

CEE High-Performance T8 Specification

For Terms and Usage, see next page

Equipment	Specification			
High Performance T8 Lighting Systems	Energy-efficiency specifications based on performance characteristics relating to 4' T8 lamp with a not-to-exceed nominal wattage of 32W. The lamps and ballast must be tested in accordance with the appropriate IESNA and ANSI reference standards, and must meet OSHA/NRTL and UL safety guidelines. These lamps should be applied in accordance with national best practices in lighting design such as (1) IESNA Recommended Practices and (2) Lighting power densities prescribed by local and state building codes.			
Performance Characteristics for Systems				
Mean System Efficacy	≥ 90 MLPW for Instant Start Ballasts ≥ 88 MLPW for Programmed Rapid Start Ballasts			
Performance Characteristics for Lamps				
Color Rendering Index (CRI)	≥ 80			
Minimum Initial Lamp Lumens	≥ 3100 Lumens ¹			
Lamp Life ²	≥ 24,000 hrs at three hours per start.			
Lumen Maintenance -or- Minimum Mean Lumens	≥ 94% -or- ≥ 2900 Mean Lumens			
Performance Characteristics for Ballasts³				
Ballast Efficacy Factor (BEF) BEF = [BF x 100] / Ballast Input Watts Based on: (1) Type of ballast (2) No. of lamps driven by ballast (3) Ballast Factor	Instant-Start Ballast (BEF)			
	Lamps	Low BF ≤ 0.85	Norm 0.85 < BF ≤ 1.0	High BF ≥ 1.01
	1	≥ 3.08	≥ 3.11	≥ 3.03
	2	≥ 1.60	≥ 1.58	≥ 1.55
	3	≥ 1.04	≥ 1.05	≥ 1.04
	4	≥ 0.79	≥ 0.80	≥ 0.77
	6	N/A	N/A	≥ 0.52
	Programmed Rapid-Start Ballast (BEF)			
	1	≥ 2.84	≥ 2.84	≥ 2.95
	2	≥ 1.48	≥ 1.47	≥ 1.51
	3	≥ 0.97	≥ 1.00	≥ 1.00
	4	≥ 0.76	≥ 0.75	≥ 0.75
	6	N/A	N/A	≥ 0.50
	Ballast Frequency	20 to 33 kHz or ≥ 40 kHz		
Power Factor	≥ 0.90			
Total Harmonic Distortion	≤ 20%			

¹ For lamps with color temperatures ≥4500 K, 2950 minimum initial lamp lumens are specified pending further consideration by CEE.

² Life rating is based on a Rapid Start or Programmed-Rapid Start Ballast tested in accordance to ANSI C82.11. When used on an Instant Start Ballast, life may be slightly reduced depending upon the operating hours per start.

³ Multi-Voltage Ballasts must meet or exceed the listed Ballast Efficiency Factor when operated on at least one of the intended operating voltages.

DEFINITIONS

Color Rendering: The effect that the spectral characteristic of the light emitted by the lamp has on the color appearance of the objects illuminated by the lamp.

Initial Lumens: Amount of luminous flux emitted by a lamp after 100 hours of operation at 25°C.

Lamp Life: Number of operating hours that a lamp lasts (based upon the lamp-ballast combination) at 3 hours duty cycle.

Lumen Maintenance: Ratio of mean lumens to initial lumens.

Mean Lumens: Amount of luminous flux emitted by a lamp at 40% of the rated lamp life.

Ballast Efficacy Factor (BEF): Measurement used to compare the efficiency of differing lighting systems. Ratio of ballast factor to the ballast supply power times 100.

Ballast Factor (BF): Measurement of the ability to produce light (lumens) from fluorescent lamps. Ratio of lamp lumens produced when the lamp or lamps are operated by a given ballast to the lamp lumens produced when the lamp or lamps are operated on a reference ballast.

Ballast Frequency: The frequency at which the ballast operates the lamp, measured in Hertz (Hz) or kilohertz (kHz).

Mean System Efficacy: Measure of "efficiency" of a lamp in terms of the ratio between mean visible output (mean lumen) to lamp/ballast electric power input (Watts), measured in Mean Lumens per Watt (MLPW).

Power Factor: The ballast Power Factor is the measurement of how effectively it converts the voltage and current supplied by the power source into watts of usable power delivered to the ballast.

Total Harmonic Distortion: Total harmonic distortion (THD) measures the degree to which the current wave shape is distorted from a sinusoidal wave, expressed as a percentage. Detrimental harmonic components may interfere with electronic equipment.

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CEE Reduced Wattage T8 Specification

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Energy efficiency specifications based on performance characteristics relating to 4' T8 lamp with nominal wattages of 28-watt or 25-watt. The lamps and ballast must be tested in accordance with the appropriate IESNA and ANSI reference standards and must meet OSHA NRTL and UL safety guidelines. These lamps should be applied in accordance with national best practices in lighting design such as (1) IESNA Recommended Practices and (2) lighting power densities prescribed by local and state building codes.

Application Guidance

- Reduced wattage lamps are best used to replace 700 or 800 series 32 W T8 lamps in existing lighting systems.
- For new construction and major renovation, higher system efficiency can be obtained by using an optimum combination of 32 W high performance lamps and high efficiency electronic ballasts. See the CEE High Performance T8 specification for more information: <http://library.cee1.org/content/cee-high-performance-t8-specification>
- Today's reduced wattage lamps are designed to be operated on instant start or program start ballasts. Compatibility can vary within applications. Consult manufacturer's literature before specifying products.
- Lamps are typically incompatible with dimming ballasts and should not be used in dimming applications unless the lamp and ballast manufacturers have approved a specific application for dimming.
- Reduced wattage lamps may demonstrate dim light, spiraling, pulsing, and other undesirable behavior in cooler temperature rooms or while warming up.
- System performance varies based on lamp or ballast components. CEE recommends testing compatibility before proceeding to replace 32 W lamps with any reduced wattage product.

Performance Characteristics for Systems For lamps with a color temperature less than 4500 K, the ballast and lamp combination mean system efficacy is ≥ 90 MLPW. For systems with lamps of color temperatures greater than or equal to 4500 K, the specified efficiency is ≥ 88 MLPW.

Performance Characteristics for Linear Lamps				
Wattage	28-watt		25-watt	
Color temperature	< 4500K	≥ 4500K	< 4500K	≥ 4500K
Minimum initial lamp lumens	≥ 2585	≥ 2480	≥ 2400	≥ 2300
Minimum mean lumens ¹ or lumen maintenance	≥ 2430	≥ 2335	≥ 2256	≥ 2185
	94%			
Lamp life ²	≥ 18,000 hours			
CRI	≥ 80			
Performance Characteristics for U-6" Lamps				
Wattage	28-watt		25-watt	
Minimum initial lamp lumens	≥ 2500		≥ 2250	
Minimum mean lumens ¹ or lumen maintenance	≥ 2200		≥ 1980	
	88%			
Lamp life ²	≥ 18,000 hours			
CRI	≥ 80			

Performance Characteristics for 28- and 25-watt Ballasts ³			
Ballast frequency	20 to 33 kHz or ≥ 40 kHz		
Power factor	≥ 0.90		
Total harmonic distortion	≤ 20%		
Instant Start Ballast BEF, All Ballast Factor Ranges			
Ballast Efficacy Factor (BEF)	Number of Lamps	28-watt Systems	25-watt Systems
BEF = [BF x 100] / Ballast Input Watts	1	≥ 3.52	≥ 3.95
Based on:	2	≥ 1.76	≥ 1.98
(1) Type of ballast	3	≥ 1.16	≥ 1.32
(2) Number of lamps driven by ballast	4	≥ 0.88	≥ 0.99
(3) Ballast Factor			

¹ Mean lumens measured at 7,200 hours

² Life rating is based on an Instant Start Ballast tested in accordance to ANSI protocols. When used on Program Start Ballast, life may be increased depending upon the operating hours per start.

³ Multivoltage Ballasts must meet or exceed the listed Ballast Efficiency Factor when operated on at least one of the intended operating voltages.

Definitions

Color Rendering: The effect that the spectral characteristic of the light emitted by the lamp has on the color appearance of the objects illuminated by the lamp.

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Lumen Maintenance: Ratio of mean lumens to initial lumens.

Mean Lumens: Amount of luminous flux emitted by a lamp at 40% of the rated lamp life.

Ballast Efficacy Factor (BEF): Measurement used to compare the efficiency of differing lighting systems. Ratio of ballast factor to the ballast supply power times 100.

Ballast Factor (BF): Measurement of the ability to produce light (lumens) from fluorescent lamps. Ratio of lamp lumens produced when the lamp or lamps are operated by a given ballast to the lamp lumens produced when the lamp or lamps are operated on a reference ballast.

Ballast Frequency: The frequency at which the ballast operates the lamp, measured in Hertz (Hz) or kilohertz (kHz).

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