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Supplement to ANSI C81.64-1993 (R1998)

American National Standard

Approved March 22, 1999 Secretariat: National Electrical Manufacturers Association

Guidelines and General Information for Electric Lamp Bases, Lampholders, and Gauges

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INSTRUCTIONS:

This supplement is intended to:

- replace pages 3-4,
- replace pages 9-10 and insert 10a-10b, and
- replace pages 19-20 and insert 20a-20d

of ANSI C81.64-1993 (R1998).

Whether supplements are inserted into the mother document in lamp abbreviation code number or kept separate as issued is entirely at the discretion of the purchaser. It is optional also to discard the general title page, however it is suggested that it be retained, most conveniently in the back of the book, to document the dates each updated version of the individual sheets was received.

Discard this instruction sheet when finished.

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Example:

EP39 - a screw base with a lateral pin for position orienting.

3.3.1.2 Modifier II

A base characterized in accordance with the rules in this specification may receive a designation already reserved for an existing base. If such bases are not (or not perfectly) interchangeable with due regard to electrical or mechanical requirements, a capital X, Y, Z or U or a combination of two or more of these is added to the primary designation of the base. These modifying letters follow the primary designation.

If mechanically fixed contacts are at an angled position relative to the base axis, the letter J is used.

Example:

BY22d - a B22 base meeting special requirements.
GY5.3 - a G5.3 base which is not interchangeable with the primary G5.3 base.

3.3.1.3 Modifier III

In exceptional cases, part (a) of a designation may be preceded by a number, usually a 2. This indicates that the complete fit is built-up from two (or more) single, similar fits.

Example:

2G13 - A fit consisting of two G13 bases, mounted at a certain distance (such a base is used on U-shaped fluorescent lamps).

3.3.2 Part (b)

Part (b) of a designation consists of a number, which indicates the approximate value in millimeters of the principal dimension of the fit. This value is rounded to a maximum of one digit behind the decimal point, if appropriate. The relation between the principal dimension and the primary designation letter is as follows:

For **B-BA-BM-K-S & SV** - The diameter of the shell.

- **E** - The crest diameter of the screw thread.
- **F** - The diameter or other similar important dimension of the contact.
- **G** - For two pins, the distance between centers of the pins. For more than two pins, the diameter of the circumscribed circle on which the centers of the pins are situated.
- **P** - The most important dimension of that part by which the lamp is located laterally.
- **R** - The largest transverse dimension of that part of the insulating body which is essential for the fit of the holder.
- **T** - The external width measured across the contact plates.
- **W** - The combined thickness of the glass part (or the part of other insulating material) and one lead-in wire followed by the multiplication sign (x) and the width of the base.

Examples:

BA15d - Bayonet (automobile) base having a shell diameter of approx. 15 mm.
G13 - A two-pin base having a pin spacing of approx. 13 mm.

3.3.3 Part (c)

Part (c) of a designation consists of lower case letters indicating the number of contacts, plates, pins, etc. or flexible connections.

The following code letters are used in this group:

"s" for one contact **"d"** for two contacts **"t"** for three contacts
"q" for four contacts **"p"** for five contacts

The shell of a base shall not be considered as a contact regardless of whether it is a current carrying component or not. The contacts need not be of the same shape.

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Examples:

E26d - An E26 base having two bottom contacts.
G10q - A base having four contact pins.

3.3.4 Part (d)

Part (d) of a designation, if necessary, consists of symbols preceded by a hyphen to indicate additional elements that are important for interchangeability (e.g. a number 3 for a 3-pin bayonet base or an indication number for a key configuration).

Examples:

B22d-3 - A B22 base having three locating pins.
G24d-1 - A plug-in base having two pins and a specific key configuration.

3.3.5 Part (e)

Part (e) of a designation consists of numbers immediately following an oblique stroke to indicate the approximate overall length of the base expressed in millimeters. This length includes protruding insulation but excludes the height of contacts or pins.

Examples:

E26/24 - An E26 base having an overall length of approx. 24 mm.

The length of an SV (festoon) base is measured between the open end of the shell and a circle of 3.5 mm diameter on the cone. In order to avoid misunderstanding, this length is stated behind a hyphen but before the oblique stroke if used.

3.3.6 Part (f)

Part (f) of a designation consists of a number for bases having a skirt or spun-in shell. A number of the (f) group position is preceded by the multiplication sign (x) in the designation. The number indicates the approximate outside diameter of the skirt (excluding any flare) or the inside diameter of the open-end, in millimeters.

Examples:

E26/50x39 - A screw base with a crest diameter of the thread of approximately 26 mm and overall length of approximately 50 mm and a skirt diameter of approximately 39 mm.

BAY15d/19 - Bayonet (automobile) base having offset locating pins, a diameter of approximately 15 mm, two contact plates and an overall length of approximately 19 mm.

R17d/10x35 - Recessed double contact base having a largest transverse dimension of its insulating body of approx. 17 mm (essential for fit in holder), shell height of approximately 10 mm and a shell diameter of approximately 35 mm.

T7.2 - Telephone base having an external width of 7.2 mm approximately, measured across the contact plates.

4 Guide to the Selection of a Base for a Newly Designed Lamp

The selection of a type of base for any specific application should take into account both the inherent design capabilities of the base (and its related holder) and also the service requirements of the application. Among the items that in particular need to be considered are (1) the voltage that will be applied, (2) the normal operating temperature, and (3) the degree of optical precision involved in the application. The capabilities of a base should equal or exceed the electrical, thermal, optical, and other requirements for the application.

The guidelines set forth in Table I are offered to assist in the choice of bases for newly designed lamps for specific applications. A detailed list of the present C81.61 standards for bases is included with the general characteristics of each base.

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6.2. Form of Thread

The screw thread as used on either the base or the holder has a theoretical cross section consisting of two circular segments which are tangent to each other and have essentially equal radii. The contour of the threads and the general relationship of the diameter limits are shown in Figure 1.

6.3. Gauging of Thread Dimensions

6.3.1 General

Specific information for gauge design is described in detail in Section 9 of this publication. General information is given in 6.3.2 through 6.3.4.

6.3.2 Bases

Two "go" gauges of the threaded type are generally specified, one for unmounted bases and one for bases mounted on finished lamps. These gauges check simultaneously the maximum of both the major and minor diameters. They also check the minimum length of the threaded section of the base (dimension T or T_1 as appropriate). Each size of threaded gauge should have, as a reference, a threaded master plug for checking it.

One "not-go" unthreaded ring gauge is specified. It is used both for unmounted bases and for bases mounted on finished lamps. This gauge checks the minimum major diameter.

The minimum minor diameter is not specified in the standard and, therefore, no means is provided for checking it.

6.3.3 Holders

A "go" gauge of the threaded plug type should be specified. This gauge checks simultaneously the minimum of both the major and minor diameters. It also checks the minimum and maximum depth from the top of the threaded shell to the depressed center contact.

A "not-go" unthreaded plug gauge is specified. This gauge checks the maximum minor diameter.

The maximum major diameter is not specified in the standard and, therefore, no means is provided for checking it.

6.3.4 Bases and Holders

No gauges are provided for checking the thread form of either the base or the holder. The contour may, however, be examined on an optical comparator or similar equipment.

There should not be any perceptible shoulder at the tangent point of the crest and root radii of the threaded gauges. The radii at the crest of the thread gauges shall not exceed the specified values but may be less by 0.001 inch (0.025 mm). Conversely, the radii at the root of the thread gauges shall be not less than the values specified but may be greater by 0.001 inch (0.025 mm).

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6.4. Contact-Making Gauges

The specific gauges for use with each size of base or holder are described in detail in the Standard Sheets of ANSI C81.63.

The purpose of these gauges is to assure that both the base and the holder have compatible diameters and lengths so that the base (on a finished lamp) can always be inserted into a holder far enough to make solid contact with the center electrical contact of the holder. The gauges are concerned not only with the length of the threaded section of the shell, but also with the bulb shoulder size and shape (of the lamp) and with the entrance opening of the holder, to insure that there are no restrictions against entry of a finished lamp.

6.5. Gauge-Making Tolerances

6.5.1 General

Specific tolerances are given on each gauge sheet. The comments in 6.5.2 and 6.5.3, however, explain some of the principles on which the system of tolerances is based.

6.5.2 Thread Diameter Gauges

The gauge-making tolerance is always specified in the direction to make it additive to the product tolerance. (A manufacturer, however, if he wishes to obtain slightly closer control of his product, should use gauges that have been made with tolerances subtractive to the product tolerance.)

The relationship of the gauge-making tolerances to product tolerance is shown graphically in Figure 5 of Section 10.

6.5.3 Contact-Making Gauges

For these gauges the tolerances are subtractive to the product tolerance since a single "dividing line" has been established between the base and holder and it is necessary for each product (base

and holder) to stay on its own side of the dividing line. The application of this principle results in tolerances having directions as follows:

For the base gauge:		For the holder gauge:	
Base Gauge	Tolerance	Holder Gauge	Tolerance
Axial dimensions	+	Axial dimensions	-
Radial dimensions	-	Radial dimensions	+

6.6. Notes on Principles of Dimensioning

A "no-man's land" is provided between the *maximum* base diameter and the *minimum* holder diameter. This is at least large enough to allow for two gauge-making tolerances (one base and one holder) without overlap.

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A larger maximum diameter is specified for the base mounted on a finished lamp than for the base alone. This provides an allowance for lamp manufacturing tolerances.

No minimum limit for the minor diameter of the base thread is specified, and no maximum limit for the major diameter of the holder thread is specified, since these limits would not affect the fit of the base in the holder.

6.7 Lead-in wire Connections

It is internationally agreed that the term "solder" stands for any possible way of attaching the lead-in wires to the base contacts.

7 Holding Systems for Small Integral Reflector Projection Lamps with Rims of Various Sizes

7.1 Scope

Methods of holding small integral reflector lamps, such as those used in projection equipment, and the interrelationship of lamp dimensions, rim-centering devices, bases, and electrical connection assemblies are described in this section.

Certain requirements, not given in C81.62 on lampholders, are specified for double-ended flexible holding systems.

7.2 Types of Holding Systems

7.2.1 Push-On Connector System

In this system, the lamp is supported entirely at its reflector end and employs a flexible electrical connector.

7.2.2 Double-Ended Flexible System

In this system, a unitized device provides support at both ends of the lamp.

7.3. Components of Systems

7.3.1 Rim-Centering Devices

a. Two-Inch Diameter Reflector Rim. The two methods of centering this size reflector rim in the holding system are described in American National Standard for electric lamps - two-inch (51-mm) integral-reflector-rim reference projection lamp dimensions of centering systems, ANSI C78.1413. These methods are identified as (1) the precise method and (2) the common method. In each case, the rim-centering device provides at least part of the means of supporting the lamp. Either of the two rim-centering devices may be used with either of the holding systems.

b. 1.65-Inch (42-mm) Diameter Reflector Rim. The centering method for this size reflector rim is described in American National Standard for Electric Lamps - 1.65-inch (42-mm) integral reflector projection lamps with GX5.3 or GY5.3 bases - dimensions and centering system, ANSI C78-1417. The rim-centering device provides at least part of the means of supporting the lamp. This device may be used with either holding system.

c. 1.38-Inch (35-mm) Diameter Reflector Rim. The two methods of centering this size reflector rim in the holding system are described in American National Standard for

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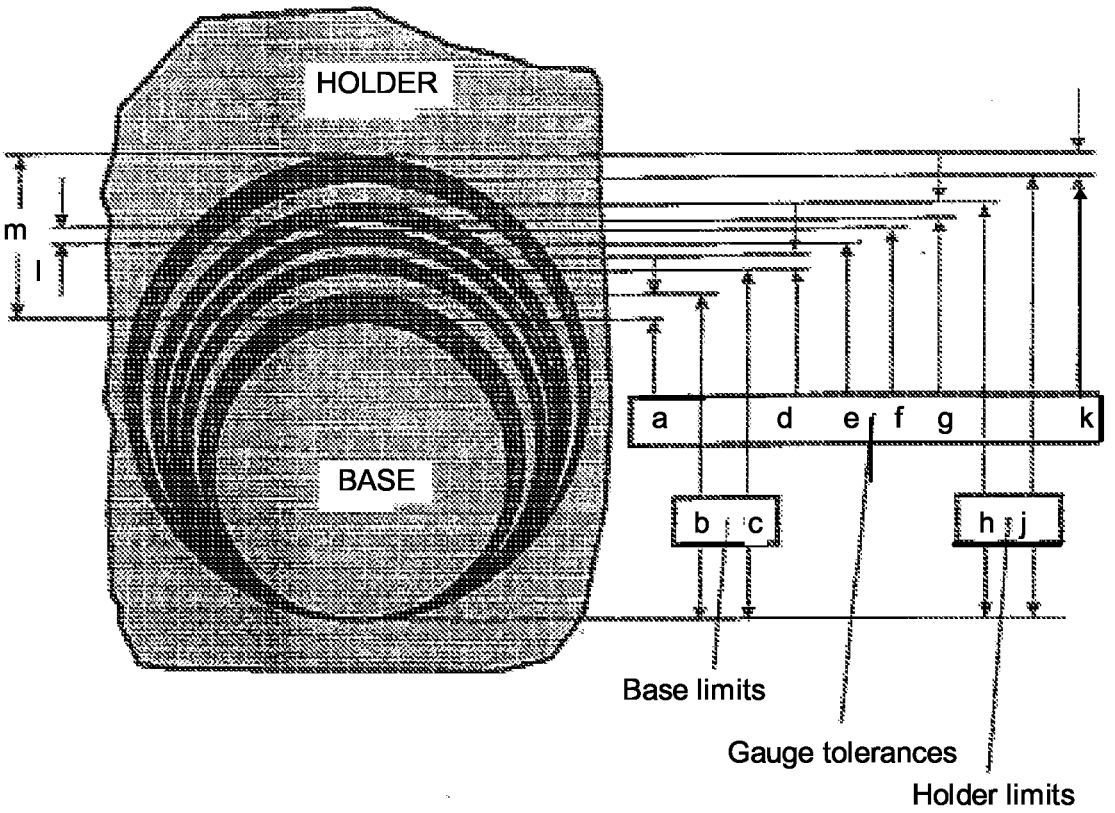
Electric Lamps - Dimensions and centering systems for projection lamps - 35 mm integral reflector rim reference lamps with GZ4 bases, ANSI C78.1421. These methods are identified as (1) the precise method, and (2) the common method. In each case, the rim-centering device provides at least part of the means of supporting the lamp. Either of the two rim-centering devices may be used with either of the holding systems.

7.3.2 Lamp Dimensions

a. Two-Inch Diameter Reflector Rim. Detailed lamp dimensions for the 2-inch integral reflector lamps are covered in American National Standard for electric lamps - two-inch (51-mm) integral-reflector-rim reference projection lamp dimensions of centering systems, ANSI C78.1413.

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a. Tolerance "NOT GO" base gauge

b. Minimum base diameter (according to base sheet)

c. Maximum base diameter (according to base sheet)

d. Tolerance "GO" base gauge

e. Possible limit after wear "GO" base gauge

f. Possible limit after wear "GO" holder gauge

g. Tolerance "GO" holder gauge.

h. Minimum holder diameter (according to holder sheet)

j. Maximum holder diameter (according to holder sheet)

k. Tolerance "NOT GO" holder gauge

l. Minimum clearance between base and holder (no man's land)

m. Maximum clearance between base and holder

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11 Creepage distances and clearances for bases on finished lamps.

11.1 General

With the issue of IEC 664-1, Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests, the subcommittees of IEC TC34, Lamps and related equipment, have revised their publications to line up with the requirements of IEC 60664-1.

11.2 Lampholders

To show a clear relation to the luminaire standard the voltage groupings have been chosen to line up with IEC 60598-1.

Live parts and adjacent metal parts shall be adequately spaced. Creepage distances and clearances shall be not less than the values shown in Table 1.

Table 1 is based on the following parameters.

- installation category II (this is the category of equipment to be supplied from the fixed installation)
- pollution degree 2 (normally, only non-conductive pollution occurs but occasionally a temporary conductivity caused by condensation can be expected).
- inhomogeneous field
- basic insulation
- up to 2000m above sea level
- distances in air

Extension of the table to cover other installation categories or higher pollution degrees is under consideration.

Table 1 - Minimum distances for a.c. (50 Hz/60 Hz) sinusoidal voltages

Rated voltage (r.m.s.)						
over: (V)	0	50	150	250	500	750
up to and including: (V)	50	150	250	500	750	1000
Creepage distance (mm)						
Material with PTI						
≥ 600 [1)]	0.6	1.4	1.7	3	4	5.5
< 600 [1)]	1.2	1.6	2.5	5	8	10
Clearances (mm)	0.2	1.4	1.7	3	4	5.5
NOTE: 1 PTI (Proof Tracking Index) in accordance with IEC 60112.						

In the case of creepage distances to parts not energized or not intended to be grounded, where no tracking can occur, the values specified for material with PTI ≥ 600 apply for all materials (in spite of the real PTI).

For creepage distances subjected to working voltages of less than 60 s duration the values specified for materials with PTI ≥ 600 apply for all materials.

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For creepage distances not liable to contamination by dust or moisture the values specified for material with PTI ≥ 600 apply (independently of the real PTI).

However, the distances between live contacts and the lampholder face (reference plane) shall be in accordance with the values given in the relevant holder sheets of ANSI C81.62, if required.

In the case of non-sinusoidal pulse voltages, the clearances shall be not less than the values shown in Table 2.

Table 2 - Minimum clearances for non-sinusoidal pulse voltages

Rated pulse voltage (peak kV)	2	2.5	3	4	5	6	8
Minimum clearance (mm)	1	1.5	2	3	4	5.5	8

NOTES:
1. The distances specified in Table 2 are derived from 3.1.2.1 of IEC 60664-1 (inhomogeneous field conditions). For distances subjected to both sinusoidal voltage as well as non-sinusoidal pulses, the minimum required distance shall be not less than the highest value indicated in either table.
2. Creepage distances shall be not less than the required minimum clearances.

11.3 Lamp bases

Creepage and clearance distances for bases on finished lamps are usually given in ANSI C81.61, because the special conditions under which bases are used may allow smaller distances as required for the luminaire as well as for the holder.

NOTE - It might be necessary to increase the distances on the unmounted cap in order to compensate for influences during lamp manufacturing, e.g. influence of soldering on creepage distances.

IEC 60598-1 takes care of this exemption with the following statement in Section 11 (creepage distances and clearances):

"The values in the table for minimum distances do not apply to components for which separate IEC publications exist, but apply only to the mounting distances in the luminaire."

Moreover, the distances in IEC 60598-1 were partly influenced by the electric strength test of section 10 where the insulation has to withstand a test voltage of: twice working voltage + 1000V. Especially in the working voltage range 50 V up to 150 V this requirement caused very much increased distances. This test voltage will, however, not be applied to the lamp and therefore the distance on the cap can be aligned directly with the rated voltage of the lamp.

Other special conditions as mentioned above are highlighted in Sections 11.3.1 to 11.3.5.

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11.3.1 Safety or performance reasons

The values in IEC 60598-1 and the lampholder standards are based on safety aspects. Therefore the worst case i.e. the inhomogeneous field is the basis for the clearance and the associated creepage distances.

For bases, in a number of cases, a creepage or clearance distance does not provide a safety function but serves only for performance purposes, i.e. there is not a basic protection against electric shock but an operational insulation* (necessary for correct operation).

An example of such a situation is the E14 base, where the lampholder shall be so designed that the lamp bases are not accessible when they become live during insertion and when they are fully inserted. Therefore breakdown of the insulation between the contacts of the base (sometimes the shell of the base is one of the contacts) will not impair the safety of the system and therefore the dimensioning of the clearance might go into the direction of homogeneous field conditions.

* Definition from 3.7.5 of IEC 61058-1 "Operational insulation: Insulation between live parts which have a potential difference between them and which are necessary for the correct operation of the switch during its life".

This is of special interest for pulse voltages where, by a well designed contour of the base (and the corresponding holder), much higher values can be achieved than are allowed for safety reasons according to Table 2. Since in practice, real homogeneous field conditions are hardly reached, the ability of the design must be checked by tests.

11.3.2 Time under voltage stress

The creepage distances of IEC 60664-1 have been determined for insulation intended to be under voltage stress for a long time (or continuously). Technical committees responsible for equipment in which insulation is under voltage stress for only a short time may consider allowing smaller creepage distances than those specified in IEC 60664-1 Table 4. For such cases the following guidelines are given:

1) Except for pollution degree 4, the creepage corresponding to one voltage step (of IEC 60664-1) lower may be used for insulation stressed for a total of 15000h or less. Similarly, for insulation stressed 1500h or less, the creepage distance corresponding to two voltage steps lower may be used. These degrees of relaxation from the conditions of continuous stress are provisional.

2) Alternatively, for pollution degree 2, the creepage distances in Table 4 of IEC 60664-1 for material with PTI $\geq$ 600 are applicable for all material groups.

The usual lamp life represents a short time condition under voltage stress and, in order to maintain reliable electrical contact, pollution degrees higher than 2 are not permitted. Therefore, if high pollution occurs, the contact area has to be protected.

Additionally, the operation of the lamp will cause accelerated drying of the insulating surface which will prevent tracking.

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In order to have the possibility to look at a base independent of its use on special lamps, it was decided to apply the alternative 2, to new base designs which, together with the direct relation to the rated voltage of the lamp, results in the following Table 3:

Table 3 - Minimum distances for a.c. (50Hz/60Hz) sinusoidal voltages

Rated voltage (r.m.s.) over: (V) up to and including: (V)	0 50	50 150	150 250	250 500	500 750	750 1000
Creepage distances and clearances (mm)	0.6	1 [1)]	1,5 [2)]	3 [3)]	4	5.5 [4)]

NOTES:
1) In IEC 60664-1: 0.8mm. The higher value was chosen to allow for impulse voltages up to 2kV.
2) In IEC 60664-1: 1.25mm. The higher value was chosen to allow for impulse voltages up to 2.5kV.
3) In IEC 60664-1: 2.5 mm. The higher value was chosen to allow for impulse voltages up to 4kV.
4) In IEC 60664-1: 5 mm. The higher value was chosen to allow for impulse voltages up to 6kV.
5) In case of non-sinusoidal pulse voltages, the clearance shall be not less than the values shown in Table 2.

The above data have to be seen as basic requirements. In the development of a new fit, all parameters which might have an influence on the final creepage or clearance distance have to be taken into account. The result of this consideration is given on the standard sheet for the cap. Therefore the relevant value(s) on the standard sheet has (have) priority over the basic requirements.

NOTE - As in pollution degree 2 temporary condensation has the most influence on creepage distances the above requirements apply to the inside and to the outside of the unmounted cap as well.

11.3.3 Influence of electrical stress on solid insulation

In practice, as far as electric stress is concerned, two failure mechanisms of solid insulation are relevant:

1) Due to dielectric loss at high electric stress, increased heating will occur, which may lead to thermal instability and thermal breakdown. This usually takes place within some minutes and can be verified rather easily by a high-voltage test.

   This aspect is called short-term stress.

2) Solid insulation systems typically include gaps or voids either caused by different layers of insulation and interfaces between insulating parts, or by imperfect manufacturing of the solid insulating material. In such small gaps or voids partial discharges (PD)* are very likely to occur at much lower stress than being typical for the thermal breakdown of solid insulation and will eventually cause failure of insulating materials.

* Definition from IEC 60664-1: Electric discharge that partially bridges the insulation.

Both the measurement of the phenomenon and the failure analysis are much more complicated than for the thermal breakdown, i.e. this aspect cannot be checked with a high voltage test.

This failure is the result of long-term stress.

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11.3.4 Short-term stress

In case of lamp bases this is a condition which usually occurs during the ignition phase of discharge lamps, where non-sinusoidal pulse voltages are applied.

Usually the risk of thermal breakdown (if insulation material is not ceramic) begins at pulse voltages above 5 kV (peak value) but it has to be noted that in amendment 2 to IEC 60926, which deals with the introduction of ignitors with pulses over 5 kV, the following time limitations are given:

Ignitors with pulse voltages over 10 kV shall be provided with a device for time limitation of the starting operation. This device shall, in the case of non-igniting lamps, interrupt the generation of starting pulses within 3 s.

Ignitors with pulse voltages over 5 kV and up to 10 kV shall be provided with a time limitation device which shall interrupt the generation of pulses within 60 s.

11.3.5 Long-term stress

As already mentioned, partial discharges (PD) are the basic reason for failure.

In air, PD may occur at peak voltages in excess of 300 V (the Paschen minimum). In practice it is unlikely to occur below 500 V. Failure is by gradual erosion and/or treeing leading to puncture or surface flashover. Insulation systems may have different properties: some can tolerate discharges throughout the economic life (e.g. ceramic insulators), others must be discharge-free. Voltage, repetition rate of discharges and discharge magnitude are important parameters.

As for bases, long term stress is usually caused by voltages equal or smaller than the voltage of the mains supply; partial discharges in most cases are not likely to occur.

For further information see sub clause 3.3 of IEC 60664-1 (requirements for design of solid insulation).

If solid insulation is subjected to high frequencies, the dielectric losses of solid insulation and partial discharges become increasingly important. A technical report giving data with regard to the behavior of dielectric under high-frequency stresses, making use of information available from literature and other sources, is just under consideration.

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American National Standard

ANSI C81.64-1993

Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges

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AMERICAN NATIONAL STANDARD

Guidelines And General Information For Electrical Lamp Bases, Lampholders And Gauges

Secretariat C81
National Electrical Manufacturers Association

Approved December 27, 1993
American National Standards Institute

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Foreword (This Foreword is not part of American National Standard C81.64-1993)

This American National Standard, Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges, C81.64-1993, gives guidance and information to designers and testing personnel on the use of ANSI C81.61-1990, ANSI C81.62-1991 and ANSI C81.63-1991.

It includes the designation system, a guide to the selection of bases and general information regarding bases, lampholders and gauges.

Suggestions for improvement of this standard will be welcome. They should be sent to the Secretary of Committee C81, National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Electric Lamp Bases and Holders, C81. Committee approval of the standard does not necessarily imply that all committee members voted for its approval.

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American National Standard for Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges

1 Scope

This standard gives guidance and information to designers and testing personnel on the use of ANSI C81.61-1990, ANSI C81.62-1991, and ANSI C81.63-1991.

It includes the designation system, a guide to the selection of bases and general information regarding bases, lampholders and gauges.

This standard is intended to be used by standards engineers in those cases where new proposals have to be prepared, so as to achieve uniformity in base/lampholder/gauge standards and testing procedures.

It will be extended and updated whenever need arises.

It contains the information from ANSI and the IEC in regard to bases and holders in general use today, together with their relevant gauges. The gauges illustrated, although generally accepted in principle, are not necessarily the only form in which they can be made.

This standard is applicable to bases, lampholders and gauges with the object of securing international interchangeability and safety.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI C78.1-1991, *American National Standard for the Dimensional and Electrical Characteristics of Fluorescent Lamps - Rapid-Start Types*

ANSI C78.2-1991, *American National Standard for the Dimensional and Electrical Characteristics of Fluorescent Lamps - Preheat - Start Types*

ANSI C81.61-1990, *American National Standard for Electric Lamp Bases*

ANSI C81.62-1991, *American National Standard for Electric Lampholders*

ANSI C81.63-1991, *American National Standard for Gauges for Electric Lamp Bases and Lampholders*

ANSI C78.1413-1989, *American National Standard for Electric Lamps - Two Inch (51mm) Integral-Reflector-Rim Reference Projection Lamps - Dimensions of Centering Systems*

ANSI C78.1417-1985, *American National Standard for Electric Lamps - 1.625-inch (42-mm) Integral Reflector Projection Lamps with GX5.3 or GY5.3 Bases - Dimensions and Centering System.*

ANSI C78.1421-1992, *American National Standard for Electric Lamps - Dimensions and Centering Systems for Projection Lamps - 35mm Integral Reflector Rim Reference Lamps with GZ4 Bases*

IEC 400-1992*, *Lampholders for Tubular Fluorescent Lamps and Starter Holders*

ISO/IEC Guide 51*, *Guidelines for the Inclusion of Safety-Aspects in Standards*

*Available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036

3 International designation of lamp bases and lampholders

3.1 Introduction

A coding system is in existence that can be used to assign designations to bases and lampholders. Meaningful assignment can be made to the letters, numbers and symbols that make up this designation. The system has gained international acceptance and should be used as much as possible.

It is self-evident that there is a relationship between a certain base and the lampholder to be used with it. This relation is reflected in the relevant designation, part of which is used in common for the two products.

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As a consequence of this system it is possible to compare bases and holders from various manufacturers and, where they are interchangeable, the same designation can be assigned to them. This system is also a powerful instrument for controlling proliferation of designs. Assignments of designations to new types of bases and holders should be made in accordance with this system.

3.2 Designation system

It is an objective of this system that each assigned designation should be short and as easily pronounceable as possible to stimulate its use in practice.

This system is based on several sub-parts made up of letters, numbers and symbols, each part having its own characteristics. Only one designation shall be assigned to a particular base and holder. This system does not attempt to identify materials. Parts of a designation are joined directly together with no spaces or other separator marks.

A completed designation of bases and holders takes the form as follows:

Designation of base: (a) (b) (c)-(d)/(e)x(f)

Designation of lampholder: (a) (b) (c)-(d)

NOTE—The use of an abbreviated base designation is permitted unless this might cause misunderstanding.

The section of the designation preceding the oblique stroke refers to information which is important with regard to interchangeability of lamps fitted with a certain base in the corresponding lampholder. That particular section of the designation will be the same for both the base and its associated holder. The part of the base designation following the oblique stroke, if present, refers to certain important dimensions of the base which are not a necessary part of the interchangeability requirements of the lamp in the lampholder. Such dimensions are, however, important for the mutual interchangeability of bases of different origin on one type of lamp.

3.3 Primary designation letters

3.3.1 Part (a)

Part (a) of a designation consists of one or more capital letters indicating the type of base. Although the following list refers to bases, it has an analogous meaning for the holder.

B—Bayonet base

BA—Bayonet base, originally intended for automobile lamps

BM—Bayonet base for miners lamp

E—Screw base (Edison)

F—A base with one projected contact. Different forms of the contact are indicated by a small letter after the letter F, as follows:

a—cylindrical pin
b—fluted pin
c—pin of special shape

G—Two or more projecting contacts, such as pins or posts

K—A base with cable connection

P—Prefocus base

R—Recessed contact base

S—Shell base without protruding elements to hold the base in the lampholder

SV—Shell base with conical end (V-shaped)

T—Telephone lamp base

W—A base wherein the electrical contact with the lampholder is made directly through the lead-in wires which lie on the surface of the base. The glass part (or the part of other insulating material) being essential for the fit in the holder. This designation also covers a separate base of insulating material as a substitute for the integral base and meeting the same interchangeability requirements.

NOTE—Some earlier designs resemble a Wedge in shape; this led to the introduction of the reference letter "W."

X—If it is not possible to apply a designation by following the rules listed, such bases will be designated with a capital letter "X" followed by a serial number.

Examples:

E26—a screw base
Fa8—a base with one cylindrical contact pin
X511—a glass base with two separate metal wings

3.3.1.1 Modifier I

If a base has additional characteristics, covered by one of the above capital letters, which can be indicated by further capital letters, the whole combination of letters will be shown, the most significant letter(s) being placed first.

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Example:

EP39—a screw base with a lateral pin for position orienting.

3.3.1.2 Modifier II

A base characterized in accordance with the rules in this specification may receive a designation already reserved for an existing base. If such bases are not (or not perfectly) interchangeable with due regard to electrical or mechanical requirements, a capital X, Y, Z or U or a combination of two or more of these is added to the primary designation of the base. These modifying letters follow the primary designation.

If mechanically fixed contacts are at an angled position relative to the base axis, the letter J is used.

Examples:

BY22d—a B22 base meeting special requirements.

GY5.3—a G5.3 base which is not interchangeable with the primary G5.3 base.

3.3.1.3 Modifier III

In exceptional cases, part (a) of a designation may be preceded by a number, usually a 2. This indicates that the complete fit is built-up from two (or more) single, similar fits.

Example:

2G13—A fit consisting of two G13 bases, mounted at a certain distance (such a base is used on U-shaped fluorescent lamps).

3.3.2 Part (b)

Part (b) of a designation consists of a number, which indicates the approximate value in millimeters of the principal dimension of the fit. The relation between the principal dimension and the primary designation letter is as follows:

For B-BA-BM-K-S & SV —The diameter of the shell

E—The crest diameter of the screw thread.

F—The diameter or other similar important dimension of the contact.

G—For two pins, the distance between centers of the pins.

For more than two pins, the diameter of the circumscribed circle on which the centers of the pins are situated.

P—The most important dimension of that part by which the lamp is located laterally.

R—The largest transverse dimension of that part of the insulating body which is essential for the fit of the holder

T—The external width measured across the contact plates

W—The combined thickness of the glass part (or the part of other insulating material) and one lead-in wire followed by the multiplication sign (x) and the width of the base

Examples:

BA15d—Bayonet (automobile) base having a shell diameter of approximately 15 mm

G13—A two-pin base having a pin spacing of approximately 13 mm

3.3.3 Part (c)

Part (c) of a designation consists of lower case letters indicating the number of contacts, plates, pins, etc. or flexible connections.

The following code letters are used in this group:

s—one contact
d—two contacts
t—three contacts
q—four contacts
p—five contacts

The shell of a base shall not be considered as a contact regardless of whether it is a current carrying component or not. The contacts need not be of the same shape.

Examples:

E26d—An E26 base having two bottom contacts

G10q—A base having four contact pins

3.3.4 Part (d)

Part (d) of a designation, if necessary, consists of symbols preceded by a hyphen to indicate additional elements that are important for interchangeability (e.g. a number 3 for a 3-pin bayonet base or an indication number for a key configuration).

Examples:

B22d-3—A B22 base having three locating pins.

G24d-1—A plug-in base having two pins and a specific key configuration.

3.3.5 Part (e)

Part (e) of a designation consists of numbers immediately following an oblique stroke to indicate the

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approximate overall length of the base expressed in millimeters. This length includes protruding insulation but excludes the height of contacts or pins.

Example:

E26/24— An E26 base having an overall length of approx. 24 mm.

The length of an SV (festoon) base is measured between the open end of the shell and a circle of 3.5 mm diameter on the cone. In order to avoid misunderstanding, this length is stated behind a hyphen but before the oblique stroke if used.

3.3.6 Part (f)

Part (f) of a designation consists of a number for bases having a skirt or spun-in shell. A number of the (f) group position is preceded by the multiplication sign (x) in the designation. The number indicates the approximate outside diameter of the skirt (excluding any flare) or the inside diameter of the open-end, in millimeters.

Examples:

E26/50x39— A screw base with a crest diameter of the thread of approximately 26 mm and overall length of approximately 50 mm and a skirt diameter of approximately 39 mm

BAY15d/19— Bayonet (automobile) base having offset locating pins, a diameter of approximately 15 mm, two contact plates and an overall length of approximately 19 mm

R17d/10x35— Recessed double contact base having a largest transverse dimension of its insulating body of approximately 17 mm (essential for fit in holder), shell height of approximately 10 mm and a shell diameter of approximately 35 mm

T7.2— Telephone base having an external width of 7.2 mm approximately, measured across the contact plates

4 Guide to the selection of a base for a newly designed lamp

The selection of a type of base for any specific application should take into account both the inherent design capabilities of the base (and its related holder) and also the service requirements of the application. Among the items that in particular need to be considered are: (1) the voltage that will be applied, (2) the normal operating temperature; and (3) the degree of optical precision involved in the application. The capabilities of a base should equal or exceed the electrical, thermal, optical, and other requirements for the application.

The guidelines set forth in table 1 are offered to assist in the choice of bases for newly designed lamps for specific applications. A detailed list of the present C81.61 standards for bases is included with the general characteristics of each base.

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The definitions of the terms used in table 1 are as follows:

Consideration	Code	Definition
Service	G	*General lighting service:* Residential, industrial, exterior, etc.
	P	*Projection service:* Flood, slide, studio, etc., involving reflector or lens system, or both
	M	*Miniature lamp service:* Indicator, pilot, telephone, etc.
	T	*Transport service:* Automobile, aircraft, boat, etc.
Voltage Range	XL	Extra low 0—15 V
	L	Low 16—50 V
	S	Standard 51—150 V
	H	High 151—250 V
	XH	Extra high Above 250 V
Precision	N	*Nonprecision:* Refers to applications in which no repeatable optical positioning of the light source is required.
	L	*Low precision:* Refers to applications in which a low degree of optical repeatability is required. An example might be the use of "back light" by means of a simple reflector.
	H	*High precision:* Refers to applications in which a high degree of optical repeatability is required without the need for individual adjustment. Such situations usually exist where lamps are used in conjunction with reflector or lens systems, or both, the combination being intended to achieve specific beam characteristics.
High Temp.	**	Denotes a base suitable for use with lamps (and lampholders) of high temperature ratings.
	R	*Restricted usage:* Specific limitations in accordance with the appropriate standard.
High Wattage or Current	**	Denotes a base suitable for use with lamps (and lampholders) of high wattage or current ratings.
	R	*Restricted usage:* Specific limitations in accordance with the appropriate standard.

**Denotes a base suitable for use with lamps (and lampholders) of high temperature ratings, high wattage or current ratings.

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Table 1–Guide to the selection of a base according to required fit and lamp usage

Code	Common Name	Serv.	Volt Range	Prec.	High Temp	High Wattage or Current	C81.61 Standard Sheet Number
BA9	Miniature Bayonet Base	M-T	XL Note	L			1-10-1
BA15s, BA15d	Candelabra Single-Contact	M-P-T	S	L			
	and Double-Contact Bayonet Bases	M-P-T	S	L			1-20-1
BAY15s, BAY15d	-	T	XL	L			1-22-1
BAZ15d	-	T	XL	L			1-23-1
BY22d	-	G	XH	N	**		1-30-1
E5	Midget Screw Base	M	XL†	N			1-100-1
E10	Miniature Screw Base	M	L	N			1-111-1
E11	Mini-Can Screw Base	G-P	S	L	**	**	1-123-1
E12	Candelabra Screw Base	G	S Note	N			1-131-1
E17	Intermediate Screw Base	G	S Note	N			1-144-1
E26/24	Single-Contact Medium Screw Base	G	S Note	N			1-157-1
E26d	Double-Contact Medium Screw Base	G	S	N			1-158-1
E26/50x39	Skirted Medium Screw Base	G	S Note	N	**		1-159-1
E26/53x39	Special Skirted Medium Screw Base	G	S Note	N	**		1-162-1
E39	Mogul Screw Base	G	XH	N	**	**	1-185-1
E39d	Double-Contact Mogul Screw Base	G	S	N			1-187-1
EP39	Position-Oriented Mogul Screw Base	G	XH	N	**	**	1-202-1
Fa8	Single-Pin Base	G	XH	N			1-250-1
G1.3-2.4	Subminiature Bipin Base (T3/4)	M	L	N			1-288-1
G1.3-3.2	Subminiature Bipin Base (T1)	M	L	N			1-291-1
G2.5	Subminiature Bipin Base (T1-1/4)	M	L	N			1-294-1
G3.2	Subminiature Bipin Base (T1-3/4)	M	L	N			1-297-1
G3.9	-	M	L	N			1-300-1
G5	Miniature Bipin Base	G	H	N			1-310-1
G5.3	-	P	H	L			1-320-1
GX5.3	-	P	L	H			1-321-1
GY5.3	-	P	S	H			1-322-1
G6.35/GY6.35	-	P	L	L			1-340-1
GZ6.35	-	P	L	L			1-342-X *
G7.9/GX7.9	-	P	S/L	H	R		1-356-1
G9.5	-	P	H	H			1-368-1
GY9.5/GZ9.5	-	P	H	H	R **		1-369-1
G10q	Four-Pin Circular Flu. Lamp Base	G	H	N			1-383-1
2G11	-	G	XH	N			1-393-1
G13	Medium Bipin Base	G	XH	N			1-406-1

Continued

*No standard sheet has been issued for this item. The sheet number is held in reserve.

**Denotes a base suitable for use with lamps (and lampholders) of high temperature ratings, high wattage or current ratings.

†The recommended working voltage is not to exceed 25 volts.

NOTE—It is recognized that applications exist in which voltages exceed the maximum values given in this table.

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Table 1–continued

Code	Common Name	Serv.	Volt. Range	Prec.	High Temp.	High Wattage or Current	C81.61 Standard Sheet Number
2G13	U-Shaped Fluorescent Base	G	XH	N			1-420-1
GX16d	Mogul & Extend. Mogul End-Prong Base	T	L	N			1-430-1
GX16d	Termination	T	L	N			1-431-1
G17t	Tri-Pin Prefocus Base	P	H	H			1-439-1
G17q/GX17q	Four-Pin Prefocus Base	P	H/L	H			1-440-1
G20	Mogul-Bipin Base	G	XH	N			1-452-1
G22	Medium Bipost Base	G-P	H	H	**	**	1-466-1
G23	-	G	XH	N			1-475-1
GX23	-	G	XH	N			1-476-1
G24d,G24q	-	G	XH	N			1-493-1
G32/GX32	-	G	XH	N			1-506-X *
G38	Mogul Bipost Base	P	H	H	**	**	1-519-1
P13.5s	Single-Contact Miniature Flanged Base	M	XL	H			1-600-1
P28	Medium Prefocus Base	P	H	H			1-700-1
P30	Candelabra Prefocus Base	P	H	H			1-709-1
P40	Mogul Prefocus Base	P	H	H			1-715-1
R7s	Recessed Single-Contact Base	G-P	H Note	N		**	1-770-1
R12.5	-						1-774-X *
R17d	Recessed Double-Contact Base	G	XH	N			1-777-1
SX4	Submidget Flanged Base	M	XL	N			1-850-1
S5.7	Midget Grooved Base	M	L	N			1-856-1
SX6	Midget Flanged Base	M	L	N			1-862-1
T7.2-1	Telephone Slide Base No. 1	M	S	N			1-875-1
T7.2-2	Telephone Slide Base No. 2	M	S	N			1-876-1
T7.2-3	Telephone Slide Base No. 3	M	S	N			1-877-1
T7.2-5	Telephone Slide Base No. 5	M	S	N			1-878-1
T7.2-6	Telephone Slide Base No. 6	M	L	N			1-879-1
T7.2-7	Telephone Slide Base No. 7	M	S	N			1-880-1
T7.2-8	Telephone Slide Base No. 8	M	S	N			1-881-1

*No standard sheet has been issued for this item. The sheet number is held in reserve.

**Denotes a base suitable for use with lamps (and lampholders) of high temperature ratings, high wattage or current ratings.

NOTE—It is recognized that applications exist in which voltages exceed the maximum values given in this table.

5 Nonproliferation policy base and lampholder fits

5.1 Introduction

ANSI C81.61 and C81.62 contain a great number of base/holder fits. Due to new lamp product developments and advances in technology there is a continuous demand for new fits.

Unrestricted introduction of new fits may lead to:

— Unnecessary proliferation (unjustified diversity, chaos)

— Confusion in the market (less customer satisfaction)

— Logistic problems (storage, handling)

— Costly small run production (no benefits due to economy of scale)

— Increased safety risk due to misapplication of bases and holders

5.2 Scope

This section describes the ANSI and the IEC policy concerning the standardization of base/holder fits.

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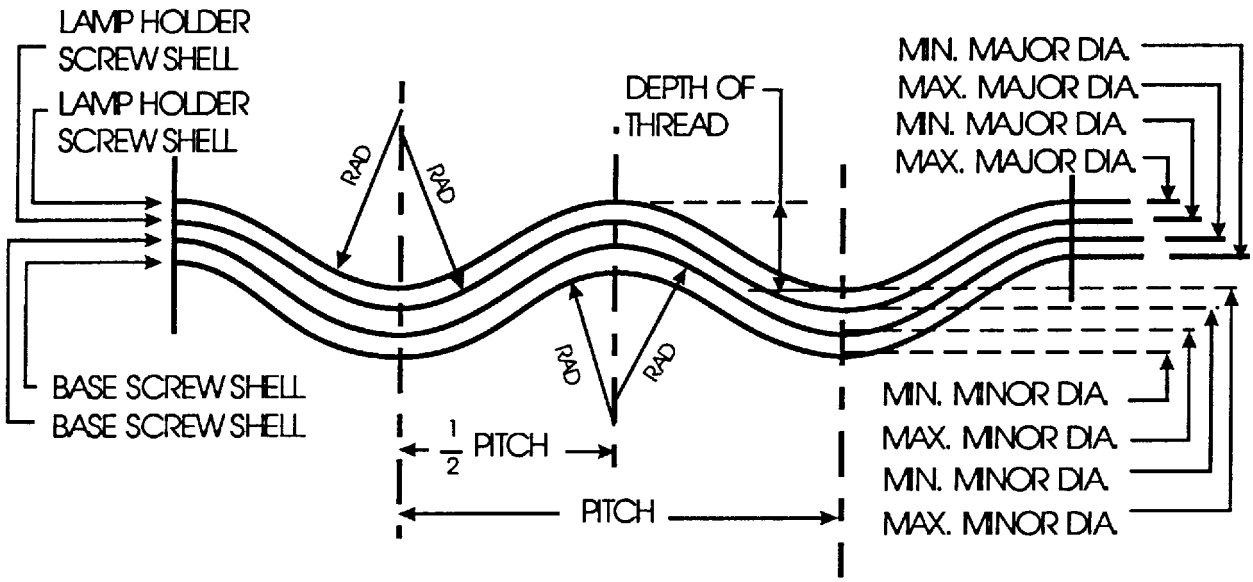


Figure 1—Shape and limits of threads

It gives guidelines for the justification to standardize new fits.

5.3 Standardization policy statement

It is the ANSI and the IEC policy to limit the number of base/holder fits to a justified minimum, meaning an active policy of non-proliferation in this area.

5.4 Guidelines and general information

Regarding the Standardization Policy Statement of nonproliferation, the following guidelines for justification of new base/holder fits should be considered.

—The introduction of new base/holder fits is justified when one or more of the following criteria apply:

- — Established safety risks; e.g., in cases of serious or medium safety risks* with regard to the probability of application of improper lamp types.
- — Fits for lamps with new and/or improved technical properties, for which none of the existing fits is suitable; e.g., new lamp developments and/or applications requiring improved pre-focus and retention features.

*For levels of risks and probable rate of occurrence, see ISO/IEC Guide 51: "Guidelines for the inclusion of safety-aspects in standards."

- — Existence of governmental laws and regulations; e.g., NHTSA or ECE Regulations (lighting regulations for road vehicles).

NOTE—When considering a new fit one should keep in mind that:

—Standardization of complete systems, including bases, holders and gauges is essential.

—Performance problems, in general, do not justify the development of a new fit. Such problems can usually be overcome by instructions for use and/or marking.

6 General information on screw shell lamp bases, holders and gauges

6.1 Scope

This section covers background information for all sizes of screw-shell lamp bases, both as separate bases and also in their final form as mounted on finished lamps, and for the corresponding sizes of screw-shell lampholders.

The screw shells used for plug-type fuses and fuseholders employ the same thread form and the same thread dimensions as the medium (E26) size of lampholder and unmounted base. See Standard Sheets 1-157 and 2-157 of ANSI C81.61 and C81.62 for further details.

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6.2 Form of thread

The screw thread as used on either the base or the holder has a theoretical cross section consisting of two circular segments which are tangent to each other and have essentially equal radii. The contour of the threads and the general relationship of the diameter limits are shown in Figure 1.

6.3 Gauging of thread dimensions

6.3.1 General

Specific information for gauge design is described in detail in Section 9 of this publication. General information is given in 6.3.2 through 6.3.4

6.3.2 Bases

Two "GO" gauges of the threaded type are generally specified, one for unmounted bases and one for bases mounted on finished lamps. These gauges check simultaneously the maximum of both the major and minor diameters. They also check the minimum length of the threaded section of the base (dimension T or T_1 as appropriate). Each size of threaded gauge should have, as a reference, a threaded master plug for checking it.

One "NOT-GO" unthreaded ring gauge is specified. It is used both for unmounted bases and for bases mounted on finished lamps. This gauge checks the minimum major diameter.

The minimum minor diameter is not specified in the standard and, therefore, no means is provided for checking it.

6.3.3 Holders

A "GO" gauge of the threaded plug type should be specified. This gauge checks simultaneously the minimum of both the major and minor diameters. It also checks the minimum and maximum depth from the top of the threaded shell to the depressed center contact.

A "NOT-GO" unthreaded plug gauge is specified. This gauge checks the maximum minor diameter.

The maximum major diameter is not specified in the standard and, therefore, no means is provided for checking it.

6.3.4 Bases and holders

No gauges are provided for checking the thread form of either the base or the holder. The contour may, however, be examined on an optical comparator or similar equipment.

There should not be any perceptible shoulder at the tangent point of the crest and root radii of the threaded gauges. The radii at the crest of the thread gauges shall not exceed the specified values but may be less by 0.001 inch (0.025 mm). Conversely, the radii at the root of the thread gauges shall be not less than the values specified but may be greater by 0.001 inch (0.025 mm).

6.4 Contact-making gauges

The specific gauges for use with each size of base or holder are described in detail in the Standard Sheets of ANSI C81.63.

The purpose of these gauges is to assure that both the base and the holder have compatible diameters and lengths so that the base (on a finished lamp) can always be inserted into a holder far enough to make solid contact with the center electrical contact of the holder. The gauges are concerned not only with the length of the threaded section of the shell, but also with the bulb shoulder size and shape (of the lamp) and with the entrance opening of the holder, to insure that there are no restrictions against entry of a finished lamp.

6.5 Gauge-making tolerances

6.5.1 General

Specific tolerances are given on each gauge sheet. The comments in 6.5.2 and 6.5.3, however, explain some of the principles on which the system of tolerances is based.

6.5.2 Thread diameter gauges

The gauge-making tolerance is always specified in the direction to make it additive to the product tolerance. (A manufacturer, however, if he wishes to obtain slightly closer control of his product, should use gauges that have been made with tolerances subtractive to the product tolerance.)

The relationship of the gauge-making tolerances to product tolerance is shown graphically in Figure 5 of Section 10.

6.5.3 Contact-making gauges

For these gauges the tolerances are subtractive to the product tolerance since a single "dividing line" has been established between the base and holder and it is necessary for each product (base and holder) to stay on its own side of the dividing line. The application of this principle results in tolerances having directions as follows:

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For the base gauge:

Base Gauge	Tolerance
Axial dimensions	+
Radial dimensions	-

For the holder gauge:

Holder Gauge	Tolerance
Axial dimensions	-
Radial dimensions	+

6.6 Notes on principles of dimensioning

A "no-man's land" is provided between the *maximum* base diameter and the *minimum* holder diameter. This is at least large enough to allow for two gauge-making tolerances (one base and one holder) without overlap.

A larger maximum diameter is specified for the base mounted on a finished lamp than for the base alone. This provides an allowance for lamp manufacturing tolerances.

No minimum limit for the minor diameter of the base thread is specified, and no maximum limit for the major diameter of the holder thread is specified, since these limits would not affect the fit of the base in the holder.

7 Holding systems for small integral reflector projection lamps with rims of various sizes

7.1 Scope

Methods of holding small integral reflector lamps, such as those used in projection equipment, and the interrelationship of lamp dimensions, rim-centering devices, bases,and electrical connection assemblies are described in this section.

Certain requirements, not given in C81.62 on lampholders, are specified for double-ended flexible holding systems.

7.2 Types of holding systems

7.2.1 Push-on connector system

In this system, the lamp is supported entirely at its reflector end and employs a flexible electrical connector.

7.2.2 Double-ended flexible system

In this system, a unitized device provides support at both ends of the lamp.

7.3 Components of systems

7.3.1 Rim-centering devices

a. Two-Inch Diameter Reflector Rim

The two methods of centering this size reflector rim in the holding system are described in American National Standard for electric lamps - two-inch (51-mm) integral-reflector-rim reference projection lamp dimensions of centering systems, ANSI C78.1413. These methods are identified as (1) the precise method and (2) the common method. In each case, the rim-centering device provides at least part of the means of supporting the lamp. Either of the two rim-centering devices may be used with either of the holding systems.

b. 1.65-Inch (42-mm) Diameter Reflector Rim

The centering method for this size reflector rim is described in American National Standard for Electric Lamps - 1.65-inch (42-mm) integral reflector projection lamps with GX5.3 or GY5.3 bases - dimensions and centering system, ANSI C78-1417. The rim-centering device provides at least part of the means of supporting the lamp. This device may be used with either holding system.

c. 1.38-Inch (35-mm) Diameter Reflector Rim

The two methods of centering this size reflector rim in the holding system are described in American National Standard for Electric Lamps - Dimensions and centering systems for projection lamps - 35 mm integral reflector rim reference lamps with GZ4 bases, ANSI C78.1421. These methods are identified as (1) the precise method, and (2) the common method. In each case, the rim-centering device provides at least part of the means of supporting the lamp. Either of the two rim-centering devices may be used with either of the holding systems.

7.3.2 Lamp dimensions

a. Two-Inch Diameter Reflector Rim

Detailed lamp dimensions for the 2-inch integral reflector lamps are covered in American National Standard for electric lamps - two-inch (51-mm) integral-reflector-rim reference projection lamp dimensions of centering systems, ANSI C78.1413.

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Close control over certain lamp dimensions is essential to the proper operation of the double-ended flexible holding system.

b. 1.65-Inch (42-mm) Diameter Reflector Rim

Detailed lamp dimensions for the 1.65-inch integral reflector lamps are covered in American National Standard for electric lamps - 1.65-inch (42-mm) integral reflector projection lamps with GX5.3 or GY5.3 bases - dimensions and centering system, ANSI C78-1417. Close control over certain lamp dimensions is essential to the proper operation of the double-ended flexible holding system.

c. 1.38-Inch (35-mm) Diameter Reflector Rim

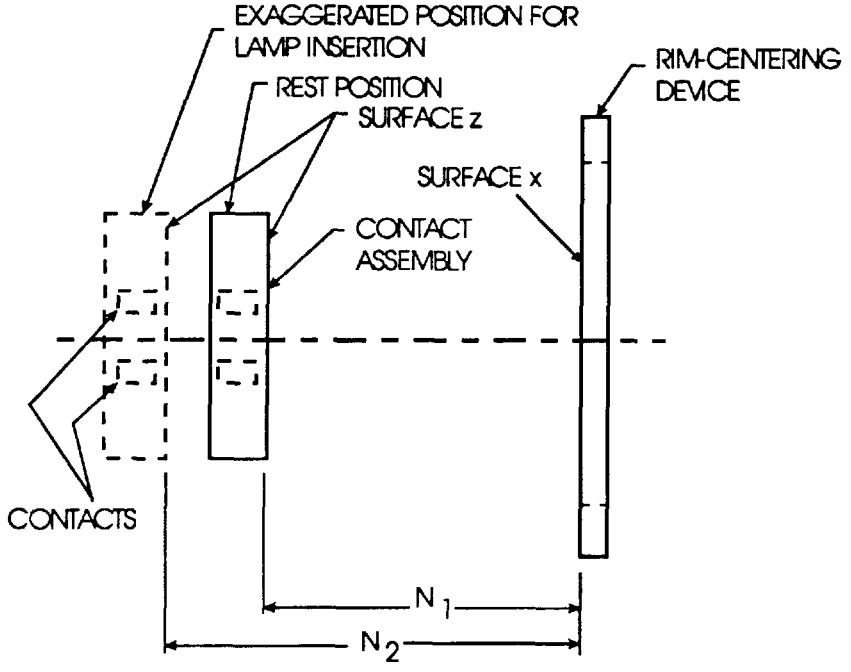
Detailed lamp dimensions for the 1.38-inch integral reflector lamps are covered in American National Standard for electric lamps. Dimensions and centering systems for projection lamps - 35-mm integral reflector rim reference lamps with GZ4 bases, ANSI C78.1421. Close control over certain lamp dimensions is essential to the proper operation of the double-ended flexible holding system.

7.3.3 Connectors and contact assemblies

The dimensional requirements for connectors, contact assemblies, or both, for use in these holding systems are specified in ANSI C81.62.

7.4 Push-on connector system

In this system, a lamp is supported and positioned at the reflector end. The rim-centering device provides for the positioning and aiming of the lamp while springs or similar elements hold the lamp's rim against the reference surface of the centering device. Electrical connection is made by means of a connector on a flexible cord. This system is



Dimension	Standard (inches)		Nearest Metric Equivalent (mm)	
	Min.	Max.	Min.	Max.
N_1	—	1.430	—	36.33
N_1	1.489	—	37.92	—

Figure 2—Double-ended flexible holding system

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designed for installation of a lamp by a simple slide-in motion to locate the reflector rim against mechanical stops and the reference surface, and for pushing the connector onto the lamp's base.

7.5 Double-ended flexible holding system

This double-ended system is a device that provides support at both the reflector and base ends of a lamp. A rim-centering device provides the primary support and location function at the reflector end. Auxiliary springs or similar elements may be required for additional holding force. At the base end, a contact assembly provides both electrical connection and support functions. This system is designed for simple one-motion installation of a lamp, to locate the reflector rim against mechanical stops and the reference surface while the base pins simultaneously slide into the grooves in the contact assembly.

The double-ended flexible holding system requires that the contact assembly be able to move slightly in the direction of the lamp axis with respect to the reference surface of the rim-centering device. This movement permits insertion of the lamp and accommodates normal manufacturing variations in lamp length. Dimensions N_1 and N_2 in Figure 2 define the limits of this movement.

The support for the contact assembly may be designed to provide either partial pressure or full longitudinal pressure to keep the lamp's reflector rim pressed firmly against the rim-centering device. Springs or similar elements may be employed to assist in providing this longitudinal force. The bearing surfaces of the contact assembly and lamp base are those surfaces marked *surface z* for each component. It is desirable that the surface z of the holder contact assembly have a lead-in angle at the edge where the surface z of the base would enter during lamp insertion.

The contact assembly shall be positioned at the proper elevation to permit complete entry of a lamp down to the rim-centering device stops and to provide contact with the base's pins. The contact assembly or its contacts shall be able to move slightly in a plane perpendicular to the lamp axis to accommodate some misalignment in the location of the lamp base pins with respect to the center of the rim's centering device.

The holder contact assembly may be designed in either of two ways depending upon the intended voltage application. These methods are: (1) the two pins simultaneously enter two corresponding slots in the contact assembly or (2) the two base pins both enter the same slot and the two contacts are located one above the other at the appropriate points. Details of these designs are shown in the base and holder standard.

7.6 Gauging

The possible use of gauges for checking these types of holders is under consideration.

8 Fit system for G5 & G13 based tubular fluorescent lamps and lampholders

8.1 Scope

This section provides an explanation of the fit system of G5 and G13 based tubular fluorescent lamps in combined pairs of inflexible lampholders. It is focussed on contact-making and retention.

In the case of flexible and flexibly mounted lampholders, the variations in lamp length are mostly compensated by this type of holder. This is not the case with inflexible holders which are also inflexibly mounted. The following explanations concentrate on this type of holder.

8.2 Lamp and base dimensions

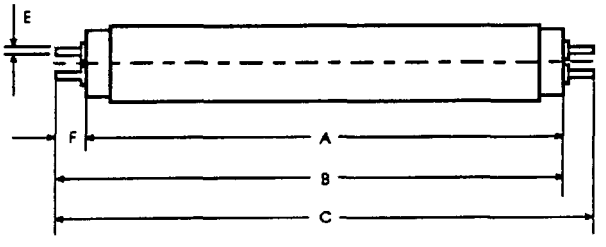


Figure 3—Dimensions

8.2.1 Lamp dimensions

See American National Standard for the Electrical and Dimensional Characteristics of Fluorescent Lamps, ANSI C78.1, and C78.2.

A = base face to base face

B = base face to end of opposite base pins

C = overall length of the lamp, end of base pin to end of opposite base pin

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Reference	Standard Dimensions (Inches)		Metric Equivalents of Standard Dimensions (millimeters)	
	Min.	Max.	Min.	Max.
A	-	X	-	X
B	X + 0.181*	X + 0.28	X + 4.6	X + 7.1
C	-	X + 0.56	-	X + 14.2

*IEC uses the value of 0.185 in. (4.7mm)

The values for dimensions A, B and C are derived from a basic value, designated X, which is equal to A_{max}.

8.2.2 Base alignment

Both pins (excluding bosses) of the two bases of an assembled lamp shall pass simultaneously without binding through parallel slots, each 0.113 in. (2.87mm) in width for G5 caps and 0.120 in. (3.05mm) for G13 caps, suitably spaced longitudinally to receive the lamp.

Lamps which pass through the slots in accordance with this requirement will be satisfactory in combined pairs of lampholders complying with the gauges in ANSI C81.63.

It should be noted that in the G5 and G13 systems the limiting values are not calculated by summation or subtraction of adverse tolerances but that this system is based on statistical tolerancing.

8.2.3 Base pin dimensions

See American National Standard for Electrical Lamp Bases, ANSI C81.61

Reference	Standard Dimensions (inches)		Metric Equivalents of Standard Dimensions (millimeters)	
	Min.	Max.	Min.	Max.
F (length)	0.260*	0.300	6.60*	7.62
E (dia.)	0.090	0.105	2.29	2.67

*For G13 bases this dimension is 0.250 in. (6.35mm), with the 0.260 in. (6.60mm) under consideration.

8.3 Lampholder dimensions

See American National Standard for Electrical Lamp Holders, ANSI C81.62

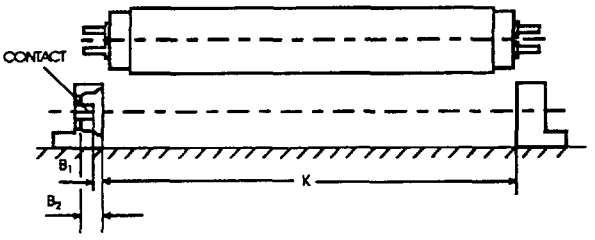


Figure 4—Dimensions

K—distance lampholder face to lampholder face (mounting distance).

B_1—distance between live contacts and lampholder face

B_2—minimum depth of entry slot

X—$A_{max.}$ lamp (see drawing Clause 8.2 for dimension A).

8.4 Contact making in inflexible holder systems

(For gauges, see ANSI C81.63; for contact-making forces and other lampholder tests, see IEC 400).

Reference	Standard Dimensions (Inches)				Metric Equivalent to Standard Dimensions (millimeters)			
	G13		G5		G13		G5	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
K	X + 0.0039	X + 0.055	X + 0.0078	X + 0.070	X + 0.1	X + 1.4	X + 0.2	X + 1.8
B1 (Note 1)	-	0.100	-	0.100	-	2.5	-	2.5
B2 (Note 2,3)	0.265	-	0.250	-	6.73	-	6.35	-

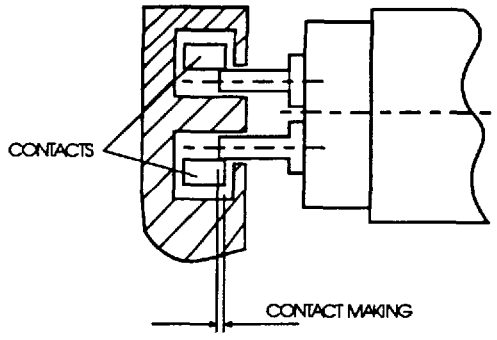
NOTES

1 *Only applicable to inflexible lampholders.*

2 This dimension is such that when the holders are situated at a minimum mounting distance (Kmin.), a maximum length lamp will be accepted without trouble.

3 IEC requires this dimension to be 0.290 in. (7.35mm).

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A lamp operating in a vertical position may be expected to sit with its lower base face on the holder face.

If the holder spacing is at a maximum (K_{max}) and the lamp length, base face to opposite pins is at a minimum (B_{min}), electric contact must still be ensured.

In this situation of the shortest lamp being inserted into a combined pair of holders, vertically mounted at maximum distance, with holder dimension B_1 at its maximum, electrical contact is safeguarded at the base pins of the upper base over a contact making distance of:

G5: (B_{min} - K_{max} - B_{1max}) = (X + 0.181 in. (4.6mm)) - (X + 0.055 in. (1.4mm)) - 0.100 in. (2.5mm) = 0.026 in. (0.7mm)

G13: (B_{min} - K_{max} - B_{1max}) = (X + 0.181 in. (4.6mm)) - (X + 0.070 in. (1.8mm)) - 0.100 in. (2.5mm) = 0.011 in (0.3mm)

NOTE—The smaller overlap in case of G13, compared with G5, is due to the required larger mounting tolerances for the holders.

8.5 Safety of inflexible holder systems (dimensional)

In the most onerous position described under item 8.4 (shortest lamp, widest mounting distance holders) the lamp shall not fall out of a combined pair of holders.

For most holder constructions this is safeguarded by a contact overlap distance of:

G5: (B_{min} - K_{max}) = (X + 0.181 in. (4.6mm)) - (X + 0.055 in. (1.4mm)) = 0.126 in. (3.2mm)

G13: (B_{min} - K_{max}) = (X + 0.181 in. (4.6mm)) - (X + 0.070 in. (1.8mm)) = 0.111 in. (2.8mm)

NOTE—The smaller overlap in case of G13, compared with G5 is due to the required larger mounting tolerances for the holders.

9 Information on gauge design

9.1 General

Base and lampholder dimensions are in most cases checked by the gauges specified in ANSI C81.63. Advantages of this method over other measuring techniques are:

— Procedure is easy
Testing by means of gauges is a simple "right/wrong" check that can be made by less-qualified staff.

— Uniformity
Specifying gauges will help to make sure that everyone checks in the same way and that discussions on the method to be adopted will be avoided.

— Functional method
In many cases, because of interacting dimensions, a specially designed gauge checking a number of dimensions simultaneously is the best aid to find out if the product under examination complies with its functional requirements.

A consequence of the gauge system is that allowance must be given for gauge manufacturing tolerances. Although usually small in comparison with the tolerance of the product under test, they form, however, a complicating factor for the entire system.

Generally tolerances for gauges have been specified in ISO standards. The very special character of base and lampholder systems have, however, necessitated its own approach of the gauge-tolerance system in ANSI C81.64, Section 10.

9.2 Relationship of standards for bases, lampholders and gauges in ANSI C81.61, ANSI C81.62 and ANSI C81.63 (see Chart 1)

It is recommended that the requirements for a base/lampholder system of fit are specified in the following order:

a.1 A base/holder fit in general starts with the base dimensions and tolerances of the base on the finished lamp.

a.2 Sometimes not all requirements are specified in the base sheet, some being defined by a gauge (e.g. the combination of pin diameter and spacing for G13 bases).

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b. Part of the dimensions specified in the base sheet are checked by one or several gauges.

Aided with this data, the lampholder is usually defined as follows:

c. Lampholder gauges are designed as a dummy base and are based on maximum and/or minimum base dimensions supplemented with the requirements to be met with these dummies (e.g. the maximum and/or minimum allowable forces needed to insert or withdraw the gauges).

d. A lampholder sheet should give the design information necessary for interchangeability and safety along with additional dimensional requirements.

e. If desired, additional holder gauges will be specified serving to check the requirements that are not covered by the dummy bases.

9.3 "GO" and "NOT GO" gauges

Distinction is made between "GO" and "NOT GO" gauges. Every gauge not being a "NOT GO" gauge should be regarded as a "GO" gauge.

NOTE—Sometimes several gauging tasks (e.g. individual gauge holes) are combined in one and the same piece of metal. They are to be used for separate gauging tasks.

The "GO" gauges are subdivided like this:

— Gauges that check only one dimension

— Gauges that check two or more dimensions independently from each other

— Gauges that check a combination of two or more dimensions

— Gauges that define the boundary within (or outside) which the product must lie

— Gauges designed as dummy bases for lampholder checks

— Gauges designed as dummy lampholders for base and/or lamp checks

"NOT GO" gauges can check only one dimension per gauge.

Explanation: In the hypothetical case of a "NOT GO" gauge checking more dimensions simultaneously, the gauge approves the product if one dimension is correct even if the remaining dimensions are outside the limits.

9.4 Gauge design

When designing gauges, the direction of the gauge tolerances must be chosen at an early stage from one of the three basic principles:

a. Each product complying with the dimensions specified in the product sheet will be certain to be approved by the gauge.

b. Each product approved by the gauge complies with the dimensions specified in the product sheet.

c. The dimensional requirements of the product are determined by the gauge and are not fully specified as dimensional requirements in the product sheet.

Each of these three principles has its own application area and has its own consequences for the design, for the tolerance area of the gauge involved and also for the product under test.

Under principle a, the direction of the gauge tolerance is in favor of the product dimensions being checked (benefit of the doubt for the manufacturer). In extreme cases, the product dimension checked may be inside the gauge-tolerance area and, thus, slightly outside the limits given on the product sheet. The maker of the product has the entire product tolerance area available.

A proviso is that there shall be a "no man's land" between the maximum base dimension and the minimum lampholder dimension on the product sheet.

NOTE—This system also includes the lampholder gauges based on the minimum lampholder dimensions even if they are shaped as a dummy base.

Under principle b, the direction of the gauge tolerance is to the disadvantage of the dimensions checked.

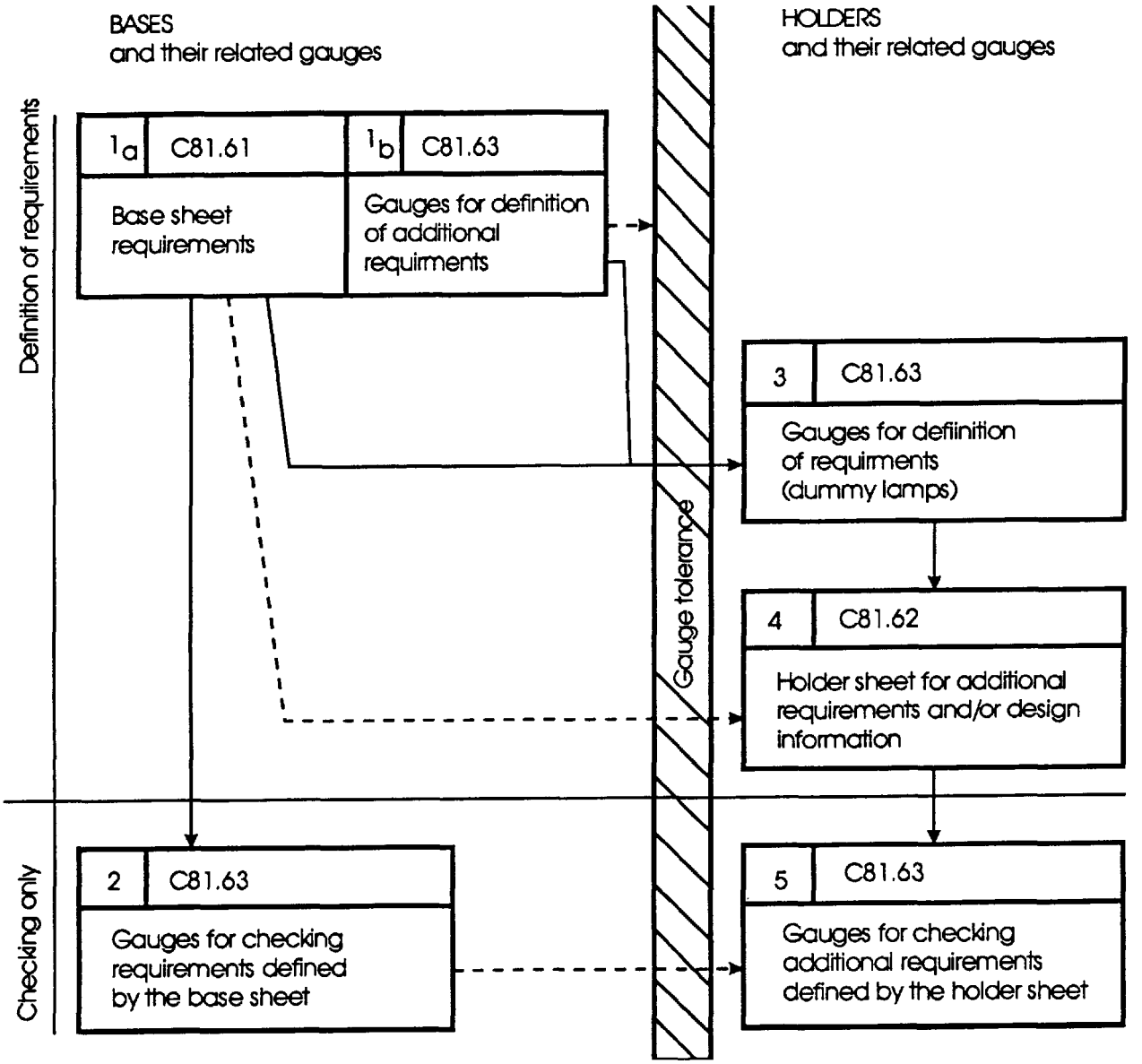
The tolerance area available to the maker of the product checked is a bit smaller than the value specified in the product sheet.

This system is employed for those dimensions that define a boundary between base (or lamp) and lampholder (or luminaire).

Besides, this system will have to be used in those cases where the "no man's land" between maximum base and minimum lampholder is absent.

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Relationship of standards for bases, lampholders and gauges in ANSI C81.62, C81.62, and ANSI C81.63.



Numbers 1*a*, 1*b*, 3, 4, 5 show the sequence of design steps for standards

—— Main influence

- - - - Supplementary influence

Chart 1

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NOTE—Lampholder gauges shaped as a dummy base and based on the maximum and/or minimum base dimension shall have the direction of the gauge tolerances such that the lampholder dimensions to be checked will never create an interference fit with the base.

Examples:

Gauges 3-171 and 3-165, for testing contact-making for the E26 system. (Lampholder gauge tolerances in "minus" direction for linear dimensions and in "plus" direction for diameters. Lamp gauges in "plus" direction for linear dimensions and in "minus" direction for diameters.)

Under principal c, for these gauges there are no dimensions on the product sheet on which one should base oneself. However, the direction of the tolerance should be consistently chosen with respect to the functioning of the cap and lampholder fit.

Examples:

Gauge 3-406 for G13 base, the portion that checks the combined pin diameter and displacement of pins and gauge 3-447 for testing G13 lampholders with regard to entry of lamppins.

(Base gauge tolerances in "plus-minus" direction for the distance between the centers of the holes and in "plus" direction for diameter E_1 Lampholder gauges in "minus" direction for the distance between the centers of the pins in gauge I and in "plus" direction for this distance in gauge II.

For both gauges the tolerance of the diameter of the pins is in the "plus" direction.)

10 Recommended tolerances for gauges

10.1 General

Unlike other gauge systems as specified in ISO, the gauges specified in ANSI C81.63 and IEC 61-3 make no distinction between gauges used by manufacturers and gauges used by the end user. Both use the same gauge type with the same gauge tolerance range.

10.2 Risk of misinterpretation

It is possible that a product approved by one gauge is rejected at a later stage by another gauge of the same type, i.e. in cases where the product dimension under test is just within the gauge tolerance range. This is why the tolerance range should be kept as small as possible, so as to reduce the risk of such misinterpretation and the associated discussions to a minimum.

10.3 Consequences for the base/lampholder fit

An overlap of the tolerance ranges of various gauge types is undesirable, this is why these tolerance ranges will have to be put in line with one another.

This means that the tolerance range for a holder gauge can only start at the point where the tolerance range of the base gauge ends. In consequence, these tolerance ranges and their extent have some influence on the accuracy of the base-lampholder fit to be attained.

The gauge tolerance range must be kept small so as to keep its influence small.

10.4 Inspection and measurement of gauges

In addition to the feasibility of the gauge manufacture, one should also consider the possibility of regular inspections as to whether the gauges still comply with the dimensions required. This implies that, for reasons of manufacturability, inspection and costs, a sort of opposite requirement is put forward, i.e. the wish for larger gauge tolerances, so as to make gauge inspection/manufacture easier and thus less expensive.

However, the gauge requirements relative to the products to be checked are more important than the desire for easier manufacture and inspection. This means that increasing the gauge tolerance should be considered only if reliable inspection of the gauge dimension is reasonably no longer possible.

10.5 Recommended tolerances in detail when drafting standard sheets for gauges

For the directions of the gauge tolerances (plus or minus) see Section 6 of this publication.

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Gauge tolerances advised are as follows.

Table 2—Gauge Tolerances

Diameters of cylindrical holes or plugs	0.01 mm
Diameters for female E-thread gauges for checking maximum cap thread	0.03 mm
An extra after-wear limit is added here because of the considerable wear of these gauges	0.02 mm
Diameters for male E-thread gauges for checking the minimum lampholder thread	0.02 mm
Extra after-wear limit	0.01 mm
Dimensions of cross-section of profiled holes or plugs	0.01mm/0.02mm*
Length/depth dimensions	0.02mm/0.05mm*
Center-to-center distance of two or more holes/pins	0.01 mm
Radii	0.05 mm
Dimensions that do not affect measurement	≥0.01mm
Max. eccentricity of the axis of some dimensions versus the reference axis	0.005 mm
Angles	10'
Pitches of E-thread	0.01 mm**

*In complicated designs the tolerance behind the oblique stroke can be chosen.

**Measured over the full screw length.

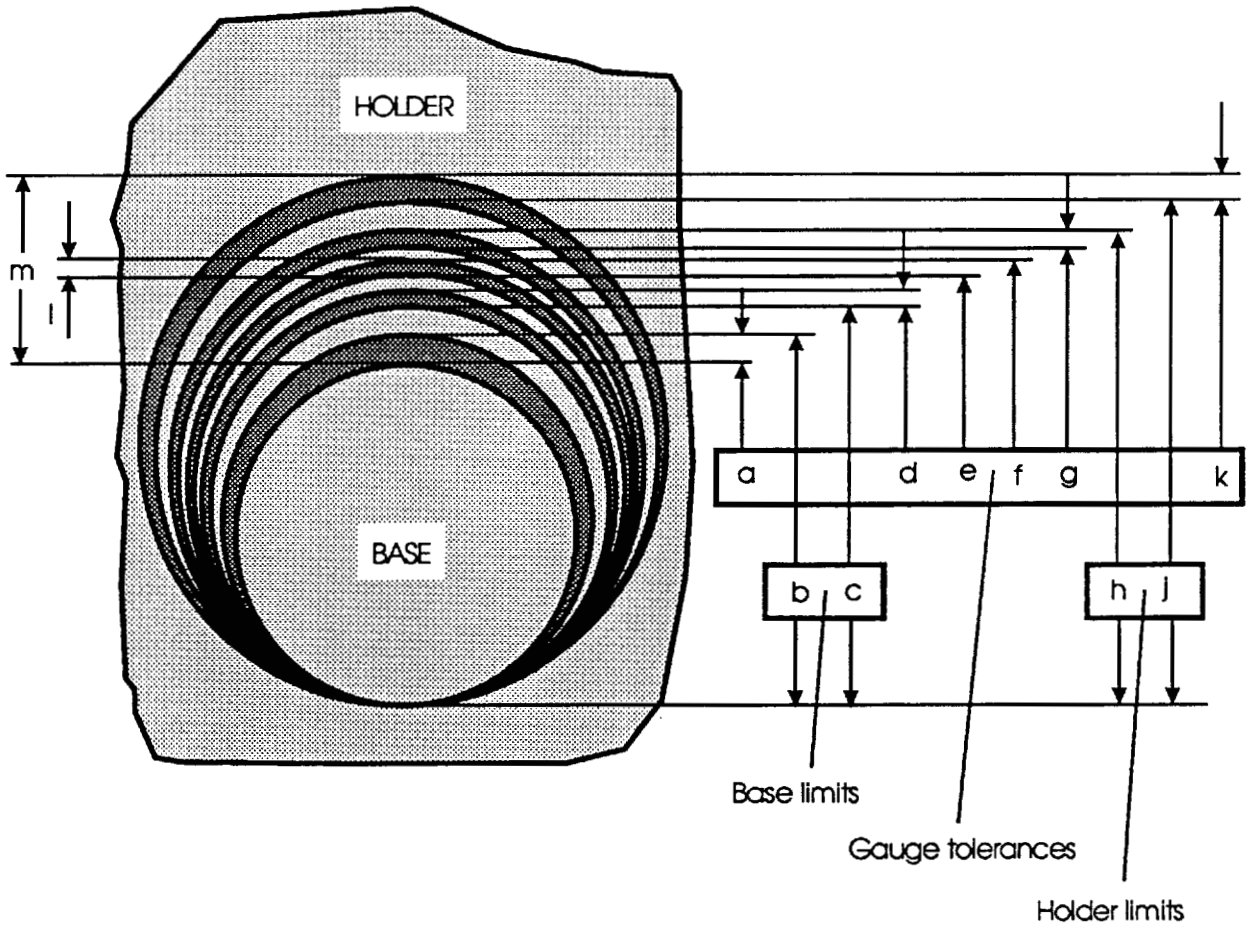
Remarks

— In the case of composite dimensions, this may lead to an addition for the individual tolerances needed.

— In the case of extreme narrow tolerances on the product the gauge tolerances have to be reduced in relation to it.

— Hardness should be specified only for the parts subject to wear.

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a. Tolerance "NOT GO" base gauge
b. Minimum base diameter (according to base sheet)
c. Maximum base diameter (according to base sheet)
d. Tolerance "GO" base gauge
e. Possible limit after wear "GO" base gauge
f. Possible limit after wear "GO" holder gauge
g. Tolerance "GO" holder gauge
h. Minimum holder diameter (according to holder sheet)
j. Maximum holder diameter (according to holder sheet)
k. Tolerance "NOT GO" holder gauge
l. Minimum clearance between base and holder (no man's land)
m. Maximum clearance between base and holder

Figure 5

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ANSI C81.64-1993

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ANNEX A
(normative)
Formats for standard sheets

A.1 The following formats are recommended for use in the preparation of new standard sheets for bases, lampholders, and gauges. The formats presented here must be viewed as guidelines only, because there are many special situations that arise throughout the range of all types of bases.

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A.2 FORMAT FOR BASE STANDARD SHEETS

[Enter IEC designation and name of base]

ANSI C81.61-19xx
Standard Sheet 1 - [ ]-x
Page [ ] of [ ]

The designation assigned to this base by the International Electrotechnical Commission (IEC) is [ ]. (Or use option A). [Enter option 1, 2 or 3].

(A) The designation assigned to this base, in accordance with the coding system of the International Electrotechnical Commission (IEC), is [ ].

(1) This standard sheet is equivalent to IEC 61.

(2) This standard sheet is nearly equivalent to IEC 61.

(3) At the time of issuance of this standard, there was no comparable IEC standard in existence.

The drawing(s) is/are intended only to indicate the dimensions to be controlled.

[Place Drawing(s) here.]

NOTE—Use third angle projection system. Use variable length space, as required.

[Enter Table of dimensions below or after drawing.]

Reference	Standard Dimensions (Inches)			Nearest Metric Equivalent (Millimeters)		
	Min.	Nom.	Max.	Min.	Nom.	Max.
[A]	xx	--	xx	xx	--	xx
[B]	--	xx	--	--	xx	--
[C]	xx	--	--	xx	--	xx

NOTES:

1 Above is a typical dimensional table format. Other options are:

(i) Further subdivision of table for "Unmounted" and "Finished Lamps"

(ii) Use metric only for new bases

2 Assignment of reference codes should follow a pattern established by a similar base. For instance; d = thread major diameter, d1 = thread minor diameter, T = thread penetration.

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BASE FORMAT Cont.

[Repeat Title] [Repeat Header]

NOTES
[Enter: Optional notes related to drawing and dimensional table.]

NOTES:
1 Assign note numbers in the order of their appearance on the drawing and in the table.
2 Within a note use the dual dimensional form ____in. (____mm), as appropriate.

[Enter Thread form table here, if required.]

Form of [ ] Screw Threads

Threads per inch	[ ]
Pitch of thread	[ ]
Radius of thread	[ ]
Direction of threads	[ ]

GAUGING:
[Enter: Optional gauging statements, similar to B, C, and D.]

(B) G13 Base "GO" Gauge, 3-XXX:
When a lamp is fully inserted into the gauge, the center contact shall be in contact with surface x of the gauge.

(C) G13 Base "NOT GO" Gauge, 3-YYY:
The center contact of a base shall not project beyond the opposite surface of the gauge. Only the mass of the gauge itself shall be used in the test.

(D) G13 Contact Making Gauge, 3-ZZZ:
A lamp shall fit into the gauge until surface w reaches surface v or projects beyond it.

See ANSI C81.63 for gauges.

LAMPHOLDER:
See ANSI C81.62, Standard Sheet [2-].

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A.3 FORMAT FOR LAMPHOLDER STANDARD SHEETS

[Enter IEC Designation and Name of Lampholder]

ANSI C81.61-19xx
Standard Sheet 1-[ ]-x
Page [ ] of [ ]

The designation assigned to this lampholder by the International Electrotechnical Commission (IEC) is [ ]. (Or use option A). [Enter option 1, 2 or 3.].

(A) The designation assigned to this lampholder, in accordance with the coding system of the International Electrotechnical Commission (IEC), is [ ].

(1) This standard sheet is equivalent to IEC 61.

(2) This standard sheet is nearly equivalent to IEC 61.

(3) At the time of issuance of this standard, there was no comparable IEC standard in existence.

The drawing(s) is/are intended only to indicate the dimensions to be controlled.

[Place drawing(s) here.]

NOTE—Use third angle projection system. Use variable length space, as required.

[Enter Table of dimensions below or after drawing.]

Reference	Standard Dimensions (Inches)			Nearest Metric Equivalent (Millimeters)		
	Min.	Nom.	Max.	Min.	Nom.	Max.
[A]	XX	--	XX	XX	--	XX
[B]	--	XX	--	--	XX	--
[C]	XX	--	--	XX	--	XX

NOTES:

1 Above is a typical dimensional table format. Another option is to use metric dimensions only for new lampholders.

2 Assignment of reference codes should follow a pattern established by a similar base. For instance: D = thread major diameter, D1 = thread minor diameter,

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LAMPHOLDER FORMAT Cont.

[Repeat Title] [Repeat Header]

NOTES:
[Enter Optional notes related to drawing and dimensional table.]

NOTES

1 Assign note numbers in the order of their appearance on the drawing and in the table.

2 Within a note use the dual dimensions form ____in. (____mm), as appropriate.

[Enter Thread form table here, if required]

Form of [ ] Screw Threads

Threads per inch	[ ]
Pitch of thread	[ ]
Radius of thread	[ ]
Direction of threads	[ ]

GAUGING:
[Enter: Optional gauging statements, similar to B, C, and D.]

(B) Lampholder "GO" Gauge, 3-XXX:
It shall be possible to screw the gauge into the lampholder smoothly. When the gauge is fully screwed in, the threaded portion of the lampholder shall be coplanar with, or project beyond, surface y1 but it shall not project beyond surface y2.

(C) Lampholder Contact-Making Gauge, 3-YYY:
When the gauge is fully screwed into a lampholder, the indicator lamp (IL) shown in the test circuit shall light. In this position there shall be clearance between the gauge and the upper edge of the holder, if the holder is made of ceramic or other material that may scratch the lamp bulb.

(D) Lampholder "NOT-GO" Gauge, 3-ZZZ:
The screw thread of the lampholder shall be considered to be correct if the gauge does not enter by its own mass, so far that the holder thread protrudes beyond surface t.

See ANSI C81.63 for gauges.

BASES:
See ANSI C81.61, Standard Sheet [1-xxx.]

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A.4 FORMAT FOR GAUGE STANDARD SHEETS

[Enter Name of Gauge for IEC Designation and Common name of Base or Lampholder)

ANSI C81.63-19xx
Std. Sheet 3-[ ]-x
Page [ ] of [ ]

The drawing is intended only to illustrate the essential dimensions of the gauge.

[Place Drawing(s) here.]

NOTE—Use third angle projection system. Use variable length space, as required.

[Enter Table of dimensions below or after the drawing.]

Reference	Dimension (inches)	Tolerance (inches)	Nearest Metric Equivalent (millimeters)
[A]	x.xx	+x.xx	x.xx
[B]	x.xx	-x.xx	x.xx
[C]	xx.xx	±x.xx	xx.xx
Mass (pounds)	**Tolerance**		**Nearest Metric Equivalent (grams)**
x.xx	10%		xx.xx

NOTE—Above is a typical dimensional table format. Gauge dimensions should be based primarily in the "standard dimensions" of the associated product.

PURPOSE:
[Enter Statement of purpose similar to option A.]

(A) To check lamp dimensions, particularly the combination of base length and bulb shoulder shape, for their effect on contact making in a lampholder.

For details of [ ] bases (lampholders), see ANSI C81.61 (C81.62) Standard Sheet 1-xxx (2-xxx).

TESTING:
[Enter Step-by-step procedures for the use of this gauge, similar to B.]

(B) Push the base of the lamp into the gauge and check the relationship of surfaces w and v. Also, check for the presence of any conductive material above surface x.

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ANNEX B
(*informative*)
Historical background of the edison screw fit

The Edison type of base screw shell has been used for over 100 years and it is interesting to note how little the earliest base screw shells differed from the modern shells which this specification is intended to standardize. The pitch of the thread of the Edison base screw shell has remained unaltered since the beginning.

As early as 1888, the Edison Lamp Works had lampholder screw shells made in accordance with a gauge, the diameter of which differed from the present standard mainly in that it had a slight taper. This gauge had a maximum diameter at the large end of 1.053 inches, tapering to a diameter of 1.029 inches at the small end. In 1890, the Edison Lamp Works made another gauge which was, as nearly as possible, the same as the earlier gauge and was intended to duplicate it. The 1890 gauge had a maximum diameter of 1.055 inches at the large end, tapering to 1.030 inches at the small end. This gauge had threads 0.035-inch deep.

The lampholder screw shells made according to this gauge, and base screw shells to fit, were used very extensively, and when standardization was considered in 1902 by the leading lampholder manufacturers of the United States they adopted, as the standard, the Edison Lamp Works lampholder screw shell and base screw shell which had been in use over 20 years. As a result of the conference at which the above standard was adopted, all of the leading lampholder manufacturers were supplied with duplicates of the 1890 gauge of the Edison Lamp Works.

The base screw shell which was standardized at this time to match the lampholder screw shell had a diameter at the large end of 1.035 inches and at the small end of 1.027 inches.

In 1908, a slight change was made in the standard. This consisted of reducing the taper of the lampholder screw shell without in any way limiting the usefulness of the lampholders which were in service. The modified lampholder screw shell tapered from a maximum diameter of 1.050 inches to a minimum diameter of 1.042 inches.

About this time, the base screw shell was made straight sided instead of tapered, and of such a diameter that it would pass a ring gauge of 1.037 inches, but would not pass one of 1.031 inches. No change was made in the pitch and number of threads and the depth of thread remained, as originally, 0.035 inch.

In 1912, a further slight change was made by eliminating all taper from the lampholder screw shell making it of such dimensions that it would not pass a threaded plug of 1.051 inches in diameter but would pass a threaded plug of 1.045 inches in diameter. This modification from the preceding lampholder screw shell was very slight but made the lampholder shell correspond more closely to the base shell. At this time, the depth of thread was changed to 0.033 inch.

In 1915, a committee, consisting of representatives of the interested industries, was appointed by The American Society of Mechanical Engineers to consider the standardization of base and lampholder screw shells. This committee developed and published a report covering standards for four base and lampholder screw shells, namely, miniature, candelabra, medium, and mogul. To this original list of four screw shells, a fifth, the intermediate, was added in February 1927.

Following its established policy, The American Society of Mechanical Engineers in July 1928 presented its Transaction No. 1474, Rolled Threads for Screw Shells of Electric Sockets and Lamp Bases (1915) to the American Standards Association for review and suggested the appointment of a sectional committee to develop an American Standard specification to adequately cover present practice in the United States. This suggestion was approved by the ASA and the sponsorship was assigned jointly to the National Electrical Manufacturers Association and The American Society of Mechanical Engineers in January 1929.

The Sectional Committee on the Standardization of Rolled Threads for Screw Shells of Electric Sockets and Lamp Bases, C44, held its organization meeting in June 1929 and appointed a subcommittee to develop the first draft of the proposal for the American Standard. Meetings of the subcommittee were held in June 1929, November 1929,

December 1929, and October 1930. A preliminary draft of the subcommittee's report was distributed in quantity during May 1930, and the comments re-

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ceived were carefully considered by the subcommittee in preparing the revision which was presented to the members of the C44 Sectional Committee for approval by letter ballot. Upon the completion of this ballot on May 1, 1931, the proposal was submitted to the sponsor organizations for approval and subsequent transmission to the ASA for final approval and designation as an American Standard. This approval was given on December 10, 1931.

The standard, as approved in 1931, included, in a modified form, the specifications published as Transaction No. 1474 (1915) of The American Society of Mechanical Engineers. The modification was in arrangement only and did not include any changes in dimensions.

In 1949, the sponsors of the C44 Committee proposed that the project be disbanded and that its work be absorbed by the ASA Sectional Committee on Lamp Bases and Holders, C81, which had been newly created under the sponsorship of the Electrical Standards Committee. This was done, and as a result the C81 Sectional Committee decided to republish the C44-1931 standard, revising and redesignating it as C81.1-1951. Again, no changes in the dimensions were made, although the arrangement of the standard was modified. The revision was approved as an American National Standard on March 21, 1951.

A succession of small changes have been made by the C81 committee. These have resulted in a general move toward tighter tolerances on base dimensions. Further changes are being considered in order to harmonize American and Japanese dimensions so that a common international standard can be defined.

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