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First Edition
May 1998

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ANSI C78.2f-1998
Supplement to ANSI C78.2-1991 (R1996)

American National Standard

Approved March 23, 1998 Secretariat: National Electrical Manufacturers Association

for electric lamps:

Dimensional and Electrical Characteristics of Fluorescent Lamps— PreHeat-Start Types— Requirements for Ballast Design— Paragraph 12.5

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Approved April 14, 1995 © Secretariat ASC C78: National Electrical Manufacturers Association

ANNEX A
(informative)

Guidelines for the Establishment of Wattage Ratings on Fluorescent Lamp Data Sheets

C1. Introduction

A typical ANSI lamp data sheet for a fluorescent lamp type shows values for both "rated wattage" and "objective" or "characteristic wattage." While rated value is assigned for identification purposes, the characteristic value is considered an average target value 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 provoke 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.

C2. Purpose

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

C3. Various Factors Affecting Rated Wattage

C3.1 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.

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

C3.2 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.

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 then 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 "rated wattage".

C3.3 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 rating of a specific lamp would be confusing to consumers. Conversely, a lamp originally developed for use on rapid-start circuits would be assigned a rated 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 rated wattage on switch-start specification can be misleading to customers who operate the lamp on a rapid-start circuit. The rating 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 rated wattage is established so that uncertainties are eliminated.

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ANSI C78.2d-1994
Correction to C78.2-1991

American National Standard

for fluorescent lamps — preheat-start types — dimensional and electrical characteristics

Approved October 19, 1994 Secretariat: National Electrical Manufacturers Association

CORRECTION

On pages 25, 27, 29, 33, and 43 of ANSI C78.2-1991, For Fluorescent Lamps - Preheat-Start Types -- Dimensional and Electrical Characteristics, it is necessary to correct the table titled **Cathode heat requirements**. The headings Voltage during operation and Voltage across dummy load were reversed in the published standard.

For Pages 25 and 29 insert the following table:

Cathode heat requirements

Voltage, nominal 8.0

Voltage during operation	Min	Max
at 90% primary	4.0	-
at rated primary	-	8.5
at 100% primary	-	9.5

Dummy load resistor ..... 26 ± 0.25 ohms

Voltage across dummy load	Min	Max
at 90% primary	6.8	-
at rated primary	-	9.0[1])
at 100% primary	-	10.0[1])

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For pages 27, 33 and 43 insert the following table:

Cathode heat requirements

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

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ANSI C78.2c-1993
Supplement to C78.2-1991

American National Standard

for electric lamps -

preheat-start types - dimensional and electrical characteristics 15W, 20W and 27W single-ended quad tube fluorescent lamps with internal means of starting with GX32d bases

Approved August 10, 1993 Secretariat: National Electrical Manufacturers Association

Contents

15 Watt, Single-Ended, Quad Tube
Preheat-Start Fluorescent Lamp
with Internal Means of Starting 2

20 Watt, Single-Ended, Quad Tube
Preheat-Start Fluorescent Lamp
with Internal Means of Starting 5

27 Watt, Single-Ended, Quad Tube
Preheat-Start Fluorescent Lamp
with Internal Means of Starting 8

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15 Watt, Single-ended, Quad tube
Preheat-start fluorescent lamp with internal means of starting.

LAMP ABBREVIATION	15W/6T5/Q/GX32/PH		
Nominal Wattage	15		
Nominal Dimensions	OAL	WIDTH	DEPTH
	142 mm	40 mm	40 mm
Bulb:	See FIG. 1		
Base Type:	GX32d-1		

Base Dimensions: Base dimensions will subsequently be incorporated into standards being developed by American National Standards Committee on Lamp Bases and Holders, C81.

DIMENSIONAL CHARACTERISTICS

	Maximum Lamp Dim. (mm)	Maximum Lamp Outline Dim. (mm)
H Base face to top of lamp	117	117
C Width of lamp	41 (NOTE 1)	45 (NOTE 2)
G Depth of lamp	41 (NOTE 1)	45 (NOTE 2)

NOTE 1: Applies to glass length only.
NOTE 2: Max. lamp outline dimensions, take into consideration bulb/base misalignment.

ELECTRICAL CHARACTERISTICS

Electrical characteristics and light output vary with ambient temperature.

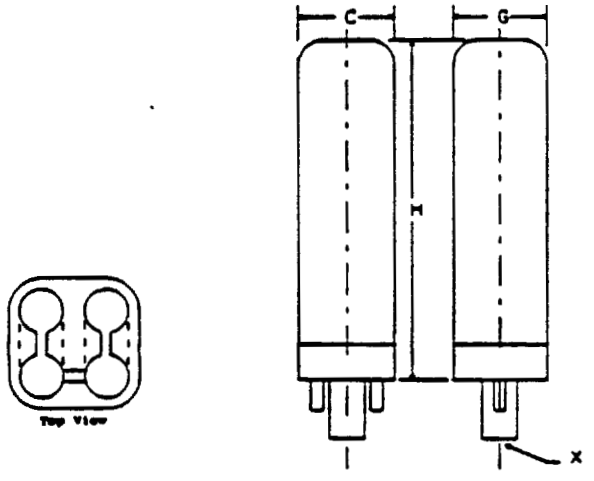

FIGURE 1

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LAMP OPERATING CHARACTERISTICS

Watts	15
Volts	53
Amperes	0.325

The preceding lamp operating characteristics are based on base up operation in a preheat-start-type circuit in an ambient temperature of 25°C (77°F) with a 60 Hz sinusoidal power supply and a reference ballast having the characteristics shown in the following section:

REFERENCE BALLAST CHARACTERISTICS

Rated Input Voltage	118
Reference Current	0.325A
Impedance	290 ohms

The general requirements for reference ballasts are stated in American National Standard Specifications for Fluorescent Lamp Reference Ballast, ANSI C82.3-1983(R1989).

CATHODE CHARACTERISTICS

Type: Low resistance

Note: Objective resistance of both cathodes in series ≈ 25 ohms

LAMP STARTING REQUIREMENTS

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 110°F (43°C). At temperatures near the top of that range, however, initial starting will be secured but not necessarily immediate restarting.

VOLTAGE BETWEEN LAMP TERMINALS

At 32°F (0°C) and above,	Min. RMS	108V
	Max. PK	400V

The voltage limits shall be met at any primary voltage between 90% and 100% of rated voltage.

PREHEAT CURRENT

Min. at 90% of rated voltage	0.280A
Max. at 106% of rated voltage	0.650A

RADIO INTERFERENCE SUPPRESSION

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of .0008 to .010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

BALLAST DESIGN NOTE

The values in this standard are based on 60 Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high frequency ballasts.

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APPLICATION DESIGN NOTE

The temperature of the lamp base measured at the bottom of the guide post (Point X in FIG. 1) shall not exceed 85°C (higher temperature under consideration).

Note 1: This temperature shall be measured:

a. With a lamp that is within 2.5% of the lamp operating characteristics.
b. With a ballast operating at 106% of rated voltage.
c. In the intended luminaire at the maximum operating temperature.

Note 2: A higher guide post temperature may be acceptable. Consult lamp manufacturer.

Note 3: This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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20 Watt, Single-ended, Quad tube
Preheat-start fluorescent lamp with internal means of starting.

LAMP ABBREVIATION	**20W/6T5/Q/GX32/PH**		
Nominal Wattage	20		
Nominal Dimensions	OAL	WIDTH	DEPTH
	155 mm	40 mm	40 mm
Bulb:	See FIG. 1		
Base Type:	GX32d-2		

Base Dimensions: Base dimensions will subsequently be incorporated into standards being developed by American National Standards committee on Lamp Bases and Holders, C81.

DIMENSIONAL CHARACTERISTICS

	Maximum Lamp Dim. (mm)	Maximum Lamp Outline Dim. (mm)
H Base face to top of lamp	130	130
C Width of lamp	41 (NOTE 1)	45 (NOTE 2)
G Depth of lamp	41 (NOTE 1)	45 (NOTE 2)

Note 1: Applies to glass length only.
Note 2: Max. lamp outline dimensions, take into consideration bulb/base misalignment.

ELECTRICAL CHARACTERISTICS

Electrical characteristics and light output vary with ambient temperature.

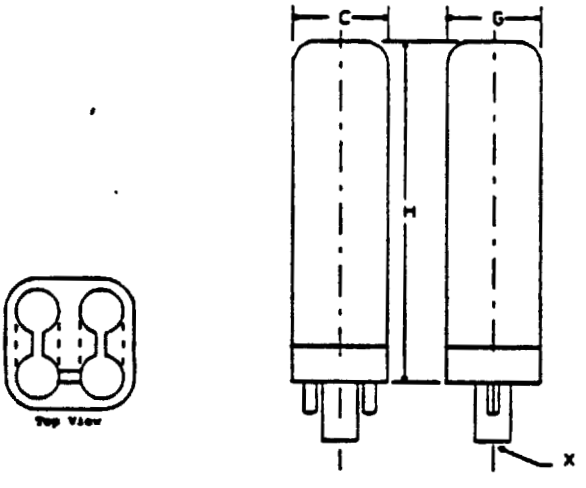

FIGURE 1

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LAMP OPERATING CHARACTERISTICS

Watts	20
Volts	53
Amperes	0.450

The preceding lamp operating characteristics are based on base up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 60 Hz sinusoidal power supply and a reference ballast having the characteristics shown in the following section:

REFERENCE BALLAST CHARACTERISTICS

Rated input voltage	118V
Reference current	0.450A
Impedance	209 ohms

The general requirements for reference ballasts are stated in American National Standard Specifications for Fluorescent Lamp Reference Ballast, ANSI C82.3-1983(R1989).

CATHODE CHARACTERISTICS

Type: Low resistance

Note: Objective resistance of both cathodes in series 25 ohms max.

LAMP STARTING REQUIREMENTS

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 110°F (50°C). At temperatures near the top of that range, however, initial starting will be secured but not necessarily immediate restarting.

VOLTAGE BETWEEN LAMP TERMINALS

At 32°F (0°C) and above,	Min. RMS	108V
	Max. PK	400V

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

PREHEAT CURRENT

Min. at 90% of rated voltage	0.405A
Max. at 106% of rated voltage	0.850A

RADIO INTERFERENCE SUPPRESSION

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of .0008 to .010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

BALLAST DESIGN NOTE

The values in this standard are based on 60 Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high frequency ballasts.

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APPLICATION DESIGN NOTE

The temperature of the lamp base measured at the bottom of the guide post (Point X in FIG. 1) shall not exceed 85°C (higher temperature under consideration).

Note: This temperature shall be measured:

a. With a lamp that is within 2.5% of the lamp operating characteristics.
b. With a ballast operating at 106% of rated voltage.
c. In the intended luminaire at the maximum operating temperature.

Note 2: A higher guide post temperature may be acceptable. Consult lamp manufacturer.

Note 3: This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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27 Watt, Single-ended, Quad tube
Preheat-start Fluorescent lamp with internal means of starting.

LAMP ABBREVIATION	27W/7T5/Q/GX32/PH		
Nominal wattage	27		
Nominal dimensions	OAL	WIDTH	DEPTH
	171 mm	40 mm	40 mm
Bulb:	See FIG. 1		
Base Type:	GX32d-3		

Base Dimensions: Base dimensions will subsequently be incorporated into standards being developed by American National Standards Committee on Lamp Bases and Holders, C81.

DIMENSIONAL CHARACTERISTICS

	Maximum Lamp Dim. (mm)	Maximum Lamp Outline Dim. (mm)
H Base face to top of lamp	146	146
C Width of lamp	41 (NOTE 1)	45 (NOTE 2)
G Depth of lamp	41 (NOTE 1)	45 (NOTE 2)

Note 1: Applies to glass length only.
Note 2: Max lamp outline dimensions, take into consideration bulb/base misalignment.

ELECTRICAL CHARACTERISTICS

Electrical characteristics and light output vary with ambient temperature.

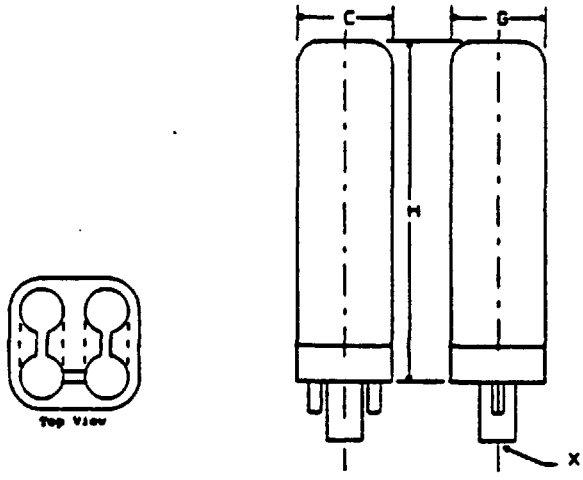

FIGURE 1

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LAMP OPERATING CHARACTERISTICS

Watts	27
Volts	54
Amperes	0.625

The preceding lamp operating characteristics are based on base up operation in a preheat-start-type circuit in an ambient temperature of 25°C (77°F) with a 60 Hz sinusoidal power supply and a reference ballast having the characteristics shown in the following section:

REFERENCE BALLAST CHARACTERISTICS

Rated input voltage	118
Reference current	0.625A
Impedance	154 ohms

The general requirements for reference ballasts are stated in American National Standard Specifications for Fluorescent Lamp Ballast, ANSI C82.3-1983(R1989).

CATHODE CHARACTERISTICS

Type: Low resistance

Note: Objective resistance of both cathodes in Series 25 ohms maximum.

LAMP STARTING REQUIREMENTS

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 110°F (43°C). At temperatures near the top of that range, however, initial starting will be secured but not necessarily immediate restarting.

VOLTAGE BETWEEN LAMP TERMINALS

At 32°F (0°C) and above,	Min. RMS	108V
	Max. PK	400V

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

PREHEAT CURRENT

Min. at 90% of rated voltage	0.540A
Max. at 106% of rated voltage	1.080A

RADIO INTERFERENCE SUPPRESSION

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of .0008 to .010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

BALLAST DESIGN NOTE

The values in this standard are based on 60 Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high frequency ballasts.

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APPLICATION DESIGN NOTE

The temperature of the lamp base measured at the bottom of the guide post (Point X in FIG.1) shall not exceed 85°C (higher temperature under consideration).

Note 1: This temperature shall be measured:

a. With a lamp that is within 2.5% of the lamp operating characteristics.
b. With a ballast operating at 106% of rated voltage.
c. In the intended luminaire at the maximum operating temperature.

Note 2: A higher guide post temperature may be acceptable. Consult lamp manufacturer.

Note 3: This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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ANSI C78.2b-1992
Supplement to ANSI C78.2-1991

American National Standard

for 9W and 13W single ended
quad tube preheat-start fluorescent lamps
with internal means of starting—
specifications
(supplement to ANSI C78.2-1991)

Approved July 28, 1992 | Secretariat: National Electrical Manufacturers Association

Contents

Lamp types — Page

9-Watt Single ended, quad tube preheat-start fluorescent lamp with internal means of starting 2

13-Watt Single ended, quad tube preheat-start fluorescent lamp with internal means of starting 5

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1 9-watt, single ended, quad tube preheat-start fluorescent lamp with internal means of starting

1.1 Lamp description

Nominal Wattage	9		
Nominal Dimensions	OAL	WIDTH	DEPTH
	112 mm	30 mm	30 mm
Bulb	See Figure 1		
Base Type	G23-2		

Base Dimensions: Base dimensions will subsequently be incorporated into standards being developed by American National Standards Committee on Lamp Bases and Holders, C81.

1.2 Dimensional characteristics

	Max. lamp dim. (mm)	Max. lamp outline (mm)
Base Face to top of lamp (H)	88	88
Width of lamp (C)	28 (Note 1)	35 (Note 2)
Depth of lamp (G)	28 (Note 1)	35 (Note 1)

NOTES
1 Applies over glass length only.
2 Maximum outline dimensions take into consideration bulb/base misalignment.

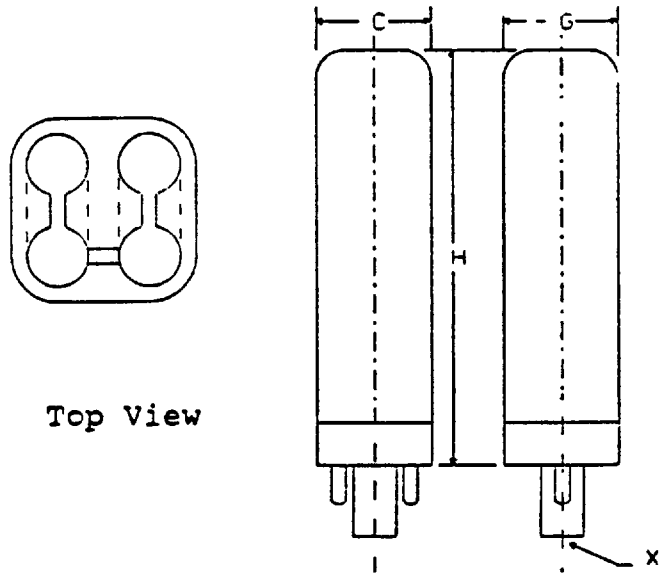

Figure 1 – Bulb

1.3 Electrical characteristics

Electrical characteristics and light output vary with ambient temperature.

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1.3.1 Lamp operating characteristics

Watts 9
Volts 59
Amperes 0.180

The preceding lamp operating characteristics are based on base up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 50 Hz sinusoidal power supply and a reference ballast having the characteristics shown in the following section:

1.3.2 Reference ballast characteristics

Rated Input Voltage . . . . . 118 V
Reference Circuit 0.180A
Impedance . . . . . 515 Ohms

The general requirements for reference ballasts are stated in American National Standard Specifications for Fluorescent Lamp Reference Ballasts, ANSI C82.3-1983 (R1989).

1.3.3 Cathode characteristics

Type . . . . . High Resistance

NOTE— Objective resistance of both cathodes in series 160 Ohms.

1.4 Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting will be secured but not necessarily immediate restarting.

The voltage limits shall be met at any primary voltage between 90 percent and 110 percent of rated voltage.

1.4.1 Voltage between lamp terminals

At 25°F (-4°C) and above, min. rms 108
max. peak 400

1.4.2 Preheat current

Min. at 90% of rated voltage . . . . . 0.153 A
Max. at 106% of rated voltage . . . . . 0.240 A

1.4.3 Radio interference suppression

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE— A lower maximum value of capacitance is under consideration.

1.5 Ballasts design note

The values in this standard are based on 60 Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high frequency ballasts.

1.6 Application design note

The temperature of the lamp base measured at the bottom of the guide post (point X in Figure 1) shall not exceed 85°C (higher temperature under consideration).

NOTES
1 This temperature shall be measured:
a. with a lamp that is within 2.5% of the lamp operating characteristics

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b. with a ballast operating at 106% of rated voltage
c. in the intended luminaire at the maximum operating temperature.

2 A higher guide post temperature may be acceptable. Consult lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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2 13-watt, single ended, quad tube preheat-start fluorescent lamp with internal means of starting

2.1 Lamp description

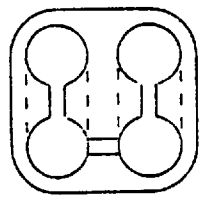
Nominal Wattage	13		
Nominal Dimensions	OAL	WIDTH	DEPTH
	123mm	30mm	30mm
Bulb	See Figure 1		
Base Type	GX23-2		

Base Dimensions: Base dimensions will subsequently be incorporated into standards being developed by American National Standards Committee on Lamp Bases and Holders, C81.

2.2 Dimensional characteristics

	Max. lamp dim. (mm)	Max. lamp outline (mm)
Base Face to top of lamp (H)	99 (Note 3)	99 (Note 3)
Width of lamp (C)	28 (Note 1)	35 (Note 2)
depth of lamp (G)	28 (Note 1)	35 (Note 2)

NOTES
1 Applies over glass length only.
2 Max. outline dimensions take into consideration bulb/base misalignment.
3 Future objective is 105mm.



Top View

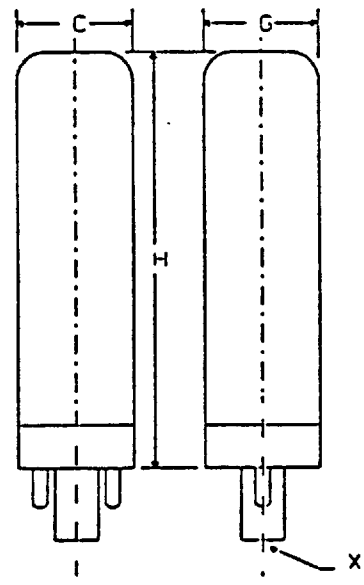


Figure 2 – Bulb

2.3 Electrical characteristics

Electrical Characteristics and light output vary with ambient temperature.

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2.3.1 Lamp operating characteristics:

Watts 13
Volts 59
Amperes 0.285

The preceding lamp operating characteristics are based on base up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with 60 Hz sinusoidal power supply and a reference ballast having the characteristics shown in the following section.

2.3.2 Reference ballast characteristics:

Rated Input Voltage . . . . . 118 V
Reference Circuit . . . . . 0.285 A
Impedance . . . . . 325 Ohms

The general requirements for reference ballasts are stated in American National Standard Specifications for Fluorescent Lamp Reference Ballasts, ANSI C82.3-1983 (R1989).

2.3.3 Cathode characteristics:

Type . . . . . Low Resistance

NOTE— Objective resistance of both cathodes in series 25 ohms.

2.4 Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting will be secured but not necessarily immediate restarting.

The voltage limits shall be met at any primary voltage between 90 percent and 110 percent of rated voltage.

2.4.1 Voltage between lamp terminals:

At 32°F (0°C) and above, min. rms 108
max. peak 400

2.4.2 Preheat current:

Min. at 90 percent of rated voltage . . . . . 0. 270 A
Max. at 106 percent of rated voltage . . . . . 0. 525 A

2.4.3 Radio interference suppression:

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE— A lower maximum value of capacitance is under consideration.

2.5 Ballast design note

The values in this standard are based on 60 Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in High Frequency Ballasts.

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2.6 Application design note

The temperature of the lamp base measurement at the bottom of the guide post (point X in figure 1) shall not exceed 85°C (higher temperature under consideration).

NOTES

1 This temperature shall be measured:
   a. with a lamp that is within 2.5% of the lamp operating characteristics
   b. with a ballast operating at 106% of rated voltage
   c. in the intended luminaire at the maximum operating temperature.

2 A higher guide post temperature may be acceptable. Consult lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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ANSI C78.2a-1991
Supplement to ANSI C78.2-1991

American National Standard

for 10W, 13W, 18W, and 26W single-ended quad tube preheat-start fluorescent lamps with internal means of starting – specifications (supplement to ANSI C78.2-1991)

Approved July 15, 1991

Secretariat: National Electrical Manufacturers Association

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10-Watt, Single-ended, Quad tube Preheat-Start Fluorescent Lamp with internal means of starting

Lamp description

Nominal wattage 10

Nominal dimensions	OAL	Width	Depth
	120	30 mm	30 mm

Bulb ..... See figure 1

Base type G24d-1

Base dimensions: Base dimensions will subsequently be incorporated into standards being developed by Accredited Standards Committee on Lamp Bases and Holders, C81.

Dimensional characteristics

	Maximum lamp dim. (mm)	Maximum outline dim. (mm)
H-Base face to top of lamp	95	95
C-Width of lamp	28 (Note 1)	35 (Note 2)
G-Depth of lamp	28 (Note 1)	35 (Note 2)

NOTES

1 Applies over glass length only.

2 Bulb/base misalignment should be considered in maximum lamp outline dimensions.

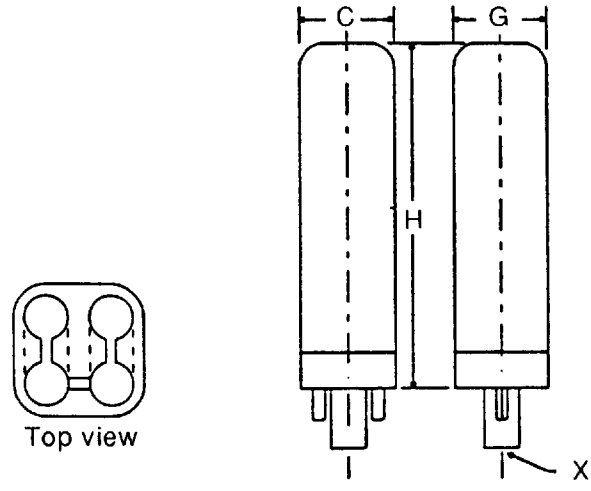

Figure 1 – 10-watt, single-ended quad tube lamp

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Electrical characteristics

Electrical characteristics and light output vary with ambient temperature.

Lamp operating characteristics

Watts 10
Volts 64
Amperes 0.190

The preceding lamp operating characteristics are based on base-up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply and a reference ballast having the characteristics shown as follows:

Reference ballast characteristics

Rated input voltage ..... 220 V
Reference current ..... 0.190 A
Impedance ..... 1080 ohms

The general requirements for reference ballasts are stated in *American National Standard Specifications for reference ballasts for fluorescent lamps*, ANSI C82.3-1983 (R1989).

Cathode characteristics

Type ..... High resistance

NOTE – Objective resistance of both cathodes in series of 100 ohms.

Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting (but not necessarily immediate restarting) will be secured.

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

Voltage between lamp terminals
At 0°F (–18°C) and above, min. rms 198
max. pk 400

Preheat current
Min. at 90% of rated primary voltage ..... 0.153 A
Max. at 106% of rated primary voltage ..... 0.275 A

Radio interference suppression

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE – A lower maximum value of capacitance is under consideration.

Ballast design note

The values in this standard are based on 60-Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high-frequency ballasts.

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Application design note

The temperature of the lamp base measured at the bottom of the guidepost (Point X in figure 1) shall not exceed 85°C. (Higher value under consideration.)

NOTES

1 This temperature shall be measured:

– with a lamp that is within 2.5% of the lamp operating characteristics;

– with a ballast operating at 106% of rated voltage;

– in the intended luminaire at the maximum operating temperature.

2 A higher guidepost temperature may be acceptable; consult the lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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13-watt, Single-ended, Quad tube Preheat-Start Fluorescent Lamp with internal means of starting

Lamp description

Nominal wattage	13		
Nominal dimensions	OAL	Width	Depth
	155 mm	30 mm	30 mm
Bulb.	See figure 1		
Base type	G24d-1		

Base dimensions: Base dimensions will subsequently be incorporated into standards being developed by Accredited Standards Committee on Lamp Bases and Holders, C81.

Dimensional characteristics

	Maximum lamp dim. (mm)	Maximum outline dim. (mm)
H-Base face to top of lamp	130	130
C-Width of lamp	28 (Note 1)	35 (Note 2)
G-Depth of lamp	28 (Note 1)	35 (Note 2)

NOTES

1 Applies over glass length only.

2 Bulb/base misalignment should be considered in maximum lamp outline dimensions.

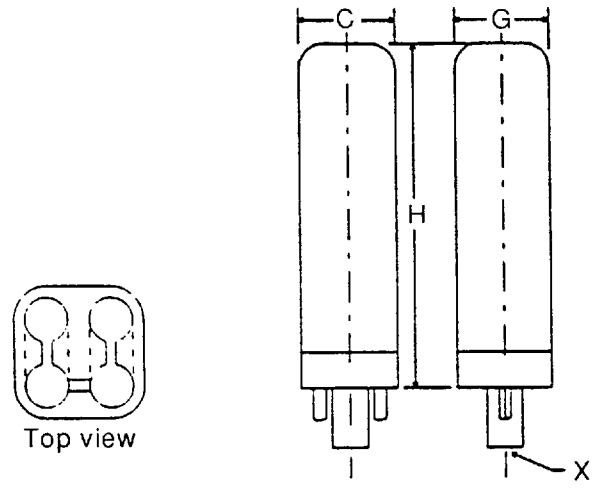

Figure 1 – 13-watt, single-ended quad tube lamp

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Electrical characteristics

Electrical characteristics and light output vary with ambient temperature.

Lamp operating characteristics

Watts 13
Volts 91
Amperes 0.170

The preceding lamp operating characteristics are based on base-up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply and a reference ballast having the characteristics shown as follows:

Reference ballast characteristics

Rated input voltage ..... 220 V
Reference current ..... 0.170 A
Impedance ..... 1080 ohms

The general requirements for reference ballasts are stated in *American National Standard Specifications for reference ballasts for fluorescent lamps*, ANSI C82.3-1983 (R1989).

Cathode characteristics

Type ..... High resistance

NOTE – Objective resistance of both cathodes in series of 100 ohms.

Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting (but not necessarily immediate restarting) will be secured.

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

Voltage between lamp terminals
At 0°F (–18 C) and above, min. rms 198
max. pk 400

Preheat current
Min. at 90% of rated primary voltage ..... 0.153 A
Max. at 106% of rated primary voltage ..... 0.275 A

Radio interference suppression

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE – A lower maximum value of capacitance is under consideration.

Ballast design note

The values in this standard are based on 60-Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high-frequency ballasts.

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Application design note

The temperature of the lamp base measured at the bottom of the guidepost (Point X in figure 1) shall not exceed 85°C. (Higher value under consideration.)

NOTES

1 This temperature shall be measured:

- with a lamp that is within 2.5% of the lamp operating characteristics;
- with a ballast operating at 106% of rated voltage;
- in the intended luminaire at the maximum operating temperature.

2 A higher guidepost temperature may be acceptable; consult the lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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18-watt, Single-ended, Quad tube Preheat-Start Fluorescent Lamp with internal means of starting

Lamp description

Nominal wattage	18		
Nominal dimensions	OAL	Width	Depth
	175 mm	30 mm	30 mm
Bulb	See figure 1		
Base type	G24d-2		

Base dimensions: Base dimensions will subsequently be incorporated into standards being developed by Accredited Standards Committee on Lamp Bases and Holders, C81.

Dimensional characteristics

	Maximum lamp dim. (mm)	Maximum outline dim. (mm)
H-Base face to top of lamp	150	150
C-Width of lamp	28 (Note 1)	35 (Note 2)
G-Depth of lamp	28 (Note 1)	35 (Note 2)

NOTES

1 Applies over glass length only.

2 Bulb/base misalignment should be considered in maximum lamp outline dimensions.

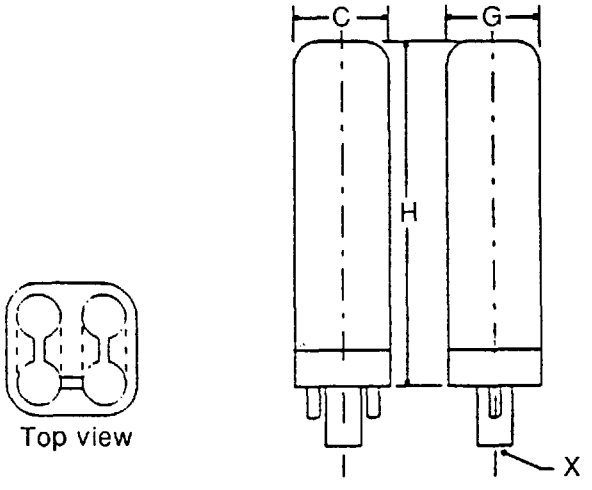

Figure 1 – 18 watt, single-ended quad tube lamp

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Electrical characteristics

Electrical characteristics and light output vary with ambient temperature.

Lamp operating characteristics

Watts 18
Volts 105
Amperes 0.190

The preceding lamp operating characteristics are based on base-up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply and a reference ballast having the characteristics shown as follows:

Reference ballast characteristics

Rated input voltage ..... 220 V
Reference current ..... 0.220 A
Impedance ..... 815 ohms

The general requirements for reference ballasts are stated in *American National Standard Specifications for reference ballasts for fluorescent lamps*, ANSI C82.3-1983 (R1989).

Cathode characteristics

Type ..... High resistance

NOTE – Objective resistance of both cathodes in series of 80 ohms.

Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting (but not necessarily immediate restarting) will be secured.

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

Voltage between lamp terminals
At 0°F (–18°C) and above, min. rms 198
max. pk 400

Preheat current
Min. at 90% of rated primary voltage ..... 0.190 A
Max. at 106% of rated primary voltage ..... 0.375 A

Radio interference suppression

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE – A lower maximum value of capacitance is under consideration.

Ballast design note

The values in this standard are based on 60-Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high-frequency ballasts.

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Application design note

The temperature of the lamp base measured at the bottom of the guidepost (Point X in figure 1) shall not exceed 85°C. (Higher value under consideration.)

NOTES

1 This temperature shall be measured:

– with a lamp that is within 2.5% of the lamp operating characteristics;

– with a ballast operating at 106% of rated voltage;

– in the intended luminaire at the maximum operating temperature.

2 A higher guidepost temperature may be acceptable; consult the lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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26-watt, Single-ended, Quad tube Preheat-Start Fluorescent Lamp with internal means of starting

Lamp description

Nominal wattage 26

Nominal dimensions	OAL	Width	Depth
	195 mm	30 mm	30 mm

Bulb ..... See figure 1

Base type G24d-3

Base dimensions: Base dimensions will subsequently be incorporated into standards being developed by Accredited Standards Committee on Lamp Bases and Holders, C81.

Dimensional characteristics

	Maximum lamp dim. (mm)	Maximum outline dim. (mm)
H-Base face to top of lamp	170	170
C-Width of lamp	28 (Note 1)	35 (Note 2)
G-Depth of lamp	28 (Note 1)	35 (Note 2)

NOTES

1 Applies over glass length only.

2 Bulb/base misalignment should be considered in maximum lamp outline dimensions.

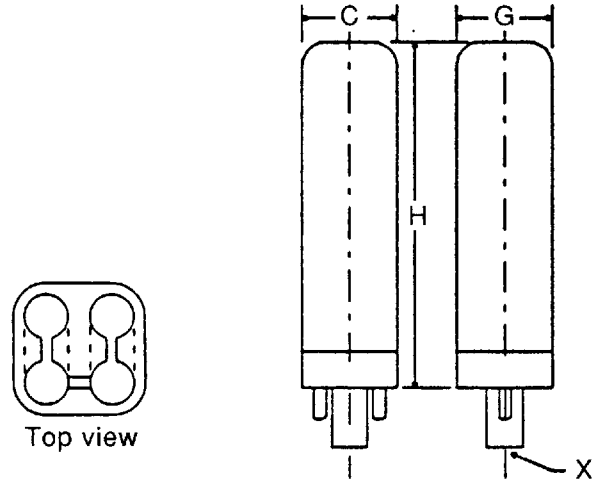

Figure 1 – 26-watt, single-ended quad tube lamp

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Electrical characteristics

Electrical characteristics and light output vary with ambient temperature.

Lamp operating characteristics
Watts.....26
Volts.....110
Amperes.....0.315

The preceding lamp operating characteristics are based on base-up operation in a preheat-start-type circuit at an ambient temperature of 25°C (77°F) with a 60-Hz sinusoidal power supply and a reference ballast having the characteristics shown as follows:

Reference ballast characteristics
Rated input voltage .....220 V
Reference current.....0.315 A
Impedance .....546 ohms

The general requirements for reference ballasts are stated in *American National Standard Specifications for reference ballasts for fluorescent lamps*, ANSI C82.3-1983 (R1989).

Cathode characteristics
Type.....Low resistance

NOTE – Objective resistance of both cathodes in series of 25 ohms.

Lamp starting requirements

The following values are intended to provide reliable starting at the ambient temperatures indicated and at higher temperatures up to a maximum of 122°F (50°C). At temperatures near the top of that range, however, initial starting (but not necessarily immediate restarting) will be secured.

The voltage limits shall be met at any primary voltage between 90% and 110% of rated voltage.

Voltage between lamp terminals
At 0°F (–18°C) and above, min. rms 198
max. pk.....400

Preheat current
Min. at 90% of rated primary voltage .....0.270 A
Max. at 106% of rated primary voltage .....0.550 A

Radio interference suppression

In order to assist in suppressing radio interference, starters shall contain a capacitor within the limits of 0.0008 to 0.010 microfarad connected internally in such a manner as to be effectively in parallel with the lamp.

NOTE – A lower maximum value of capacitance is under consideration.

Ballast design note

The values in this standard are based on 60-Hz operating characteristics. The RFI suppression capacitor may affect starting or operating parameters in high-frequency ballasts.

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Application design note

The temperature of the lamp base measured at the bottom of the guidepost (Point X in figure 1) shall not exceed 85°C. (Higher value under consideration.)

NOTES

1 This temperature shall be measured:

- with a lamp that is within 2.5% of the lamp operating characteristics;
- with a ballast operating at 106% of rated voltage;
- in the intended luminaire at the maximum operating temperature.

2 A higher guidepost temperature may be acceptable; consult the lamp manufacturer.

3 This temperature limit is necessitated by the internal radio interference suppression capacitor incorporated into the base.

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American National Standard

for Fluorescent Lamps – Preheat-Start Types – Dimensional and Electrical Characteristics

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Revision of ANSI C78.2-1978
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American National Standard
for Fluorescent Lamps –

Preheat-Start Types – Dimensional and Electrical Characteristics

Secretariat
National Electrical Manufacturers Association

Approved July 15, 1991
American National Standards Institute, Inc.

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* Dual circuit information provided.

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Foreword (This foreword is not part of American National Standard C78.2-1991.)

This edition of *American National Standard for Fluorescent Lamps – Preheat-Start Types – Dimensional and Electrical Characteristics,* ANSI C78.2-1991 is technically and editorially revised to satisfy an overall objective of improved clarity. The technical changes involve incorporation of data from supplement C78.2a, some additional ballast requirements, and the addition of certain details of ballast design that had been specified in the ballast standard *American National Standard for Ballasts for Fluorescent Lamps – Specifications*, ANSI C82.1-1985 and supplements. Editorially, this standard has been patterned after *American National Standard for Mercury Lamps – Specifications*, ANSI C78.40-1985 with more general information moved to Part I, allowing the data sheets in Part IV to become simplified. Also, each data sheet is now identified with a "lamp abbreviation" and Part II graphically defines lamp dimensions. As an aid to establishing lamp abbreviations for the data sheets in a consistent manner, guidelines have been provided in Annex A, Part III.

Essentially the same lamp types are covered as in the preceding edition. However, more effort has been imparted to identify with appropriate specifications, those lamps that can be operated on both preheat (switch) start and rapid-start circuits. Prior to the publication of the 1978 edition, all of the standards for fluorescent lamps had been published as separate standards in the C78.700 series. Annex B now lists those old individual standards.

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

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee C78 on Electric Lamps. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, Committee C78 had the following members:

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AMERICAN NATIONAL STANDARD ANSI C78.2-1991

American National Standard for Fluorescent Lamps –

Preheat-Start Types– 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 preheat start circuits or for dual circuit applications. Lamp data sheets for lamps with dual circuit applications show both preheat (switch) start[1)] and rapid-start conditions. Specifications for both the lamp itself and the interactive features of lamp and ballast are given. Self-supporting, single-ended compact lamps are not included.

Lamps designed primarily for operation on other types of circuits such as rapid start and instant start are specified in other lamp standards. See clause 3. Lamp data sheets have generally been placed in the standard that covers the original application for that lamp.

Lamps for conventional systems relying on auxiliary support from external ballasts are described. The lamps are those designed for 60 Hz operation.

Lamp color is not specified herein.

Bactericidal lamps have been included because their sizes and electrical requirements are similar to some preheat fluorescent lamps.

Certain lamp types covered in this standard may be similar to those in IEC Publication 81. However, additional types are included that are used only in North America and are not specified in the IEC standard.

2 Normative references

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

ANSI C78.1-1978 (R1991), C78.1a-1980 (R1984), C78.1b-1986, C78.1c-1985, and C78.1d-1988, *Dimensional and electrical characteristics of fluorescent lamps – Rapid-start types*[2)]

ANSI C78.3-1978 and C78.3a-1985, *Dimensional and electrical characteristics of fluorescent lamps – Instant-start and cold-cathode types*[2)]

ANSI C78.4, *Dimensional and electrical characteristics of single-ended, self-supporting compact fluorescent lamps*[3)]

[1)] The terms "switch start" and "preheat start" have been used interchangeably in various standards. Herein, they are considered to be equivalent as indicated by the term "preheat (switch) start".

[2)] This standard is under revision. Contact the secretariat for more information.

[3)] This standard is under development. Contact the secretariat for more information.

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C78.5, *Guide for the performance of self-ballasted lamps*[3]

ANSI C78.180-1972 (R1989), *Specifications for fluorescent lamp starters*

ANSI C78.375-1984, *Fluorescent lamps – Guide for electrical measurements*[2]

ANSI C78.376-1969 (R 1991), *Specifications for chromaticity of fluorescent lamps*

ANSI C79.1-1980 (R1984), *Nomenclature for glass bulbs intended for use with electric lamps*

ANSI C81.20-1976, *Specifications for electric lamp bases and holders – Fluorescent types*[4]

ANSI C82.1-1985, C82.1a-1990[2], C82.1b-1990[2], and C82.1C-1990, *Specifications for fluorescent lamp ballasts*

ANSI C82.2-1984 (R1989), *Fluorescent lamp Ballasts – Method of measurement*

ANSI C82.3-1983 (R1989), *Reference ballasts for fluorescent lamps*

ANSI/IEEE 100-1988, *Dictionary of electrical and electronic terms*[2]

3 General

There are four parts to this standard.

Part I contains general information and requirements applicable to preheat start lamps and their operation. Detailed descriptions, references, and explanations for terms used in the lamp data sheets are given in this part.

Part II contains the drawings necessary to define the principles of dimensioning lamps.

Part III contains the annexes.

Part IV contains all of the lamp data sheets.

4 Definitions

The definitions in this clause relate to specific terms used in this standard.

For additional definitions, see the ballast standard, ANSI C82.1 and the electrical dictionary, ANSI/IEEE 100.

4.1 Lamps

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

4.1.2 preheat start fluorescent lamp: A fluorescent lamp designed to operate in a preheat start circuit.

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

4.2 Lamp components

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

4.2.2 high resistance cathode: A lamp cathode that exhibits a resistance in excess of 15 ohms, when heated to nominal emission temperature.

4.3 Ballast and circuit characteristics

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

4.3.2 rapid start systems: Those systems in which hot-cathode electric discharge lamps are operated under the following conditions:

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

2) Such heating is accomplished either by means of low-voltage heater windings either in the ballast itself or by separate low-voltage transformers;

3) Sufficient voltage is applied across the lamp and between the lamp and the starting aid (usually the fixture itself) to initiate the

[4] This standard was consolidated to ANSI C81.61-1990.

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discharge when the cathodes reach a temperature high enough for adequate emission; and

4) Cathode heating voltage is maintained even after the lamp is in full operation.

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

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

4.3.4 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.

4.3.5 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).

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 defined in this standard shall be made in accordance with the lamp measurements standard, ANSI C78.375.

7 Reference ballast

Reference ballast 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.

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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

The lamps specified in this standard are those designed specifically for operation in preheat start circuits. However, lamp manufacturers may form an industry consensus approving the use of a particular lamp type on both rapid-start and preheat (switch) start circuits. In such cases, the lamp data sheet will show the information for both of the appropriate circuits.

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 eighths-of-an-inch units, this standard maintains that practice. For example, a 1-inch diameter bulb is called a T8 bulb. Metric diameters are shown in parenthesis.

10.2 Base specifications

Bases on finished lamps shall comply with the base standard, ANSI C81.20. Gauges for checking bases are included in that standard.

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 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 in (3.05 mm) in width, suitably spaced longitudinally to receive the lamp.

10.3.3 *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 (2.87 mm) in width, suitably spaced longitudinally to receive the lamp.

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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 of 40-watt, T12(T38) lamps for 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 60-Hz sinusoidal power supply and 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. 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 values of voltage and preheat current, within the waveshape 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, and unless otherwise specified on the lamp data sheets, shall be 110°F (43.3°C). At temperatures near the top of a range, however, initial starting will be secured, but not necessarily immediate restarting.

12 Requirements for ballast design

12.1 General

12.1.1 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.

12.1.2 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

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Part IV as defined in subclauses 12.2, 12.3, and 12.4. Requirements for rapid and preheat (switch) start ballasts are given in these subclauses. Other special requirements may be specified on a lamp data sheet.

12.2 Lamp voltage 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 waveshape limitation as specified on the appropriate lamp 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 waveshape 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 Waveshape of rapid start starting voltages

The maximum starting voltage crest factor value for all lamps in this standard operating on rapid start circuits 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% 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, the capacitor shall shunt the two lamps farthest from ground potential. A second capacitor of the same size shall shunt the lamp farthest fro ground. If the minimum peak voltage from the lamp terminal-to-starting aid exceeds specified limit by 30% or more, the second capacitor may shunt either of the two shun lamps.

Appropriate capacitor sizes are specified on each lamp data sheet.

12.3 Cathode heating

The specified limits shall be met at rated input voltage to the ballast unless otherwise specified on the lamp data sheet.

12.3.1 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.

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

12.4 Operating current waveshape

The waveshape of the lamp current supplied to a fluorescent lamp in a rapid start or in a For Preheat (switch) start circuits circuit shall have a crest factor that does not exceed 1.70, unless otherwise specified on a lamp data sheet.

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.

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13 Requirements for luminaire design

13.1 General

A luminaire intended for use with a particular lamp type shall provide the appropriate starting aid, 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, or other circuits as designated, 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.

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

13.2.2 Unless otherwise specified on the lamp data sheet, the 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:

Type of Fluorescent Lamp	Maximum Distance	
	in	mm
T5 linear lamps	1/4	6
All other linear lamps		
If rated 500mA or less	1/2	13
If rated greater than 500mA	1	25

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Part II – Principles of dimensioning

The diagrammatic drawing (see figure 1) in this part gives graphical definitions of the dimensional code letters used on the individual lamp data sheets

This drawing is intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp data sheets.

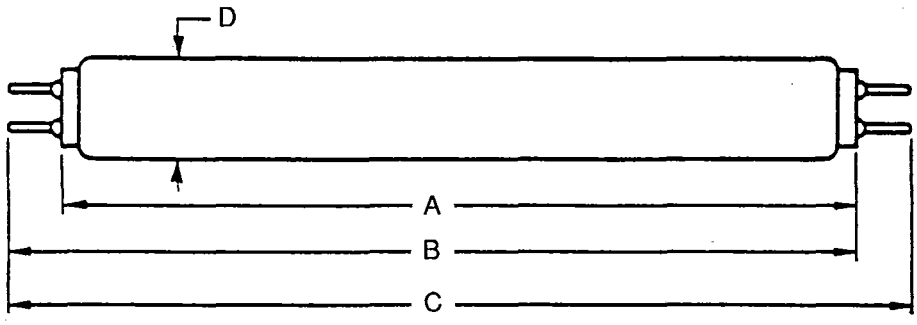

Figure 1 – Linear lamps – G5, G13, G20 Bipin bases

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Part III – Annexes

Annex A
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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 designation system, is identified by wattage, length, bulb size, circuit application, and bulb shape or base in some cases.

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 Designation system

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, as follows:

1) Lamp rated or nominal wattage;

2) Lamp nominal length;

3) Bulb diameter;

4) Lamp shape, as required;

5) Lamp base, as required;

6) Circuit and/or special description.

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 6 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".

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 where 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 above length without any separator. The bulb diameter information comprises two subparts. The first is a letter to indicate bulb's cross-sectional shape and the other part is the cross-sectional diameter. The bulb shape is identified by a letter symbol as follows:

T – Round cross-sectional tubular bulb

PG – Power groove indented bulb

Bulb diameter values shall be entered in the conventional eighths-of-an-inch system.

For those special cases where 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

Exceptions to the linear assumption, such as circular, U-shape, and compact single-ended lamps are called out with a special code in this length section of the abbreviation. Special descriptions are defined as follows:

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U1 – U-shaped lamp, 1-5/8 inch leg centers

U3 – U-shaped lamp, 3-5/8 inch leg centers

U6 – U-shaped lamp, 6-inch leg centers

C8 – Circular shaped lamp, 8-inch diameter of circle

C12 – Circular shaped lamp, 12-inch diameter of circle

C16 – Circular shaped lamp, 16-inch diameter of circle

T – Twin, Two parallel legs with a common base

Q – Quad, Four parallel legs, square, with a common base

As new lamps of similar design to the above are standardized, additional numerical values may be used within the established pattern. Radically new lamp shapes will necessitate the establishment of new letter codes and definitions in this clause.

A.2.5 Lamp base

The lamp's base code may be used as part of the designation 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. The compact, single-ended family of lamps, for example, employs a variety of bases for use in particular circuits. Proper base codes are noted in the base standard, ANSI C81.20.

A.2.6 Circuit and/or special description

This part of the identification shall follow the slashed separator that 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.

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 as follows:

RS – Rapid start
PH – Preheat start (starter)
IS – Bipin base, instant start
SP – Single pin base, instant start
HO – 800 milliamperes and 1000 milliamperes, high output, rapid start
1.5A – 1500 milliamperes, 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

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A.3 Sample abbreviations

Following are several sample abbreviations with explanations.

30W/36T12/RS	30 watt, 36 inch T12, rapid start
40W/22T12/U6/RS	40 watt, 22 inch T12, U-shaped - 6 inch leg center spacing, 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, 1500mA, rapid start
4W/6T5/PH	4 watt, 6 inch T5, preheat start
30W/36T8/PH-B	30 watt, 36 inch T8, preheat start, bactericidal lamp
40W/60T12/IS	40 watt, 60 inch T12, bipin base, instant start
75W/96T12/SP	75 watt, 96 inch T12, single pin, instant start
5W/4T4/T/G23/PH	5 watt, 4 inch T4, twin, G23 base, preheat start
13W/5T4/Q/G23-2/PH	13 watt, 5 inch T4, quad, G23-2 base, preheat start
36-39W/16T5/T/2G11/PH-RS	36-39 watt, 16 inch T5, twin, 2G11 base, preheat and rapid start

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Annex B
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Former designations of C78 fluorescent lamp standards

Prior to the 1978 versions of ANSI C78.1 and ANSI C78.2, fluorescent lamps were specified on individual American National Standards. Those individual standards are listed below.

Title	Former ANSI Designation
4 Watt, 6 Inch, T5, Preheat-Start Fluorescent Lamp	C78.400-1972
6 Watt, 9 Inch, T5, Preheat-Start Fluorescent Lamp	C78.401-1972
8 Watt, 12 Inch, T5, Preheat-Start Bactericidal Lamp	C78.1200-1972
8 Watt, 12 Inch, T5, Preheat-Start Fluorescent Lamp	C78.402-1972
13 Watt, 21 Inch, T5, Preheat-Start Fluorescent Lamp	C78.417-1972
14 Watt, 15 Inch, T8, Preheat-Start Fluorescent Lamp	C78.424-1972
14 Watt, 15 Inch, T12, Preheat-Start Fluorescent Lamp	C78.403-1972
15 Watt, 18 Inch, T8, Preheat-Start Fluorescent Lamp	C78.404-1972
15 Watt, 18 Inch, T8, Preheat-Start Bactericidal Lamp	C78.1201-1972
15 Watt, 18 Inch, T12, Preheat-Start Fluorescent Lamp	C78.405-1972
18 Watt, 24 Inch, T8, Preheat-Start Fluorescent Lamp	C78.418-1975
18 Watt, 26 Inch, T8, Preheat-Start Fluorescent Lamp	C78.419-1972
19 Watt, 28 Inch, T8, Preheat-Start Fluorescent Lamp	C78.420-1972
19 Watt, 30 Inch, T8, Preheat-Start Fluorescent Lamp	C78.421-1972
20 Watt, 24 Inch, T12, Preheat-Start Fluorescent Lamp	C78.406-1972
25 Watt, 28 Inch, T12, Preheat-Start Fluorescent Lamp	C78.422-1972
25 Watt, 33 Inch, T12, Preheat-Start Fluorescent Lamp	C78.423-1972
30 Watt, 36 Inch, T8, Preheat-Start Fluorescent Lamp	C78.407-1972
30 Watt, 36 Inch, T8, Preheat-Start Bactericidal Lamp	C78.1202-1972
90 Watt, 60 Inch, T12, Preheat-Start Fluorescent Lamp	none
90 Watt, 60 Inch, T17, Preheat-Start Fluorescent Lamp	C78.411-1973

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Annex C
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Bibliography

IEC Publication 81, *Tubular fluorescent lamps for general lighting service*[5)]

[5)] Available from the American National Standards Institute,11 West 42nd Street, New York, NY 10036.

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Part IV – Lamp specification data

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

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 clause 10 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 8.0V)
Objective (ohms) 70
Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.16
max, A 0.25
Preheat time (at 0.22 A preheat current)
min, s 0.5

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (μF) (at 60 Hz)		0.06

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

Cathode heat requirements

Voltage, nominal 8.0

Voltage during operation	Min	Max
at 90% primary	5.4	–
at rated primary	6.0	8.0
at 110% primary	–	8.8

Dummy load resistor ..... 70 ± 1.0 ohms

Voltage across dummy load	Min	Max
at 90% primary	6.5	–
at rated primary	7.2	8.4
at 110% primary	–	9.2

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

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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.16
max, A 0.25
Preheat time (at 0.22 A preheat current)
min, s 0.5

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (μF) (at 60 Hz)		0.06

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

Cathode heat requirements

Voltage, nominal 8.0

Voltage during operation	Min	Max
at 90% primary	5.4	–
at rated primary	6.0	8.0
at 110% primary	–	8.8

Dummy load resistor ..... 70 ± 1.0 ohms

Voltage across dummy load	Min	Max
at 90% primary	6.5	–
at rated primary	7.2	8.4
at 110% primary	–	9.2

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

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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.16
max, A 0.25
Preheat time (at 0.22 A preheat current)
min, s 0.5

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (μF) (at 60 Hz)		0.06

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

Cathode heat requirements

Voltage, nominal 8.0

Voltage during operation	Min	Max
at 90% primary	5.4	–
at rated primary	6.0	8.0
at 110% primary	–	8.8

Dummy load resistor ..... 70 ± 1.0 ohms

Voltage across dummy load	Min	Max
at 90% primary	6.5	–
at rated primary	7.2	8.4
at 110% primary	–	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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.16
max, A 0.25
Preheat time (at 0.22 A preheat current)
min, s 0.5

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

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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.18
max, A 0.27
Preheat time (at 0.22 A preheat current)
min, s 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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.44
max, A 0.65
Preheat time (at 0.55 A preheat current)
min, s 0.75

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (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 8.0

Voltage during operation	Min	Max
at 90% primary	6.8	–
at rated primary	–	9.0[1)]
at 110% primary	–	10.0[1)]

Dummy load resistor ..... 26 ± 0.25 ohms

Voltage across dummy load	Min	Max
at 90% primary	4.0	–
at rated primary	–	8.5
at 110% primary	–	9.5

[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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.44
max, A 0.65
Preheat time (at 0.55 A preheat current)
min, s 0.75

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (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 8.0

Voltage during operation	Min	Max
at 90% primary	6.8	–
at rated primary	–	9.0[1)]
at 110% primary	–	10.0[1)]

Dummy load resistor ..... 29 ± 0.3 ohms

Voltage across dummy load	Min	Max
at 90% primary	4.0	–
at rated primary	–	8.5
at 110% primary	–	9.5

[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

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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.44
max, A 0.65
Preheat time (at 0.55 A preheat current)
min, s 0.75

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (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 8.0

Voltage during operation	Min	Max
at 90% primary	6.8	–
at rated primary	–	9.0[1)]
at 110% primary	–	10.0[1)]

Dummy load resistor ..... 26 ± 0.3 ohms

Voltage across dummy load	Min	Max
at 90% primary	4.0	–
at rated primary	–	8.5
at 110% primary	–	9.5

[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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
- min, A 0.44
- max, A 0.65

Preheat time (at 0.55 A preheat current)
- min, s 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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.44
max, A 0.65
Preheat time (at 0.55 A preheat current)
min, s 0.75

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (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 8.0

Voltage during operation	Min	Max
at 90% primary	6.8	–
at rated primary	–	9.0[1)]
at 110% primary	–	10.0[1)]

Dummy load resistor ..... 29 ± 0.3 ohms

Voltage across dummy load	Min	Max
at 90% primary	4.0	–
at rated primary	–	8.5
at 110% primary	–	9.5

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

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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.35
max, A 0.80
Preheat time (at 0.55 A preheat current)
min, s 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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.35
max, A 0.80
Preheat time (at 0.55 A preheat current)
min, s 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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.35
max, A 0.80
Preheat time (at 0.55 A preheat current)
min, s 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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.35
max, A 0.80
Preheat time (at 0.55 A preheat current)
min, s 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

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 clause 10 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
  Minimum (ohms) ..... TBD

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

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Preheat current
min, A 0.44
max, A 0.65
Preheat time (at 0.55 A preheat current)
min, s 0.75

For starterless circuits (rapid start)

	Single lamp	Ballast 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, maximum	2.0	2.0
Starting capacitor size		
minimum (μF) (at 60 Hz)		0.008
maximum (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 8.0

Voltage during operation	Min	Max
at 90% primary	6.8	–
at rated primary	–	9.0[1)]
at 110% primary	–	10.0[1)]

Dummy load resistor ..... 29 ± 0.3 ohms

Voltage across dummy load	Min	Max
at 90% primary	4.0	–
at rated primary	–	8.5
at 110% primary	–	9.5

[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, 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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.41
max, A 0.95
Preheat time (at 0.60 A preheat current)
min, s 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 clause 10 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

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

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Preheat current at 90 - 110% primary voltage
min, A 0.41
max, A 0.95
Preheat time (at 0.60 A preheat current)
min, s 0.75

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

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 clause 10 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

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

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Preheat current
min, A 0.40
max, A 0.65
Preheat time (at 0.53 A preheat current)
min, s 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 clause 10 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

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

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Preheat current
- min, A 0.40
- max, A 0.65

Preheat time (at 0.53 A preheat current)
- min, s 1.0

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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 clause 10 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

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

	Single lamp	Two lamp 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

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Preheat current
min, A 1.45
max, A 2.20
Preheat time (at 1.80 A preheat current)
min, s 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 clause 10 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

Information for ballast design (conditions of clause 12 apply)

Lamp starting requirements

For preheat (switch) start circuits

	Single lamp	Two lamp 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

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Preheat current
min, A 1.45
max, A 2.20
Preheat time (at 1.80 A preheat current)
min, s 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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