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# Approved EO 4 Specifications

# Lighting Fixtures, Ballasts, and Lamps

## Covered Products

This category shall cover the following lighting products:

A) Fixtures

- Overhead workspace luminaires
- High-bay lighting fixtures
- Recessed can fixtures
- Other interior fixtures
- Street lighting
- Parking lot lighting
- Wall packs
- Security lighting

B) Ballasts

- Efficient T-8 fluorescent ballasts
- Other electronic ballasts

C) Lamps

- Linear T-8 Lamps (fluorescents and LEDs)
- Linear T-5 Lamps (fluorescents and LEDs)
- Circular and U-Bend Lamps (fluorescents and LEDs)
- Replacement lamps for high-intensity discharge fixtures
- Screw-in LEDs
- Pin-based CFLs and LEDs

Products not compliant with this specification:

- Linear T-12 fluorescents are not compliant with this specification
- Linear T-9 Fluorescents are not compliant with this specification
- Please note that Fluorescent T-12, T-9, and circular and U-bend T-8 and T-5 lamps and fixtures are not compliant with this specification.

## Goal

To eliminate the purchase of inefficient lighting and high mercury content lighting in New York State facilities and require highly efficient lighting, including the use of mercury-free LED technology when possible.

## Background

On December 28, 2012, Governor Andrew M. Cuomo issued Executive Order No. 88, which directed state agencies to decrease energy consumption in state buildings by 20 percent in seven years. This directive, coupled with Executive Order No. 4 and statistics from the United States Department of Energy indicating lighting is the largest source of electricity consumption in commercial buildings, provide an awareness of the potential opportunity in energy efficiency. By procuring highly efficiency lighting, large cost-savings and emission reductions may be realized across state government.

Highly efficiency lighting with little or no mercury content is now widely available to meet the state's sustainability directives.

## Guidance

Lighting upgrades and retrofits can be performed in different ways. Frequently facilities conduct lamp or ballast change-outs without changing out complete fixtures. It is recommended that all options be considered when changing out lighting. This specification is broken out into fixtures (A), ballasts (B), and lamps (C).

Specifications and recommendations are unique in these areas, though universal specifications and recommendations precede the specific breakouts. Please read the universal specifications and the specifications related to the fixtures, ballasts, or lamps being considered.

## 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.

**Color Rendering Index (CRI)**: A measure of how accurately an artificial light source displays colors. CRI is determined by comparing the appearance of a colored object under an artificial light source to its appearance under incandescent light. The higher the CRI, the better the artificial light source is at rendering colors accurately. High (above 80) CRI is preferred in the home. ENERGY STAR requires that qualified fixtures have lamps with CRI above 80.

**Compact Fluorescent Lamp (CFL)**: An (1) integrally ballasted fluorescent lamp with a medium screw base, (2) pin based (GU24) line voltage retrofit lamp, or (3) pin based (GU24) line voltage conversion lamp, with a rated range of 115 to 130 volts designed as a direct replacement for a general service incandescent lamp.

**Dark Sky Compliant**: A designation given to outdoor lighting fixtures that meet the International Dark Sky Association's (IDA) requirements for reducing excess ambient lighting and light pollution, including the effects of unnatural lighting on the environment. Examples of features for lights in this category include being fully shielded (having a full cutoff).

**Efficacy**: A description of the efficiency of a light source, as measured in light produced (lumens) per unit of power consumed (watts).

**Fixture**: A device designed to create artificial light comprised of a lamp and any corresponding ballast or driver.

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

**Fluorescent System**: A combination of fluorescent lamps and Ballasts 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 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 (2010).

**Full cutoff**: The luminous intensity (in candelas) at or above an angle of 90 above nadir is zero, and the luminous intensity (in candelas) at or above a vertical angle of 80 above nadir does not numerically exceed 10% of the luminous flux (in lumens) of the lamp or lamps in the luminaire.

**Lamp**: In the lighting industry, "lamp" is the term for a light source. Lamps typically refer to the light emitting portion of a luminaire designed to be changed out without the help of an electrician.

**Lumen**: The SI (International Systems of Units/ Système International d'Unités) unit for the amount of light emitted per second.

**Luminaire**: A complete electric light unit, including the lamp, corresponding ballast or driver, and optics.

**Mercury**: A chemical element necessary for fluorescent lighting and a known toxin.

**Maximum Mercury**: The total mass of mercury in a lamp, most frequently expressed in milligrams.

**Photometry**: the science of the measurement of light, in terms of its perceived brightness to the human eye. Also called photometrics.

**Rated life**: A light's estimated lifetime measured in hours. For all light bulbs, lifetime is determined by operating a sample of bulbs according to industry test standards. The time that half of the test sample fails is considered rated life. By definition, some lamps will fail before their rated life and some will operate beyond their rated life. The ENERGY STAR CFL criteria require additional testing to show that the sample can withstand a number of short start cycles and monitors early failures throughout testing.

**Total Cost of Ownership (TCO)**: An analysis that can be used to assess all of the costs of owning a particular product throughout its lifecycle, including acquisition costs, operation expenses and end-of-life costs. It is intended to provide an apples-to-apples comparison between differing models or brands of a similar product.

**Watt**: The SI (International Systems of Units/ Système International d'Unités) unit for power, measured in Joules per second.

## Standard Setting and Certification Entities

Various national entities 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 nonprofit 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. CEE partners (manufacturers, retailers, and government

agencies) also contribute to the collaborative process. The U.S. Department of Energy and the Environmental Protection Agency both provide support through active participation as well as funding. Visit https://www.cee1.org for additional information on CEE, including product specifications and a list of qualifying products.

**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 nonprofit 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).

**International Dark Sky Association (IDA)**: Administers the Fixed Seal of Approval program, which certifies outdoor lighting fixtures that minimize glare, reduce light trespass and protect the night sky. The IDA evaluates fixtures based on the **Upward Light Output Ratio (ULOR)**: meaning the "amount of upward flux a fixture produces." IDA also educates lighting designers, manufacturers, technical committees and the public about controlling light pollution. Visit http://darksky.org for more information.

**Designlights™ Consortium (DLC)**: DLC is a collaboration of utility companies, energy efficiency program administrators, and regional public service organizations that is committed to raising commercial awareness of the benefits of efficient lighting. For additional information on DLC, including product specifications and a list of qualifying products, visit the DLC website at https://www.designlights.org.

**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 interest 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 places 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. Visit https://www.gov.uk/guidance/rohs-compliance-and-guidance for additional information on RoHS.

**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 United States Department of Labor. OSHA's role is to assure safe and healthful working conditions 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.

**ENERGY STAR®**: ENERGY STAR is a U.S. Environmental Protection Agency (EPA) voluntary program to identify and promote energy-efficient products and buildings to reduce energy consumption, improve energy security, and reduce pollution through voluntary labelling of or other forms of communication about products and buildings that meet the highest energy efficiency standards. Visit https://www.energystar.gov for additional information on ENERGY STAR, including product specifications and a list of qualifying products.

## Overarching Specifications

The following guidelines apply to all fixture, ballast, and lamp purchases.

**Mandatory Items:**

Packaging:

- Packaging shall comply 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 is intentionally added or contain incidental concentrations of lead, cadmium, mercury or hexavalent chromium which together are greater than 100 parts per million by weight (0.01%).

Labeling:

- In accordance with the rule being generated by the FTC under 16 CFR Par 305, all lamp packages will have a "Lighting Facts" label that meets the requirements of the FTC.

RoHS Compliance:

- Restriction of Hazardous Substances is a directive of the European Parliament that covers a wide variety of toxins

in electrical appliances. All fixtures shall be in ROHS compliance.

Proper recycling of old lamps and ballasts:

- Fluorescent lamps always contain mercury and should be recycled at a proper recycling center per state and local regulations. Ballasts can contain chemicals such as polychlorinated biphenyls (PCBs) that shall be recycled in accordance with state and local regulations.
- Vendors shall offer lamp and ballast collection services.

State and local energy codes for lighting levels:

- New York State, in addition to some NYS municipalities, have minimum lighting level requirements for a variety of settings. Though minimum lighting levels shall be met per code, it is also recommended to use ASHRAE 90.1 recommendations regarding lighting levels.

**Recommended Items:**

The use of Design Lights Consortium (DLC)-listed LEDs:

- DLC-listed is highly recommended as these fixtures have a high degree of lighting quality, are energy efficient, and contain no mercury. In certain circumstances, such as with A-19 fixtures, the fixture type is not covered by the DLC. In this case, ENERGY STAR® certification is highly recommended.

The involvement of an Lighting Certified (LC) or Certified Lighting Efficiency Professional (CLEP) lighting designer:

- Lighting design is complex and involves a large number of variables. Using a certified lighting designer is recommended for any installation with a project cost over $50,000.

Internal review of photometrics:

- Review of photometrics by internal staff is recommended for any installation with a project cost over $10,000- the photometrics can be requested from the manufacturer.

Total cost of ownership analysis:

- Total cost of ownership analysis is recommended for all projects, and end of life costs (proper disposal or recycling) should be included in the analysis.

Packaging:

- The use of bulk packaging.
- The use of reusable packaging.
- The use of innovative packaging that reduces the weight of packaging, reduces packaging waste, or utilizes packaging that is a component of the product.
- That all packaging remain the property of the supplier and not become the property of the affected state entity under any circumstance or condition. The vendor shall certify that the packaging material will be reused, recycled, or composted, and managed in compliance with applicable local, state, and federal laws.
- Packaging that maximizes recycled content and/or meets or exceeds the minimum post-consumer content level for packaging in the U.S. Environmental Protection Agency Comprehensive Procurement Guidelines.
- Packaging that is recyclable or compostable.

Following manufacturer's recommendations for application and installation:

- It is possible to install high quality lighting that is not designed for the application intended. For example, sometimes high quality parking lot lighting can be installed in an office setting. This can lead to issues as the parking lot lighting may not meet the lighting needs of the office environment. It is also possible to improperly install fixtures in ways that can reduce their efficiency and/or their useful life. Following manufacturer's recommendations can help avoid these situations.
- Review and consider the process of changing out fixtures with vendors prior to making a purchase, some change outs will be more complex, labor intensive, and expensive than others.

The Qualified Products Lists for the Design Lights Consortium, ENERGY STAR, and the Consortium for Energy Efficiency can be at:

- DLC QPL: https://www.designlights.org/QPL
- ENERGY STAR LED Fixtures QPL: https://www.energystar.gov/productfinder/product/certified-light-fixtures/results
- CEE QPL: http://library.cee1.org/content/commercial-lighting-qualifying-products-lists

Please note specifications are divided into fixtures (A), ballasts (B), and lamps (C).

## A. Fixture Specifications

All EO4 compliant fixture installations shall be either ENERGY STAR certified or Design Lights Consortium-listed:

- DesignLights Consortium (DLC). For a list of DLC-Qualified Fixtures, see https://www.designlights.org/QPL
- ENERGY STAR. For a list of ENERGY STAR-Certified Light Fixtures, go to https://www.energystar.gov/productfinder/product/certified-light-fixtures/results DLC-listed fixtures are highly recommended because emit high-quality light, are energy efficient, and contain no mercury. In certain circumstances, such as with A19 fixtures, the fixture type is not covered by the DLC. In this case, ENERGY STAR certification is required.

### 1. Overhead Workspace Fixtures

- DLC-listed or ENERGY STAR-certified LED fixtures shall be used if there are multiple fixture replacements.

### 2. High-Bay Lighting Fixtures

- DLC-listed, LED-Illuminated fixtures shall be used if there are multiple fixture replacements.

- If there are individual fixture replacements, compliant high-bay fixtures may also include high-efficiency high-intensity discharge (HID) systems that contain ceramic metal halide lamps and electronic HID ballasts.
- If there are individual fixture replacements, compliant high-bay fixtures may also include high-efficiency, high-output T5 fluorescent lamps and compatible NEMA Premium Efficiency electronic ballasts.
- High-bay fixtures that include magnetic ballasts, generic electronic fluorescent ballasts designed for 4-foot T8 systems, T12 (linear or U-bent) or T9 (circular) lamps, preheat fluorescent lamps, incandescent or halogen lamps, probe-start metal halide lamps, or mercury vapor lamps, are not compliant with this specification.

**3. Recessed Can Fixtures**

- ENERGY STAR-certified LED-Illuminated fixtures shall be used if there are multiple fixture replacements.
- If individual fluorescent recessed can fixtures are needed, compliant fixtures shall include electronic ballasts and 4-pin compact fluorescent lamps only.

**4. Track Lighting and Other Interior Fixtures**

- DLC listed or ENERGY STAR certified LED fixtures shall be used when installing track lighting or other interior fixtures.

**5. Outdoor Fixtures**

- DLC listed or ENERGY STAR certified LED fixtures shall be used when installing new outdoor lighting fixtures.
- All EO4 compliant outdoor fixtures shall be full cut-off to avoid ambient light pollution.

Additional Guidance for Replacing Lighting Fixtures:

- If replacing existing overhead lighting fixtures for interior illumination, or installing entirely new fixtures in a space, a DesignLights Consortium (DLC)-listed LED fixture is always recommended.
- LED products that do not meet DLC requirements should not be installed, with the exception of fixtures that are covered by the ENERGY STAR certification.
- When replacing individual fixtures or lamps, there may be a need for replacement with in-kind technology or very similar style LED technology to maintain coherence with existing fixtures in the room. In such cases, look for products that improve energy efficiency, reduce mercury and other toxic chemicals, and improve light quality.
  - For example, new fluorescent luminaires designed for 4-foot T8 fluorescent lamps should contain a NEMA Premium Efficiency electronic ballast and a high-efficiency T8 that is on the Consortium for Energy Efficiency (CEE) Qualified Product List (http://library.cee1.org/content/commercial-lighting-qualifying-products-lists).
- It is desirable that all outdoor lighting be International Dark-Sky Association (IDA)-compliant in order to mitigate the impact of artificial light on the nighttime environment. Visit http://darksky.org/fsa/ for a list of compliant products.
- For outdoor lighting fixtures, consider factors in the environment that may disrupt the light. For example, fixtures should be designed to avoid interference from debris that can shorten the useful life of the light or inhibit light output, such as dirt and insects.
- It is important to always consider manufacturer's recommendations for use and installation.

## B. Ballast Specifications

In cases where individual ballasts fail, replacements may be needed. Below are specifications and purchasing guidance related to fluorescent and HID ballasts.

- All EO 4-compliant ballasts shall be RoHS-compliant.

**1. Extra-efficient Electronic Ballasts for Linear 4-Foot T8 Fluorescent Systems**

- All EO4-compliant replacement ballasts for 4-foot T8 fluorescent systems shall be extra-efficient. This means they shall be on the current list of NEMA Premium Efficiency Ballasts (https://www.nema.org/Policy/Energy/Efficiency/Documents/nema_premium_electronic_ballast_program.pdf).
- Generic electronic ballasts for 4-foot T8s do not comply with this specification.

**2. Electronic Ballasts for High-Efficiency Linear Other T8 and T5 Fluorescent Systems**

- All EO4-compliant replacement fluorescent ballasts (except for 4-foot T8 lamps, which shall be electronic and on the NEMA Premium Efficiency List) shall be electronic.
- Magnetic fluorescent ballasts do not comply with this specification.

**3. Electronic Ballasts for Pin-Based Compact Fluorescent Lighting Systems**

- All EO4-compliant replacement ballasts for pin-based compact fluorescent lamps shall be electronic and designed to be compatible with 4-pin CFLs, which are much more energy efficient than 2-pin CFLs.
- Magnetic ballasts for pin-based CFLs do not comply with this specification.

**4. Electronic Ballasts for High Intensity Discharge (HID) Lighting Systems**

- All EO 4-compliant replacement ballasts for high-intensity discharge (HID) lighting systems shall be electronic and be designed to accommodate ceramic metal halide lamps.
- Magnetic HID ballasts do not comply with this specification.

Additional Guidance for Replacing Ballasts

- Ballasts manufactured before 1980 may contain polychlorinated biphenyls (PCBs), which are highly persistent toxic chemicals; such ballasts shall be managed in accordance with state and local regulations.

- Newer ballasts (manufactured after 1980) should be collected and recycled.

## C. Lamp Specifications

This portion is to be used when replacing lamps but not upgrading to entirely new fixtures.

**1. 4-foot T8 Linear Lamps**

- All EO 4-compliant 4-foot linear tube lamps shall meet one of the following criteria:
  - ➔ DLC listed 4-foot LED linear T-8 Lamps (recommend for large lamp change-outs) OR
  - ➔ Fluorescent lamp on the CEE Qualified Product List (http://library.cee1.org/content/commercial-lighting-qualifying-products-lists)
  - ➔ Maximum mercury content of 3.5 mg (RoHS-Compliant)
  - ➔ Minimum rated life of 30,000 hours when tested on instant start ballasts with 3-hour starts
  - ➔ 4-foot T8 lamps that are not on the CEE QPL are not compliant with this specification because they are less efficient and have a lower Color Rendering Index.
  - ➔ 4-foot high-output T8 (T8HO) fluorescent lamps are not compliant with this specification.
  - ➔ 4-foot T12 lamps are not compliant with this specification.
  - ➔ Preheat 4-foot T8s and T12s are not compliant with this specification.

Additional Guidance for Replacing 4-Foot Fluorescent Lamps:

- If faced with the replacement of a 4-foot T12 fluorescent lamp, affected entities are highly encouraged to upgrade to a comparable Design Lights Consortium (DLC)-certified LED fixture. Changing to a T-8 fixture with a 4-foot linear LED insta-fit product is not recommended in this scenario.
- Please note that magnetic ballasts containing polychlorinated biphenyls (PCBs) were present in many T-12 products produced prior to 1978, and may still be present in older fixtures. PCBs present a serious environmental hazard and shall be disposed of in accordance with federal, state, and local requirements.

**2. Linear T8 Lamps <4-foot**

All EO 4-compliant fluorescent lamps shorter than 4 feet shall meet one of the following standards:

- DLC-listed LED T8 Lamp <4 feet in length

OR

- High-efficiency fluorescent T8 lamp that meets the following criteria:
  - ➔ CRI = 80+
  - ➔ Rated Life Minimum: 24,000 hours when tested on instant start ballasts with 3-hour starts
  - ➔ Maximum mercury content: 3.5 mg per lamp (RoHS-compliant)
- T12s shorter than 4 feet are not compliant with this specification.
- Preheat T8s that are shorter than 4 feet are not compliant with this specification.

**3. Linear T8 Lamps >4 foot**

All EO 4-compliant T8 lamps longer than 4 feet shall meet one of the following standards:

- High-efficiency fluorescent T8 lamp that meets the following criteria:
  - ➔ CRI = 80+
  - ➔ Rated Life Minimum: 24,000 hours when tested on instant start ballasts with 3-hour starts
  - ➔ Maximum mercury content: 10 mg per lamp

OR

- DLC-listed LED T8 lamp >4 foot in length (Note: there are currently no DLC-listed LED T8 lamps >4 feet in length; however, if they become available, they would comply with this specification.)
- T12s longer than 4 feet are not compliant with this specification.
- Preheat T8s that are longer than 4 feet are not compliant with this specification.

**4. U-bend T8 Lamps**

All EO 4-compliant U-bend T8 lamps shall meet the following standards:

- DLC-listed LED U-bend T8 lamp (Note: there are currently no DLC-listed LED u-bent lamps; however, if they become available, they would comply with this specification. In the absence of a U-bend T8 lamp option, it is recommended that a full fixture replacement be instituted.)
- U-bent T12 fluorescent lamps do not meet this specification.

**5. Linear T5 Lamps**

All EO 4-compliant linear T5 lamps shall meet the following standards:

- High-efficiency linear fluorescent T5 lamp that meets the following criteria:
  - ➔ Minimum CRI: 80
  - ➔ Maximum mercury content: 3 mg per lamp (RoHS Compliant)
  - ➔ Minimum rated life: 30,000 hours on program start ballasts with 3-hour starts
- Minimum efficacy: 96 lumens/watt

OR

- DLC-listed LED T5 lamp

(Note: there are currently no DLC-listed linear LED T5 lamps; however, if they become available, they would comply with this specification.)

Additional Guidance for Replacing Linear T5 Fluorescent Lamps

- High-CRI linear T5 fluorescent lamps are already a very energy-efficient technology.

- It is recommended that purchasers consider upgrading to a DLC-Certified LED fixture, while weighing the cost, estimated energy savings, and rate of return on investment.

**6. Circular T5 Lamps**

All EO 4-compliant circularT5 lamps shall meet the following standards:

- DLC-listed Circular LED T5 lamp

  (Note: there are currently no DLC-listed circular LED T5 lamps; however, if they become available, they would comply with this specification. In the absence of a circular T-5 lamp option, it is recommended that a full fixture replacement be instituted)

- Circular T9 lamps do not comply with this specification.

Additional Guidance for Replacing Linear, Circular and U-Bent Lamps:

- LED replacement tube lamps are preferred because they have a significantly lower wattage than fluorescent tubes with a comparable lumen output. They are recommended for large-scale re-lamping projects.
- High-efficiency fluorescent lamps may be needed for small-scale lamp replacements in order to match other lamps in existing fixtures.
- It is often cost-effective to replace a fluorescent fixture with a DLC-listed LED fixture.
- Always check that lamps are compatible with the installed ballast.
- Replacement lamps should always be installed using manufacturer suggested guidelines.
- Many existing lights operate with magnetic ballasts, which may contain polychlorinated biphenyls (PCBs) if they were produced prior to 1978, and may still be present in older fixtures. PCBs present serious environmental and health hazards and shall be disposed of in accordance with federal, state, and local requirements.

**7. Specifications for Screw-In Light Bulbs**

This category includes both omni-directional lamps (e.g., A19, A21, globes, candles, bullets, replacements for screw-in high-intensity discharge lamps, etc.) as well as directional lamps (e.g., PAR lamps, BR20, BR30, MR16, etc.) for general lighting purposes.

All EO 4-compliant screw-in lamps shall meet the following standards:

- Light source is light emitting diodes (LEDs) AND be ENERGY STAR certified: ENERGY STAR ENERGY STAR LED Fixtures QPL: https://www.energystar.gov/productfinder/product/certified-light-fixtures/results
- ENERGY STAR-certified CFLs and HID lamps do not meet this specification.

Additional Guidance for Replacing Screw-in Lamps

- Screw-in lamps can be highly variable in terms of color temperature and light distribution. Review these items in every upgrade to ensure the new screw-in lamps will meet expectations.
- Please note that some – but a declining number of – ENERGY STAR-certified lamps are compact fluorescent lamps (CFLs). LEDs are preferable to CFLs because LEDs have a higher efficacy and a longer rated life; in addition, they are mercury-free.

**8. Pin-based LED and Compact Fluorescent Replacement Lamps**

All EO 4-compliant pin-based compact lamps shall meet one or more of the following standards:

- LED lamp with one or more of the following certifications/listings:

  ➔ DesignLights Consortium (DLC)

OR

  ➔ ENERGY STAR

AND

  ➔ RoHS-Compliant

- Fluorescent lamp that meets the following criteria:

  ➔ 4-pin base
  ➔ Minimum rated lamp life of 12,000 hours
  ➔ Maximum mercury content: 2.5 mg per lamp
  ➔ CFLs shall not be used in outdoor applications

Additional Guidance for Replacing Pin-Based Compact Lamps

- Pin-based LED lamps may overheat in recessed cans that were not specifically designed for LED lamps (due to high-heat conditions). Read manufacturer's instructions carefully before using.
- Fixtures with 2-pin CFLs are less energy efficient than 4-pin. Therefore, it is recommended that fixtures with 2-pin CFLs be replaced with LED fixtures.
- CFLs that contain amalgam mercury (instead of liquid mercury) are preferred because they tend to have a lower mercury content and a longer rated life.
- CFLs should not be used outdoors because fluorescent technology does not function efficiently in colder temperatures.