

American National Standard

Approved July 23, 2002

Secretariat: ANSLG National Electrical Manufacturers Association

For Lamp Ballasts-- Definitions— for Fluorescent Lamps and Ballasts

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American National Standard

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Foreword (This Foreword is not part of ANSI C82.13-2002.)

Suggestions for improvement of this standard should be submitted to the Secretariat C82, American National Lighting Group of the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209. This standard was processed and approved by Accredited Standards Committee (ASC) on Electric Lamps, C82, and its Work Group C82-1. Committee approval of the standard does not necessarily imply that all committee members voted for that approval.

Information concerning the approval of this standard is based on the documents listed in the table below:

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First Edition	82 (1)/m676	82 (1)/m677v2

At the time it approved this standard, the ASC 82 had the following members:

Howard Wolfman, Chair ASC 82
David Mullen, Technical Coordinator
Randolph N. Roy, Secretariat and Coordinating Editor
Ken Denton, Consulting Editor

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Edison Electric Institute (Delegate)	Al Maguire
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At the time it approved this standard, the C82-1 Work Group had the following members:

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John Marshall, Vice Chair
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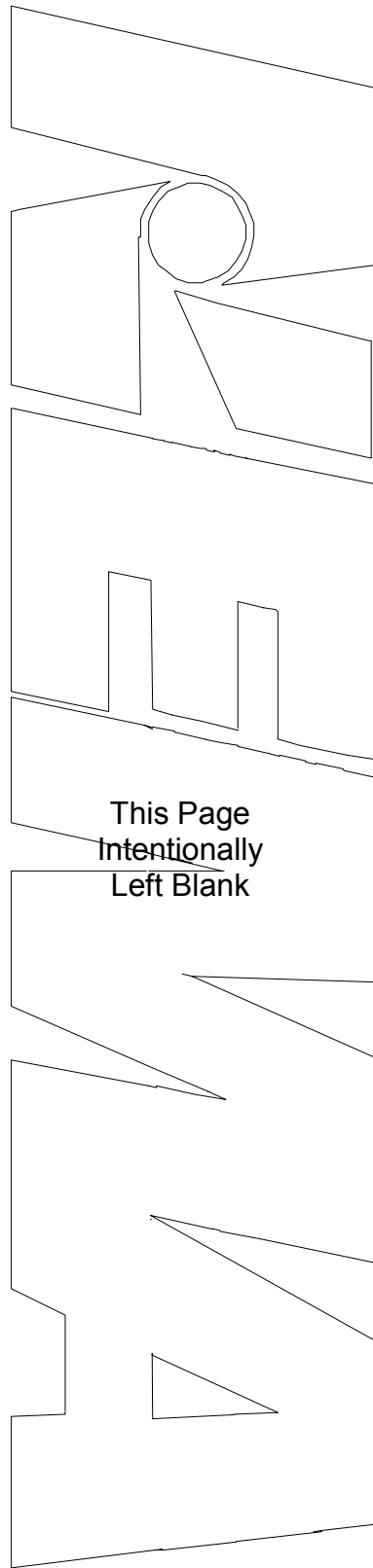
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TABLE of CONTENTS

Foreword.....	iii
1 Scope	1
2 Normative references	1
3 Definitions.....	1
Annex I (informative) Bibliography	A-3



AMERICAN NATIONAL STANDARD

for Lamp Ballasts-- Definitions— for Fluorescent Lamps and Ballasts

1 Scope

This standard provides definitions of terms used in ANSI C78 and C82 series standards for fluorescent lamps and ballasts. Individual standards may also include additional definitions specific to that standard.

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 edition of the standards indicated below.

ANSI C78.81-2001 – *Double-based fluorescent lamps - Dimensional and Electrical Characteristics,*

ANSI C78.901-2001 – *Single-based fluorescent lamps, - Dimensional and Electrical Characteristics.*

3 Definitions

bactericidal lamp: A low pressure mercury electric discharge lamp with a bulb that transmits bactericidal ultraviolet-C radiation.

ballast efficacy factor (BEF): The ballast factor of a ballast in percent divided by the power input to the ballast. Note: This term was developed solely for regulatory purposes. It is not necessarily a measurement of ballast efficiency.

ballast factor (BF): The output of a ballast delivered to a reference lamp(s) in terms of power or light divided by the output of the relevant reference ballast delivered to the same reference lamp(s).

cold-cathode lamp: An electric discharge lamp in which the electrodes, operating at less than incandescent temperatures, furnish electron current by field emission, and in which the cathode drop is relatively high (75 to 150 volts). The current density at the cathodes is relatively low, and cathodes become impractically large for currents greater than a few hundred milliamperes.

color appearance: The actual color of the lamp is called the color appearance and is defined in terms of the spectral tri-stimulus values (color coordinates) according to the recommendations of the International Commission on Illumination (CIE). For color coordinates near the black body loci, the correlated color temperature (Kelvin) can be used to define color appearance. For further clarification see CIE Publication No. 15, Supplement No. 2, CIE Publication No. 13.3, and the Illumination Engineering Society (IES) Handbook.

color rendition: The effect that the spectral characteristics of the light emitted by the lamp has on the color appearance of the objects illuminated by is called color rendition. The color rendering index is defined in terms of a comparison of the spectral tri-stimulus values of the objects under test illumination and standard illumination according to the recommendations of CIE Publication No. 13.3.

constant current cathode heating: Circuit in which the cathodes are heated to emission temperature prior to lamp starting by a source which applies an essentially constant value of current.

constant voltage cathode heating: Circuit in which the cathodes are heated to emission temperature prior to lamp starting by a source which applies an essentially constant value of voltage.

crest factor: The ratio of the peak value of lamp current (or voltage) to the root-mean square (rms) value of the lamp current (or voltage).

deactivated lamp: A lamp which lacks sufficient emissive material on one or both of its cathodes or lacks circuitry to properly heat the cathode in order to obtain normal operation.

external electronic preheat start circuit: A circuit in which the cathode preheating function is provided as part of an external electronic ballast.

fluorescent lamp: A low pressure mercury electric discharge lamp in which a fluorescing coating transforms some of the ultraviolet energy, generated by the discharge, into light.

fluorescent lamp ballast: A device that, by means of resistance, inductance, capacitance, or electronic elements, singly or in combination, controls the current, voltage, and waveform to the proper values for starting and operation of fluorescent lamps.

fluorescent lamp reference ballast: A special inductive-type ballast having certain prescribed characteristics. It serves as a comparison standard for use in testing ballasts or lamps and is also used in selecting the reference lamps that are necessary for the testing of ballasts. The reference ballast is characterized by constant impedance over a wide range of operating current and also by constant characteristics that are relatively uninfluenced by time and temperature. A reference ballast may be either of the following types.

adjustable-impedance type: A reference ballast consisting of an adjustable inductive reactor and a suitable adjustable resistor in series. These two components are usually designed so that the resulting combination has sufficient current-carrying capacity and range of impedance to be used with a number of different sizes of lamps. The impedance and power factor of the reactor-resistor combination are adjusted and checked each time the unit is used.

fixed-impedance type: A reference ballast designed for use with one specific type of lamp and after adjustment during the original calibration, expected to hold its established impedance throughout normal use.

harmonic content: The square root of the sum of the rms values squared of the harmonic components, excluding the fundamental.

high frequency ballast: A device which operates at a supply frequency of 50 or 60 Hz and operates the lamp at frequencies greater than 10 kHz.

high frequency current crest factor: The high frequency current crest factor is equal to the peak current of the modulated or unmodulated envelope divided by the effective rms current. In the case where the high frequency is modulated by the mains frequency, the modulated envelope must be used.

high resistance cathode: A lamp cathode that exhibits a resistance above 15 ohms when heated to a nominal emission temperature.

hot-cathode lamp: An electric discharge lamp in which the electrodes operate at incandescent temperatures and the cathode fall voltage is relatively low (less than 20 volts). The current density at the cathodes is relatively high, and lamps may be designed to carry an desired current up to several amperes. The energy to maintain the cathodes at a sufficient thermal emission may come either from the arc (arc heating), from circuit elements (voltage heating), or from both.

informative reference: Publications containing information related to a standard which may be of interest but is not a requirement of that standard.

initial performance values: The photometric and electrical characteristics at the end of the 100 hour aging period.

input power factor: Power factor is dependent upon the current's wave shape as well as the phase relationship between the current and voltage. The power factor is to be calculated by determining the ratio of the active power to the apparent power. The active power is to be measured with a wattmeter capable of indicating the average power in watts. The apparent power is to be the product of the true rms values of the input voltage and current.

$$\text{Power Factor} = \frac{\text{Active Power (watts)}}{\text{Apparent Power (volt amperes)}}$$

instant-start systems: Those systems in which electric discharge lamps are started by the application to the lamps of a voltage sufficiently high to eject electrons from the electrodes by field emission, to initiate electron flow through the lamp, to ionize the gases, and to start a discharge through the lamps without previous heating of the electrodes.

internal conductive coating: A coating that is made of a transparent conductive material and is applied to the inside of a fluorescent bulb, which acts as an aid to starting.

lamp class: A grouping of lamps with common physical, dimensional, and electrical characteristics.

lamp color: The color characteristics of a lamp as defined by the color appearance and the color rendition.

lamp type: A grouping of lamps within a lamp class having common photometric characteristics

limiting value: In a specification the greatest or smallest admissible value of one of the quantities. (see also IEV-151-04-02)

low resistance cathode: A lamp cathode that exhibits a resistance in the range of 2 to 15 ohms when heated to a nominal emission temperature.

modified rapid-start type systems: Those systems in which hot-cathode electric discharge lamps are operated under the following conditions: (1) the lamps are started with the cathodes heated to a temperature sufficient for adequate electron emission and without establishing local ionization across the cathodes; (2) such heating is accomplished either by means of low-voltage heater windings in the ballast itself, by separate low-voltage transformers, or by other means of heating the cathodes; (3) sufficient voltage is applied across the lamp and between the lamp and the starting aid (usually the luminaire itself) to initiate the discharge when the cathodes reach a temperature high enough for adequate emission; and (4) cathode heating is reduced or removed after the lamp is in full operation.

multiple shape (M): The shape designation for a single-based lamp using a combination of tubes (multiple) which is not covered by any other shape designation.

normative reference: Publication containing provisions which, through reference in the text of a standard, constitute provisions of that standard.

nominal overall length: A convenient number assigned to identifying a lamp in relation to the size of the luminaire in which it is to be used.

nominal value: A suitable approximate quantity value used to designate or identify a component, device or equipment. (see also IEV-151-0401)

parallel cathode heating: A method of supplying cathode heating voltage from one ballast winding to two cathodes that are electrically connected in parallel to that winding.

programmed start system: Those systems in which the sequence for starting of hot-cathode electric discharge lamps is as follows: (1) the lamp cathodes are initially preheated to a temperature sufficient for adequate electron emission and without establishing local ionization across the cathodes; (2) this heating is accomplished by supplying the required energy from a voltage or current source in the ballast itself, while during the preheating period the voltage across the lamp is kept below a level to initiate a glow discharge; (3) after the preheating period the voltage across the lamp is increased to a sufficient level to initiate the arc breakdown; and (4) cathode heating may be reduced or removed after the lamp is in full conduction.

quad shape (Q): The shape of a single-based lamp in which the bulb of the finished lamp is formed essentially into four parallel legs, two each in planes parallel to each other.

radio interference suppression capacitor: A capacitor, usually located in the base of certain lamps or in an external starter, which is connected in parallel to the lamp in order to suppress radio interference. Such a capacitor, if located in a lamp, will be specified on the lamp data sheet.

rapid-start type systems: Those systems in which hot-cathode electric discharge lamps are operated under the following conditions: (1) the lamps are started with the cathodes heated to a temperature sufficient for adequate electron emission and without establishing local ionization across the cathodes; (2) such heating is accomplished either by means of low-voltage heater windings in the ballast itself, by separate low-voltage transformers, or by other means of heating the cathodes/ (3) sufficient voltage is applied across the lamp and between the lamp and the starting aid (usually the fixture itself) to initiate the discharge when the cathodes reach a temperature high enough for adequate emission; and (4) cathode heating is maintained even after the lamp is in full operation.

Note - Two types of rapid-start systems have evolved: (1) those for lamps with nominal 3.6 volt cathodes (low resistance) and (2) those for lamps with nominal 8.0 volt cathodes (high resistance). In some cases the same lamp can be suitable for operation in either rapid-start or switch-start (preheat-start) system.

rated lamp life: The length of time declared by the manufacturer during which 50% of any large number of lamps reach the end of their individual lives.

rated value: A quantity value for specified operating conditions of a component, device or equipment. The value and conditions are specified in the relevant standard or assigned by the manufacturer or responsible vendor. (see also IEV-151-04-03)

rating: The set of rated values and operating conditions. (see also IEV-151-04-04)

reference current: That value of current at which the impedance of a reference ballast is specified and measured. The reference current for each size of reference ballast is normally the same as the rated current of the lamp type which the ballast is intended to operate. Since the reference ballast is a standard that is representative of the impedance of lamp power sources installed, it is not necessary to change this current value unless major changes in lamp standards require modification of the ballast impedance. The reference current for each reference ballast is specified in the applicable American National Standard for the Dimensional Electrical Characteristics of Fluorescent Lamps, ANSI C78.81, and C78.901.

reference lamps: Seasoned lamps which under stable operating conditions and in conjunction with the specified reference ballast operate at values of lamp voltage, lamp wattage (for rapid-start lamps arc wattage is to be used and not total wattage), and lamp current, each within 2-1/2% of the values given in the appropriate lamp standard (see American National Standard Dimensional and Electrical Characteristics of Fluorescent Lamps, ANSI C78.81, and C78.901). Reference lamps of the rapid-start type are operated in circuits in which their cathodes are continuously heated by appropriate low-voltage power sources.

run-up time: The time needed after switching on the supply for the lamp to reach 80% of its stabilized luminous flux.

self-ballasted compact fluorescent lamp: A compact fluorescent lamp unit that incorporates, permanently enclosed, all elements that are necessary for the starting and stable operation of the lamp, and which does not include any replaceable or interchangeable parts. The unit is intended as an alternative to an incandescent lamp in an existing Edison screw lampholder. For test purposes, self-ballasted lamp units shall be regarded as conventional lamps.

self-supporting, single-based compact fluorescent lamp: A fluorescent lamp of small, compact shape with a single base which performs the entire mechanical support function.

square shape (S): The shape of a single-based lamp in which the tube is formed into a nominally square shape.

starting aid: A grounded, conductive plane located parallel to a lamp. It can be a conventional part of the luminaire. The voltage difference between a lamp's cathode and the plane aids in initiation of the discharge.

starting time: The time needed after switching on for the lamp to start fully and remain lighted at the supply voltage and temperature defined in the requirements section.

switch-start (preheat) systems: Systems in which hot-cathode electric discharge lamps are started with the cathodes preheated through the use of a starting switch, either manual or automatic in its operation;. The starting switch, when closed, connects the two cathodes, in series, in the ballast circuit so that current flows to heat the cathodes to emission temperature. When the switch is opened, a voltage surge is produced which initiates the discharge. Only the arc current flows through the cathodes after the lamp is in operation.

total harmonic distortion: This term has caused some confusion and is not always defined in the same way. Read any standard carefully to determine which definition is being used. Typically in the U.S. it refers to the ratio of the rms values of the harmonic content to that of the fundamental current, expressed as a percentage. It may also be called Harmonic Factor

$$THD(fund) = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \dots}}{\sqrt{I_1^2}}$$

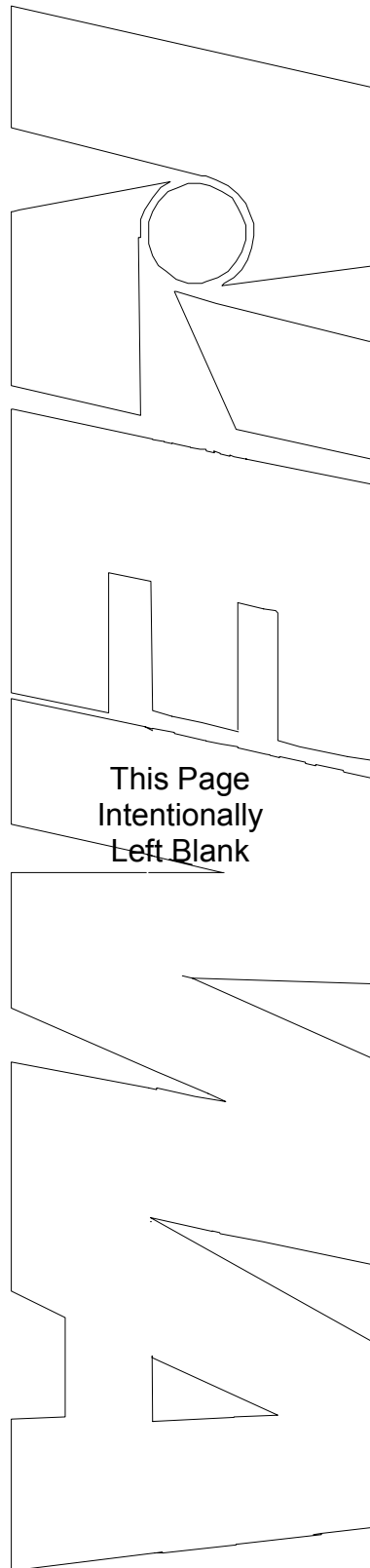
Another definition of total harmonic distortion is the ratio of the harmonic content to the rms value of the periodic current (all of the harmonic components including the fundamental) expressed as a percentage. This definition is used in CSA and IEC standards.

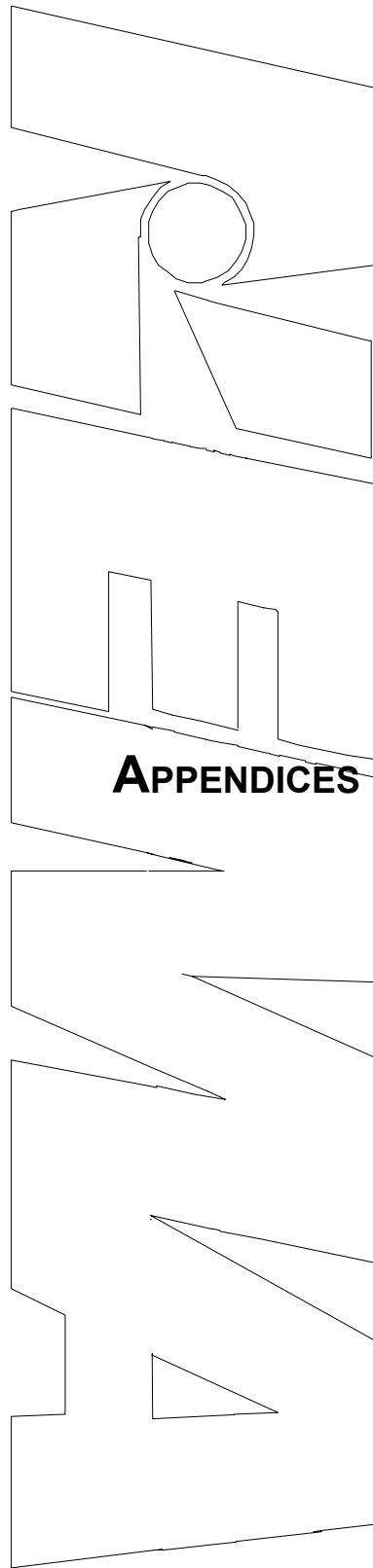
$$THD(rms) = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \dots}}{I_{rms}}$$

triple shape (TR): The shape of a single based lamp in which the bulb of the finished lamp consists of three twin tubes in a delta formation or in an arch.

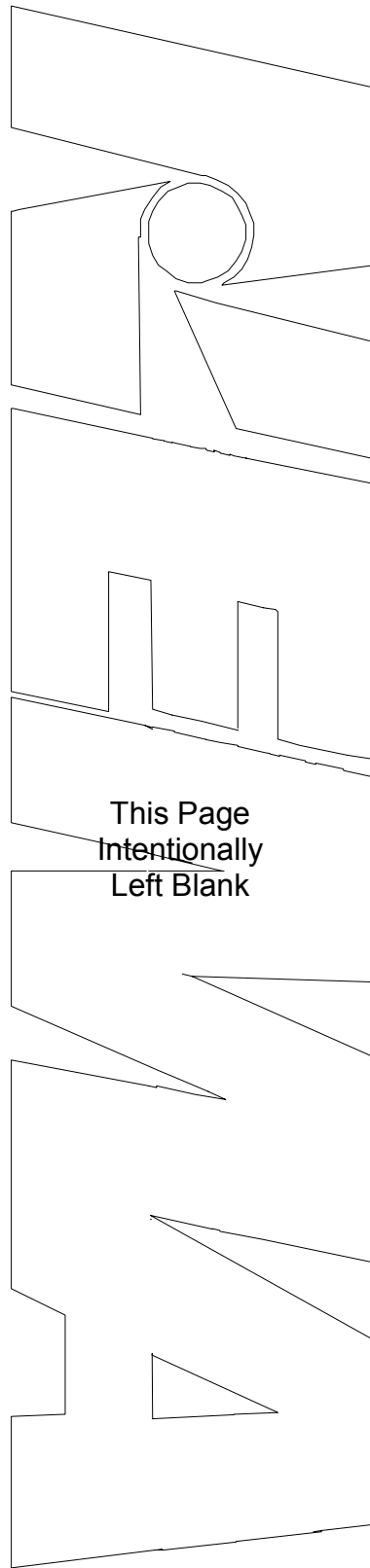
Note: *TR is a new shape designator to address the increased use of this lamp type. Some publications may refer to triple tube using their former multiple shape (M) designator*

twin shape (T): The shape of a single-based lamp in which the bulb of the finished lamp is formed essentially into two parallel legs,





APPENDICES



ANNEX I
Informative

Selected Bibliography

IEC Publication 60050-845: 1987-12 *International Electrotechnical Vocabulary, 45 Lighting*

