

ANSI C78.81-2003

American National Standard

for electric lamps—

Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics

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ANSI C78.81—2003
Revision of ANSI C78.81-2001

American National Standard

Approved: October 07, 2003 Secretariat: ANSLG-- National Electrical Manufacturers Association

For Electric Lamps

Double-capped fluorescent lamps-
Dimensional and Electrical Characteristics

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FOREWORD (This Foreword is not part of ANS C78.81-2003)

Suggestions for improvement of this standard will be welcome. They should be sent to the Secretariat, C78 Committee, National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209. This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Electric lamps, C78, and it's subcommittee, C78-2. Approval of the standard does not necessarily imply that all committee members voted for its approval.

This standard is a consolidation and revision of ANSI C78.1-1991, ANSI C78.2-1991, ANSI C78.3-1991, and ANSI C78.4-1995 and supercedes all of the aforementioned standards and their supplements. Information concerning the approval of this standard is based on the documents listed in the table below:

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Randolph N. Roy, Secretariat
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AMERICAN NATIONAL STANDARD

For Electric Lamps - Double-Based Fluorescent Lamps Dimensional and Electrical Characteristics

PART I – General Information and Requirements

1 Scope

This standard sets forth the physical and electrical characteristics of the principal types of fluorescent lamps intended for application on conventional line frequency circuits, and electronic high frequency circuits. Some data sheets may specify more than one circuit application. Specifications for both the lamp itself and the interactive features of the lamp and ballast are given. Only double-based lamps of the regular linear shape are included. Single-based lamps including compact, circular, square shaped and U-shaped are found in ANSI C78.901.

Lamps for conventional systems relying on auxiliary support from external ballasts are described. These lamps are those designed for 60-Hz and/or high frequency operation.

Lamp color is not specified herein.

Certain lamp types covered in this standard may be similar to those in IEC 60081. However, additional types are included that are used only in North America and are not specified in the IEC standard.

2 General

There are four parts to this standard:

Part I Contains requirements and general information. Detailed descriptions, references, and explanations of the terms used in the lamp data sheets are given in this part. It also defines the principles of dimensioning lamps, both as finished lamps and for maximum outline purposes.

Part II Contains dimensioning principles and lamp outline drawings.

Part III Contains the annexes.

Part IV Contains all of the lamp data sheets for the lamp classes covered in this standard.

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3 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 C78.180-1972 (R2003), *Specifications for fluorescent lamp starters*

ANSI C78.375-1997, *Fluorescent lamps - Guide for electrical measurements*

ANSI C78.376-2001, *Specifications for the chromaticity of fluorescent lamps*

ANSI C78.901-2001, *Electric lamps – Fluorescent – Single-based types - Dimensional and electrical characteristics*

ANSI/IEC C78.1195-2001, *Double-capped fluorescent lamps – safety specifications*

ANSI C79.1-1994, *Nomenclature for glass bulbs intended for use with electric lamps*

ANSI C81.61-1990 (R1996), *Electric lamp bases*

ANSI C81.63-1991 (R1996), *Gauges for electric lamp bases and lampholders*

ANSI C82.1-1997, *Lamp Ballast - Line frequency fluorescent lamp ballast*

ANSI C82.3-1983 (R1995), *Reference ballasts for fluorescent lamps*

ANSI C82.11-2001, *High frequency fluorescent lamp ballasts*

IEEE 100-2000, *Dictionary of electrical and electronics terms*

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4 Definitions

The definitions in this section relate to specific terms used in this standard. For additional definitions, see the ballast standard (ANSI C82.1) and the electrical dictionary (IEEE 100)

4.1 Lamps

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

Rapid-start (RS) fluorescent lamp: A fluorescent lamp designed to operate in a rapid-start circuit.

Preheat-start (PS) fluorescent lamp: A fluorescent lamp designed to operate in a preheat-start circuit.

Instant-start (IS) fluorescent lamp: A fluorescent lamp designed to operate in an instant-start circuit.

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

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.

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.

4.2 Lamp Components

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.

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

High-resistance cathode: A lamp cathode that exhibits a resistance in the range above 15 ohms, when heated to nominal emission temperature.

4.3 Ballasts and circuit characteristics

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 operating of fluorescent lamps.

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Rapid-start circuit: A circuit in which hot-cathode electric discharge lamps are operated under the following conditions:

a) the lamps are started with the cathodes heated to a temperature sufficient for adequate electron emission and without establishing local ionization across the cathodes;

b) such heating is accompanied either by means of low-voltage heater windings in the ballast itself or by separate low-voltage transformers;

c) 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

d) cathode heating voltage is maintained even after the lamp is in full operation.

Two types of rapid-start circuits have evolved.

a) those for lamps with nominal 3.6 volt cathodes (low resistance); and

b) those for lamps with nominal 8.0 volt cathodes (high resistance).

In some cases, the lamp can be suitable for operation in either rapid-start or preheat (switch)-start circuits.

Preheat (switch)-start circuit: A circuit 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 that initiates the discharge. Only the arc current flows through the cathodes after the lamp is in operation.

Parallel cathode heating (preheating): A method of supplying cathode heating voltage from one ballast cathode heating winding to two lamp cathodes that are electrically connected in parallel with that winding.

Instant-start circuit: A circuit in which an electric discharge lamp is started by the application of a voltage sufficiently high to eject electrons from the electrodes by field emission, initiate electron flow through the lamp, ionize the gases, and start a discharge through the lamp without previous heating of the electrodes.

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

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.

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4.4 Miscellaneous

Starting aid: A conductive ground plane reference, located parallel to a lamp. The voltage difference between a lamp's cathode and the plane aids in the initiation of the arc.

5 Lamp abbreviations

Lamp abbreviations for fluorescent lamps are not officially assigned through any administered designation system. Those used on the data sheets in Part IV are assigned in accordance with the Guideline of Annex A. There is no requirement for the use of abbreviations for lamp marking.

6 Methods of measurement

Electrical measurements necessary to determine the performance of lamps that are defined in this standard shall be made in accordance with the lamp measurements standard (ANSI C78.375).

7 Reference ballasts

Reference ballasts used for measurements of fluorescent lamps shall meet the general requirements set forth in the reference ballast standard (ANSI C82.3). It should be noted that the reference ballast standard requires a power factor of 0.075±0.005 for all fluorescent reference ballasts, unless otherwise specified on a lamp data sheet. Also, note that rapid-start reference ballasts called for in this standard include 3.6 V cathode heating.

8 Product drawings

The drawings included in Part II are product drawings that show the applications of the various coded dimensions that appear on the data sheets. Drawings are only needed to depict families of lamps; the particular values vary within a family in accordance with the values on the relevant lamp data sheet.

No attempt has been made to provide maximum outline drawings to show the space occupied by the lamps. They are not provided because the need for such has not been established.

9 Application of lamps on more than one type of circuit

Lamp manufacturers may form an industry consensus approving the use of a particular lamp type on more than one type of circuit. In such cases, the lamp data sheet will show the information for all of the appropriate circuits.

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10 Lamp physical and dimensional requirements

10.1 Bulb specifications

Each lamp data sheet in Part IV specifies the necessary bulb shape and tube diameter. Bulb shapes are defined in the bulb nomenclature standard (ANSI C79.1). Due to the long established practice of referring to the diameter of fluorescent lamp bulbs in eighth-of-an-inch units, this standard maintains that practice. For example, a 1-inch diameter bulb is called a T8 bulb. Metric diameters in millimeters are shown in parentheses immediately following the customary designation.

10.2 Base specifications

Bases on finished lamps shall comply with the standard sheets included in ANSI C81.61. Standard sheets for the gauges for checking bases are included in ANSI C81.63 and its supplements. For instant-start lamps with medium or mogul bipin bases, the pins are internally shorted. Some rapid-start lamps are used with high frequency instant-start ballasts, the pins of these lamps are not internally shorted.

10.3 Lamp dimensions

10.3.1 Base alignment of finished lamps

Finished lamps shall comply with the dimensions specified on the relevant data sheet in Part IV. Graphical definitions of the dimensional code letters used on the data sheets are given in Part II.

10.3.2 Base alignment of lamps with G5 miniature bipin bases

Both pins (excluding flanges) of the two bases of an assembled lamp shall pass simultaneously without binding through parallel slots, each 0.113 in (2.87mm) in width, suitably spaced longitudinally to receive the lamp. The offset of the bulb with respect to the base axis shall comply with Table 1.

10.3.3 Base alignment of lamps with G13 medium bipin bases

Both pins (excluding flanges) of the two bases of an assembled lamp shall pass simultaneously without binding through parallel slots, each 0.120 inch (3.05 mm) in width, suitably spaced longitudinally to receive the lamp. The offset of the bulb with respect to the base axis shall comply with Table 1.

10.3.4 Base alignment of lamps with R17d recessed double-contact bases

Both base bosses of an assembled lamp shall pass simultaneously without binding through parallel slots each 0.25 inch (6.35mm) deep and 0.363 inch (9.22mm) in width, suitably spaced longitudinally to receive the lamp with the bottoms of the slots against the boss ends. The offset of the bulb with respect to the base axis shall comply with Table 1.

10.3.5 Base alignment of lamps with Fa8 single pin bases

The offset of the bulb with respect to the base axis is represented by dimension T described in Figure 1.

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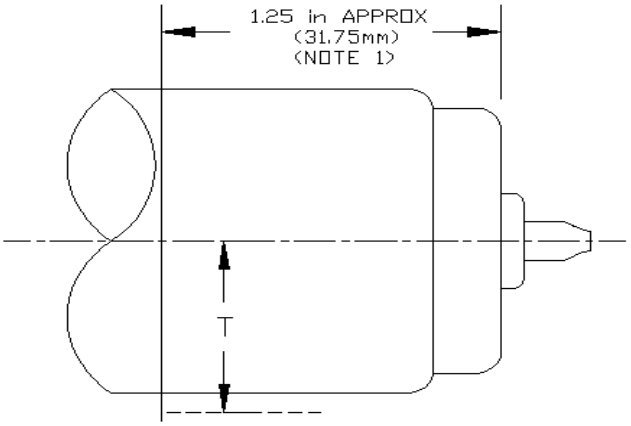

Figure 1

Table 1 – Values of Dimension M and T

Base Type/ Bulb		Dimension M Minimum Note 1		Dimension T Maximum Note 2	
		inches	millimeters	inches	millimeters
Fa8	T6	1.25	31.75	0.430	10.92
	T8	1.25	31.75	0.555	14.10
	T12	1.25	31.75	0.800	20.32
	G5	0.75	19.05	0.340	8.64
G13	T8	1.25	31.75	0.555	14.10
	T10	1.25	31.75	0.680	17.27
	T12	1.25	31.75	0.800	20.32
	G20	2.0	50.8	1.110	28.19
R17d	T12	1.25	31.75	0.800	20.32
	PG17	1.25	31.75	1.110	28.19
	TH17	1.25	31.75	1.110	28.19

Notes
1 Represents length of lamp over which dimension T is applicable.
2 The T dimension includes allowance for possible offset of the bulb with respect to the base axis. This dimension is shown separately for various bulb diameters.

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10.4 Color

Lamp colors are not specified in this standard. Lamp chromaticity is considered to be a variable within each particular type. Color coordinates for certain lamp types and certain colors are defined in the chromaticity standard (ANSI C78.376).

11 Lamp electrical characteristics

11.1 Lamp operating characteristics

The values of lamp voltage, current, and wattage shown on the individual lamp data sheets in Part IV are rated values that apply after the lamps have been aged for 100 hours. These values were chosen by consensus to represent the industry average at the time of publication. No manufacturer's average wattage shall exceed the rated value by more than 5% plus 0.5 watts. Fluorescent lamp operating characteristics are based on operation with a reference ballast (with cathode heating for rapid start characteristics) having the characteristics shown on the appropriate lamp data sheet and at an ambient temperature of 25°C, unless otherwise specified. Electrical characteristics and light output vary with ambient temperature.

Electrical measurements shall be made in accordance with ANSI C78.375.

11.2 Lamp starting requirements

Lamps shall start at the minimum starting voltages, within the wave shape limitation, as specified on each lamp data sheet under "Information for Ballast Design". Separate values apply for rapid or preheat (switch)-start operation. For preheat starting, a minimum preheat time is defined. This value is used for testing starters in accordance with ANSI C78.180.

The specified values are intended to provide reliable starting at the minimum ambient temperatures specified and above, up to a defined upper limit. Upper temperature limits depend upon ballast design and operating current as follows, unless otherwise specified on the lamp data sheets.

Table 2 – Lamp Starting Requirements

Lamp operating Current	Ballast design	Upper temperature limit
<0.5A	all	110°F (43.3°C)
>0.5A	Single lamp	110°F (43.3°C)
>0.5A	2 or 3 lamp series	150°F (65.6°C)

At temperatures near the top of a range, however, initial starting will occur, but not necessarily immediate restarting.

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12 Requirements for ballast design

12.1 General

Ballasts for use with the lamps in this standard shall meet the general requirements for fluorescent lamp ballasts as stated in the ballast standard (ANSI C82.1 or C82.11).

A ballast intended for use with a particular lamp type shall provide the lamp starting, cathode heating, and operating values specified on the relevant lamp data sheet in Part IV as defined in 12.2, 12.3, and 12.4. Requirements for rapid and preheat (switch)-start ballasts are given in these sub clauses. Other special requirements may be specified on a lamp data sheet.

12.2 Lamp starting requirements

A commercial ballast designed to be used with a particular lamp type shall provide:

a) the voltage between lamp terminals,

b) voltage from lamp terminal to starting aid, within

c) the wave shape limitation as specified on the appropriate data sheet.

The specified voltage limits shall be provided at any line voltage between 90% and 110% of the ballast's rated input voltage. Additional information for ballast design concerning wave shape of starting voltage and starting capacitor sizes are specified on particular lamp data sheets.

12.2.1 Voltage between lamp terminals

The limits shown on the appropriate lamp data sheets apply to the voltage to be supplied between those two lamp terminals that deliver the highest voltage. For series ballasts, the voltage is for two (or three) lamps in series.

12.2.2 Voltage from lamp terminal to starting aid

The limits shown on the lamp data sheets apply to the voltage to be supplied between a terminal (the one delivering the highest voltage) of each lamp and that part of the ballast that will be at a ground potential.

NOTE - Luminaires also must be at ground potential, see Clause 13.

12.2.3 Wave shape of rapid-start starting voltage

The maximum starting voltage crest factor value for all rapid and preheat-start lamps in this standard is 2.0, unless otherwise specified on the lamp data sheet. This applies both to the voltage across the lamp and to the starting aid voltage, at 90-110% of rated ballast input voltage.

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12.2.4 Starting capacitor

In a two-lamp series, rapid-start ballast, the capacitor shall shunt the lamp furthest from ground potential.

In a three-lamp series, rapid-start ballast, a capacitor shall shunt the two lamps farthest from ground potential. A second capacitor of the same size shall shunt the lamp furthest from ground. If the minimum peak voltage from the lamp terminal-to-starting aid exceeds the specified limit by 30% or more, the second capacitor may shunt either of the two shunted lamps.

Appropriate capacitor sizes are specified on each lamp data sheet.

12.3 Cathode heating

The specified voltage limits shall be provided at the ballast's rated input voltage, unless otherwise specified on the lamp data sheet.

For rapid-start circuits, the required cathode heating voltage is specified on each lamp data sheet. Both starting (dummy load) and during operation limits are given.

In addition, the appropriate value of the dummy load resistor is specified as an aid to ballast design. Where one ballast winding operates two cathodes in parallel, the dummy load should be half the value given.

For preheat (switch)-start circuits, requirements for cathode heating current during the preheating phase and the preheat time are given on the appropriate lamp data sheet.

For high frequency electronic circuits, the requirements for cathode heating are provided on the lamp data sheets, if specified.

12.4 Lamp operating current

12.4.1 Lamp operating current limits

With rated voltage applied to the ballast, the maximum lamp current in a reference lamp shall be less than the following percentages of the current delivered to the same lamp by a reference ballast at its rated input voltage unless otherwise specified on the relevant lamp data sheet.

All electronic ballasts	107.5%
Magnetic switch start ballasts	115%
Magnetic instant start ballasts	120%
Magnetic rapid start ballasts	115%

When ballasts are designed to operate more than one lamp, each circuit shall meet these requirements, both with and without lamps operating or preheating in the other circuit.

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12.4.2 Operating current waveshape

The wave shape of the lamp current supplied to a fluorescent lamp in a rapid-start or in a preheat (switch)-start, line frequency; circuit shall have a crest factor that does not exceed 1.70, unless otherwise specified on a lamp data sheet.

The wave shape of the lamp current supplied to a fluorescent lamp in an instant-start, line frequency, circuit shall have a crest factor that does not exceed 1.85, unless otherwise specified on a lamp data sheet.

The wave shape of the lamp current supplied by a high frequency ballast shall have a crest factor that does not exceed 1.7, unless otherwise specified.

12.5 Frequency to be used for high frequency operated lamps

For lamps designed for operation on high frequency, the lamp data sheets prescribe a frequency range for the reference ballast and for the testing of lamps (starting, electrical and photometric characteristics). This frequency range has been chosen for ease of reproducing test results and is not intended to restrict the design of high frequency ballasts where, for practical reasons, a higher frequency may be appropriate.

12.6 Lamp end temperature under abnormal conditions

The following applies to all high frequency electronic ballasts for lamps in this standard with a bulb diameter of T5 or less. In the case where a lamp does not start, any continuation of cathode heating shall not lead to overheating of the lamp ends. In the case where one of the electrodes is depleted or broken, while the lamp continues to operate (partial rectification) overheating of the lamp ends should be prevented by suitable measures in the circuit.

13 Requirements for luminaire design

13.1 General

A luminaire intended for use with a particular lamp type shall provide the appropriate starting aid of Clause 13.2 if required, auxiliary supports if needed, and any specialized values that may appear on the relevant lamp data sheet in Part IV.

13.2 Starting aid

Operation of fluorescent lamps on a rapid-start circuit requires the presence of a grounded, conductive starting aid. This can be a conventional part of the luminaire. The starting aid shall be connected to electrical ground.

> **NOTE** - This requirement does not apply for lamps with internal starting aids. External starting aids are not necessary for operation of such lamps.

Unless otherwise specified on a lamp data sheet, the surface of the starting aid shall be of a width at least equal to the diameter of the lamp or a minimum of 1 in (25mm) and extend

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essentially the full length of the lamp.

Unless otherwise specified on a lamp data sheet, distance from the lamp's bulb wall to the starting aid, as measured in a direction perpendicular to the surface of the starting aid, shall not be greater than the following:

Table 3 – Maximum ground plane distance

Type of fluorescent lamp	Maximum distance	
	Inch	Mm
T5 linear lamps	¼	6
T8 linear lamps with RDC bases	¾	19
All other linear lamps		
If rated 500 mA or less	½	13
If rated greater than 500 mA	1	25

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PART II - Lamp Drawings and Dimensioning Principles

The diagrammatic drawings in this part give graphical definitions of the dimensional code letters used on the individual lamp data sheets. There are three major families of lamps depicted:

a) G5, G13, G20 bipin bases, see Figure 1

b) R17d recessed double contact base, see Figure 2

c) Fa8 base, see Figure 3

These drawings (Figures 1-3) are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp data sheets.

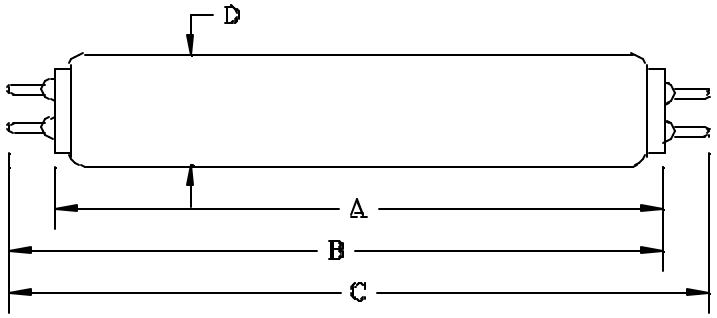

Figure 1 – Lamps with G5, G13, G20 bipin bases

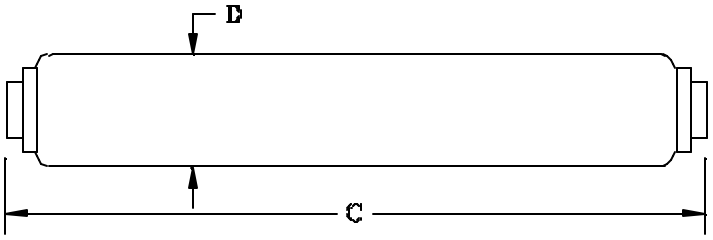

Figure 2 – Lamps with R17d recessed double-contact base

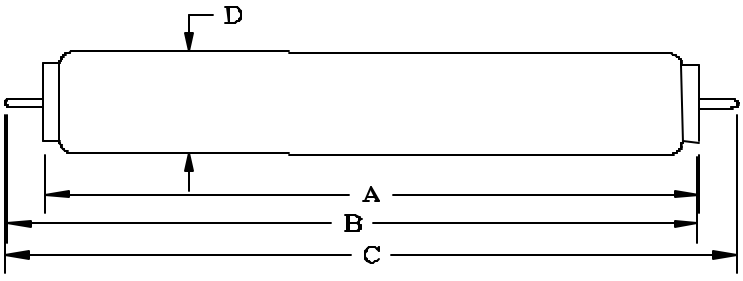

Figure 3 – Lamps with Fa8 Base

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PART III – Annexes

Annex A
(Informative)

Guide for Establishing Fluorescent Lamp Abbreviations

A.1 General

There is a need to identify lamp abbreviations for the lamps in this standard. These abbreviations will benefit users of the fluorescent lamp data sheets. A lamp, in this abbreviation system, is identified by wattage, length or shape, bulb size, and circuit application.

This guide is intended to provide a set of rules for reference in deriving abbreviations for lamp data sheets, in a consistent manner. There is no implication that abbreviations derived from this system are to be used or required for commercial literature applications.

A.2 Abbreviation

Only one abbreviation, under this system, is to be applied to a lamp data sheet. No attempt is made to identify lamp colors.

An abbreviation is comprised of six parts:

a) lamp nominal wattage;

b) lamp nominal length;

c) bulb diameter;

d) lamp shape, as required;

e) lamp base, as required;

f) circuit or special description, or both.

The parts of the abbreviation are joined directly together in the above sequence and slashes are used as separators after wattage, bulb diameter, and the lamp shape or lamp base if used. A hyphen may be used if two properties are identified under item (f) above. Otherwise, there are no spaces or other separator marks used.

A.2.1 Wattage

All lamps shall be identified by wattage, even though they may not be marketed by wattage. The wattage values shown shall be the rated or nominal wattage of the lamp. The numerical value of wattage in watts shall be followed directly by the letter "W".

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A.2.2 Length

The length of a linear lamp shall be expressed in the designation by a number representing the nominal length of the lamp, in inches. Only the numerical value is entered. This length code is based upon a first-order assumption that fluorescent lamps are linear lamps.

For those special cases in which it is necessary to identify lamp length in metric units, the abbreviations shall contain the letters "mm" immediately following the length value in millimeters.

A.2.3 Bulb diameter

Bulb diameter shall be entered directly following the length without any separator. The bulb diameter information comprises two sub-parts. The first part is a letter to indicate the bulb's cross-sectional shape. The bulb shape is identified by a letter symbol as follows:

T - Round cross-sectional tubular bulb

PG - Power groove indented bulb

The second part is the bulb diameter. Values shall be entered in the conventional eighths-of-an-inch system.

For those special cases in which it is necessary to identify bulb diameter in metric units, the abbreviation shall contain the letters "mm" immediately following the diameter value in millimeters.

A.2.4 Lamp shape

All lamps in this standard are linear.

A.2.5 Lamp base

The lamp's base code may be used as part of the abbreviation in certain cases. Those are the cases where the application of the lamp to the correct auxiliary circuit is controlled by means of the base on the lamp. Proper base codes are noted in the base standard (ANSI C81.61).

A.2.6 Circuit or special description, or both

This part of the abbreviation shall follow the slashed separator, which follows the bulb diameter or the optional shape and base information when they are provided. It is intended to help the user associate the lamp with the correct auxiliary circuit.

This abbreviation system does not necessarily identify all circuits that a lamp manufacturer may have authorized for use with a particular lamp.

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Lamps that are specified for operation at two separate wattage or current levels, on the same type of circuit, are identified in the abbreviation by the lower level only.

Typical circuit identifiers are:

RS - Rapid-start

PH - Preheat-start (starter)

IS - Bipin base, instant-start

SP - Single-pin base, instant-start

HO - 800 mA and 1000 mA, high output, rapid-start

1.5A - 1500 mA, rapid-start

Special descriptions may be necessary in certain cases to separate lamps of similar design. These special identifiers may be used in addition to the above circuit identifications, separated by a hyphen. Special descriptions are defined as follows:

B - Bactericidal lamp

CC - Cold cathode

LP - Low pressure

HP - High pressure

A.3Sample abbreviations

The following table contains several sample abbreviations with explanations:

Abbreviations	Lamp Explanation
30W/36T12/RS	30-watt, 36-inch T12, rapid-start
215W/96T12/1.5A	215-watt, 96-inch T12, 1500-mA, rapid-start
37W/24T12/HO	37-watt, 24-inch T12, high output, rapid-start
116W/48T12/1.5A	116-watt, 48-inch T12, 1500-mA, rapid-start
116W/48PG17/1.5A	116-watt, 48-inch PG17, 1500-mA, rapid-start
4W/6T5/PH	4-watt, 6-inch T5, preheat-start
30W/36T8/PH-B	30-watt, 36-inch T8, preheat-start, bactericidal
40W/60T12/IS	40-watt, 60-inch T12, bipin base, instant-start
75W/96T12/SP	75-watt, 96-inch T12 single pin, instant-start

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Annex B
(Informative)

Guidelines for the Establishment of Nominal Wattage Values on Fluorescent Lamp Data Sheets

B.1 Introduction

A typical ANSI lamp data sheet for a fluorescent lamp type shows values for both a wattage identification rating and a lamp operating characteristic wattage. While "rated wattage" is assigned for identification purposes, the "characteristic wattage" is a value used for the evaluation of results under specific measurement conditions. Since each has a separate purpose, there is no need for them to agree absolutely. However, wide disagreement could provide questions and might be misleading to readers.

These guidelines should be applied to new lamp types being standardized. They are not to be applied retroactively.

B.2 Purpose

The purpose of this appendix is to provide guidelines for the establishment of nominal wattage identification of a fluorescent lamp data sheet, relative to its associated rated wattage value.

B.3 Various Factors Affecting Nominal Wattage

B.3.1 Application Circuit

Early in the history of the development of fluorescent lamps, preheat (switch)-start circuits were used exclusively. Later, rapid-start and instant-start circuits became important also. Presently, additional circuits such as modified rapid-start, high frequency switch-start, high frequency rapid-start, etcetera are coming into use.

Although a type of fluorescent lamp may be designed for operation on one specific circuit, that lamp may be later applied on another circuit(s). Therefore, one particular type of fluorescent lamp might be utilized on one of several different auxiliary circuits. The operating power dissipation of a lamp can be expected to vary depending on the circuit in which it is used.

An overly complicated situation would occur if a lamp's nominal wattage value reflected the operational results of several different circuits. The more straightforward, simplified approach is the assignment of nominal wattage, regardless of various applications.

B.3.2 Measurements of Lamp Characteristics on Reference Ballast

Measurements of fluorescent lamps have always been made on reference ballast circuits. Lamp characteristics, including characteristic wattage, are then specified on the lamp data sheet relative to the measurements on the specified reference ballast.

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Switch-start reference circuits or rapid-start reference circuits are specified in various ANSI standards. The difference between them is that the latter incorporates continuous cathode heating. Numerically, for the same lamp type, this would amount to a wattage difference of less than 5%. Reference circuits for high frequency operation have not been fully developed yet. Where rapid-start lamp operating characteristics are given, both switch-start and rapid-start characteristics in reality are present. The terms used are arc wattage, which is analogous to operation on a switch-start reference ballast, and total wattage, which includes cathode wattage, and thus represent operation on a rapid-start reference ballast.

With the above two sets of lamp characteristics available, it is not always clear whether "arc wattage" or "total wattage" should be the basis for the "nominal wattage".

B.3.3 Hierarchy of Lamp Characteristics

When switch-start was the first application for a lamp, the rated wattage value would have been established in relation to that original switch-start data. Once established, no change would be made when new applications and additional reference ballast conditions were added. Any change in identification of a specific lamp would be confusing to the consumers. Conversely, a lamp originally developed for use on rapid-start circuits would be assigned a nominal wattage relative to lamp characteristics on the rapid-start reference ballast. A dilemma occurs, however, when both applications for the same lamp type have commercial importance.

In one sense, basing a lamp's nominal wattage on a switch-start specification can be misleading to customers who operate the lamp on a rapid-start circuit. The identification based on switch-start specifications is further removed from the actual power consumption for the rapid-start application. The reverse is true, also. Therefore, it will be beneficial to all if a fixed procedure for assignment of nominal wattage is established so that uncertainties are eliminated.

B.4 Procedure for Establishing Nominal Wattage

B4.1 For lamp types intended only for application on rapid-start circuits, or where rapid-start is the only known application when the lamp data is first approved, the nominal wattage shall be based on the rapid-start rated wattage (total wattage, including cathode heating wattage).

B4.2 For lamp types intended for use on more than one type of circuit, the nominal wattage shall be based on the most commonly used commercial circuits.

B4.3 A nominal wattage value may be rounded to the nearest appropriate value.

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Annex C
(Informative)

Bibliography

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ANSI C82.2-1984 (R1995), *Fluorescent lamp ballasts - Methods of measurement*

IEC 60081-1997, *Double-capped fluorescent lamps – performance specifications*

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PART IV—Lamp Specification Data Sheets

1 General Principals for Numbering of Data Sheets

The first number represents the number of this standard “7881” followed by the letters “ANSI”. For data sheets adopted from IEC, the IEC number will be retained and would start with “60081-IEC” or the like.

The second number is the data sheet number.

The third number represents the edition of the page of the data sheet. In cases where the data sheet has more than one page, it is possible for the pages to have different edition numbers, with the data sheet number remaining the same.

2 Data Sheet List and Sequence

The following page presents a list of all the data sheets. The list is sorted in the order of Circuit, then wattage, then bulb diameter, and then length. use this list to identify the data sheet number of the lamp. The data sheets follow in order of the wattage.

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Data Sheet Number 7881-ANSI-	Nominal Wattage (W)	Nominal length (Inch)	Bulb	Base	Reference Frequency (Hz)	Circuit / Notes
1001-1	17	24	T8	G13	60	RS
1002-1	25	36	T8	G13	60	RS
1003-1	25	36	T12	G13	60	RS
1027-1	25	48	T12	G13	60	RS or PH-shoplight
1004-1	30	36	T12	G13	60	RS
1005-2	32	48	T8	G13	60	RS
1006-1	34	48	T12	G13	60	RS
1007-1	40	60	T8	G13	60	RS
1008-1	40	48	T10	G13	60	RS
1009-1	40	1160mm	T12	G13	60	RS
1010-1	40	48	T12	G13	60	RS
1011-1	37	24	T12	RDC	60	RS-.800A
1012-1	50	36	T12	RDC	60	RS-.800A
1013-1	63	48	T12	RDC	60	RS-.800A
1014-1	75	60	T12	RDC	60	RS-.800A
1015-1	87	72	T12	G20	60	RS-.800A
1016-1	87	72	T12	RDC	60	RS-.800A
1017-1	95	96	T12	RDC	60	RS-.800A
1018-1	100	84	T12	RDC	60	RS-.800A
1019-1	113	96	T12	RDC	60	RS-.800A
1021-1	116	48	T12	RDC	60	RS-1.5A
1022-1	116	48	PG17	RDC	60	RS-1.5A
1023-1	168	72	T12	RDC	60	RS-1.5A
1024-1	168	72	PG17	RDC	60	RS-1.5A
1025-1	215	96	T12	RDC	60	RS-1.5A
1026-1	215	96	PG17	RDC	60	RS-1.5A
1501-1	44	48	T8	RDC	25K	HF
1502-1	56	60	T8	R17d	25K	HF
1503-1	66	72	T8	R17d	25K	HF
1501-1	86	96	T8	R17d	25K	HF
2001-1	4	6	T5	G5	60	PH
2002-1	6	9	T5	G5	60	PH
2003-1	8	12	T5	G5	60	PH
2004-1	8	12	T5	G5	60	PH / Bactericidal
2005-1	13	21	T5	G5	60	PH

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Data Sheet Number 7881-ANSI-	Nominal Wattage (W)	Nominal length (Inch)	Bulb	Base	Reference Frequency (Hz)	Circuit / Notes
2006-1	14	15	T8	G13	60	PH
2007-1	14	15	T12	G13	60	PH
2008-1	15	18	T8	G13	60	PH
2009-1	15	18	T8	G13	60	PH / Bactericidal
2010-1	15	18	T12	G13	60	PH
2011-1	18	24	T8	G13	60	PH
2012-1	18	26	T8	G13	60	PH
2013-1	19	28	T8	G13	60	PH
2014-1	19	30	T8	G13	60	PH
2015-1	20	24	T12	G13	60	PH
2016-1	25	28	T12	G13	60	PH
2017-1	25	33	T12	G13	60	PH
2018-1	30	36	T8	G13	60	PH
2019-1	30	36	T8	G13	60	PH / Bactericidal
2020-1	90	60	T12	G20	60	PH
2021-1	90	60	T17	G20	60	PH
3001-1	40	48	T12	G13	60	IS
3002-1	40	60	T12	G20	60	IS
3003-1	40	60	T17	G20	60	IS
3004-1	40	48	T12	Fa8	60	IS
3005-1	57	72	T12	Fa8	60	IS
3006-1	60	96	T12	Fa8	60	IS
3007-1	75	96	T12	Fa8	60	IS
3008-1	25	42	T6	Fa8	60	IS
3009-1	38	64	T6	Fa8	60	IS
3010-1	38	72	T8	Fa8	60	IS
3011-1	51	96	T8	Fa8	60	IS
3012-1		45	T8	Cap	60	Cold cathode
3013-1		69	T8	Cap	60	Cold cathode
3014-1		93	T8	Cap	60	Cold cathode

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4-Watt, 6-Inch T5, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	4W/6T5/PH
Nominal wattage	4 watts
Nominal overall length	6 in (150 mm)
Bulb designation	T5 (T16)
Base	G5, Miniature bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	5.35	-	135.9
B (Base face to end of opposite base pin)	5.53	5.63	140.5	143.0
C (End of base pin to end of opposite pin)	-	5.91	-	150.1
D (Bulb outside diameter)	0.53	0.63	13.5	16.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	4.5
Voltage (V)	29
Current (A)	0.170

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.160
Impedance (ohms)	650

Cathode characteristics

Type	High resistance
Resistance (at 8.OV)	
Objective (ohms)	70

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.16
max (A)	0.25
Preheat time (at 0.22 A preheat current)	
min (seconds)	0.5

For starterless circuits (rapid start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note)		
at 50°F (10°C) and above, (Vrms) min	105	120
at 50°F (10°C) and above, (Vrms) max	145	165
Voltage lamp terminal to starting aid		
at 50°F (10°C) and above, (Vpeak) min	400	400
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) at 60 Hz)		0.06

NOTE - These values are for lead circuits only. For lag circuits, add 3%.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	5.4	-
at rated primary (V)	6.0	8.0
at 110% primary (V)	-	8.8
Dummy load resistor	70 ± 1.0 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.5	-
at rated primary (V)	7.2	8.4
at 110% primary (V)	-	9.2

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6-Watt, 9-Inch T5, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	6W/9T5/PH
Nominal wattage	6 watts
Nominal overall length	9 in (225 mm)
Bulb designation	T5 (T16)
Base	G5, Miniature bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)		8.35	-	212.1
B (Base face to end of opposite base pin)	8.53	8.63	216.7	219.2
C (End of base pin to end of opposite pin)	-	8.91	-	226.3
D (Bulb outside diameter)	0.53	0.63	13.5	16.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	6.0
Voltage (V)	42
Current (A)	0.160

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.160
Impedance (ohms)	650

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	70

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.16
max (A)	0.25
Preheat time (at 0.22 A preheat current)	
min (seconds)	0.5

For starterless circuits (rapid start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note)		
at 50°F (10°C) and above, (Vrms) min	105	130
at 50°F (10°C) and above, (Vrms) max	145	180
Voltage lamp terminal to starting aid		
at 50°F (10°C) and above, (Vpeak) min	400	400
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTE - These values are for lead circuits only. For lag circuits, add 3%.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	5.4	-
at rated primary (V)	6.0	8.0
at 110% primary (V)	-	8.8
Dummy load resistor	70 ± 1.0 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.5	-
at rated primary (V)	7.2	8.4
at 110 % primary (V)	-	9.2

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8-Watt, 12-Inch T5, Preheat-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081.

Lamp description

Lamp abbreviation	8W/12T5/PH
Nominal wattage	8 watts
Nominal overall length	12 in (300 mm)
Bulb designation	T5 (T16)
Base	G5, Miniature bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	11.35	-	288.3
B (Base face to end of opposite base pin)	11.53	11.63	292.9	295.4
C (End of base pin to end of opposite pin)	-	11.91	-	302.5
D (Bulb outside diameter)	0.53	0.63	13.5	16.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	7.2
Voltage (V)	57
Current (A)	0.145

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.160
Impedance (ohms)	650

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	70

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.16
max (A)	0.25
Preheat time (at 0.22 A preheat current)	
min (seconds)	0.5

For starterless circuits (rapid start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note)		
at 50°F (10°C) and above, (Vrms) min	105	140
at 50°F (10°C) and above, (Vrms) max	145	190
Voltage lamp terminal to starting aid		
at 50°F (10°C) and above, (Vpeak) min	400	400
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTE - These values are for lead circuits only. For lag circuits, add 3%.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90 primary (V)	5.4	-
at rated primary (V)	6.0	8.0
at 110% primary (V)	-	8.8
Dummy load resistor	70 ± 1.0 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.5	-
at rated primary (V)	7.2	8.4
at 110% primary (V)	-	9.2

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8-Watt, 12-Inch T5, Preheat-Start Bactericidal Lamp

Lamp description

Lamp abbreviation	8W/12T5/PH-B
Nominal wattage	8 watts
Nominal overall length	12 in (300 mm)
Bulb designation	T5 (T16)
Base	G5, Miniature bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	11.35	-	288.3
B (Base face to end of opposite base pin)	11.53	11.63	292.9	295.4
C (End of base pin to end of opposite pin)		11.91	-	302.5
D (Bulb outside diameter)	0.53	0.63	13.5	16.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	7.2
Voltage (V)	57
Current (A)	0.145

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.160
Impedance (ohms)	650

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	70

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.16
max (A)	0.25
Preheat time (at 0.22 A preheat current)	
min (seconds)	0.5

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13-Watt, 21-Inch T5, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	13W/21T5/PH
Nominal wattage	13 watts
Nominal overall length	21 in (525 mm)
Bulb designation	T5 (T16)
Base	G5, Miniature bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	20.35	-	516.9
B (Base face to end of opposite base pin)	20.53	20.63	521.5	524.0
C (End of base pin to end of opposite pin)	-	20.91	-	531.1
D (Bulb outside diameter)	0.53	0.63	13.5	16.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	13
Voltage (V)	94
Current (A)	0.165

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.165
Impedance (ohms)	1200

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	70

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	180
at 50°F (10°C) and above, (Vpeak) max	400
Preheat current	
min (A)	0.18
max (A)	0.27
Preheat time (at 0.22 A preheat current)	
min (seconds)	0.5

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14-Watt, 15-Inch T8, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	14W/15T8/PH
Nominal wattage	14 watts
Nominal overall length	15 in (378 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	14.22	-	361.2
B (Base face to end of opposite base pin)	14.40	14.50	365.8	368.3
C (End of base pin to end of opposite pin)	14.67	14.78	372.6	375.4
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	14.5
Voltage (V)	45
Current (A)	0.365

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.390
Impedance (ohms)	275

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	26

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Information for ballast design (conditions of clause 12 apply:

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For starterless circuits (rapid start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note 1)		
at 50°F (10°C) and above, (Vrms) min	105	157
at 50°F (10°C) and above, (Vrms) max	145	220
Voltage lamp terminal to starting aid (see note 2)		
at 50°F (10°C) and above, (Vpeak) min	325	325
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	4.0	-
at rated primary (V)	-	8.5
at 100% primary (V)	-	9.5
Dummy load resistor	26 ± 0.25 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.8	-
at rated primary (V)	-	9.0[1]
at 100% primary (V)	-	10.0[1]

1) This voltage may be exceeded provided that at 110% primary the current through a 14 ohm resistor does not exceed 0.750 amperes.

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14-Watt, 15-Inch T12, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	14W/15T12/PH
Nominal wattage	14 watts
Nominal overall length	15 in (378 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	14.22	-	361.2
B (Base face to end of opposite base pin)	14.40	14.50	365.8	368.3
C (End of base pin to end of opposite pin)	14.67	14.78	372.6	375.4
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	14.0
Voltage (V)	40
Current (A)	0.380

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.390
Impedance (ohms)	275

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	29

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For starterless circuits (rapid start)

	Single Lamp	Ballasts for two lamps
Voltage between lamp terminals (see note 1)		
at 50°F (10°C) and above, (Vrms) min	105	157
at 50°F (10°C) and above, (Vrms) max	145	220
Voltage lamp terminal to starting aid (see note 2)		
at 50°F (10°C) and above, (Vpeak) min	280	280
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	4.0	-
at rated primary (V)	-	8.5
at 100% primary (V)	-	9.5
Dummy load resistor	29 ± 0.3 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.8	-
at rated primary (V)	-	9.0[1]
at 100% primary (V)	-	10.0[1]

1) This voltage may be exceeded provided that at 110% primary the current through a 14 ohm resistor does not exceed 0.750 amperes.

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15-Watt, 18-Inch T8, Preheat-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081.

Lamp description

Lamp abbreviation	15W/18T8/PH
Nominal wattage	15 watts
Nominal overall length	18 in (450 mm)
Bulb Designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	17.22	-	437.4
B (Base face to end of opposite base pin)	17.40	17.50	442.0	444.5
C (End of base pin to end of opposite pin)	17.67	17.78	448.8	451.6
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage(W)	15.0
Voltage (V)	55
Current (A)	0.305

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.300
Impedance (ohms)	305

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	26

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For starterless circuits (rapid-start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note 1)		
at 50°F (10°C) and above, (Vrms) min	105	157
at 50°F (10°C) and above, (Vrms) max	145	220
Voltage lamp terminal to starting aid (see note 2)		
at 50°F (10°C) and above, (Vpeak) min	325	325
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	4.0	-
at rated primary (V)	-	8.5
at 100% primary (V)	-	9.5
Dummy load resistor	26 ± 0.25 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.8	-
at rated primary (V)	-	9.0[1]
at 100% primary (V)	-	10.0[1]

1) This voltage may be exceeded provided that at 110% primary the current through a 14 ohm resistor does not exceed 0.750 amperes.

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15-Watt, 18-Inch T8, Preheat-Start Bactericidal Lamp

Lamp description

Lamp abbreviation	15W/18T8/PH-B
Nominal wattage	15 watts
Nominal overall length	18 in (450 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	17.22	-	437.4
B (Base face to end of opposite base pin)	17.40	17.50	442.0	444.5
C (End of base pin to end of opposite pin)	17.67	17.78	448.8	451.6
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	15.0
Voltage (V)	55
Current (A)	0.305

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.300
Impedance (ohms)	305

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	26

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	106
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

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15-Watt, 18-Inch T12, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	15W/18T12/PH
Nominal wattage	15 watts
Nominal overall length	18 in (450 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	17.22	-	437.3
B (Base face to end of opposite base pin)	17.40	17.50	442.0	444.5
C (End of base pin to end of opposite pin)	17.67	17.78	448.8	451.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	14.5
Voltage (V)	47
Current (A)	0.325

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.300
Impedance (ohms)	305

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	29

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For starterless circuits (rapid start)

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals (see note 1)		
at 50°F (10°C) and above, (Vrms) min	105	157
at 50°F (10°C) and above, (Vrms) max	145	220
Voltage lamp terminal to starting aid (see note 2)		
at 50°F (10°C) and above, (Vpeak) min	280	280
Wavescape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest f actors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Voltage, nominal (V) 8.0

Voltage during operation	Min	Max
at 90% primary (V)	4.0	-
at rated primary (V)	-	8.5
at 100% primary (V)	-	9.5
Dummy load resistor	29 ± 0.3 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.8	-
at rated primary (V)	-	9.0[1]
at 100% primary (V)	-	10.0[1]

1) This voltage may be exceeded provided that at 110% primary the current through a 14-ohm resistor does not exceed 0.750 amperes.

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17-Watt, 24-Inch T8, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	17W/24T8/RS
Nominal wattage	17 watts
Nominal overall length	24 in (600 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	23.22	-	589.8
B (Base face to end of opposite base pin)	23.40	23.50	594.4	596.9
C (End of base pin to end of opposite pin end)	23.67	23.78	601.2	604.0
D (Bulb, outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	16.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	1.5
Total wattage (W)	17.5
Voltage (V)	70
Current (A)	0.265

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.265
Impedance (ohms)	800

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	11.0
Minimum (ohms)	8.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 50°F (10°C) and above, (Vrms) min	140	210
at 50°F (10°C) and above, (Vrms) max	190	285
Voltage lamp terminal to starting aid (Note 2)		
at 50°F (10°C) and above, (Vpeak) min	325	325
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.04
max (µF) (at 60 Hz)		0.06

NOTES

1 These values are for lead circuits only. Values for lag circuits are under consideration.
2 These values are for crest factors of 1.55 to 2.0. Add 20% for crest factors less than 1.55.

Cathode heat requirements

Rapid start

Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.4 V max
Dummy load resistor	11.0 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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18-Watt, 24-Inch T8, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	18W/24T8/PH
Nominal wattage	18 watts
Nominal overall length	24 in (600 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	23.22	-	589.8
B (Base face to end of opposite base pin)	23.40	23.50	594.4	596.9
C (End of base pin to end of opposite pin)	23.67	23.78	601.2	604.0
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	17.5
Voltage (V)	55
Current (A)	0.385

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.380
Impedance (ohms)	240

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 - 110% primary voltage	
min (A)	0.35
max (A)	0.80
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For this lamp, a grounded metal starting aid is required.

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18-Watt, 26-Inch T8, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	18W/26T8/PH
Nominal wattage	18 watts
Nominal overall length	26 in (650 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	25.22	-	640.6
B (Base face to end of opposite base pin)	25.40	25.50	645.2	647.7
C (End of base pin to end of opposite pin)	25.67	25.78	652.0	654.8
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	18.0
Voltage (V)	56
Current (A)	0.380

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.380
Impedance (ohms)	240

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 – 110% primary voltage	
min (A)	0.35
max (A)	0.80
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For this lamp, a grounded metal starting aid is required.

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19-Watt, 30-Inch T8, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	19W/30T8/PH
Nominal wattage	19 watts
Nominal overall length	30 in (750 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	29.22	-	742.2
B (Base face to end of opposite base pin)	29.40	29.50	746.8	749.3
C (End of base pin to end of opposite pin)	29.67	29.78	753.6	756.4
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	19.0
Voltage (V)	66
Current (A)	0.345

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.380
Impedance (ohms)	240

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 – 110% primary voltage	
min (A)	0.35
max (A)	0.80
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For this lamp, a grounded metal starting aid is required.

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19-Watt, 28-Inch T8, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	19W/28T8/PH
Nominal wattage	19 watts
Nominal overall length	28 in (700 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	27.22	-	691.4
B (Base face to end of opposite base pin)	27.40	27.50	696.0	698.5
C (End of base pin to end of opposite pin)	27.67	27.78	702.8	705.6
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	19.0
Voltage (V)	62
Current (A)	0.355

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.380
Impedance (ohms)	240

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 - 110% primary voltage	
min (A)	0.35
max (A)	0.80
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For this lamp, a grounded metal starting aid is required.

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20-Watt, 24-Inch T12, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	20W/24T12/PH
Nominal wattage	20 watts
Nominal overall length	24 in (600 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	23.22	-	589.8
B (Base face to end of opposite base pin)	23.40	23.50	594.4	596.9
C (End of base pin to end of opposite pin)	23.67	23.78	601.2	604.0
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	20.5
Voltage (V)	57
Current (A)	0.380

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.380
Impedance (ohms)	240

Cathode characteristics

Type	High resistance
Resistance (at 8.0 V)	
Objective (ohms)	29

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current	
min (A)	0.44
max (A)	0.65
Preheat time (at 0.55 A preheat current)	
min (seconds)	0.75

For starterless circuits (rapid start)

	Single Lamp	Ballasts for two lamps
Voltage between lamp terminals (see note 1)		
at 50°F (10°C) and above, (Vrms) min	105	157
at 50°F (10°C) and above, (Vrms) max	145	220
Voltage lamp terminal to starting aid (see note 2)		
at 50°F (10°C) and above, (Vpeak) min	280	280
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.008
max (µF) (at 60 Hz)		0.06

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Voltage, nominal (V)	8.0	
Voltage during operation	Min	Max
at 90% primary (V)	4.0	-
at rated primary (V)	-	8.5
at 100% primary (V)	-	9.5
Dummy load resistor	29 ± 0.3 ohms	
Voltage across dummy load	Min	Max
at 90% primary (V)	6.8	-
at rated primary (V)	-	9.0[1]
at 100% primary (V)	-	10.0[1]

1) This voltage may be exceeded provided that at 110% primary the current through a 14 ohm resistor does not exceed 0.750 amperes.

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25-Watt, 36-Inch T8, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	25W/36T8/RS
Nominal wattage	25 watts
Nominal overall length	36 in (900 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	35.22	-	894.6
B (Base face to end of opposite base pin)	35.40	35.50	899.2	901.7
C (End of base pin to end of opposite pin end)	35.67	35.78	906.0	908.8
D (Bulb, outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	23.5
Approximate cathode wattage (with 3.6 V on each cathode) (W)	1.5
Total wattage (W)	25.0
Voltage (V)	100
Current (A)	0.265

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.265
Impedance (ohms)	733

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	11.0
Minimum (ohms)	8.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 50°F (10°C) and above, (Vrms) min	170	260
at 50°F (10°C) and above, (Vrms) max	230	355
Voltage lamp terminal to starting aid (Note 2)		
at 50°F (10°C) and above, (Vpeak) min	325	325
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.04
max (µF) (at 60 Hz		0.06

NOTES

1 These values are for lead circuits only. Values for lag circuits are under consideration.
2 These values are for crest factors of 1.55 to 2.0. Add 20% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.4 V max
Dummy load resistor	11.0 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min 45 V max

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25-Watt, 36-Inch T12, Rapid-Start Fluorescent Lamp

Lamp Description

Lamp abbreviation	25W/36T12/RS
Nominal wattage	25 watts
Nominal overall length	36 in. (900mm)
Bulb designation	T12 (T38)
Base	G13 Medium bipin
Circuit application	Rapid start

Dimensional Characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	35.22	-	894.6
B (Base face to end of opposite base pin)	35.40	35.50	899.2	901.7
C (End of base pin to end of opposite base pin)	35.67	35.78	906.0	908.8
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical Characteristics

Lamp Operating Characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	24.5
Approximate cathode wattage (with 3.6V on each cathode) (W)	2.0
Total wattage (W)	26.5
Voltage (V)	62
Current (A)	0.455

Reference Ballast Characteristics

Rated input voltage (V)	180
Reference current (A)	0.430
Impedance (ohms)	335

Cathode Characteristics

Type	Low resistance
Resistance (at 3.6V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for Ballast Design (conditions of clause 12 apply)

Lamp Starting Requirements

	Single lamp	Ballasts for two lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 60°F (15°C) and above, (Vrms) min	175	215
at 60°F (15°C) and above, (Vrms) max	210	290
at 60°F (15°C) and above, (Vpeak) min	280	300
Waveshape of starting voltage crest factor, max	2.0	2.0
Lamp current crest factor, max	1.9	1.9
Starting capacitor size		
min (µF) (at 60 Hz)		0.04
max (µF) (at 60 Hz)		0.06

NOTE

1 These values are for lead circuits only.

Cathode Heat Requirements

Rapid Start	
Voltage	3.6V nominal
Limits during operation	2.5V min., 4.0V max
Dummy load resistor	9.6 ohms ± 0.1 ohms
Voltage across dummy load	3.4V min., 4.5V max.

Application Note: Single lamp ballasts designed to operate the 30W/36T12/RS lamp may or may not start the 25W/36T12/RS lamp.

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25-Watt, 48-Inch T12, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	25W/48T12/RS
Nominal wattage	25 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Rapid start, Low power factor (Lag) Ballast (Shoplight)

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.0	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	24.5
Approximately cathode wattage (With 3.6 V on each cathode) (W)	1.5
Total wattage (W)	26.0
Voltage (V)	106
Current (A)	0.250

Reference ballast characteristics

Rated input voltage (V)	300V
Reference current (A)	0.250
Impedance (ohms)	1025

Cathode characteristics

Type	Rapid Start
Resistance (at 3.6 V)	
Objective (ohms).	11.5
Minimum (ohms).	9.0

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25-Watt, 48-Inch T12, Rapid-Start Fluorescent Lamp

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	200	256	395
at 50°F (10°C) and above, (Vrms) max	260	330	525
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	240	240	280
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.04	0.04
max (µF) (at 60 Hz)		0.06	0.06
Preheat (switch) start			
Voltage between lamp terminals			
at 50°F (10°C) and above, (Vrms) min	176		
at 50°F (10°C) and above, (Vrms) max	230		
at 50°F (10°C) and above, (Vpeak) max	375		
Voltage lamp terminal to ground (Vrms) max (Note 3)	135		

NOTES
1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.
3 Applies unless other means are provided to avoid instant starting.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min., 4.0 V max.
Dummy load resistor	11.5 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min., 4.5 V max.
Preheat (switch) start	
Current during preheat at rated primary voltage	0.40 A min., 0.65 A max.
Preheat time at 0.53 A preheat current	1.0 seconds min.

Application Note:
- This lamp is specifically designed for rapid start low power factor (Lag) ballasts.
- Use on other ballasts, such as rapid start high power factor F40T12 ballasts, may substantially reduce lamp life.
- Both the U.S. and Canadian federal governments are considering restrictions on the marketing and application of 48" (1200mm) T12 lamps rated at less than 28 watts.

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25-Watt, 28-Inch T12, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	25W/28T12/PH
Nominal wattage	25 watts
Nominal overall length	28 in (700 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	27.22	-	691.4
B (Base face to end of opposite base pin)	27.40	27.50	696.0	698.5
C (End of base pin to end of opposite pin)	27.67	27.78	702.8	705.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	25.0
Voltage (V)	63
Current (A)	0.460

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.460
Impedance (ohms)	190

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 – 110% primary voltage	
min (A)	0.41
max (A)	0.95
Preheat time (at 0.60 A preheat current)	
min (seconds)	0.75

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25-Watt, 33-Inch T12, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	25W/33T12/PH
Nominal wattage	25 watts
Nominal overall length	33 in (825 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	32.22	-	818.4
B (Base face to end of opposite base pin)	32.40	32.50	823.0	825.5
C (End of base pin to end of opposite pin)	32.67	32.78	829.8	832.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	25.5
Voltage (V)	61
Current (A)	0.460

Reference ballast characteristics

Rated input voltage (V)	118
Reference current (A)	0.460
Impedance (ohms)	190

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	108
at 50°F (10°C) and above, (Vpeak) max	210
Preheat current at 90 - 110% primary voltage	
min (A)	0.41
max (A)	0.95
Preheat time (at 0.60 A preheat current)	
min (seconds)	0.75

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25-Watt, 42-Inch T6, Single Pin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	25W/42T6/SP
Nominal wattage	25 watts
Nominal overall length	42 in (1050 mm)
Bulb designation	T6 (T19)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	39.10	39.30	993.1	998.2
B (Base face to end of opposite base pin)	39.42	39.65	1001.3	1007.1
C (End of base pin to end of opposite pin end)	9.74	40.00	1009.4	1016.0
D (Bulb outside diameter)	0.69	0.81	17.5	20.6

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	@.120 A	@.200 A	@.300 A
Wattage (W)	17.8	25.5	32.5
Voltage (V)	174	150	133
Current (A)	0.120	0.200	0.300

Reference ballast characteristics

Rated input voltage (V)	450	450	450
Reference current (A)	0.120	0.200	0.300
Impedance (ohms)	3200	1960	1350

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min	405

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30-Watt, 36-Inch T12, Rapid-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	30W/36T12/RS
Nominal wattage	30 watts
Nominal overall length	36 in (900 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	35.22	-	894.6
B (Base face to end of opposite base pin)	35.40	35.50	899.2	901.7
C (End of base pin to end of opposite pin end)	35.67	35.78	906.0	908.8
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	30.5
Approximate cathode wattage (with 3.6 V on each cathode) (W)	2.0
Total wattage (W)	32.5
Voltage (V)	77
Current (A)	0.430

Reference ballast characteristics

Rated input voltage (V)	180
Reference current (A)	0.430
Impedance (ohms)	335

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	150	215	305
at 50°F (10°C) and above, (Vrms) max	205	290	410
at 0°F (-17.8°C) and above, (Vrms) min	180	245	335
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	280	280	280
at 0°F (-17.8°C) and above, (Vpeak) min	500	500	500
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.04	0.04
max (µF) (at 60 Hz)		0.06	0.06

NOTES

1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.0 V max
Dummy load resistor	9.6 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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30-Watt, 36-Inch T8, Preheat-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	30W/36T8/PH
Nominal wattage	30 watts
Nominal overall length	36 in (900 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	35.22	-	894.6
B (Base face to end of opposite base pin)	35.40	35.50	899.2	901.7
C (End of base pin to end of opposite pin)	35.67	35.78	906.0	908.8
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	30.5
Voltage (V)	99
Current (A)	0.355

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.350
Impedance (ohms)	548

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	176
at 50°F (10°C) and above, (Vpeak) max	375
Preheat current	
min (A)	0.40
max (A)	0.65
Preheat time (at 0.53 A preheat current)	
min (seconds)	1.0

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30-Watt, 36-Inch T8, Preheat-Start Bactericidal Lamp

Lamp description

Lamp abbreviation	30W/36T8/PH-B
Nominal wattage	30 watts
Nominal overall length	36 in (900 mm)
Bulb designation	T8 (T25)
Base	G13, medium bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	35.22	-	894.6
B (Base face to end of opposite base pin)	35.40	35.50	899.2	901.7
C (End of base pin to end of opposite pin)	35.67	35.78	906.0	908.8
D (Bulb outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	30.5
Voltage (V)	99
Current (A)	0.355

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.350
Impedance (ohms)	548

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

Voltage between lamp terminals	
at 50°F (10°C) and above, (Vrms) min	176
at 50°F (10°C) and above, (Vpeak) max	375
Preheat current	
min (A)	0.40
max (A)	0.65
Preheat time (at 0.53 A preheat current)	
min (seconds)	1.0

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32-Watt, 48-Inch T8, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	32W/48T8/RS
Nominal wattage	32 watts
Nominal overall length	48 inches (1200 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.0	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb, outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	30.8
Approximate cathode wattage (with 3.6 V on each cathode) (W)	1.7
Total wattage (W)	32.5
Voltage (V)	137
Current (A)	0.265

Reference ballast characteristics

Rated input voltage (V)	300
Reference current (A)	0.265
Impedance (ohms)	910

Cathode characteristics

Type	Low resistance
Resistance at 3.60 Volts	12.0 +/- 2.0 ohms
Rh/Rc ratio at 3.60 Volts	4.75 +/- 0.50

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32-Watt, 48-Inch T8, Rapid-Start Fluorescent Lamp

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps in series Option A	Option B
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	200	300	315
Voltage lamp terminal to starting aid (Note 2)			
at 60°F (15.6°C) and above, (Vpeak) min	260	260	260
at 50°F (10°C) and above, (Vpeak) min	290	290	290
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.08	0.04
max (µF) (at 60 Hz)		0.12	0.06

NOTES

1 These values are for lead circuits only. For lag circuits, the values are under consideration.
2 These values are for crest factors of 1.55 to 2.0. Add 20% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.4 V max
Dummy load resistor	11.0 ohms ± 0.1 ohms
Voltage across dummy load	3.4 V min, 4.5 V max

Ground plane spacing

The requirements of 13.2 apply. However, a spacing of up to 0.75 in (19 mm) is allowed if the ground plane is at least 2 in (51 mm) wide.

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Information for high frequency ballast design

This lamp type is rated for use on 60Hz magnetic ballasts but is widely used on high frequency electronic ballasts.

Typical lamp electrical characteristics without coil heat will be as follows when the lamp is operated at 25Khz with a resistive reference ballast which is adjusted to provide approximately the same light output as a 60 Hz reference ballast

Lamp current (A)	0.217
Lamp voltage (V)	136
Lamp wattage (W)	29

High frequency instant start ballasts for this lamp shall not be designed to have a nominal lamp current of less than 0.155A

Maximum lamp high frequency current crest factor 1.7

Starting requirements

The following values are for 50 F and above. The requirements shall be met at any primary voltage between 90% and 110% of ballast's rated input voltage.

Instant start operation

Voltage, Vrms minimum	465 (Note 1)
Maximum starting time, msec	100

Note 1: A higher open circuit voltage must be provided if necessary to meet the starting time requirement. The maximum start time must not be exceeded.

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Not for Resale

34-Watt, 48-Inch T12, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	34W/48T12/RS
Nominal wattage	34 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.0	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	32.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	2.0
Total wattage (W)	34.0
Voltage (V)	79
Current (A)	0.460

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.430
Impedance (ohms)	439

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 60°F (15.5°C) and above, (Vrms) min	200	256
at 60°F (15.5°C) and above, (Vrms) max	260	330
at 60°F (15.5°C) and above, (Vpeak) min peak	315	380
Waveshape of starting voltage crest factor, max	2.0	2.0
Lamp current crest factor, maximum	1.9	1.9
Starting capacitor size		
min (µF) (at 60 Hz)		0.04
max (µF) (at 60 Hz)		0.06

NOTE

1 These values are for lead circuits only. For lag circuits, the values are under consideration.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.0 V max
Dummy load resistor	9.6 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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37-Watt, 24-Inch T12, 0.800-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	37W/24T12/HO
Nominal wattage	37 watts
Nominal overall length	24 in (600 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	21.72	21.91	551.7	556.5
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	30.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W).	37.0
Voltage (V)	41
Current (A)	0.800

Reference ballast characteristics

Rated input voltage (V)	230
Reference current (A)	0.800
Impedance (ohms)	275

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	85	145	230
at 0°F (-17.8°C) and above, (Vrms) min	110	195	260
at -20°F (-28.9°C) and above, (Vrms) min	140	225	290
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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38-Watt, 64-Inch T6, Single Pin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	38W/64T6/SP
Nominal wattage	38 watts
Nominal overall length	64 in (1600 mm)
Bulb designation	T6 (T19)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	61.10	61.30	1551.9	1557.0
B (Base face to end of opposite base pin)	61.42	61.65	1560.1	1565.9
C (End of base pin to end of opposite pin end)	61.74	62.00	1568.2	1574.8
D (Bulb outside diameter)	0.69	0.81	17.5	20.6

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	@.120 A	@.200 A	@.300 A
Wattage (W)	26.8	38.5	50.0
Voltage (V)	267	233	201
Current (A)	0.120	0.200	0.300

Reference ballast characteristics

Rated input voltage (V)	600	600	600
Reference current (A)	0.120	0.200	0.300
Impedance (ohms)	4180	2560	1740

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min 540

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38-Watt, 72-Inch T8, Single Pin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	38W/72T8/SP
Nominal wattage	38 watts
Nominal overall length	72 in (1800 mm)
Bulb designation	T8 (T25)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	69.10	69.30	1755.1	1760.2
B (Base face to end of opposite base pin)	69.42	69.65	1763.7	1769.1
C (End of base pin to end of opposite pin end)	69.74	70.00	1771.4	1778.0
D (Bulb outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	@.120 A	@.200A	@.300 A
Wattage (W)	25.0	38.0	50.0
Voltage (V)	245	220	195
Current (A)	0.120	0.200	0.300

Reference ballast characteristics

Rated input voltage (V)	600	600	600
Reference current (A)	0.120	0.200	0.300
Impedance (ohms)	4180	2560	1740

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min 540

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40-Watt, 60-Inch T8, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	40W/60T8/RS
Nominal wattage	40 watts
Nominal overall length	60 in (1500 mm)
Bulb designation	T8 (T25)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	59.05	-	1499.9
B (Base face to end of opposite base pin)	59.24	59.33	1504.7	1507.0
C (End of base pin to end of opposite pin end)	59.50	59.61	1511.3	1514.1
D (Bulb, outside diameter)	0.94	1.10	23.9	27.9

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	38.5
Approximate cathode wattage (with 3.6 V on each cathode) (W)	1.5
Total wattage (W)	40.0
Voltage (V)	172
Current (A)	0.265

Reference ballast characteristics

Rated input voltage (V)	300
Reference current (A)	0.265
Impedance (ohms)	790

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	11.0
Minimum (ohms)	8.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 50°F (10°C) and above, (Vrms) min .	250	385
at 50°F (10°C) and above, (Vrms) max	340	520
Voltage lamp terminal to starting aid (Note 2)		
at 50°F (10°C) and above, (Vpeak) min	325	325
Waveshape of starting voltage crest factor, max	2.0	2.0
Starting capacitor size		
min (µF) (at 60 Hz)		0.04
max (µF) (at 60 Hz)		0.06

NOTES

1 These values are for lead circuits only. For lag circuits, the values are under consideration.
2 These values are for crest factors of 1.55 to 2.0. Add 20% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.4 V max
Dummy load resistor	11.0 ohms ± 0.1 ohm
Voltage across dummy load	3.4 ohms ± 4.5 ohm

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40-Watt, 48-Inch T10, Rapid-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	40W/48T10/RS
Nominal wattage	40 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T10 (T32)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.0	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb, outside diameter)	1.16	1.34	29.5	34.0

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	40.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	2.0
Total wattage (W)	42.0
Voltage (V)	104
Current (A)	0.420

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.430
Impedance (ohms)	439

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single Lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	200	256	395
at 0°F (-17.8°C) and above, (Vrms) max	260	330	525
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	240	240	280
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.04	0.04
max (µF) (at 60 Hz)		0.06	0.06

NOTES

1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.0 V max
Dummy load resistor	9.6 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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40-Watt, T12, 1160-Millimeter, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	40W/1160mmT12/RS
Nominal wattage	40 watts
Nominal overall length	1160 mm
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Rapid start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	45.67	-	1160.0
B (Base face to end of opposite base pin)	45.85	45.95	1164.6	1167.1
C (End of base pin to end of opposite pin end)	-	46.23	-	1174.2
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	38.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	2.0
Total wattage (W)	40.0
Voltage (V)	98
Current (A)	0.432

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.430
Impedance (ohms)	439

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	200	256	395
at 50°F (10°C) and above, (Vrms) max	260	330	525
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	240	240	280
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.04	0.04
max (µF) (at 60 Hz)		0.06	0.06

NOTES

1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.0 V max
Dummy load resistor	9.6 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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40-Watt, 48-Inch T12, Rapid-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	40W/48T12/RS
Nominal wattage	40 watts
Nominal overall length	48 in (1200 mm)
Bulb Designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Rapid start and preheat (switch)-start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.0	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	39.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	2.0
Total wattage (W)	41.0
Voltage (V)	101
Current (A)	0.430

Reference ballast characteristics

Rated input voltage (V)	236
Reference current (A)	0.430
Impedance (ohms)	439

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	9.6
Minimum (ohms)	7.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	200	256	395
at 50°F (10°C) and above, (Vrms) max	260	330	525
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	240	240	280
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.04	0.04
max (µF) (at 60 Hz		0.06	0.06
Preheat (switch) start			
Voltage between lamp terminals			
at 50°F (10°C) and above, (Vrms) min	176		
at 50°F (10°C) and above, (Vrms) max	230		
at 50°F (10°C) and above, (Vpeak) max	375		
Voltage lamp terminal to ground			
(Vrms) max (Note 3)	135		

NOTES

1 These values are for lead circuits only. For lag circuits, add 3%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.
3 Applies unless other means are provided to avoid instant starting.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	2.5 V min, 4.0 V max
Dummy load resistor	9.6 ohms ± 0.1 ohm
Voltage across dummy load	3.4 V min, 4.5 V max
Preheat (switch) start	
Current during preheat,	
at rated primary voltage	0.55 A min, 0.75 A max
Preheat time at 0.65-A	
preheat current	1.0 s min

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40-Watt, 48-Inch T12, Medium Bipin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	40W/48T12/IS
Nominal wattage	40 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	G13, Medium bipin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	47.22	-	1199.4
B (Base face to end of opposite base pin)	47.40	47.50	1204.1	1206.5
C (End of base pin to end of opposite pin end)	47.67	47.78	1210.8	1213.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	40.5
Voltage (V)	104
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	430
Reference current (A)	0.425
Impedance (ohms)	930

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min	385

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40-Watt, 60-Inch T12, Mogul Bipin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	40W/60T12/IS
Nominal wattage	40 watts
Nominal overall length	60 in (1500 mm)
Bulb designation	T12 (T38)
Base	G20, Mogul bipin
Circuit Application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	58.30	-	1480.8
B (Base face to end of opposite base pin)	58.72	58.93	1491.5	1496.8
C (End of base pin to end of opposite pin end)	59.34	59.56	1507.2	1512.8
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	42
Voltage (V)	107
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	430
Reference current (A)	0.425
Impedance (ohms)	930

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements
Voltage
at 50°F (10°C) and above, (Vrms) min 385

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40-Watt, 60-Inch T17, Mogul Bipin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	40W/60T17/IS
Nominal wattage	40 watts
Nominal overall length	60 in (1500 mm)
Bulb designation	T17 (T53)
Base	G20, Mogul bipin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	58.30	-	1480.8
B (Base face to end of opposite base pin)	58.72	58.93	1491.5	1496.8
C (End of base pin to end of opposite pin end)	59.34	59.56	1507.2	1512.8
D (Bulb outside diameter)	2.00	2.19	50.8	55.5

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	42
Voltage (V)	107
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	430
Reference current (A)	0.425
Impedance (ohms)	930

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage	
at 50°F (10°C) and above, (Vrms) min	385

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40-Watt, 48-Inch T12, Single Pin, Instant-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	40W/48T12/SP
Nominal wattage	40 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	45.10	45.30	1143.0	1150.6
B (Base face to end of opposite base pin)	45.42	45.65	1153.7	1159.5
C (End of base pin to end of opposite pin end)	45.74	46.00	1161.8	1168.4
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	39
Voltage (V)	100
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	430
Reference current (A)	0.425
Impedance (ohms)	930

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min	385

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44 watt, 48-inch T8, 0.4 A
HF Rapid-Start Fluorescent Lamp

Lamp Description:

Lamp abbreviation	44W/48T8/HO
Nominal Wattage	44 watts
Nominal overall length	48 inches (1200 mm)
Bulb designation	T8 (T25)
Nominal diameter	1 inch (25.4mm)
Base type	RI7d (T8) Recessed double contact
Circuit application	HF Rapid start, Preheat start, or Programmed Start

Dimensional characteristics: *(definitions of Part II apply)*

	Inches		Millimeters	
	Min	Max	Min	Max
C (End of opposite base bosses)	45.72	45.91	1161.3	1166.1
D (Bulb, outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	HF (20-26kHz) (Note 1)
Arc wattage (W)	42.0
Approximate cathode wattage (With 3.6V on each cathode) (W)	2.0
Total wattage (W)	44.0
Voltage (V)	106.0
Current (A)	0.400

Reference ballast characteristics (20 - 26 kHz) (Note 1)

Rated input voltage (V)	300
Impedance (Ohms)	476
Reference Current (A.)	0.400

Note:

1. The above frequency has been chosen for ease of reproducing test results and is not intended to imply the correct frequency range for practical applications.

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Cathode Characteristics:

Hot resistance at test current (Ohms)	9.5 ± 1.9
Test current (A) (Note 2)	0.390

Note:

2. The average value of the resistance ratio, R_h/R_c, of the coils of 10 cathodes shall be within 4.75 ± 0.5, where R_h is the resistance of the cathode when heated with the test current as specified and R_c is the resistance of the cold cathode, both excluding leadwire resistance.

Information for high frequency ballast design: (where applicable, conditions of clause 12 apply)

Starting:

It is recognized that more than one type of circuit can properly start and operate this lamp type. These limits shall be met at any primary voltage between 90% and 110% of rated voltage and will provide reliable starting.

Cathode heating requirements in terms of R_h/R_c:

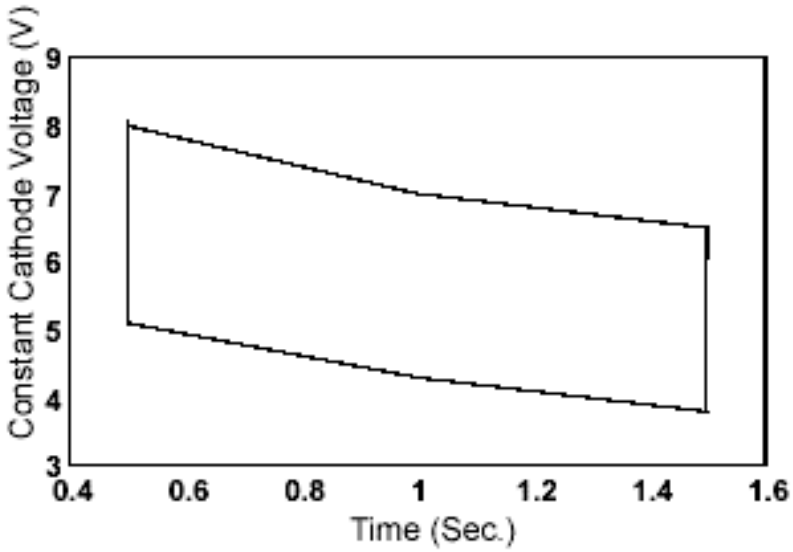
The value of the R_h/R_c ratio immediately prior to lamp starting shall be not less than 4.25 nor greater than 6.5. This is a dynamic value and must be attained by each cathode at the beginning of the transition from glow to operating current. Minimum preheat time must be greater than 400 ms.

Cathode heating requirements in terms of cathode voltage:

Time to emission (t_e) Constant Cathode Voltage

	Min	Max
0.5 Sec	5.1 V	8.0 V
1.0 Sec	4.3 V	7.0 V
1.5 Sec	3.8 V	6.5 V

(See drawing for times other than those specified)



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Voltage between lamp terminals: (Notes 3 and 4)

Time at Temperature			Open circuit voltage across lamp (V)	
$t < t_e$			Max. (rms)	150
$t > t_e$	50°F	(+10°C)	Min. (rms)	300
$t > t_e$	0°F	(-18°c)	Min. (rms)	375
$t > t_e$	-20°F	(-29°C)	Min. (rms)	435

Notes:

3. Sinusoidal voltages, frequency 20 - 26 kHz, with a grounded starting aid plane.
4. Ballasts which meet the R_s/R_c preheat requirements are not required to meet the limit on maximum voltage across the lamp during preheat period.

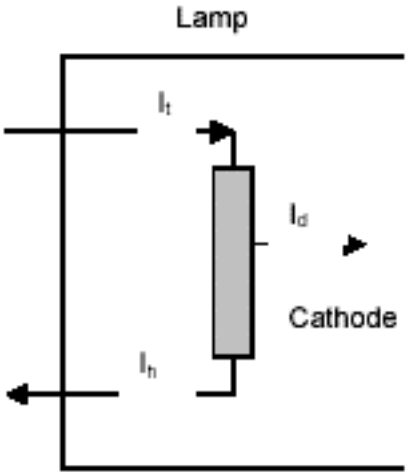
Starting Aid Plane:

Maximum distance ..... 32 mm (1.25 inches)

Operation:

Cathode heating requirements during running and dimming conditions:

In an operating lamp at least part of the emissive material has to be kept at a sufficiently high temperature for good lamp performance. Above a certain limiting value the discharge current itself can take care of this. Below this limit value, additional electrode current has to be applied. See diagram.



I_d = Discharge Current
I_h = Heating Current
$I_t = I_d + I_h$

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	I_d (Note 5)	I_h (Note 6)	I_t (Note 7)
Nominal operation	350-595 mA	<490 mA	350<1<630 mA
Dimming operation	35-350 mA	<490 mA	385<1<630 mA

Notes:

5. Discharge currents < 350 mA require additional electrode heating (I_h). Operation in this lamp current range may not provide ANSI specified ballast factors. Discharge currents > 595 mA will have a negative effect on lamp life.
6. Heating currents >490 mA will cause accelerated end blackening.
7. I_t is the highest current measured through any one lead to the electrode. I_t has a maximum value to avoid local overheating of the electrodes. For I_d < 350 mA, when extra electrode heating is applied, the minimum electrode heating is covered by the lower limit set to I_t.

Deep Dimming:

Dimming with electronic ballasts at an t_d < 35 mA is not yet specified.

Current Crest Factor:

Current Crest Factor	<1.70

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56 watt, 60-inch T8, 0.4 A
HF Rapid-Start Fluorescent Lamp

Lamp Description:

Lamp abbreviation	56W/60T8/HO
Nominal Wattage	56 watts
Nominal overall length	60 inches (1500 mm)
Bulb designation	T8 (T25)
Nominal diameter	1 inch (25.4mm)
Base type	RI7d (T8) Recessed double contact
Circuit application	HF Rapid start, Preheat start, or Programmed Start

Dimensional characteristics: (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (End of opposite base bosses)	57.72	57.91	1466.1	1470.9
D (Bulb, outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	HF (20-26kHz) (Note 1)
Arc wattage (W)	54.0
Approximate cathode wattage (With 3.6V on each cathode) (W)	2.0
Total wattage (W)	56.0
Voltage (V)	135.0
Current (A)	0.400

Reference ballast characteristics (20 - 26 kHz) (Note 1)

Rated input voltage (V)	330
Impedance (Ohms)	476
Reference Current (A.)	0.400

Note:

1. The above frequency has been chosen for ease of reproducing test results and is not intended to imply the correct frequency range for practical applications.

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Cathode Characteristics:

Hot resistance at test current (Ohms)	9.5 ± 1.9
Test current (A) (Note 2)	0.390

Note:

2. The average value of the resistance ratio, R_h/R_c, of the coils of 10 cathodes shall be within 4.75 ± 0.5, where R_h is the resistance of the cathode when heated with the test current as specified and R_c is the resistance of the cold cathode, both excluding leadwire resistance.

Information for high frequency ballast design: (where applicable, conditions of clause 12 apply)

Starting:

It is recognized that more than one type of circuit can properly start and operate this lamp type. These limits shall be met at any primary voltage between 90% and 110% of rated voltage and will provide reliable starting.

Cathode heating requirements in terms of R_h/R_c:

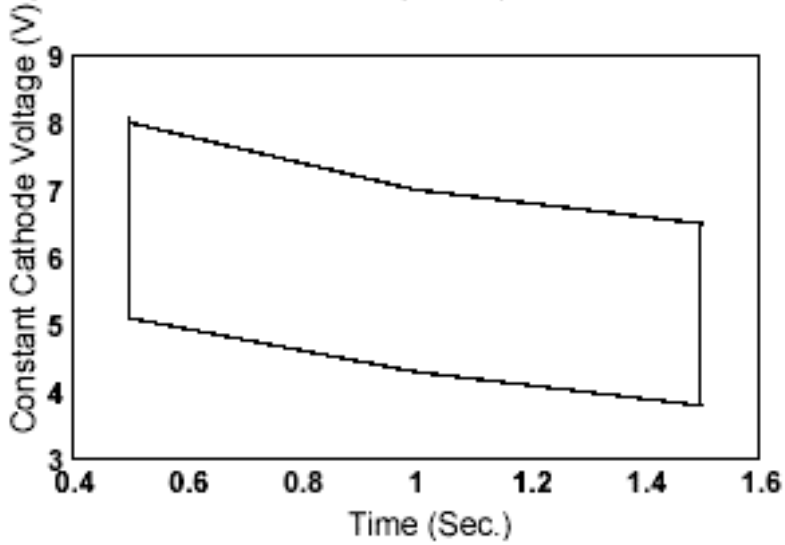
The value of the R_h/R_c ratio immediately prior to lamp starting shall be not less than 4.25 nor greater than 6.5. This is a dynamic value and must be attained by each cathode at the beginning of the transition from glow to operating current. Minimum preheat time must be greater than 400 ms.

Cathode heating requirements in terms of cathode voltage:

Time to emission (t_e) Constant Cathode Voltage

	Min	Max
0.5 Sec	5.1 V	8.0 V
1.0 Sec	4.3 V	7.0 V
1.5 Sec	3.8 V	6.5 V

(See drawing for times other than those specified)



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Voltage between lamp terminals: (Notes 3 and 4)

Time at Temperature			Open circuit voltage across lamp (V)	
$t < t_e$			Max. (rms)	180
$t > t_e$	50°F	(+10°C)	Min. (rms)	350
$t > t_e$	0°F	(-18°c)	Min. (rms)	460
$t > t_e$	-20°F	(-29°C)	Min. (rms)	530

Notes:

3. Sinusoidal voltages, frequency 20 - 26 kHz, with a grounded starting aid plane.
4. Ballasts which meet the R_s/R_c preheat requirements are not required to meet the limit on maximum voltage across the lamp during preheat period.

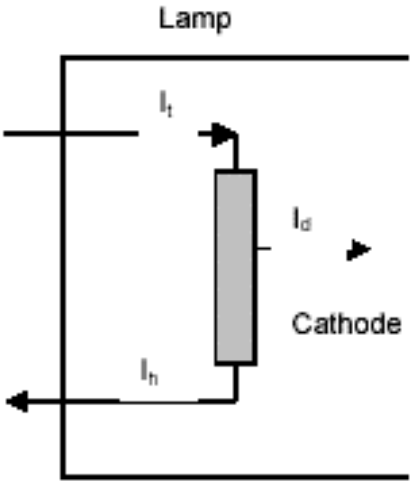
Starting Aid Plane:

Maximum distance ..... 32 mm (1.25 inches)

Operation:

Cathode heating requirements during running and dimming conditions:

In an operating lamp at least part of the emissive material has to be kept at a sufficiently high temperature for good lamp performance. Above a certain limiting value the discharge current itself can take care of this. Below this limit value, additional electrode current has to be applied. See diagram.



I_d = Discharge Current
I_h = Heating Current
$I_t = I_d + I_h$

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	I_d (Note 5)	I_h (Note 6)	I_t (Note 7)
Nominal operation	350-595 mA	<490 mA	350<1<630 mA
Dimming operation	35-350 mA	<490 mA	385<1<630 mA

Notes:

5. Discharge currents < 350 mA require additional electrode heating (I_h). Operation in this lamp current range may not provide ANSI specified ballast factors. Discharge currents > 595 mA will have a negative effect on lamp life.
6. Heating currents >490 mA will cause accelerated end blackening.
7. I_t is the highest current measured through any one lead to the electrode. I_t has a maximum value to avoid local overheating of the electrodes. For I_d < 350 mA, when extra electrode heating is applied, the minimum electrode heating is covered by the lower limit set to I_t.

Deep Dimming:

Dimming with electronic ballasts at an t_d < 35 mA is not yet specified.

Current Crest Factor:

Current Crest Factor	<1.70

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50-Watt, 36-Inch T12, 0.800-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	50W/36T12/HO
Nominal wattage	50 watts
Nominal overall length	36 in (900 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	33.72	33.91	856.5	861.3
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	43.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	50.0
Voltage (V)	59.0
Current (A)	0.800

Reference ballast characteristics

Rated input voltage (V)	230
Reference current (A)	0.800
Impedance (ohms)	260

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min .	115	195	300
at 0°F (-17.8°C) and above, (Vrms) min	155	235	340
at -20°F (-28.9°C) and above, (Vrms) min	190	260	360
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55,

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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51-Watt, 96-Inch T8, Single Pin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	51W/96T8/SP
Nominal wattage	51 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	T8 (T25)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	93.10	93.30	2364.7	2369.8
B (Base face to end of opposite base pin)	93.42	93.65	2372.9	2378.7
C (End of base pin to end of opposite pin end)	93.74	94.00	2381.0	2387.6
D (Bulb outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	@.120 A	@.200 A	@.300A
Wattage (W)	33.5	51.0	67.0
Voltage (V)	325	295	263
Current (A)	0.120	0.200	0.300

Reference ballast characteristics

Rated input voltage (V)	750	750	750
Reference current (A)	0.120	0.200	0.300
Impedance (ohms)	5100	3150	2150

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min 675

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57-Watt, 72-Inch T12, Single Pin, Instant-Start Fluorescent Lamp

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Lamp description

Lamp abbreviation	57W/72T12/SP
Nominal wattage	57 watts
Nominal overall length	72 in (1800 mm)
Bulb designation	T12 (T38)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	69.10	69.30	1755.1	1760.2
B (Base face to end of opposite base pin)	69.42	69.65	1763.2	1769.1
C (End of base pin to end of opposite pin end)	69.74	70.00	1771.4	1778.0
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	57
Voltage (V)	149
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	525
Reference current (A)	0.425
Impedance (ohms)	1100

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage	
at 50°F (10°C) and above, (Vrms) min	475

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60-Watt, 96-Inch T12, Single Pin, Instant-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	60W/96T12/SP
Nominal wattage	60 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	T12 (T38)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	93.10	93.30	2364.7	2369.8
B (Base face to end of opposite base pin)	93.42	93.65	2372.9	2378.7
C (End of base pin to end of opposite pin end)	93.74	94.00	2381.0	2387.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	60.5
Voltage (V)	157
Current (A)	0.440

Reference ballast characteristics

Rated input voltage (V)	625
Reference current (A)	0.425
Impedance (ohms)	1280

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage	
at 50°F (10°C) and above, (Vrms) min	565
Lamp current crest factor	2.00 max

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63-Watt, 48-Inch T12, 0.800-Ampere and 1.0-Ampere, Rapid-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081.

Lamp description

Lamp abbreviation	63W/48T12/HO
Nominal wattage	63 watts at 0.800 A, 71 watts at 1.0 A
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A and 1.0 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	45.72	45.91	1161.3	1166.1
D (Bulb, outside diameter)	1.41	1.59	335.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	At 0.800 A	At 1.000 A
Arc wattage (W)	56.0	64.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0	7.0
Total wattage (W)	63.0	71.0
Voltage (V)	78.0	71.0
Current (A)	0.800	1.000

Reference ballast characteristics

Rated input voltage (V)	230	230
Reference current (A)	0.800	1.000
Impedance (ohms)	244	200

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	155	256	385
at 0°F (-17.8°C) and above, (Vrms) min	203	290	405
at -20°F (-28.9°C) and above, (Vrms) min	240	310	405
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage, during operation	3.6 V nominal
Limits	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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66 watt, 72-inch T8, 0.4 A
HF Rapid-Start Fluorescent Lamp

Lamp Description:

Lamp abbreviation	66W/72T8/HO
Nominal Wattage	66 watts
Nominal overall length	72 inches (1800 mm)
Bulb designation	T8 (T25)
Nominal diameter	1 inch (25.4mm)
Base type	RI7d (T8) Recessed double contact
Circuit application	HF Rapid start, Preheat start, or Programmed Start

Dimensional characteristics: (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (End of opposite base bosses)	69.72	69.91	1770.9	1775.7
D (Bulb, outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	HF (20-26kHz) (Note 1)
Arc wattage (W)	64.0
Approximate cathode wattage (With 3.6V on each cathode) (W)	2.0
Total wattage (W)	66.0
Voltage (V)	161.0
Current (A)	0.400

Reference ballast characteristics (20 - 26 kHz) (Note 1)

Rated input voltage (V)	350
Impedance (Ohms)	468
Reference Current (A.)	0.400

Note:
1. The above frequency has been chosen for ease of reproducing test results and is not intended to imply the correct frequency range for practical applications.

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Cathode Characteristics:

Hot resistance at test current (Ohms)	9.5 ± 1.9
Test current (A) (Note 2)	0.390

Note:

2. The average value of the resistance ratio, R_h/R_c, of the coils of 10 cathodes shall be within 4.75 ± 0.5, where R_h is the resistance of the cathode when heated with the test current as specified and R_c is the resistance of the cold cathode, both excluding leadwire resistance.

Information for high frequency ballast design: (where applicable, conditions of clause 12 apply)

Starting:

It is recognized that more than one type of circuit can properly start and operate this lamp type. These limits shall be met at any primary voltage between 90% and 110% of rated voltage and will provide reliable starting.

Cathode heating requirements in terms of R_H/R_c:

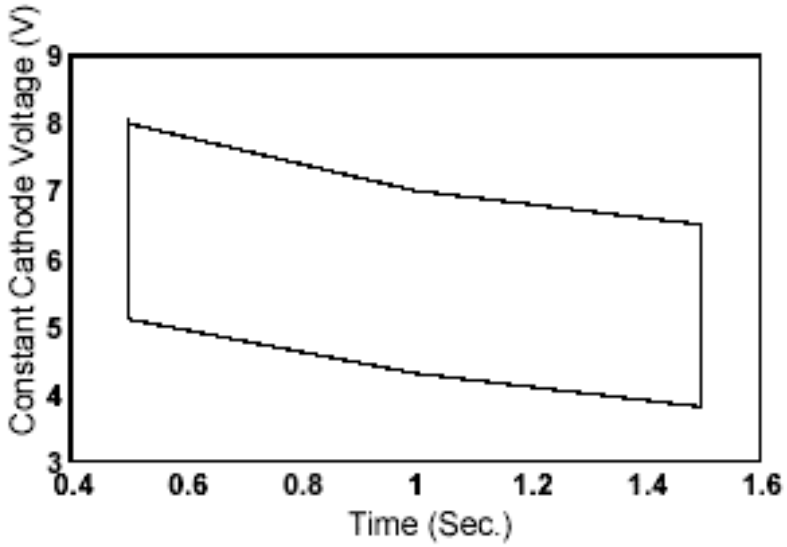
The value of the R_H/R_c ratio immediately prior to lamp starting shall be not less than 4.25 nor greater than 6.5. This is a dynamic value and must be attained by each cathode at the beginning of the transition from glow to operating current. Minimum preheat time must be greater than 400 ms.

Cathode heating requirements in terms of cathode voltage:

Time to emission (t_e) Constant Cathode Voltage

	Min	Max
0.5 Sec	5.1 V	8.0 V
1.0 Sec	4.3 V	7.0 V
1.5 Sec	3.8 V	6.5 V

(See drawing for times other than those specified)



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Voltage between lamp terminals: (Notes 3 and 4)

Time at Temperature			Open circuit voltage across lamp (V)	
$t < t_e$			Max. (rms)	200
$t > t_e$	50°F	(+10°C)	Min. (rms)	380
$t > t_e$	0°F	(-18°c)	Min. (rms)	530
$t > t_e$	-20°F	(-29°C)	Min. (rms)	610

Notes:

3. Sinusoidal voltages, frequency 20 - 26 kHz, with a grounded starting aid plane.
4. Ballasts which meet the R_e/R_c preheat requirements are not required to meet the limit on maximum voltage across the lamp during preheat period.

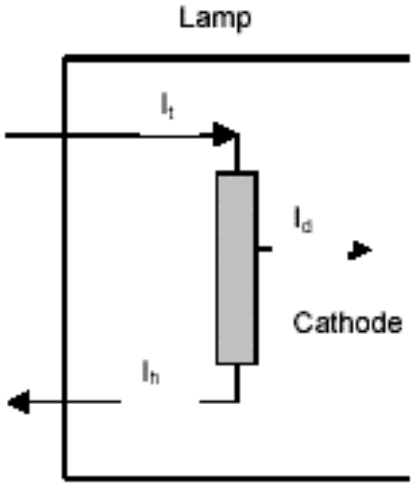
Starting Aid Plane:

Maximum distance ..... 32 mm (1.25 inches)

Operation:

Cathode heating requirements during running and dimming conditions:

In an operating lamp at least part of the emissive material has to be kept at a sufficiently high temperature for good lamp performance. Above a certain limiting value the discharge current itself can take care of this. Below this limit value, additional electrode current has to be applied. See diagram.



I_d = Discharge Current
I_h = Heating Current
$I_t = I_d + I_h$

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	I_d (Note 5)	I_h (Note 6)	I_t (Note 7)
Nominal operation	350-595 mA	<490 mA	350<1<630 mA
Dimming operation	35-350 mA	<490 mA	385<1<630 mA

Notes:

5. Discharge currents < 350 mA require additional electrode heating (I_h). Operation in this lamp current range may not provide ANSI specified ballast factors. Discharge currents > 595 mA will have a negative effect on lamp life.
6. Heating currents >490 mA will cause accelerated end blackening.
7. I_t is the highest current measured through any one lead to the electrode. I_t has a maximum value to avoid local overheating of the electrodes. For I_d < 350 mA, when extra electrode heating is applied, the minimum electrode heating is covered by the lower limit set to I_t.

Deep Dimming:

Dimming with electronic ballasts at an t_d < 35 mA is not yet specified.

Current Crest Factor:

Current Crest Factor	<1.70

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75-Watt, 60-Inch T12, 0.800-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	75W/60T12/HO
Nominal wattage	75 watts
Nominal overall length	60 in (1500 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	57.72	57.91	1466.1	1470.0
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	68.5
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	75.5
Voltage (V)	98
Current (A)	0.800

Reference ballast characteristics

Rated input voltage (V)	300
Reference current (A)	0.800
Impedance (ohms)	325

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single Lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	210	325	470
at 0°F (-17.8°C) and above, (Vrms) min	240	350	475
at -20°F (-28.9°C) and above, (Vrms) min	290	365	475
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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75-Watt, 96-Inch T12, Single Pin, Instant-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081.

Lamp description

Lamp abbreviation	75W/96T12/SP
Nominal wattage	75 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	T12 (T38)
Base	Fa8, single pin
Circuit application	Instant start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	93.10	93.30	2364.7	2369.8
B (Base face to end of opposite base pin)	93.42	93.65	2372.9	2378.7
C (End of base pin to end of opposite pin end)	93.74	94.00	2381.0	2387.6
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	75
Voltage (V)	197
Current (A)	0.425

Reference ballast characteristics

Rated input voltage (V)	625
Reference current (A)	0.425
Impedance (ohms)	1280

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

Voltage

at 50°F (10°C) and above, (Vrms) min	565

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86-Watt, 96-Inch T8, 0.4 A HF-Rapid-Start Fluorescent Lamp

Lamp Description

Lamp abbreviation	86W/96T8/HO
Nominal wattage	86 watts
Nominal overall length	96 inches (2400 mm)
Bulb designation	T8 (T25)
Nominal diameter	1 inch (25.4mm)
Base type	RI7d (T8) recessed double contact
Circuit application	HF rapid start, preheat start, or programmed start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (End of opposite base bosses)	93.72	93.91	2380.5	2385.3
D (Bulb, outside diameter)	0.94	1.10	24.0	27.8

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

	HF (20-26kHz) (Note 1)
Arc wattage (W)	84.0
Approximate cathode wattage (With 3.6V on each cathode) (W)	2.0
Total wattage (W)	86.0
Voltage (V)	216.0
Current (A)	0.395

Reference ballast characteristics (20 - 26 kHz) (Note 1)

Rated input voltage (V)	450
Impedance (ohms)	595
Reference current (A.)	0.395

NOTE

1 The above frequency has been chosen for ease of reproducing test results and is not intended to imply the correct frequency range for practical applications.

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86-Watt, 96-inch T8, 0.4 A
HF Rapid-Start Fluorescent Lamp

Cathode characteristics

Hot resistance at test current (ohms)	9.5 ± 1.9
Test current (A) (Note 2)	0.390

NOTE

2 The average value of the resistance ratio, R_h/R_c, of the coils of 10 cathodes shall be within 4.75 ± 0.5, where R_h is the resistance of the cathode when heated with the test current as specified and R_c is the resistance of the cold cathode, both excluding leadwire resistance.

Information for high frequency ballast design (where applicable, conditions of clause 11 apply)

Starting

It is recognized that more than one type of circuit can properly start and operate this lamp type. These limits shall be met at any primary voltage between 90% and 110% of rated voltage and will provide reliable starting.

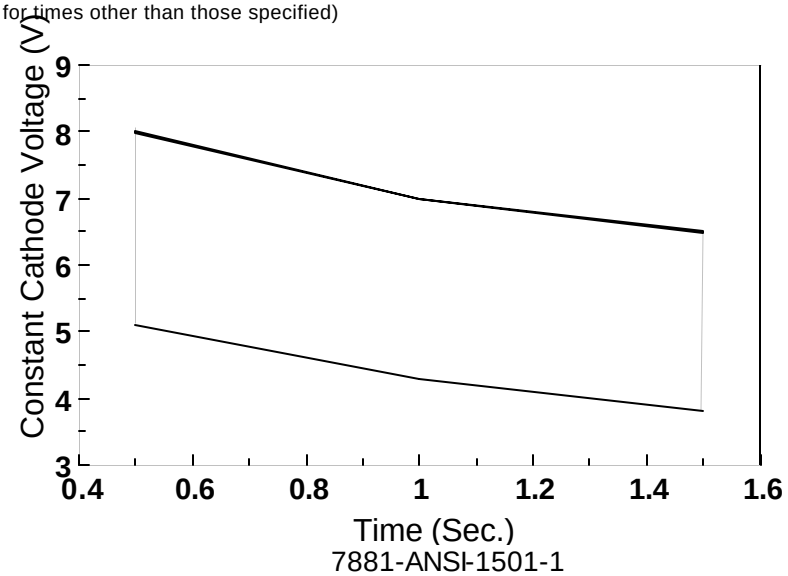
Cathode heating requirements in terms of R_h/R_c

The value of the R_h/R_c ratio immediately prior to lamp starting shall be not less than 4.25 nor greater than 6.5. This is a dynamic value and must be attained by each cathode at the beginning of the transition from glow to operating current. Minimum preheat time must be greater than 400 ms.

Cathode heating requirements in terms of cathode voltage

Time to emission (t_e)	Constant Cathode Voltage	
	Min	Max
0.5 Sec	5.1 V	8.0 V
1.0 Sec	4.3 V	7.0 V
1.5 Sec	3.8 V	6.5 V

(See drawing for times other than those specified)



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Voltage between lamp terminals: (Notes 3 and 4)

Time at	Temperature		Open circuit voltage across lamp (V)	
t t_e			Max. (rms)	300
$t > t_e$	50°F	(+10°C) ……	Min. (rms)	550
$t > t_e$	0°F	(-18°c) ……	Min. (rms)	790
$t > t_e$	-20°F	(-29°C) ……	Min. (mis)	875

NOTES

3 Sinusoidal voltages, frequency 20 –26 kHz, with a grounded starting aid plane.

4 Ballasts which meet the R_h/R_c preheat requirements are not required to meet the limit on maximum voltage across the lamp during preheat period.

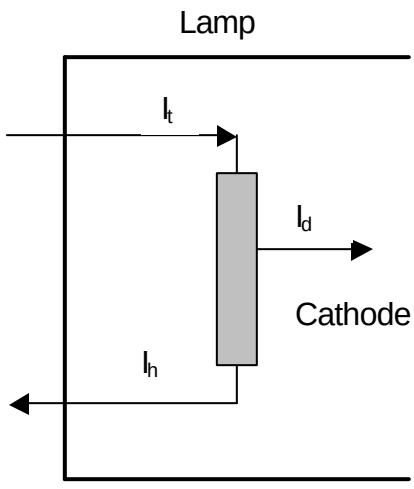
Starting Aid Plane

Maximum distance 32 mm (1.25 inches)

Operation

Cathode heating requirements during running and dimming conditions:

In an operating lamp at least part of the emissive material has to be kept at a sufficiently high temperature for good lamp performance. Above a certain limiting value the discharge current itself can take care of this. Below this limit value, additional electrode current has to be applied. See diagram.



I_d = Discharge Current
I_h = Heating Current
$I_t = I_d + I_h$

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86-Watt, 96-inch T8, 0.4 A
HF Rapid-Start Fluorescent Lamp

	I_d (Note 5)	I_h (Note 6)	I_t (Note 7)
Nominal operation	350-595 mA	<490 mA	350<1<630 mA
Dimming operation	3-350 mA	<490 mA	385<1<630 mA

NOTES

5 Discharge currents < 350 mA require additional electrode heating (I_h). Operation in this lamp current range may not provide ANSI specified ballast factors. Discharge currents > 595 mA will have a negative effect on lamp life.

6 Heating currents >490 mA will cause accelerated end blackening.

7 I_t is the highest current measured through any one lead to the electrode. I_t has a maximum value to avoid local overheating of the electrodes. For I_d < 350 mA, when extra electrode heating is applied, the minimum electrode heating is covered by the lower limit set to I_t.

Deep Dimming:
Dimming with electronic ballasts at an t_d < 35 mA is not yet specified.

Current Crest Factor:

Current Crest Factor	<1.70

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87-Watt, 72-Inch T12, G20 Base, 0.800-Ampere and 1.0-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	87W/72T12/H0
Nominal wattage	87 watts at 0.800 A, 101 watts at 1.0 A
Nominal overall length	72 in (1800 mm)
Bulb designation	T12 (T38)
Base	G20, Mogul bipin
Circuit application	Rapid start, 0.8 A and 1.0 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	70.30	-	1785.6
B (Base face to end of opposite base pin)	70.72	70.93	1796.3	1801.6
C (End of base pin to end of opposite pin end)	-	71.56	-	1817.6
D (Bulb, outside diameter)	1.41	1.59	35.7	40.5

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	At 0.800 A	At 1.000 A
Arc wattage (W)	80.0	94.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0	7.0
Total wattage (W)	87.0	101.0
Voltage (V)	117.0	108.0
Current (A)	0.780	0.985

Reference ballast characteristics

Rated input voltage (V)	300	300
Reference current (A)	0.800	1.000
Impedance (ohms)	315	257

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	260	395	550
at 0°F (-17.8°C) and above, (Vrms) min	283	410	550
at -20°F (-28.9°C) and above, (Vrms) min	340	420	550
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start

Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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87-Watt, 72-Inch T12, R17d base, 0.800-Ampere and 1.0-Ampere, Rapid-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081.

Lamp description

Lamp abbreviation	87W/72T12/HO
Nominal wattage	87 watts at 0.800 A, 101 watts at 1.0 A
Nominal overall length	72 in (1800 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A and 1.0 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	69.72	69.91	1770.9	1775.7
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	At 0.800 A	At 1.000 A
Arc wattage (W)	80.0	94.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0	7.0
Total wattage (W)	87.0	101.0
Voltage (V)	117.0	108.0
Current (A)	0.780	0.985

Reference ballast characteristics

Rated input voltage (V)	300	300
Reference current (A)	0.800	1.000
Impedance (ohms)	315	257

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	260	395	550
at 0°F (-17.8°C) and above, (Vrms) min	283	410	550
at -20°F (-28.9°C) and above, (Vrms) min	340	420	550
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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90-Watt, 60-Inch T12, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	90W/60T12/PH
Nominal wattage	90 watts
Nominal overall length	60 in (1500 mm)
Bulb designation	T12 (T38)
Base	G20, Mogul bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	58.30	-	1480.8
B (Base face to end of opposite base pin)	58.72	58.93	1491.5	1496.8
C (End of base pin to end of opposite pin)	-	59.56	-	1512.8
D (Bulb outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	90
Voltage (V)	65
Current (A)	1.5

Reference ballast characteristics

Rated input voltage (V)	150
Reference current (A)	1.50
Impedance (ohms)	78.5

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

	Single lamp	Ballasts for two lamps
Voltage between lamp terminals		
at 50°F (10°C) and above, (Vrms) min	132	(see note)
at 50°F (10°C) and above, (Vpeak) max	350	450
Preheat current		
min (A)	1.45	
max (A)	2.20	
Preheat time (at 1.80 A preheat current)		
min (seconds)	2.0	

NOTE - These lamps, when operated two in series are suitable for operation at voltages provided by the usual 265-277 V power sources (nominal 480 V, 3 phase, 4 wire system) in conjunction with series-type ballasts.

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90-Watt, 60-Inch T17, Preheat-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	90W/60T17/PH
Nominal wattage	90 watts
Nominal overall length	60 in (1500 mm)
Bulb designation.	T17 (T54)
Base	G20, Mogul bipin
Circuit application	Preheat start

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
A (Base face to base face)	-	58.30	-	1480.8
B (Base face to end of opposite base pin)	58.72	58.93	1491.5	1496.8
C (End of base pin to end of opposite pin)	-	59.56	-	1512.8
D (Bulb outside diameter)	2.00	2.19	50.8	55.6

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage (W)	90
Voltage (V)	65
Current (A)	1.5

Reference ballast characteristics

Rated input voltage (V)	150
Reference current (A)	1.50
Impedance (ohms)	78.5

Cathode characteristics

Type	High resistance

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

	Single lamp	Ballasts for two lamps in series
Voltage between lamp terminals		
at 50°F (10°C) and above, (Vrms) min	132	(see note)
at 50°F (10°C) and above, (Vpeak) max	350	450
Preheat current		
min (A)	1.45	
max (A)	2.20	
Preheat time (at 1.80 A preheat current)		
min (seconds)	2.0	

NOTE - These lamps, when operated two in series are suitable for operation at voltages provided by the usual 265-277V power sources (nominal 480V, 3 phase, 4 wire system) in conjunction with series-type Ballast.

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95-Watt, 96-Inch T12, 0.800-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	95W/96T12/HO
Nominal wattage	95 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	93.72	93.91	2380.5	2385.3
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	90.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	97.0
Voltage (V)	126
Current (A)	0.830

Reference ballast characteristics

Rated input voltage (V)	400
Reference current (A)	0.800
Impedance (ohms)	415

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Ballasts for two lamps	Ballasts for three lamps
Rapid start		
Voltage between lamp terminals (Note 1)		
at 60°F (15.5°C) and above, (Vrms) min	465	660
Voltage lamp terminal to starting aid (Note 2)		
at 60°F (15.5°C) and above, (Vpeak) min	600	600
Waveshape of starting voltage crest factor, max	2.0	2.0
Lamp current crest factor, max	1.90	1.90
Starting capacitor size		
min (µF) (at 60 Hz)	0.06	0.06
max (µF) (at 60 Hz)	0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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100-Watt, 84-Inch T12, 0.800-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	100W/84T12/HO
Nominal wattage	100 watts
Nominal overall length	84 in (2100 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 0.8 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	81.72	81.91	2075.7	2080.5
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	93.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	100.0
Voltage (V)	135
Current (A)	0.800

Reference ballast characteristics

Rated input voltage (V)	400
Reference current (A)	0.800
Impedance (ohms)	430

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	280	430	605
at 0°F (-17.8°C) and above, (Vrms) min	330	445	605
at -20°F (-28.9°C) and above, (Vrms) min	360	455	605
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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113-Watt, 96-Inch T12, 0.800-Ampere and 1.0-Ampere, Rapid-Start Fluorescent Lamp

This standard data sheet is compatible with IEC 60081

Lamp description

Lamp abbreviation	113W/96T12/HO
Nominal wattage	113 Watts at 0.800 A 128 Watts at 1.00 A
Nominal overall length	96 in. (2400mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid Start, 0.8 A and 1.0 A, for cold temperature installation

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	93.72	93.91	2380.5	2385.3
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	At 0.800 A	At 1.000 A
Arc wattage (W)	106.0	121.0
Approximate cathode wattage (with 3.6V on each cathode) (W)	7.0	7.0
Total wattage (W)	113.0	128.0
Voltage (V)	153	139
Current (A)	0.790	1.000

Reference ballast characteristics

Rated input voltage (V)	400	400
Reference current (A)	0.800	1.000
Impedance (ohms)	415	337

Cathode characteristics

Type	Low resistance
Resistance (at 3.6V)	
Objective (ohms)	3.2
Minimum (ohms)	2.5

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	295	465	660
at 0°F (-17.8°C) and above, (Vrms) min	330	480	660
at -20°F (-28.9°C) and above, (Vrms) min	360	490	660
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	325	325	325
at 0°F (-17.8°C) and above, (Vpeak) min	600	600	600
at -20°F (-28.9°C) and above, (Vpeak) min	700	700	700
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 6%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.0 V min, 4.0 V max
Dummy load resistor	3.2 ohms + 0.05 ohms
Voltage across dummy load	3.4 V min, 4.5 V max

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116-Watt, 48-Inch T12, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	116W/48T12/1.5 A
Nominal wattage	116 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	45.72	45.91	1161.3	1166.1
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	109.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	116.0
Voltage (V)	84
Current (A)	1.500

Reference ballast characteristics

Rated input voltage (V)	300
Reference current (A)	1.500
Impedance (ohms)	179

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	160	250	350
at 0°F (-17.8°C) and above, (Vrms) min	205	265	350
at -20°F (-28.9°C) and above, (Vrms) min	240	300	385
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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116-Watt, 48-Inch PG17, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	116W/48PG17/1.5 A
Nominal Wattage	116 watts
Nominal overall length	48 in (1200 mm)
Bulb designation	TD17 (TD54)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	45.72	45.91	1161.3	1166.1
D (Bulb, outside diameter)	2.00	2.22	50.8	56.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	109
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	116.0
Voltage (V)	84
Current (A)	1.500

Reference ballast characteristics

Rated input voltage (V)	300
Reference current (A)	1.500
Impedance (ohms)	179

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	160	250	350
at 0°F (-17.8°C) and above, (Vrms) min	205	265	350
at -20°F (-28.9°C) and above, (Vrms) min	240	300	385
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz) .		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummv load	3.4 V min, 4.5 V max

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168-Watt, 72-Inch T12, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	168W/72T12/1.5 A
Nominal wattage	168 watts
Nominal overall length	72 in (1800 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	69.72	69.91	1770.9	1775.7
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	161.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	168.0
Voltage (V)	125
Current (A)	1.520

Reference ballast characteristics

Rated input voltage (V)	350
Reference current (A)	1.500
Impedance (ohms)	197

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	225	350	500
at 0°F (-17.8°C) and above, (Vrms) min	270	360	500
at -20°F (-28.9°C) and above, (Vrms) min	310	400	535
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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168-Watt, 72-Inch PG17, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	168W/72PG17/1.5 A
Nominal wattage	168 watts
Nominal overall length	72 in (1800 mm)
Bulb designation	TD17 (TD54)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	69.72	69.91	1770.9	1775.7
D (Bulb, outside diameter)	2.00	2.22	50.8	56.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	161.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	168.0
Voltage (V)	125
Current (A)	1.520

Reference ballast characteristics

Rated input voltage (V)	350
Reference current (A)	1.500
Impedance (ohms)	197

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	225	350	500
at 0°F (-17.8°C) and above, (Vrms) min	270	360	500
at -20°F (-28.9°C) and above, (Vrms) min	310	400	535
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

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215-Watt, 96-Inch T12, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	215W/96T12/1.5 A
Nominal wattage	215 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	T12 (T38)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	93.72	93.91	2380.5	2385.3
D (Bulb, outside diameter)	1.41	1.59	35.8	40.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	208.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	215.0
Voltage (V)	163
Current (A)	1.500

Reference ballast characteristics

Rated input voltage (V)	400
Reference current (A)	1.500
Impedance (ohms)	215

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.0
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	300	470	675
at 0°F (-17.8°C) and above, (Vrms) min	355	470	675
at -20°F (-28.9°C) and above, (Vrms) min	400	500	690
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz) .		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

Additional starting requirements for ballasts for two lamps in series

At 90% of rated line voltage and with the cathode circuits for the ballasts loaded with the specified dummy load resistances, ballast shall supply a minimum of 0.725-A to a 500-ohm noninductive resistor connected across the ballast lamp leads that supply the highest voltage. The measurement shall be made at an ambient temperature of 25°C (77°F).

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215-Watt, 96-Inch PG17, 1.5-Ampere, Rapid-Start Fluorescent Lamp

Lamp description

Lamp abbreviation	215W/96PG17/1.5 A
Nominal wattage	215 watts
Nominal overall length	96 in (2400 mm)
Bulb designation	TD17 (TD54)
Base	R17d, Recessed double contact
Circuit application	Rapid start, 1.5 A

Dimensional characteristics (definitions of Part II apply)

	Inches		Millimeters	
	Min	Max	Min	Max
C (Ends of opposite base bosses)	93.72	93.91	2380.5	2385.3
D (Bulb, outside diameter)	2.00	2.22	50.8	56.4

Electrical characteristics

Lamp operating characteristics (conditions of clause 11 apply)

Wattage	
Arc wattage (W)	208.0
Approximate cathode wattage (with 3.6 V on each cathode) (W)	7.0
Total wattage (W)	215.0
Voltage (V)	163
Current (A)	1.500

Reference ballast characteristics

Rated input voltage (V)	400
Reference current (A)	1.500
Impedance (ohms)	215

Cathode characteristics

Type	Low resistance
Resistance (at 3.6 V)	
Objective (ohms)	3.2
Minimum (ohms)	2.0

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Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

	Single lamp	Ballasts for two lamps	Ballasts for three lamps
Rapid start			
Voltage between lamp terminals (Note 1)			
at 50°F (10°C) and above, (Vrms) min	300	470	675
at 0°F (-17.8°C) and above, (Vrms) min	355	470	675
at -20°F (-28.9°C) and above, (Vrms) min	500	500	690
Voltage lamp terminal to starting aid (Note 2)			
at 50°F (10°C) and above, (Vpeak) min	400	400	400
at 0°F (-17.8°C) and above, (Vpeak) min	575	575	575
at -20°F (-28.9°C) and above, (Vpeak) min	650	650	650
Waveshape of starting voltage crest factor, max	2.0	2.0	2.0
Starting capacitor size			
min (µF) (at 60 Hz)		0.06	0.06
max (µF) (at 60 Hz)		0.12	0.12

NOTES

1 These values are for lead circuits only. For lag circuits, add 10%.
2 These values are for crest factors of 1.55 to 2.0. Add 10% for crest factors less than 1.55.

Cathode heat requirements

Rapid start	
Voltage	3.6 V nominal
Limits during operation	3.3 V min, 4.3 V max
Dummy load resistor	3.2 ohms ± 0.05 ohm
Voltage across dummy load	3.4 V min, 4.5 V max

Additional starting requirements for ballasts for two lamps in series

At 90% of rated line voltage and with the cathode circuits for the ballasts loaded with the specified dummy load resistances, ballast shall supply a minimum of 0.725-A to a 500-ohm noninductive resistor connected across the ballast lamp leads that supply the highest voltage. The measurement shall be made at an ambient temperature of 25°C (77°F).

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25-Millimeter, 45-Inch, Cold-Cathode Fluorescent Lamp

Lamp description

Lamp abbreviation	45T8/CAP/CC
Nominal overall length	45 in (1125 mm)
Bulb	25 mm (1.00 in)
Base type	Cap
Diameter of cap	0.69 in (17.5 mm)

Dimensional characteristics

	Inches		Millimeters	
	Min	Max	Min	Max
Lamp length from ends of opposite base caps	44.88	45.13	1140.0	1146.3
Bulb diameter	0.95	1.04	24.1	26.4
Length of cap	0.94	1.00	23.9	25.4

Electrical characteristics

Lamp operating characteristics

	Low pressure	High pressure
Wattage (W)	26	28
Voltage (V)	250	270
Current (A)	0.120	0.120

The preceding lamp operating characteristics are based on operation in a cold-cathode type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply.

Information for ballast design

Lamp starting requirements

Voltage (see note)	450 V

NOTE - Ballast open-circuit voltage at rated line voltage.

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25-Millimeter, 69-Inch, Cold-Cathode Fluorescent Lamp

Lamp description

Lamp abbreviation	69T8/CAP/CC
Nominal overall length	69 in (1725 mm)
Bulb	25 mm (1.00 in)
Base type	Cap
Diameter of cap	0.69 in (17.5 mm)

Dimensional characteristics

	Inches		Millimeters	
	Min	Max	Min	Max
Lamp length from ends of opposite base caps	68.88	69.13	1749.6	1755.9
Bulb diameter	0.95	1.04	24.1	26.4
Length of cap	0.94	1.00	23.9	25.4

Electrical characteristics

Lamp operating characteristics

	Low pressure	High pressure
Wattage (W)	34	37
Voltage (V)	330	350
Current (A)	0.120	0.120

The preceding lamp operating characteristics are based on operation in a cold-cathode type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply.

Information for ballast design

Lamp starting requirements

Voltage (see note)	600 V	750 V

NOTE - Ballast open-circuit voltage at rated line voltage.

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25-Millimeter, 93-Inch, Cold-Cathode Fluorescent Lamp

Lamp description

Lamp abbreviation	93T8/CAP/CC
Nominal overall length	93 in (2325 mm)
Bulb	25 mm (1.00 in)
Base type	Cap
Diameter of cap	0.69 in (17.5 mm)

Dimensional characteristics

	Inches		Millimeters	
	Min	Max	Min	Max
Lamp length from ends of opposite base caps	92.88	93.13	2359.2	2365.5
Bulb diameter	0.95	1.04	24.1	26.4
Length of cap	0.94	1.00	23.9	25.4

Electrical characteristics

Lamp operating characteristics

	Low pressure	High pressure
Wattage (W)	42	46
Voltage (V)	420	450
Current (A)	0.120	0.120

The preceding lamp operating characteristics are based on operation in a cold-cathode type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply.

Information for ballast design

Lamp starting requirements

Voltage (see note)	750 V	835 V

NOTE - Ballast open-circuit voltage at rated line voltage.

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