

IEC 60921:1988, *Ballasts for tubular fluorescent lamps – Performance requirements*

IEC 60923:1988, *Ballasts for discharge lamps (excluding tubular fluorescent lamps) – Performance requirements*

IEC 60925:1989, *D.C. supplied electronic ballasts for tubular fluorescent lamps – Performance requirements*

Lampholders and starterholders shall additionally comply with the gauging and interchangeability requirements of the appropriate IEC component standard where applicable after building into the luminaire.

0.5.3 Components for which no appropriate IEC standard exists shall satisfy the relevant requirements of this luminaire standard as part of the luminaire. Lampholders and starterholders shall additionally comply with the gauging and interchangeability requirements of the appropriate IEC component standard where applicable.

NOTE – Examples of components are lampholders, switches, transformers, ballasts, flexible cables and cords and plugs.

0.5.4 Compliance with this standard can only be assured if protective shields of identical specification are used.

0.6 List of sections of part 2

1. Fixed general purpose luminaires.
2. Recessed luminaires.
3. Luminaires for road and street lighting.
4. Portable general purpose luminaires.
5. Floodlights.
6. Luminaires with built-in transformers for tungsten filament lamps.
7. Portable luminaires for garden use.
8. Handlamps.
9. Photo and film luminaires (non-professional).
10. Portable child-appealing luminaires.
11. Not used at present.
12. Not used at present.
13. Not used at present.
14. Not used at present.
15. Not used at present.
16. Not used at present.
17. Luminaires for stage lighting, television and film studios (outdoor and indoor).
18. Luminaires for swimming-pools and similar applications.
19. Air-handling luminaires (safety requirements).
20. Lighting chains.
21. Not used at present.
22. Luminaires for emergency lighting.
23. Extra low voltage lighting systems for filament lamps.
24. Luminaires with limited surface temperatures.
25. Luminaires for use in clinical areas of hospitals and health care buildings.

Table Q.1 – Minimum values for electrical tests

Test	Class of luminaire and compliance			
	Class I luminaires	Class II luminaires metal encased	Class III metal encased with supply above 25 V	Class II and class III luminaires insulation encased
FUNCTION TEST/CIRCUIT CONTINUITY (with lamp or simulation lamp)	Generally at normal operating voltage			
EARTH CONTINUITY Applied between earthing terminal on luminaire and the most accessible parts likely to become live. . . Adjustable luminaires placed in most onerous position.	Maximum resistance 0,50 Ω Measured by passing a minimum current of 10 A at between 6 V and 12 V for at least 1 s.	Not applicable		
a) ELECTRIC STRENGTH OR b) INSULATION RESISTANCE Measured between the live and neutral terminals linked together and the earth terminal or between the conductors of class II and class III luminaires and the metal enclosure	Maximum breakdown current 5 mA. Measured by applying a minimum voltage of 1,5 kV a.c. for a minimum of 1 s or 1,5 $\sqrt{2}$ d.c. kV OR Minimum resistance 2 M.Ω Measured by applying 500 V d.c. for 1 s	Maximum breakdown current 5 mA. Measured by applying a minimum voltage of 1,5 kV a.c. for a minimum of 1 s or 1,5 $\sqrt{2}$ d.c. kV OR Minimum resistance 2 M.Ω Measured by applying 500 V d.c. for 1 s	Maximum breakdown current 5 mA. Measured by applying a minimum voltage of 400 V a.c. for a minimum of 1 s or 400 $\sqrt{2}$ d.c. V OR Minimum resistance 2 M.Ω Measured by applying 100 V d.c. for 1 s	Not applicable
POLARITY Tested at incoming terminals	Where necessary for correct functioning of luminaire	Not applicable		

SECTION 1: DEFINITIONS

1.1 General

This section gives general definitions applicable to luminaires.



1.2 Definitions

For the purpose of all sections of this part 1, the following definitions apply; other definitions related to lamps are to be found in the relevant lamp standards.

Where the terms "voltage" and "current" are used, they imply the r.m.s. values unless otherwise stated.

1.2.1 Luminaire

Apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and where necessary circuit auxiliaries together with the means for connecting them to the supply.

NOTE – A luminaire with integral non-replaceable lamps is regarded as a luminaire except that the tests are not applied to the integral lamp or integral self ballasted lamp.

1.2.2 Main part (of luminaire)

That which is fixed to the mounting surface or is directly suspended from it or standing on it (it may or may not carry the lamps, lampholders and auxiliary gear).

NOTE – In luminaires for tungsten filament lamps, the part carrying the lampholder is normally the main part.

1.2.3 Ordinary luminaire

A luminaire providing protection against accidental contact with live parts but without any other special protection against dust, solid objects or moisture.

1.2.4 General purpose luminaire

A luminaire which is not designed for a special purpose.

NOTE – Examples of general purpose luminaires include pendants, some spotlights and certain fixed luminaires for surface or recessed mounting. Examples of special purpose luminaires are those for rough usage, photo and film applications and swimming-pools.

1.2.5 Adjustable luminaire

A luminaire, the main part of which can be turned or moved by means of joints, raising and lowering devices, telescopic tubes or similar devices.

NOTE – An adjustable luminaire may be fixed or portable.

1.2.6 Basic luminaire

The smallest number of assembled parts that can satisfy the requirements of any of the sections of part 2 of IEC 60598.

Annex Q (informative)

Conformity testing during manufacture

General

The tests specified in this annex should be carried out by the manufacturer on each luminaire after production and are intended to reveal, as far as safety is concerned, unacceptable variations in material and manufacture. These tests are intended not to impair the properties and the reliability of the luminaire, and they vary from certain type tests in the standard by the lower voltages utilised.

More tests may have to be conducted to ensure that every luminaire conforms with the sample approved under the type test to this specification. The manufacturer should determine these tests from his experience.

Within the framework of the quality manual, the manufacturer may vary this test procedure and its values to one better suited to his production arrangements, and may make certain tests at an appropriate stage during manufacture, provided it can be proved that at least the same degree of safety is ensured as specified in this annex.

Testing

Electrical tests should be conducted on 100 % of all units produced as scheduled in table Q.1. Failed products are to be quarantined for scrap or rebuild.

Visual inspection should take place to ensure that:

- a) all specified labels are securely in place;
- b) manufacturers' instructions are placed within the luminaire, where necessary;
- c) luminaire is complete, and that mechanical check against a checklist for the product has been carried out.

All products passing these tests should be suitably identified.

1.2.7 Combination luminaire

A luminaire consisting of a basic luminaire in combination with one or more parts which may be replaced by other parts, or used in a different combination with other parts and changed either by hand or with the use of tools.

1.2.8 Fixed luminaire

A luminaire which cannot easily be moved from one place to another, either because the fixing is such that the luminaire can only be removed with the aid of a tool, or because it is intended for use out of easy reach.

NOTE – In general, fixed luminaires are designed for permanent connection to the supply, but connection may also be made by means of a plug or similar device.

Examples of luminaires intended for use out of easy reach are pendants and luminaires designed for fixing to a ceiling.

1.2.9 Portable luminaire

A luminaire which, in normal use, can be moved from one place to another while connected to the supply.

NOTE – Luminaires for wall mounting provided with a non-detachable flexible cable or cord for connection to a plug and luminaires which may be fixed to their support by means of a wing screw, a clip or a hook so that they can easily be removed from their support by hand, are considered to be portable luminaires.

1.2.10 Recessed luminaire

A luminaire intended by the manufacturer to be fully or partly recessed into a mounting surface.

NOTE – The term applies both to luminaires for operation in enclosed cavities and to luminaires for mounting through a surface such as a suspended ceiling.

1.2.11 Rated voltage

The supply voltage or voltages assigned to the luminaire by the manufacturer.

1.2.12 Supply current

The current at the supply terminals when the luminaire has stabilized in normal use at the rated voltage and frequency.

1.2.13 Rated wattage

The number and rated wattage of the lamps for which the luminaire is designed.

1.2.14 Non-detachable flexible cable or cord

A flexible cable or cord which can only be removed from the luminaire with the aid of a tool.

NOTE – Luminaires may be provided with non-detachable flexible cables and cords or designed for use with non-detachable flexible cables or cords e.g. types X, Y or Z attachments.

- c) Choose a protective shield that has a transmission throughout the region 200 nm-315 nm in accordance with the calculated value T .

Example

$$P_{\text{eff}}^* = 50 \text{ mW/klm}$$

$$t_s = 8 \text{ h per day}$$

$$E_a = 2\,000 \text{ lx}$$

$T < 0,01$ The transmission of the protective shield should be lower than 1 % throughout the actinic region of the spectrum.

The procedure described in a), b) and c) will ensure the interchangeability of metal halide lamps and also in the case of different metal halide additives, provided that the maximum P_{eff}^* value of a lamp is observed.

P.3 Procedure B

In the case of doubt, direct measurement of the UV radiation from a luminaire shall be performed in order to check the suitability of the shield and the influence of reflector materials having significant differences in reflectance for UV and visible radiation, for example when non-metallic finishes are used.

The result of the direct measurement for a luminaire E_{eff}^* shall comply to the following requirement:

$$E_{\text{eff}}^* \leq \frac{8,3 \cdot 10^3}{t_s \cdot E_a}$$

where

E_{eff}^* is the measured specific effective irradiance, defined as the effective irradiance of the UV radiation E_{eff} related to the illuminance.

$$\text{The dimension of } E_{\text{eff}}^* \text{ is: } \frac{\text{mW}}{\text{m}^2} / \text{klx}$$

1.2.15 Live part

A conductive part which may cause an electric shock in normal use. The neutral conductor shall, however, be regarded as a live part.

NOTE – The test to determine whether or not a conductive part is a live part which may cause an electric shock is given in annex A.

1.2.16 Basic insulation

Insulation applied to live parts to provide basic protection against electric shock.

NOTE – Basic insulation does not necessarily include insulation used exclusively for functional purposes.

1.2.17 Supplementary insulation

Independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation.

1.2.18 Double insulation

Insulation comprising both basic insulation and supplementary insulation.

1.2.19 Reinforced insulation

A single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation.

NOTE – The term "insulation system" does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

1.2.20 (Not used at present.)

1.2.21 Class 0 luminaire (applicable to ordinary luminaires only)

A luminaire in which protection against electric shock relies upon basic insulation. This implies that there are no means for the connection of accessible conductive parts, if any, to the protective conductor in the fixed wiring of the installation, reliance in the event of a failure of the basic insulation being placed on the environment.

NOTE 1 – Class 0 luminaires may have either an enclosure of insulating material which forms a part or the whole of the basic insulation or a metal enclosure which is separated from live parts by at least basic insulation.

NOTE 2 – If a luminaire with an enclosure of insulating material has provision for earthing internal parts, it is class 1.

NOTE 3 – Class 0 luminaires may have parts with double insulation or reinforced insulation.

Annex P (normative)

Requirements for the protective shield to be fitted to luminaires using metal halide lamps for protective measures against UV radiation

P.1 Introduction

Luminaires, intended for use with metal halide lamps for which protective measures regarding emitted UV radiation are required, shall be fitted with an adequate protective shield. The following procedure shall be used for the selection of the shield:

P.2 Procedure A

- a) Establish the maximum P_{eff}^* value for the lamp from information made available by the lamp manufacturer.

NOTE 1 – P_{eff}^* stands for specific effective power of an unshielded lamp and is defined as the effective power of the UV radiation P_{eff}^* related to the luminous flux. For practical reasons its dimension is: mW/klm.

NOTE 2 – P_{eff}^* is obtained by weighting the spectral power distribution of the lamp with the action spectrum published by the ACGIH (for reference see: Threshold Limit Values and Biological Exposure Indices, ACGIH, Cincinnati, Ohio) and endorsed by the WHO (World Health Organization).

NOTE 3 – The range of the action spectrum will be extended from 200 nm – 315 nm to 200 nm – 400 nm; however, for the purpose of this estimation the weighting between 200 nm and 315 nm should suffice for white-light sources for general lighting purposes.

- b) Estimate the requirements for the protective shield regarding the UV radiation in terms of its transmission characteristics T for the practical situation as follows, taking into account the expected application of the luminaire:

$$T \leq \frac{DEL}{3,6 \cdot P_{\text{eff}}^* \cdot t_s} \times \frac{1000}{E_a}$$

where

T is the maximum transmission at operating temperature for any wavelength between 200 nm and 315 nm;

DEL is the Daily Exposure Limit (= 30 J/m²);

t_s is the expected maximum exposure time per day in hours;

E_a is the expected maximum illuminance in lux.

The equation can be simplified to be:

$$T < \frac{8,3 \cdot 10^3}{P_{\text{eff}}^* \cdot t_s \cdot E_a}$$

NOTE – The formula is valid under the assumption that common reflector materials, for example anodized aluminium have the same reflectivity for UV radiation as for the visible radiation, which is the case within the necessary accuracy.

1.2.22 Class I luminaire

A luminaire in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

NOTE 1 – For a luminaire intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

NOTE 2 – Where a luminaire designed as class I is fitted with a two-core flexible cord or cable with a plug which cannot be introduced into a socket-outlet with earthing contact (formerly class 0I), the protection is then equivalent to that of class 0, but the earthing provisions of the luminaire in all other respects should fully comply with the requirements of class I.

NOTE 3 – Class I luminaires may have parts with double insulation or reinforced insulation.

1.2.23 Class II luminaire

A luminaire in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as double insulation or reinforced insulation are provided, there being no provision for protective earthing or reliance upon installation conditions.

NOTE 1 – Such a luminaire may be of one of the following types:

- a) A luminaire having a durable and substantially continuous enclosure of insulating material which envelopes all metal parts with the exception of small parts such as nameplates, screws and rivets which are isolated from live parts by insulation at least equivalent to reinforced insulation. Such a luminaire is called an insulation encased class II luminaire.
- b) A luminaire having a substantially continuous enclosure of metal, in which double insulation is used throughout, except for those parts where reinforced insulation is used because the application of double insulation is manifestly impracticable. Such a luminaire is called a metal-encased class II luminaire.
- c) A luminaire which is a combination of types a) and b) above.

NOTE 2 – The enclosure of an insulation-encased class II luminaire may form a part or the whole of the supplementary insulation or the reinforced insulation.

NOTE 3 – If earthing is provided to assist starting, but is not connected to an accessible metal part, the luminaire may still be deemed to be of class II. Lamp caps, shells and starting stripes on lamps are not regarded as accessible metal parts unless the tests of annex A show them to be live parts.



NOTE 4 – If a luminaire with double insulation and/or reinforced insulation throughout has an earthing terminal or an earthing contact, it is class I construction. However, a fixed class II luminaire intended for looping-in may have an internal terminal for maintaining the electrical continuity of an earthing conductor not terminating in the luminaire, provided that the terminal is insulated from accessible metal parts by class II insulation.



NOTE 5 – Class II luminaires may have parts in which protection against electric shock relies on operation at safety extra-low voltage (SELV).


1.2.24 Class III luminaire

A luminaire in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV are not generated.

NOTE – A class III luminaire should not be provided with means for protective earthing.

Thermally protected ballasts are marked with the symbol  or . The dots are replaced by the rated maximum case temperature in °C when the protector opens the circuit.

Thermally protected ballasts with the symbol  or  with values up to and including 130 °C provide complete protection of the luminaire mounting surface without any additional measures in the luminaire being necessary. This implies compliance on a time related basis with the maximum case temperature permitted under abnormal conditions i.e. 130 °C, and, under failed ballast conditions, with a mounting surface temperature not exceeding 180 °C.

Thermally protected ballasts with a symbol  with values above 130 °C have to be checked in combination with the luminaire as specified for luminaires with a thermal protector external to the ballast.

Luminaires with a thermal protector external to the ballast, and luminaires with thermally protected ballasts with a marked value above 130 °C, are checked by measuring the temperature of the luminaire mounting surface until the thermal protector opens the circuit. During the test the temperature of the luminaire mounting surface is recorded and shall not exceed, the maximum temperature permitted under abnormal conditions, i.e. 130 °C nor on time related basis up to the maximum temperature under failed ballast conditions (see table N.1).

Table N.1 – Thermal protection operation

Maximum temperature of the mounting surface °C	Maximum time for attainment of maximum temperature from 135 °C Minutes
Over 180	0
Between 175 and 180	15
Between 170 and 175	20
Between 165 and 170	25
Between 160 and 165	30
Between 155 and 160	40
Between 150 and 155	50
Between 145 and 150	60
Between 140 and 145	90
Between 135 and 140	120

1.2.25 Rated maximum ambient temperature (t_a)

The temperature assigned to a luminaire by the manufacturer to indicate the highest sustained temperature in which the luminaire may be operated under normal conditions.

NOTE – This does not preclude temporary operation at a temperature not exceeding ($t_a + 10$) °C.

1.2.26 Rated maximum operating temperature of the case of a ballast, capacitor or starting device (t_c)

The highest permissible temperature which may occur on the outer surface (at the indicated place if marked) of the component under normal operating conditions at the rated voltage or maximum of the rated voltage range.

1.2.27 Rated maximum operating temperature of a winding (t_w)

The operating temperature of a ballast winding which gives an expectancy of 10 years' continuous service (at that temperature).

1.2.28 Ballast

A unit inserted between the supply and one or more discharge lamps which by means of inductance, capacitance or resistance, single or in combination, serves mainly to limit the current of the lamp(s) to the required value.

It may also include means for transforming from the supply voltage and arrangements which help to provide starting voltage and preheating current, prevent cold starting, reduce stroboscopic effect, correct the power factor and suppress radio interference.

1.2.29 Independent lamp control gear

Lamp control gear consisting of one or more separate elements so designed that it, or they, can be mounted separately outside a luminaire with protection according to the marking on the lamp control gear and without any additional enclosure.

1.2.30 Built-in lamp control gear

Lamp control gear designed to be built into a luminaire and not intended to be mounted outside a luminaire without special precautions.

1.2.31 Integral lampholder

A part of a luminaire which supports the lamp and provides electrical contact with it and which is designed as part of the luminaire.

1.2.32 Ballast compartment

That part of the luminaire in which the ballast is intended to be mounted.

1.2.33 Translucent cover

The light-transmitting parts of the luminaire which may also protect the lamps and other component parts. This term includes diffusers, lens panels and similar light-control elements.

N.2.1 Spacing

The ballast or transformer is spaced from the mounting surface by a minimum distance of either:

- a) 10 mm, including a minimum of 3 mm air space between the outer surface of the luminaire case and the mounting surface of the luminaire, and a minimum of 3 mm air space between the ballast or transformer and the inner surface of the luminaire case.

If there is no ballast or transformer case, the distance of 10 mm shall apply from the active part for example winding of the ballast.

The luminaire case should be substantially continuous in the protected area of the ballast/transformer permitting a separation of less than 35 mm between the active part of the ballast/transformer and the mounting surface, otherwise the requirement of item b) applies. There are no requirements with regard to the substance of the luminaire case material, which can be insulating material complying with clause 4.15.

If there is no luminaire case between ballast or transformer and the luminaire mounting surface, then the distance between the two should be at least 35 mm.

- b) 35 mm. The spacing of 35 mm is primarily to take account of stirrup mounted luminaires where the ballast/transformer to mounting surface distance is often much greater than 10 mm.

N.2.2 Temperature measurements of mounting surface under abnormal or failed ballast conditions

Temperature measurements can be carried out to verify that the luminaire mounting surface will not reach too high temperatures whether under abnormal conditions or under failed ballast conditions.

These requirements and tests are based on the assumption that during failure of the ballast or transformer, for example owing to short-circuited windings, the ballast winding temperature will not exceed 350 °C for a duration of more than 15 min, and that the related temperature of the mounting surface will then not exceed 180 °C for a duration of more than 15 min.

Similarly, during abnormal ballast conditions the temperature of the mounting surface shall not exceed 130 °C. At ambient temperature and at 1,1 times the supply voltage, the temperature of the windings and mounting surface are measured and plotted on a graph; then a straight line is drawn through these points. The extrapolation of this straight line shall not reach a point representing a mounting surface temperature of 180 °C at a winding temperature of 350 °C (see figure 9).

For normally flammable surfaces, the limiting temperatures for the mounting surface related to the ignition temperature of wood as a function of time (see figure 27).

N.3 Thermal protectors

Thermal protectors can be part of the ballast or external to the ballast.

- Requirements for thermally protected ballasts are covered by the relevant ballast standard.

1.2.34 Fixed wiring

A cable which is part of the fixed installation to which the luminaire is connected.

NOTE – Fixed wiring may be brought into the luminaire and connected to terminals, including terminals of lampholders, switches and the like.

1.2.35 Appliance coupler

A means enabling a flexible cable to be connected at will to the luminaire. It consists of two parts: a connector provided with contact tubes which is the part integral with or designed to be attached to the flexible cable connected to the supply; an appliance inlet, provided with contact pins, which is the part incorporated in or fixed to the luminaire.

1.2.36 External wiring

Wiring generally outside the luminaire but delivered with it.

NOTE 1 – External wiring may be used for connecting the luminaire to the supply, to other luminaires, or to any external ballast.

NOTE 2 – External wiring is not necessarily outside the luminaire for its full length.

1.2.37 Internal wiring

Wiring generally inside the luminaire and delivered with it, which forms the connection between terminals for external wiring or supply cables and terminals of lampholders, switches and similar components.

NOTE – Internal wiring is not necessarily inside the luminaire for its full length.

1.2.38 Normally flammable material

Material having an ignition temperature of at least 200 °C and which will not deform or weaken at this temperature.

Examples: Wood and materials based on wood of more than 2 mm thickness.

NOTE – The ignition temperature and the resistance of normally flammable materials to deformation or weakening are based on widely accepted values determined during a test period of 15 min.

1.2.39 Readily flammable material

Material which cannot be classified as either normally flammable or non-combustible.

Examples: Wood fibre and materials based on wood of up to 2 mm thickness.


1.2.40 Non-combustible material


Material incapable of supporting combustion.

NOTE – For the purpose of this standard, materials such as metal, plaster and concrete are regarded as non-combustible materials.

Annex N (informative)

Explanation to luminaire marking

When a luminaire is provided with the symbol , this denotes that it is suitable for direct mounting on normally flammable surfaces. Normally flammable surfaces are defined to include building materials such as wood, and materials based on wood, of more than 2 mm thickness.

Originally the relevant luminaire requirements applied only to luminaires incorporating a ballast or transformer. Since the use of the symbol , has received wide acceptance over the last ten years, the use of the symbol is extended to cover all luminaires, including luminaires for incandescent lamps.

The original  marking requirements were based on two distinct characteristics:

- a) Protection against flames, which were expected to be possible at the end of ballast life, (see 4.16.1 of IEC 60598-1 (1986)).
- b) Protection against heat produced by the ballast both during abnormal condition (short-circuited starter) as well as due to accidental failure (see 4.16.2 of IEC 60598-1 (1986)).

N.1 Protection against flame

Practical experience over the last ten years has shown no evidence in regard to the supposed emission of flames from ballast windings at the end of ballast life.

Other components, such as capacitors, are subjected to a destruction test to verify that these components will fail in a safe way.

Further bearing in mind that extinguishing properties of flammable luminaire materials are tested in accordance with clause 4.15, it was concluded that there was no evidence which justified to keep the requirement for intervening material between windings and mounting surface. This requirement was, therefore, deleted from the second edition of IEC 60598-1.

N.2 Protection against heat

To safeguard the mounting surface against excessive heat, three equivalent protection options are given by the standard, at the choice of the manufacturer:

- spacing;
- temperature measurement;
- thermal protector.

1.2.41 Flammable material

Material which does not comply with the glow-wire test requirements of 13.3.2.

1.2.42 Safety extra-low voltage (SELV)

A voltage which does not exceed 50 V a.c. r.m.s. (see note 1) between conductors, or between any conductor and earth, in a circuit which is isolated from the supply mains by means such as a safety isolating transformer or converter with separate windings.

NOTE 1 – The d.c. value is under consideration.

NOTE 2 – The voltage limit should not be exceeded either at full load or no-load, but it is assumed, for the purpose of this definition, that any transformer or converter is operated at its rated supply voltage.

1.2.43 Working voltage

The highest r.m.s. voltage which may occur across any insulation at rated supply volts, transients being neglected, in open-circuit conditions or during normal operation.

1.2.44 Type test

A test or series of tests made on a type test sample, for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard.

1.2.45 Type test sample

A sample consisting of one or more similar units submitted by the manufacturer or the responsible vendor for the purpose of a type test.

1.2.46 By hand

Not requiring the use of a tool, a coin or other object.

1.2.47 Terminal

That part of a luminaire or component which is necessary to make electrical connection to a conductor. See sections 14 and 15.

1.2.48 Looping-in (feed through)

A system of mains supply connection to two or more luminaires where each supply conductor is taken into and out of the same terminal.

NOTE – A supply conductor may be cut to facilitate connections to a terminal. (See figure 20.)

1.2.49 Through wiring

Wiring which passes through the luminaire intended for interconnection of a row of luminaires.

NOTE 1 – Some countries do not permit joints in through wiring.

NOTE 2 – The luminaire may or may not be electrically connected to the through wiring (see figure 20).



Annex M
(informative)

**Conversion guide for table IX of IEC 60598-1 (2nd edition) to table 11.1 –
Determination of creepage distances and clearances**

Creepage distances and clearances in millimetres between	Luminaires of classes 0 and I	Luminaires of class II	Luminaires of class III
Maximum working voltage (not exceeding) (V)	24 250 500 1 000	24 250 500	50
(1) Live parts of different polarity	Basic insulation Creepage or clearance PTI \geq or $<$ 600	Basic insulation Creepage or clearance PTI \geq or $<$ 600	Basic insulation Creepage or clearance PTI \geq or $<$ 600
(2) Live parts and accessible metal parts, also between live parts and the outer accessible surface of insulating parts	Basic insulation Creepage or clearance PTI \geq or $<$ 600	Reinforced insulation Creepage or clearance PTI \geq or $<$ 600	Basic insulation Creepage or clearance PTI \geq or $<$ 600
(3) Parts which may become live due to the breakdown of functional * insulation in luminaires of class II and accessible metal parts		Supplementary insulation Creepage or clearance PTI \geq or $<$ 600	
(4) The outer surface of a flexible cord or cable and an accessible metal part to which it is secured by means of a cord grip, cable carrier or clip of insulating material		Supplementary insulation Creepage or clearance PTI \geq or $<$ 600	
(5) Not used			
(6) Live parts and other metal parts, between them and the supporting surface (ceiling, wall, table, etc.) or between live parts and the supporting surface where there is no intervening metal	Supplementary insulation	Reinforced insulation	Basic insulation
* In this context functional insulation is understood to be basic insulation.			

The presence of informative annex M is for guidance only and should not be used as a compliance clause.

1.2.50 Starting device

An apparatus that, by itself or in combination with other components in the circuit, provides the appropriate electrical conditions to start a discharge type of lamp.

1.2.51 Starter

A starting device, usually for fluorescent lamps, that provides for the necessary preheating of the electrodes and in combination with the series impedance of the ballast, causes a surge in the voltage applied to the lamp.

1.2.52 Ignitor

A starting device that generates voltage pulses to start a discharge lamp and that does not provide for preheating of electrodes.

1.2.53 Terminal block

An assembly of one or more terminals in or on a housing or body of insulating material to facilitate interconnection between conductors.

1.2.54 Rough service luminaire

A luminaire designed to withstand severe mechanical handling.

NOTE 1 – The luminaire may:

- be permanently fixed, or
- be temporarily fixed on a construction or stand, or
- incorporate an integral stand or handle.

NOTE 2 – Such luminaires are for use where normally rough circumstances occur, or where temporary lighting is required, for example on building sites, engineering workshops and similar applications.

1.2.55 Electro-mechanical contact system

A connection system within a luminaire by which the main part carrying the lampholder is electrically and mechanically connected to the base plate or suspension device. It may or may not incorporate an adjusting device.

The system may be dedicated to a specific luminaire design or may provide for connection of a variety of luminaire types.

Figure IS 03 describes an electro-mechanical contact system as defined in 1.2.55. As such the requirements of 4.11.6 and 7.2.1 apply.

Because, in the situation described, the base and gear tray are unique and non-interchangeable, the base plate does not require marking with the rated current of the electrical connection, as specified in 3.2.

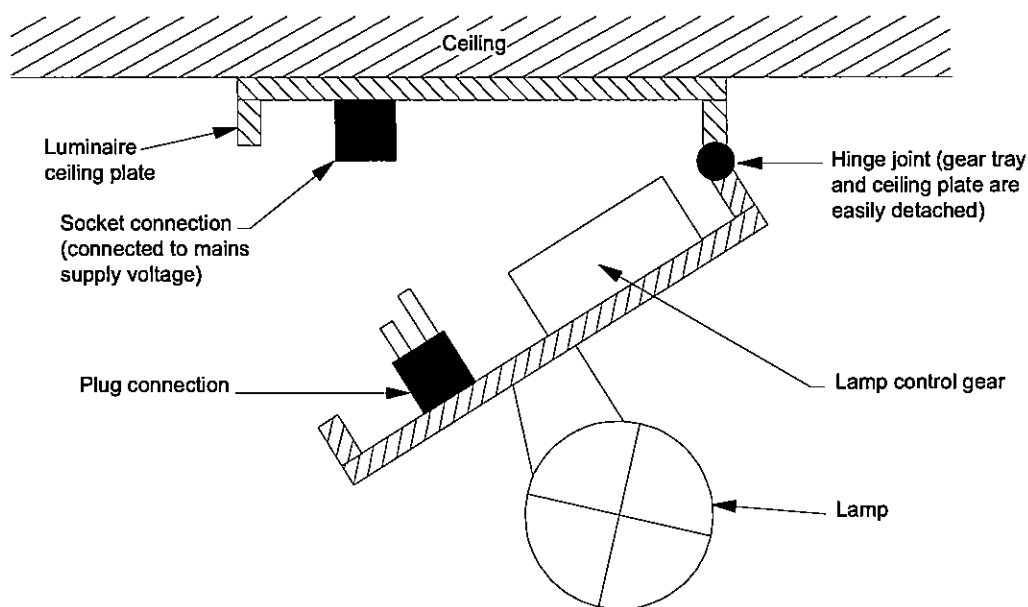
L.6 Reflector design

The materials used in the reflection of light also reflect the infra-red spectrum in a very similar manner. Thus an optically efficient reflector will also reflect most IR radiation from the luminaire thus reducing overheating effects.

It is very important that hot spots are not concentrated on parts of the luminaire and lamp where they can affect performance or reduce the durability of materials. In particular, it is recommended that reflected light (and IR) is not focused back onto the lamp wall, lamp filament or arc tube. This will affect the life of the lamp and in extreme cases may cause failure of the lamp envelope or arc tube.

The maximum operating temperatures given in the lamp standards should not be exceeded (see normative references in 0.2).

2



IS

IEC 871/97

Figure IS 03 – Electro-mechanical contact system with plug/socket connection

1.2.56 Extra-low voltage d.c. supplied fluorescent luminaire

A luminaire for operation from a battery voltage not exceeding 48 V d.c. nominal and incorporating a d.c./a.c. inverter using transistors for supplying power to one or more fluorescent lamps.

NOTE 1 – Extra-low voltage d.c. supplied fluorescent luminaires may generate internal voltages higher than the supply power, and thus not belong to class III. A risk of electric shock should be taken into account and guarded against with such luminaires.

NOTE 2 – The value of 48 V is under consideration.

1.2.57 Mounting surface

The part of any building, furniture or other structure which a luminaire may in any way be attached to, suspended from, stood on or placed upon in normal use and which will or is intended to support the luminaire.

1.2.58 Integral component

A component which forms a non-replaceable part of a luminaire and which cannot be tested separately from the luminaire.

1.2.59 Self-ballasted lamps

A unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source.

NOTE 1 – The light source component of a self-ballasted lamp is not replaceable.

NOTE 2 – The ballast component is part of the self-ballasted lamp; it is not part of the luminaire. It is discarded at the end of the life of the unit.

NOTE 3 – For test purposes, self-ballasted lamp units should be regarded as conventional lamps.

NOTE 4 – For examples and further information, see IEC 60972.

- d) cast iron or malleable iron at least 3,2 mm thick, coated with a minimum of 0,05 mm zinc on the outside surfaces and a visible coating of such material on the inside surface;
- e) sheet steel, zinc-coated, average coating thickness 0,02 mm;
- f) polymeric materials, see under clause L.1.

Metal components in contact with one another should be made from metals which lie close to each other in the galvanic series to avoid electrolytic corrosion. For example, brass or other copper alloys should not be used in contact with aluminium or aluminium alloys; contact between either of these groups of materials and stainless steel is much more acceptable.

Plastic materials used outdoors should usually be chosen from those whose characteristics do not change significantly during long periods of service, e.g. acrylics.

Cellulose materials are in general unsatisfactory for conditions of high humidity, either indoors or outdoors, and others including polystyrene, while suitable for use indoors, are liable to severe deterioration if used outdoors owing to the combination of moisture and solar radiation.

Where the construction of plastic luminaires intended for high humidity conditions (indoor or outdoors) includes cemented joints, it is essential that the cement used be able to withstand continuous exposure to moisture for long periods without deterioration.

NOTE – The electrical safety of luminaires for outdoor use under humid conditions is checked by the tests of section 9.

L.5 Chemically corrosive atmospheres

Luminaires to be used in atmospheres where chemically corrosive vapour or gases may be present in considerable concentration, and especially where condensation appears, require that the precautions given above for outdoor luminaires be observed and that the following additional precautions be taken:

- a) In general, luminaires whose bodies are made by casting a corrosion-resistant metal will give better service than sheet metal luminaires.
- b) Where metals are used they should, as far as possible, be chosen for resistance to the particular corrosive substance present, as most metals are subject to attack by some corrosive substance. Die-cast aluminium will be satisfactory for most applications.
- c) Similarly, the paints or other protective systems used should be chosen with regard to particular corrosive substances or groups of corrosive substances. For example, paints which are highly acid-resistant may not be able to withstand attack by some alkalis.
- d) Plastics such as acrylics, PVC and polystyrene are very resistant to attack by most inorganic acids and alkalis. They are, however, liable to attack by a number of organic liquids and vapours and as the effect depends on both the type of plastic and the particular chemical, materials should be chosen to suit the particular conditions.
- e) Vitreous enamel finishes are resistant to many chemicals, but it is essential that the enamel coating be free from broken areas or cracks if satisfactory service is to be obtained in highly corrosive atmospheres.

1.2.60 Semi-luminaire

A unit similar to a self-ballasted lamp but designed to utilize a replaceable light source and/or starting device.

NOTE 1 – The light source component and/or starting device of a semi luminaire is readily replaceable.

NOTE 2 – The ballast component is not replaceable and is not disposed of each time a light source is replaced.

NOTE 3 – A lampholder is required for a supply connection.

NOTE 4 – For examples and further information, see IEC 60972.

1.2.61 Plug-ballast/transformer

A ballast or transformer incorporated in an enclosure provided with an integral plug as the means of connection to the electrical supply.

1.2.62 Mains socket-outlet-mounted luminaire

A luminaire provided with an integral plug as the means of both mounting and connection to the electrical supply.

1.2.63 Clip-mounted luminaire

An integral assembly of a luminaire and resilient spring clip, securing the luminaire in position on its mounting surface by a single hand action.

1.2.64 Lamp connectors

A set of contacts specially designed to provide a means of electrical contact but not to support the lamp.

1.2.65 Mains socket-outlet

An accessory having socket-contacts designed to engage with the pins or blades of a mains plug and having terminals for the connection of cables or cords.

1.2.66 Rewireable luminaire

A luminaire so constructed that the flexible cable or cord can be replaced using general purpose tools.

1.2.67 Non-rewireable luminaire

A luminaire so constructed that the flexible cable or cord cannot be separated from the luminaire using general purpose tools without making the luminaire permanently unusable.

NOTE – Examples of general purpose tools are screwdrivers, spanners, etc.

1.2.68 Lamp control gear

Devices employed for the control of lamps, for example ballasts, transformers and step-down convertors.

NOTE – The definition does not include devices for the switching of lamps or the control of brightness such as dimmers and daylight sensors.

Special attention should be given to:

- continuous service temperature;
- UV and visible radiation;
- static and dynamic mechanical impact;
- oxidizing atmospheres.

Some combinations of these influences have particular importance and may make the material unsuitable for the intended application. For example, the combination of UV radiation and heat may produce a green substance from PVC cable insulation, indicating the degradation of the insulation. The properties published in respect of particular materials of given generic names can differ depending on the fillers or inhibitors used, the manufacturing procedure and the design.

L.3 Rust resistance

Luminaires for use in normal indoor atmospheres may be made from a wide variety of materials.

Sheet metal components of the luminaire should be suitably pre-treated and surface finished, e.g. stove-enamelled.

Unpainted aluminium reflectors and louvres should be of an aluminium alloy with an anodic coating.

Auxiliary components of luminaires, such as clips, hinges, etc. when electroplated with suitable materials will give satisfactory service in normal indoor atmospheres. Suitable coatings are zinc, nickel/chromium and tin.

NOTE – The electrical safety of luminaires for indoor use under humid conditions is checked by the tests of section 9.

L.4 Corrosion resistance

Luminaires for use outdoors, or indoors in atmospheres of high humidity should have adequate resistance to corrosion. Although it is assumed that these luminaires will not be required to operate in conditions where chemical vapours are present, it should be remembered that all atmospheres contain a small proportion of corrosive gases such as sulphur dioxide and that in the presence of moisture these can cause severe corrosion over a long period of time.

In the assessment of the resistance to corrosion of a luminaire, it should be borne in mind that the interior of a closed luminaire (even if it has one or more drain-holes) is much less subject to corrosion than the exterior.

The following metals or combinations are known to provide adequate corrosion resistance:

- a) copper and bronze, or brass containing not less than 80 % copper;
- b) stainless steel;
- c) aluminium (sheet, extruded or cast) and die-cast zinc, known to be resistant to atmospheric corrosion;