

## E04 – Lamp Specification, Non-CFL Fluorescents

This specification applies to bids solicited after the effective date. Guidance is also provided for purchases made from existing contracts that include products that may not meet E04 specs or may not be available from contract. The guidance section should be used by purchasers to make decisions about lamp/fixture replacement prior to making purchases through OGS contract.

### LAMPS

#### COVERED PRODUCTS

This category shall cover tubular fluorescent lighting products (lamps) requiring separate ballasts including:

- Linear: T12, T8, and T5
- U-Bent: T12 and T8
- Circular: T5 and T9

Note: Guidance on separately ballasted, pin-base “biax” lamps of single, twin, triple and long twin tube configurations will be provided at a later date.

#### DEFINITIONS

**Ballast:** A device used to start and operate fluorescent lamps. The ballast provides the necessary starting voltage, while limiting and regulating the lamp current during operation.

**Ballast Factor (“BF”):** Measurement of the ability to produce light (lumens) from fluorescent lamps. BF is the ratio of lamp lumens produced when the lamp(s) are operated by a specified ballast to the lamp lumens produced when the lamp(s) are operated on a reference ballast. BF is indicated as a fraction, such as 0.88BF. The lower the Ballast Factor, the less energy it will use. However, low BF ballasts will decrease the lumen output of the lamps(s).

**Ballast Efficacy Factor (“BEF”):** A measurement used to compare the efficiency of differing lighting systems. Ratio of ballast factor to the ballast supply power times 100. The higher the BEF, the more efficient the ballast.

**Fluorescent Lamp:** A tubular coated glass envelope containing a gas that produces visible light when electricity is applied to the lamp’s ballast.

**Fluorescent System:** A combination of Fluorescent Lamps and Ballast that have been tested in accordance with the appropriate Illuminating Engineering Society (IES) and American National Standards Institute (ANSI) reference standards, and that meet Occupational Safety and Health Administration (OSHA), Nationally Recognized Testing Laboratories (NRTL), and Underwriters Laboratories (UL) safety guidelines. These systems should be applied in accordance with national best practices in lighting design such as IES Recommended Practices and lighting power densities prescribed by the Energy Conservation Construction Code of New York State (2007).

**Maximum Mercury:** The total weight of mercury in a lamp.

#### **STANDARD SETTING AND CERTIFICATION ENTITIES**

There are various national entities that provide guidance and specifications for the purchase of energy efficient lighting equipment. They are defined here as a guide.

**American National Standards Institute (ANSI):** ANSI is a private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States. The organization also coordinates U.S. standards with international standards so that American products can be used worldwide. ANSI facilitates the development of American National Standards by accrediting the procedures of standards-developing organizations.

**Consortium for Energy Efficiency (CEE):** CEE is a nonprofit public benefit corporation that promotes the manufacture and purchase of energy-efficient products and services. CEE members include utilities, statewide and regional market transformation administrators, environmental groups, research organizations, and state energy offices in the U.S. and Canada. Also contributing to the collaborative process are CEE partners: manufacturers, retailers, and government agencies. The U.S. Department of Energy and the Environmental Protection Agency both provide support through active participation as well as funding. For additional information on CEE, including product specifications and a list of qualifying products, visit the CEE website at [www.cee1.org](http://www.cee1.org).

**Federal Trade Commission (FTC):** A federal agency whose purpose is to create free enterprise, prevent restraint of trade and monopolies, and protect consumers against deceptive practices such as false advertising.

**Illuminating Engineering Society (IES):** IES is a non-profit society whose mission is to improve the lighted environment by bringing together lighting professionals and by translating that knowledge into actions that benefit the public. Members of the IES are regarded as the top professionals in their industry and are globally respected for their knowledge. Lighting Standards and Guides are developed through the committee consensus standards development process approved by the American National Standards Institute (ANSI).

**DesignLights™ Consortium (DLC):** DesignLights™ Consortium (DLC) is a collaboration of Northeastern utility companies, energy efficiency program administrators, and regional public service organizations that is committed to raising commercial awareness of the benefits of efficient lighting.

**National Electrical Manufacturers Association (NEMA):** NEMA is the trade association for the electrical manufacturing industry. NEMA provides a forum for the development of technical standards that are in the best interests of the industry and users, advocacy of industry policies

on legislative and regulatory matters, and collection, analysis, and dissemination of industry data.

**Restriction of Hazardous Substances (RoHS) Directive:** RoHS is a European Parliament and Council Directive that restricts the use of certain hazardous substances in electrical and electronic equipment. It bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. For additional information on RoHS please visit [www.rohs.gov.uk/](http://www.rohs.gov.uk/)

**Nationally Recognized Testing Laboratory (NRTL):** NRTL is a part of OSHA's Directorate of Technical Support and Emergency Management. The Program recognizes private sector organizations as NRTLs, and recognition signifies that an organization has met the necessary qualifications specified in the regulations for the Program. The NRTL Program determines that specific equipment and materials or products meet consensus-based standards of safety to provide the assurance that these products are safe for use in the U.S. workplace.

**Occupational Safety and Health Administration (OSHA):** OSHA is an agency within the US Department of Labor. OSHA's role is to assure safe and healthful working conditions for working men and women, by: authorizing enforcement of the standards developed under the OSHA Act; assisting and encouraging the States in their efforts to assure safe and healthful working conditions; and providing for research, information, education, and training in the field of occupational safety and health.

**Underwriters Laboratories (UL):** Underwriters Laboratories® is an independent product safety certification organization that tests products and writes standards for safety. UL evaluates more than 19,000 types of products, components, materials and systems annually with 20 billion UL Marks appearing on 72,000 manufacturers' products each year.

## **T 12 FLUORESCENT LAMPS**

**SELECTION GUIDANCE FOR PURCHASERS:** If faced with the replacement of a T12 fluorescent lamp, affected entities are **highly encouraged** to upgrade the system to a T8 (1" in diameter lamp) fluorescent system including new lamps and electronic ballasts (T8 lamps are not designed to run on T12 ballasts). There are several reasons for this:

- Magnetic ballasts used to drive T12 lamps will cease to be manufactured in 2010.
- Although outlawed in 1978, magnetic ballasts containing polychlorinated biphenyls (PCBs) may still be present in old T12 fixtures. PCBs present a serious environmental hazard and must be disposed of in accordance with federal, state and local requirements.
- T12 fluorescent systems use more energy than T8 fluorescent systems
- T12 Energy Saver lamps save energy by reducing light output by 15% compared to 40W T12 lamps which were outlawed as part of EPA Act 1996.
- T8 lamps provide better color rendering and longer life than T12 lamps.

If affected entities are seeking to replace T12 U-Bend lamps, it is noted that these lamps are not intended for use: (1) at lamp ambient temperatures below 60 degrees Fahrenheit or in drafty locations, (2) on low power factor ballasts, (3) reduced current/reduced light output ballasts, (4) dimming ballasts, or (5) on inverter operated emergency lighting systems unless specifically listed for use with that lamp.

**SPECIFICATION:** All T12 lamps shall meet the following requirements:

**TABLE 1: Requirements for T12 lamp replacements**

NEMA Class	Lamp Type	Ballast Type	Ballast Factor (BF)	Minimum Color Rendering Index (CRI)	Minimum Rated Lamp Life (See Note 1)	Maximum Mercury Content
34W/48T12/G13/RS (See Note 2)	Straight	Electronic Rapid Start	≤ 0.88	80	20,000 hours	10mg
60W/96T12/Fa8/IS	Straight	Electronic Instant Start	≤ 0.90	80	12,000 hours	10mg
34W/22T12/U6/2G13/RS (See Note 2)	U-Bend	Electronic Rapid Start	≤ 0.88	80	18,000 hours	8mg

Note 1: Minimum rated lamp life is based on 3 hour/start cycle.

**T8 FLUORESCENT LAMPS**

**SELECTION GUIDANCE FOR PURCHASERS:** T8 (1" in diameter) fluorescent lamps with electronic ballasts can save up to 40% in energy savings over T12 systems with no reduction in light output. Several options are available depending on the application.

**HIGH PERFORMANCE T8 (HPT8) SYSTEMS:**

HPT8 Systems are 4 foot light fixtures that incorporate high-lumen 32 W T8 linear lamps *and* high-efficiency ballasts. HPT8 Systems reduce energy costs compared to T12 or standard T8 systems, and produce equivalent or higher light output than standard T8s with better light quality. To achieve energy savings, high lumen 32 W lamps are matched with low ballast factor (BF) ballasts. The lamps and ballasts must be tested in accordance with the appropriate IES and ANSI reference standards, and must meet OSHA / NRTL and UL safety guidelines.

**REDUCED WATTAGE SYSTEMS:**

Reduced wattage T8 Lighting Systems are comprised of 4 foot T8 linear lamps with nominal wattages of 28 watts or 25 watts combined with high efficiency ballasts. The lamps and ballasts must be tested in accordance with the appropriate IES and ANSI reference standards, and must meet OSHA / NRTL and UL safety guidelines.

Reduced Wattage Systems are best used to replace 700 or 800 series 4 foot 32 W T8 lamps in existing lighting systems, or for one-for-one lamp/ballast replacements in over-lighted spaces, such as old T12 fixtures where fixture design does not allow for reducing the number of lamps.

Most reduced wattage lamps are designed to operate on instant start ballasts exclusively. Performance characteristics for these ballasts are based on the BEF for all ballast factor ranges.

Reduced wattage lamps are not compatible with dimming ballasts and should not be used for dimming applications. Reduced wattage lamps exhibit undesirable behaviors (dim light, spiraling, pulsing) in cooler temperature rooms or if placed near insulated cold air ducts. Reduced Wattage T8 lamps have a lower lamp life than 32W HPT8 lamps. If lamp life is an important factor, consider 32W HPT8 lamps with low ballast factor ballasts.

**OTHER T8 LAMP TYPES:**

Other applications exist where T8 lamps are recommended for use in place of T12 lamps. These include 2x2' fixtures that use 2 foot lamps or U-bent lamps and 8 foot fixtures that use linear lamps. Affected entities are encouraged to replace T12 lamps and ballasts with T8 lamps and high-efficiency electronic ballasts and consider the following guidance

**APPLICATION (1):** For new construction and major renovations, where dimming may be required, and cool ambient temperatures exist, purchaser shall use HPT8 Systems.

**SELECTION REQUIREMENT FOR PURCHASERS OF HPT8 SYSTEMS:** For one-for-one replacements, affected entities shall choose HPT8 Systems with low BF ballasts. In new construction, affected entities shall choose normal or high BF ballasts to allow for lighting designs that use fewer fixtures or fewer lamps per fixture.

**SPECIFICATION:** All high performance T8 systems shall meet the following requirements

<b>Performance Characteristics for High Performance T8 (32W) Systems</b>				
Mean System Efficacy	$\geq 90$ MLPW for Instant Start Ballasts $\geq 88$ MLPW for Programmed Rapid Start Ballasts			
<b>Performance Characteristics for Lamps</b>				
Color Rendering Index (CRI)	$\geq 80$			
Minimum Initial Lamp Lumens	$\geq 3100$ Lumens <sup>1</sup>			
Lamp Life <sup>2</sup>	$\geq 24,000$ hours at three hours per start			
Lumen Maintenance –or- Minimum Mean Lumens	$\geq 94\%$ -or- $\geq 2900$ Mean Lumens			
Maximum Mercury Content	5mg			
<b>Performance Characteristics for Ballasts</b>				
When selecting an HPT8 32W lamp, an appropriate ballast meeting the requirements below must also be selected.				
Ballast Efficacy Factor (BEF)	Instant-Start Ballast BEF			
	Lamps	Low BF $\leq 0.85$	Normal $0.85 < BF \leq 1.0$	High BF $\geq 1.01$
BEF = [BFx100]Ballast Input Watts  Based On: (1) Type of Ballast (2) No. of lamps driven by ballast (3) Ballast Factor	1	>3.08	>3.11	n/a
	2	>1.60	>1.58	>1.55
	3	>1.04	>1.05	>1.04
	4	>0.79	>0.80	>0.77
	Programmed Rapid-Start Ballast BEF			
	1	$\geq 2.84$	$\geq 2.84$	n/a
	2	$\geq 1.48$	$\geq 1.47$	$\geq 1.51$
	3	$\geq 0.97$	$\geq 1.00$	$\geq 1.00$
4	$\geq 0.76$	$\geq 0.75$	$\geq 0.75$	
Ballast Frequency	20 to 33 kHz or > 40 kHz			
Power Factor	$\geq 0.90$			
Total Harmonic Distortion	$\leq 20\%$			

<sup>1</sup> For lamps with color temperatures < 4500K

<sup>2</sup> Life rating based on Rapid Start or Programmed-Rapid Start Ballast. Life rating may be slightly reduced on an Instant Start Ballast, depending on the operating hours per start.



## T 5 FLUORESCENT LAMPS

**SELECTION GUIDANCE FOR PURCHASERS:** T5 linear fluorescent lamps are 5/8" (16 mm) in diameter and are made in metric lengths. There are different types of T5 lamps: standard T5, high lumen T5, and T5 high output (T5HO). Standard T5 wattages range from 14 watts to 35 watts depending upon their length. Standard T5 lamps are commonly used in recessed or suspended fixtures where space is at a premium or where the use of fewer lamps is desirable. T5HO versions, typically 51 watts, are best used in suspended fixtures in spaces with higher ceilings and in highbay applications where a large lumen output is needed to deliver appropriate light levels. The T5HO lamps are designed for high temperatures.

The T5 lamp only operates on high frequency electronic ballasts and is designed to provide maximum light output when its ambient temperature is 35°C. At room temperature (25°C) T5 lamps installed in a recessed fixture with parabolic reflectors will operate close to their optimum temperature.

T5 lamps in general are not appropriate for replacing or retrofitting T12 or T8 lamps due to their metric length and lamp holder design. Instead T5 fluorescent lamps with electronic ballasts are best used in new fixtures designed around their smaller size, unique lengths and thermal characteristics.

**SPECIFICATION:** All T5 lamp systems shall meet the following lamp and ballast requirements.

T5 Lamp Type / wattages	Application (New Fixtures)	Ballast Requirements: PF, THD, BF	Rated Life Minimum (hrs)*	CRI Minimum	Maximum Mercury Content
Standard T5 / 13 – 35 watts	General office, commercial, etc.	PF > 0.98; THD < 10%; BF ≤ 1.0 Bi-level switching	20,000	85	5mg
High Output (HO) T5 24 – 80 watts	High Bay (fixture installed at least 15 feet above the floor)	PF > 0.98; THD < 10%; BF ≤ 1.0; rated for 90°C ambient temperature; Bi-level switching	20,000	85	5mg
High Lumen T5 / 26 – 51 watts	General office, commercial, etc.	PF > 0.98; THD < 10%; BF ≤ 1.0 Bi-level switching	20,000	85	5mg

*\*Note: Minimum rated lamp life is based on a 3 hr/start cycle testing, Programmed Start Universal (120 – 277 volts) Ballast*

## CIRCULAR LAMPS

**SELECTION GUIDANCE FOR PURCHASERS:** T9 (1" in diameter) Circular fluorescent lamps operating on magnetic ballasts may still be present in many offices. If faced with the replacement of a T9 circular fluorescent lamp, affected entities are **highly encouraged** to replace the system with a T5 circular fluorescent fixture including new lamp and electronic ballast<sup>1</sup> or other ballasted or compact fluorescent fixture options that fit the space. There are several reasons for this:

- Magnetic ballasts used to drive T9 circular lamps will cease to be manufactured in 2010.
- Although outlawed in 1978, magnetic ballasts containing polychlorinated biphenyls (PCBs) may still be present in old T9 circular fixtures. PCBs present a serious environmental hazard.
- T9 fluorescent systems use more energy than T5 fluorescent systems

- T5 lamps provide better light output and color rendering, have longer life, and are dimmable, and use less energy.

<sup>1</sup>T5 circular lamps are not designed to run on magnetic ballasts.

CAUTION: Some T9 circular lamps cannot be used on dimming circuits, emergency exit fixtures or lights, electronic timers, photocells or lighted switches. In outdoor applications they should be used only in enclosed fixtures to avoid exposure to weather.

**SPECIFICATION:** All T9 lamps shall meet the following requirements.

Circular Lamp	Rated Life (hrs)* / <u>Minimum</u>	CRI Minimum	Maximum Mercury Content
T9 Circular Lamp	12,000	80	10mg

**SPECIFICATION:** must be purchased with electronic ballasts and shall meet the following requirements.

Circular Lamp	Rated Life (hrs)* / <u>Minimum</u>	CRI Minimum	Maximum Mercury Content
T5 Circular Lamp	16,000	85	10mg

**SPECIFICATIONS**

**THE FOLLOWING SPECIFICATIONS APPLY TO ALL LAMPS AND BALLASTS LISTED ABOVE**

**Environmental Performance:**

**Restriction of Hazardous Substances (RoHS) Directive:**

Affected state entities are encouraged to purchase lamps identified in this specification that comply with the RoHS Directive. All bidders responding to solicitations are required to disclose whether the product(s) offered comply with the final requirements of the European RoHS Directive 2002/95/EC.

**Take-Back / Recycling:**

Contractors are required to offer recycling programs for mercury containing lamps and ballasts. Each contractor shall describe their recycling program and explain how it will provide certification of mercury recovery. Documentation shall be provided to the affected entity demonstrating that these products have been disposed of in an environmentally sound manner in compliance with applicable local, state and federal laws.

**Low mercury content lamps:**

Affected entities are encouraged to purchase lamps with the lowest amount of mercury available. Fluorescent lamps containing less mercury than the limits established above are currently available.

**Disclosure of Mercury in Lamps:**

Contractors shall disclose the amount of mercury or range of mercury in milligrams for each type of mercury-added lamp sold. Mercury-added lamps shall be defined as any device to which elemental mercury or mercury compounds are intentionally added. Contractors shall maintain an online listing of all lamps they offer under state contract, including a clear designation of the amount of mercury or range of mercury in milligrams for each type of mercury-added lamp sold.

**Packaging:**

In accordance with Environmental Conservation Law section 37-0205, packaging shall not contain inks, dyes, pigments, adhesives, stabilizers, or any other additives to which any lead, cadmium, mercury or hexavalent chromium exceed the following concentration level: 100 parts per million by weight (0.01%).

**Labeling:**

In accordance with the rule being generated by the FTC under 16 CFR Part 305 set to go into effect in mid-2011, all lamp packages will have a "Lighting Facts" label that meets the requirements of the FTC and provides information about the light output (in lumens), the energy cost, the lamp's rated life, the color tone or temperature, input watts, and whether the bulb contains mercury.