

Appendix

Lamp Sizing Guide

Lamp Size/Diameter

The diameter of a lamp, at its maximum dimension, is expressed in eighths of an inch. Examples: The diameter of an A19 lamp is 19-eighths of an inch, or 2-3/8", at its widest point. A T8 lamp has a diameter of 8-eighths, or one inch.

Light Center Length (L.C.L.)

The distance between the center of the filament, or arc tube, and a reference plane — usually the bottom of the lamp base. See L.C.L. Reference Plane Location chart below.

L.C.L. Reference Plane Location

Base Type	Location
All Screw Bases (except Mini-Can.)	Bottom of base contact
Mini-Can	Where diameter of ceramic base insulator is .531 inches
3-Contact Medium	Bottom of base contact
Mogul Medium Prefocus	Top of base fins
Mogul Prefocus	Top of base fins
Medium BiPost	Base end of bulb (Glass lamps) Bottom of ceramic base (Quartz lamps)
Mogul BiPost	Shoulder of posts (Glass lamps) Bottom of ceramic base (Quartz lamps)
2-Pin Prefocus	Bottom of ceramic base.
S.C. or D.C. Bayonet Candelabra	Top of base pins
Medium Bayonet	Top of base pins
S.C. or D.C. Prefocus	Plane of locating bosses on prefocus collar
Medium 2-Pin	Bottom of metal base shell

Maximum Overall Length (M.O.L.)

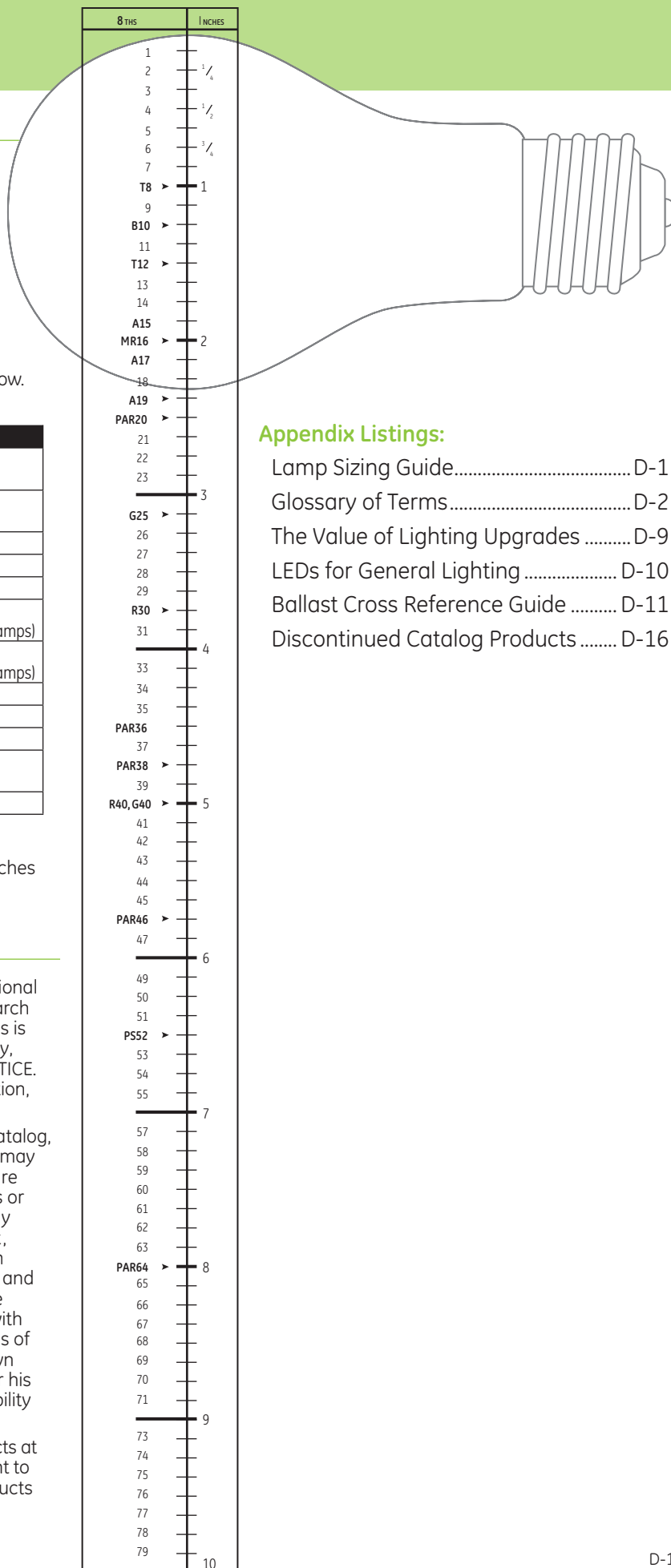
The end-to-end measurement of a lamp, expressed in inches or millimeters.

Important Notice

This catalog is a compilation of accumulated data. Additional information is constantly being uncovered through research and testing, which may modify the data given herein. This is particularly true of newer lamps and ballasts. Accordingly, SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE. For the latest lamp and ballast design data and information, contact your GE Representative.

The data and suggested applications contained in this catalog, as well as any additional information our representative may be able to furnish, are for general information only and are not intended and should not be taken as representations or warranties as to the suitability of a lamp or ballast for any particular application or use in any particular equipment, nor are our representatives authorized to make any such warranties. Applications and conditions of use are many and varied, and beyond our control. We cannot possibly have the same degree of knowledge that the purchaser has with respect to the design of his equipment and the conditions of its use. Therefore, it is up to the purchaser to make its own determination as to the suitability of a lamp or ballast for his intended application or use and to assume the responsibility for that determination.

General Electric desires to supply the best possible products at all times. For this reason, General Electric reserves the right to make changes in its products, and to introduce new products or discontinue existing ones without notice.



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Glossary of Terms

Ambient Temperature

Ambient temperature which refers to the temperature inside the fixture in the air surrounding the fluorescent lamp or LED. Fluorescent lamp light output and LED life are affected by the ambient temperature.

Amperes

("Amps") A measure of electrical current. In incandescent lamps, the current is related to voltage and power as follows: Watts (power) = Volts x Amps (current).

ANSI (American National Standards Institute)

A consensus-based organization which coordinates voluntary standards for the physical, electrical and performance characteristics of lamps, ballasts, luminaires and other lighting and electrical equipment.

ANSI Ballast Type

A reference to the ANSI document describing the lamp which also lists the characteristics of the ballast required to operate the lamp. Technically, therefore, it is incorrect to refer to "Ballast Type" with the ANSI code but this misuse is common. The following naming system is used: H – mercury lamps; M – metal halide lamps; S – high pressure sodium lamps; L – low pressure sodium lamps.

ANSI Codes

These are 3-letter codes assigned by the American National Standards Institute. They provide a system of assuring mechanical and electrical interchangeability among similarly coded lamps from various manufacturers. General Electric uses the assigned ANSI Codes as lamp ordering codes for most projection lamps.

Auto Reset Shutdown Circuit

Circuit senses lamp end life and will automatically shut off power to the lamp(s). When a new lamp is inserted in the socket, the ballast resets, and turns on the lamp automatically. Some shutdown circuits require the power to be cycled before a new lamp will re-light.

Ballast

An auxiliary piece of equipment required to start and to properly control the flow of current to gas discharge light sources such as fluorescent and high intensity discharge (HID) lamps. Typically, magnetic ballasts (also called electromagnetic ballasts) contain copper windings on an iron core while electronic ballasts are smaller and more efficient and contain electronic components.

Ballast Efficacy Factor (BEF)

Defined as ballast factor x 100 divided by input watts. The value is used to evaluate various lighting systems based on light output and power input. The BEF can only be used to compare systems operating the same type and quantity of lamps.

Ballast Factor (BF)

This is the percentage of a lamp's rated lumen output that can be expected when operated on a specific, commercially available ballast. Note that the "rated output" is sometimes measured on a reference ballast unlike ones that actually operate the lamp in the field. For example, a ballast with a ballast factor of 0.93 will result in the lamp's emitting 93% of its rated lumen output. A ballast with a lower BF results in less light output and also generally consumes less power.

Ballast Hum

Sound generated by the vibration of laminations in the iron core of the transformer or inductor present in the ballast.

Ballast Losses

Power or energy dissipated in the ballast as heat and not converted to lamp energy.

Ballast Luminous Efficiency (BLE)

A new (2011) metric measuring the ratio of total fluorescent lamp arc power to the input power supplied to the ballast.

Base Temperature (Maximum)

The maximum operating temperature permitted for the base in Celsius. Fixture manufacturers need to ensure that these conditions are satisfied in their fixture.

Beam Angle

The angular dimension of the cone of light from reflectorized lamps (such as R and PAR types) encompassing the central part of the beam out to the angle where the intensity is 50% of maximum. The beam angle (sometimes called "beam spread") is often part of the ordering code for reflectorized lamps. Example: The 50PAR30/HIR/NFL25 is a 50 watt PAR30 narrow flood lamp with a beam angle of 25 degrees, i.e. 12.5 degrees on either side of the center (see FIELD ANGLE).

Bi-Pin

Any base with two metal pins for electrical contact. This is the typical base for a fluorescent tube of 1 to 4 feet in length. It consists of 2 prong contacts that connect into the fixture. Medium bi-pins are used with type T-8 and T-12 tubular fluorescent lamps, and miniature bi-pins are used for tubular T-5 fluorescent lamps.

Biax®

GE trademark for its biaxial family of high-efficiency and long-life compact fluorescent lamps. DBX (Double Biax), TBX (Triple Biax) and QBX (Quad Biax) refer to the number of U-shaped legs present in the lamp.

Bright from the Start™

A GE brand name for a family of hybrid compact fluorescent lamps (CFL) that eliminate the warm up time to full brightness associated with traditional CFLs.

British Thermal Unit (BTU)

Unit of energy used in HVAC calculations. 1 BTU = 1055 joules; 1kWh = 3412 BTU.

Bulb Size

Bulb shape followed by its size (the maximum diameter of the bulb expressed in eighths of an inch). For Compact Fluorescent products, "S", "D", "T", and "Q" are used to represent Single, Double, Triple and Quad Biax® sizes. The code also includes a reference such as T4 to represent the size of the tube. Rectangular headlamps are designated as "Rect" and the number of millimeters horizontally.

Canadian Energy Standards

Indicates ballast complies with Canadian Energy Standards and meets the requirements of CAN/CSA C654-M91.



Canadian Standards Association (CSA)

Association that generates product performance and safety standards for many Canadian industries.

Candela (cd)

The measure of luminous intensity of a source in a given direction. The term has been retained from the early days of lighting when a standard candle of a fixed size and composition was defined as producing one candela in every direction. A plot of intensity versus direction is called a candela distribution curve and is often provided for reflectorized lamps and for luminaires with a lamp operating in them.

Candlepower

An obsolete term for luminous intensity; current practice is to refer to this simply as candelas (see CANDELA).

Candlepower Distribution Curve

A graphical presentation of the distribution of light intensity of a light source, usually a reflector lamp or luminaire.

Capacitor

Device in ballast that stores electrical energy. Often used for power factor correction and lamp regulation.

Cathode

Metal filaments that emit electrons in a fluorescent lamp. Negatively charged free electrons emitted by the cathode are attracted to the positive electrode (anode), creating an electric current between the electrodes (see ELECTRODE).

Cathode Resistance

Resistance of the cathode in a Fluorescent lamp. It is measured "cold" before the lamp is turned on (Rc) or "hot" after the lamp is turned on (Rh). The ratio of the hot resistance to the cold resistance is also measured (Rh/Rc).

Center Beam Candlepower (CBCP)

Refers to the luminous intensity at the center of the beam of a blown or pressed reflector lamp (such as a PAR lamp). Measured in candelas (see CANDELA).

Ceramic Metal Halide

A type of metal halide lamp that uses a ceramic material for the arc tube instead of glass quartz, resulting in better color rendering (>80 CRI) and improved lumen maintenance. GE ConstantColor® CMH® lamps feature a 3-piece arc tube design that delivers excellent color consistency and lamp reliability.

ChromaFit™

A GE brand name for metal halide lamps designed to operate on HPS ballasts, allowing a user to switch from the yellowish color of HPS to the white color of metal halide without retrofitting ballasts. These products are available in both quartz metal halide and ceramic metal halide (CMH®) versions.

Class P Thermal Protector

A switching device sensitive to current and heat that automatically disconnects ballast if the temperature exceeds UL temperature limitations.

Coefficient of Utilization (CU)

In general lighting calculations, the fraction of initial lamp lumens that reach the work plane. CU is a function of luminaire efficiency, room surface reflectances and room shape.

Coil

Windings of copper or aluminum wire surrounding the steel core in ballast. Also refers to the entire assembly comprising the inductor or transformer.

Color Quality Scale (CQS)

A new color metric proposed by NIST (US National Institute of Standards) based on fifteen color chips instead of the eight used in CRI.

Color Rendering Index (CRI)

A measure of the ability of a light source to render object colors faithfully in comparison with a designated standard light source. Incandescent objects and daylight are both considered "standard" sources. Note that "standard" is defined for convenience in reproducibility rather than being based on user preference.

Color Temperature (Correlated Color Temperature – CCT)

A number indicating the degree of "yellowness" or "blueness" of a white light source. Measured in Kelvins, CCT represents the temperature an incandescent object (like a filament) must reach to mimic the color of the lamp. Yellowish-white ("warm") sources, like incandescent lamps, have lower color temperatures in the 2700K–3000K range; white and bluish-white ("cool") sources, such as cool white (4100K) and natural daylight (6000K), have higher color temperatures. The higher the color temperature the whiter, or bluer, the light will be.

Compact Fluorescent Lamp (CFL)

The general term applied to fluorescent lamps that are single-ended and that have smaller diameter tubes that are bent to form a compact shape. Some CFLs have integral ballasts and medium or candelabra screw bases for easy replacement of incandescent lamps.

ConstantColor®

A GE registered name for lamp families that show very little color shift over life, such as GE's Precise™ MR16 lamps and GE's ceramic metal halide (CMH®) lamps.

Cool White

A term loosely used to denote a color temperature of around 4100K. The Cool White (CW) designation is used specifically for T12 and other fluorescent lamps using halophosphors and having a CRI of 62.

Core

Component of electromagnetic ballast that is surrounded by the coil. Core is comprised of steel laminations or solid ferrite material.

Core & Coil Ballast

A ballast that uses a "Core & Coil" assembly to operate fluorescent or HID lamps. Refers to copper or aluminum windings on a steel core.

Cost of Light

Usually refers to the cost of operating and maintaining a lighting system on an ongoing basis. The 88-8-4 rule states that (typically) 88% is the cost of electricity, 8% is labor and only 4% is the cost of lamps.

covRguard®

A GE lamp encased by a plastic sleeve or coating to help contain glass fragments if the lamp breaks.

Crest Factor (Lamp Current Crest Factor)

Ratio of peak to RMS for any AC waveform. Crest factor can refer to voltage crest factor or current crest factor.

Current Type (AC/DC)

Whether the operational voltage is based on Alternating Current or Direct Current.

Daylight Harvesting

Lighting design for building interiors that

makes use of daylight as a way of reducing energy consumption.

Dimmer, Dimming Control

A device used to lower the light output of a source, usually by reducing the wattage it is being operated at. Dimming controls are increasing in popularity as energy conserving devices.

Discharge Lamp

A lamp where light is emitted from an electrical discharge between two electrodes as opposed to a filament lamp. Examples are: Fluorescent lamps and HID (High Intensity Discharge) lamps like Metal Halide, Mercury and High Pressure Sodium. All discharge lamps require some kind of current-limiting device, e.g. a ballast, to operate them.

Ecolux®

A brand for GE lamps that have reduced mercury content and pass the TCLP test.

Edison

GE's trademark for a wide range of halogen lamps for the consumer market.

Efficacy

A measurement of how effective the light source is in converting electrical energy to lumens of visible light. Expressed in lumens-per-watt (LPW), this measure gives more weight to the yellow region of the spectrum and less weight to the blue and red regions where the eye is not as sensitive. The efficiency of a light source is simply the fraction of electrical energy converted to light, i.e. watts of visible light produced for each watt of electrical power with no concern about the wavelength where the energy is being radiated. For example, a 100-watt incandescent lamp converts 7% of the electrical energy into light; discharge lamps convert 25% to 40% into light.

Efficiency

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Efficiency of Ballast

See Ballast Luminous Efficiency.

e-HID ballast (see ELECTRONIC HID BALLAST).**Electrical Discharge**

A condition under which a gas becomes electrically conducting and becomes capable of transmitting current, usually accompanied by the emission of visible and other radiation. An electric spark in air is an example of an electrical discharge, as is a welder's arc and a lightning bolt.

Electrical Testing Laboratory (ETL)

Independent testing laboratory that performs ballast tests and certifies accuracy of performance data.

Electrode

Any metal terminal emitting or collecting charged particles, typically inside the chamber of a gas discharge lamp. In a fluorescent lamp, the electrodes are typically metal filaments coated with special powders called emission mix.

Negatively charged free electrons emitted by one electrode are attracted to the positive electrode (anode), creating an electric current and arc between electrodes.

Electrodeless Lamps

Light sources where the discharge occurs in a chamber with no electrodes (no metal). The energy for the discharge is supplied by radio frequency excitation, e.g. microwaves (see INDUCTION LIGHTING and GENURA®).

Electromagnetic Ballast (see MAGNETIC BALLAST).**Electromagnetic Spectrum**

A continuum of electric and magnetic radiation that can be characterized by wavelength or frequency. Visible light encompasses a small part of the electromagnetic spectrum in the region from about 380 nanometers (violet) to 770 nanometers (red) by wavelength.

Electromagnetic Interference (EMI)

High-frequency electronic ballasts and other electronic devices can produce a small amount of radio waves that can interfere with radio and TV. Federally-mandated requirements must be met for EMI levels before an electronic device is considered FCC compliant (FCC is the Federal Communications Commission).

Electronic Ballast

A short name for a fluorescent high-frequency electronic ballast. Electronic ballasts use solid-state electronic components and typically operate fluorescent lamps at frequencies greater than 25 kHz. The benefits are: increased lamp efficacy, reduced ballast losses and lighter, smaller ballasts compared to electromagnetic ballasts. Electronic ballasts may also be used with HID (high intensity discharge) lamps (see MAGNETIC BALLASTS).

Electronic HID Ballast

An electronic ballast capable of operating an HID lamp. GE's UltraMax® (electronic HID ballast) operates PulseArc® (metal halide) and CMH® (ceramic metal halide) lamps between 250W and 400W and provides higher efficiency and significantly improved lumen maintenance over magnetic ballasts.

Elliptical Reflector (ER) Lamp

An incandescent lamp with a built-in elliptically shaped reflecting surface. This shape produces a focal point directly in front of the lamp which reduces light absorption in some types of luminaires. It is particularly effective at increasing the efficiency of baffled downlights.

Energy Policy Act (EPACT)

Comprehensive energy legislation passed by the U. S. Congress. The lighting portion includes lamp labeling and minimum energy efficacy (lumens/watt) requirements for many commonly used incandescent and fluorescent lamp types. Federal Canadian legislation sets similar minimum energy efficacy requirements for incandescent reflector lamps and common linear fluorescent lamps. Provisions for Tax Deductions expiring at the end of 2013.

ENERGY STAR®

As of this publication (2012) U.S. Department of Energy (DOE) designation for products meeting certain energy efficiency and performance standards. Among manufacturers of LEDs, GE has the largest number of ENERGY STAR® products as listed on the Federal Government's website.

EOL (End-of-Life Protection)

A circuit that senses that a lamp has reached

Glossary of Terms

end of life (compact fluorescent lamps and small-diameter linear fluorescent lamps) and turns off power to the lamp. Continuing to power the lamp beyond end of life can result in overheating of the lamp ends.

Federal Communications Commission (FCC)

The U. S. federal agency that regulates emissions in the radio frequency portion of the electromagnetic spectrum. Part 18 of the FCC rules specifies electromagnetic interference (EMI) from lighting devices at frequencies greater than 450 kilohertz (kHz). A consumer-rated Class B ballast is designed for use in the home near TV and radio receivers. It produces less electrical noise that could interfere with consumer products. A Class A-rated ballast is designed for use in commercial and industrial applications that are not in the vicinity of TV and radio receivers.

Field Angle

The angular dimension of the cone of light from reflectorized lamps (such as R and PAR types) encompassing the central part of the beam out to the angle where the intensity is 10% of maximum (see BEAM ANGLE).

Flicker

The periodic variation in light level caused by AC operation that can lead to strobe effects.

Fluorescent HO

Fluorescent HO and VHO lamps require special ballasts that generate higher currents than standard ballasts and operate the lamps at higher wattage than standard lamps. These lamps are generally less efficient than the standard product. Metal Halide HO and XHO lamps operate on the same ballasts as standard lamps and at the same wattage but are more efficient and produce higher light output than standard lamps.

Fluorescent Lamp

A high efficiency lamp utilizing an electric discharge through low pressure mercury vapor to produce ultra-violet (UV) energy. The UV excites phosphor materials applied as a thin layer on the inside of a glass tube which makes up the structure of the lamp. The phosphors transform the UV to visible light.

Footcandle (fc)

A unit of illuminance or light falling onto a surface. It stands for the light level on a surface one foot from a standard candle. One footcandle is equal to one lumen per square foot (see LUX).

Forward Current

The current in milliamperes or amperes that the driver is pushing through the LED. For a given LED package, the higher the forward current, the higher the light output, the lower the efficacy and the poorer the lumen maintenance and expected life.

Four-Pin Compact Fluorescent Lamps

A "plug-in" compact fluorescent lamp with 4 pins in the base to make electrical contact with the ballast. Four-pin lamps can be dimmed on appropriate dimming ballasts while two-pin lamps cannot.

Frequency

Rate of alternation in an AC current. Expressed in cycles per second or Hertz (Hz).

Full Spectrum Lighting

A marketing term, typically associated with light sources that are similar to some forms of natural daylight (5000K and above, 90+ CRI), but sometimes more broadly used for lamps that have a smooth and continuous color spectrum.

Genura®

GE's electrodeless compact fluorescent lamp, Genura®, uses induction to power the discharge. The chamber generates UV (just like a discharge in a regular fluorescent lamp) that is converted by phosphors to visible light. Because Genura® uses no electrodes, the life of this unique reflector lamp is longer than typical compact fluorescent products (see INDUCTION LIGHTING).

Glare

Visual discomfort caused by excessive brightness is called discomfort glare. If task performance is affected it is called disability glare. Glare can be direct glare or indirect (reflected) glare.

Group Relamping

The practice of replacing all the lamps at an installation at one time with new lamps when the lamps have operated for (typically) 65% to 70% of rated life. The two benefits of group relamping are: (1) reduced maintenance costs because of the expense and inconvenience of replacing failing lamps one at a time, and (2) improved appearance and performance since older lamps are often degrading in brightness and color as they age.

Halogen Lamp

A halogen lamp is an incandescent lamp with a filament that is surrounded by halogen gases, such as iodine or bromine. Halogen gases allow the filaments to be operated at higher temperatures and higher efficacies. The halogen participates in a tungsten transport cycle, returning tungsten to the filament and prolonging lamp life. All halogen lamps have a tungsten filament and, often, a quartz envelope.

HIR™

GE designation for high-efficiency tungsten halogen lamps. HIR lamps utilize shaped filament tubes coated with numerous layers of materials that transmit light but reflect the heat (infrared) back onto the filament. This reduces the power needed to keep the filament hot.

Harmonic

An integral multiple of the fundamental frequency (60 Hz) that becomes a component of the current.

Harmonic Distortion (see TOTAL HARMONIC DISTORTION or THD).

Hertz (Hz)

Unit used to measure frequency of alteration of current or voltage, in cycles per second.

Highbay Lighting

Lighting designed for (typically) industrial locations with a ceiling height of 25 feet and above.

High Intensity Discharge (HID) Lamp

A general term for mercury, metal halide (GE ConstantColor® CMH®, Multi-Vapor®, MXR or Arcstream®) and high-pressure sodium (GE Lucalox®) lamps. HID lamps contain compact arc tubes which enclose various gases and metal salts operating at relatively high pressures and temperatures.

High Output/Very High Output (HO, VHO) Lamps

Designation for lamps generating more light than standard lamps.

High Power Factor

A ballast whose power factor is corrected to 90% or greater.

High-Pressure Sodium (HPS) Lamp

HPS lamps are high intensity discharge light sources that produce light by an electrical

discharge through sodium vapor operating at relatively high pressures and temperatures. GE markets these lamps under the trade name of Lucalox®.

Hot Restart Time

If there is a momentary power interruption and the HID lamp goes out, there will be a delay of 10 to 15 minutes before the lamp has cooled down sufficiently to start again. This is called the Hot Restart time. PulseArc® lamps have a significantly shorter Hot Restart time (typically 3-5 minutes) than standard metal halide lamps. Lucalox® Standby lamps will start up immediately while standard Lucalox® lamps require a few minutes.

Ignitor

An electronic device providing a high voltage pulse to initiate an electrical discharge. Typically, the ignitor is paired with or is a part of the ballast.

Illuminance

The "density" of light (lumens/area) incident on a surface; i.e. the light level on a surface. Illuminance is measured in footcandles or lux.

Incandescent Lamp

A light source that generates light utilizing a thin filament wire (usually of tungsten) heated to white heat by an electric current passing through it.

Indirect Lighting

The method of lighting a space by directing the light from luminaires upwards towards the ceiling. The light scattered off the ceiling produces a soft, diffuse illumination for the entire area.

Induction Lighting

Gases can be excited directly by radio-frequency or microwaves from a coil that creates induced electromagnetic fields. This is called induction lighting and it differs from a conventional discharge, which uses electrodes to carry current into the arc. Induction lamps have no electrodes inside the chamber and generally, therefore, have longer life than standard lamps, but slightly reduced efficiency.

Infrared Radiation

Electromagnetic energy radiated in the wavelength range of about 770 to 1,000,000 nanometers. Energy in this range cannot be seen by the human eye, but can be sensed as heat by the skin.

Input Voltage

Power supply voltage required for proper operation of fluorescent or HID ballast.

Input Watts

The total power input to the ballast that includes lamp watts and ballast losses. The total power input to the fixture is the input watts to the ballast or ballasts and is the value to be used when calculating cost of energy and air conditioning loads. More than 90% of the input watts is wattage or power delivered to the lamp load with typical ballast.

Instant Start

A type of ballast designed to start fluorescent lamps as soon as the power is applied. Most T8 fluorescent lamps are being operated on electronic instant-start ballasts. Slimline fluorescent lamps operate only on instant-start circuits.

Instant-Start Lamp

A fluorescent lamp, usually with a single pin at each end, approved to operate on instant-start ballasts. The lamp is ignited by a high voltage without any filament heating.

Integral

A popular term for a compact fluorescent lamp that includes a built-in ballast (see CFL).

Joule

The fundamental unit of energy equal to 1 watt-second.

Kelvins (see COLOR TEMPERATURE).

Kilowatt (kW)

A measure of electrical power equal to 1000 watts.

Kilowatt Hour (kWh)

The standard measure of electrical energy and the typical billing unit used by electrical utilities for electricity use. A 100-watt lamp operated for 10 hours consumes 1000 watt-hours (100 x 10) or one kilowatt-hour. If the utility charges \$.10/kWh, then the electricity cost for the 10 hours of operation would be 10 cents (1 x \$.10).

L70, L85, etc.

L70 (or L85, etc.): The elapsed operating time over which a population of LED light sources will maintain 70% (or 85%) of its initial light output. This 70% number represents the expected median light output (which is close to the average light output) of the tested LED light source population. The value is often stated using the form L70(10K)= 50,000 Hours; this means that the LED light source's median light output reaches 70% of the initial light output at 50,000 Hours based on 10,000 hours of test data using TM-21 projection methods. When the L70 value is stated as "Reported" it means that tests have gone to at least 1/6th of the reported time as required by IESNA's TM-21 methodology. On the other hand, manufacturers will sometimes state a "Calculated" value of L70 which means they are using mathematical curve fitting and projection methods of TM-21 to project beyond 6 times the available test hours.

Laminations

Layers of steel, making up the "core" that is surrounded by the coils in a core & coil ballast.

Lamp

The term used to refer to the complete light source package, including the inner parts as well as the outer bulb or tube. "Lamp," of course, is also commonly used to refer to a type of small light fixture such as a table lamp.

Lamp Current Crest Factor

Ratio of peak lamp current to RMS or average lamp operating current.

Lamp Types

Filament lamps:	Incandescent, Halogen, Halogen-IR®.
Discharge Lamps:	Fluorescent, HID (High Intensity Discharge)
HID Lamps:	Mercury, HPS (High-Pressure Sodium), MH (Metal Halide) and CMH® (Ceramic Metal Halide)
LED	Solid State Lighting Devices

Lamp Watts

Power dissipated in the lamp—some of which is converted to light, some to heat and some to ultraviolet.

LED

Light Emitting Diode used as the primary light source in a wide array of LED lighting products. LEDs operate on low voltage DC. Also referred to as SSL (Solid State Lighting).

Life (see RATED LAMP LIFE).

Light

Radiant energy that can be sensed or seen by the human eye. Visible light is measured in lumens.

Light Center Length (L.C.L.)

The distance between the center of the filament, or arc tube, and a reference plane—usually the bottom of the lamp base.

Light Emitting Diode (LED)

A solid that directly converts electrical impulses into light. Some LEDs today incorporate fluorescent materials to change the color characteristics of the emitted light.

Light Loss Factor (LLF)

The product of all factors that contribute to lowering the illumination level including reflector degradation, dirt, lamp depreciation over time, voltage fluctuations, temperature effects, burn-out factor, etc.

LM79

Test procedures specified by the Illuminating Engineering Society for measurements on LED products (complete assembled systems) of lumens, watts and color in actual operating environments.

LM80

Test procedures specified by the Illuminating Engineering Society for measuring lumen depreciation of LED sources, arrays and modules—not luminaires. 6000 hour testing is minimum, but this standard does not provide methods for estimating life.

Lucalox®

The GE brand name for high-pressure sodium lamps.

Lumen

A measure of luminous flux or quantity of light emitted by a source. For example, a dinner candle provides about 12 lumens. A 60-watt Soft White incandescent lamp provides 840 lumens.

Lumen Depreciation, Lumen Maintenance

A measure of how well a lamp maintains its light output over time. It may be expressed numerically or as a graph of light output vs. time. The "mean lumens" of a lamp is the lumens at 40% of rated life (50% for HPS lamp).

Lumens Per Watt (LPW)

A ratio expressing the luminous efficacy of a light source.

Typical lamp efficacies:

Edison's first lamp	1.4 LPW
Incandescent lamps	10-20
Halogen lamps	15-30
Fluorescent lamps	35-105
LED Products	45-100
Mercury lamps.....	50-60
Metal halide lamps.....	60-120
High-pressure sodium lamps.....	60-140

Note: The values above for discharge lamps do not include the effect of the ballasts, which must be used with those lamps. Taking ballast losses into account reduces "system" or lamp ballast efficacies typically by 10-20% depending upon the type of ballast used.

Luminaire

A complete lighting unit consisting of a lamp (or lamps), ballast (or ballasts) as required together with the parts designed to distribute the light, position and protect the lamps and connect them to the power supply. A luminaire is often referred to as a fixture.

Luminaire Efficiency

The ratio of total lumens emitted by a luminaire to those emitted by the lamp or lamps used in that luminaire.

Luminance

A photometric measure of "brightness" of a surface as seen by the observer, measured in candelas per square meter.

Luminous Efficacy

The light output (lumens) of a light source divided by the total power input (watts) to that source. It is expressed in lumens per watt (see LUMENS PER WATT).

Lux (lx)

A unit of illuminance or light falling onto a surface. Lux stands for the light level on a surface one meter from a standard candle. One lux is equal to one lumen per square meter. Ten lux approximately equals one footcandle (see FOOTCANDLE).

Magnetic Ballast

A ballast used with discharge lamps that consists primarily of transformer-like copper or aluminum windings on a steel or iron core. Also called "Core & Coil" (see ELECTRONIC BALLASTS).

Maximum Overall Length (M.O.L.)

The end-to-end measurement of a lamp, expressed in inches or millimeters.

Mean Lumens

The average light output of a lamp over its rated life. Based on the shape of the lumen depreciation curve, for fluorescent and metal halide lamps, mean lumens are measured at 40% of rated lamp life. For mercury, high-pressure sodium and incandescent lamps, mean lumen ratings refer to lumens at 50% of rated lamp life (see LUMEN MAINTENANCE).

Medium Base

Usually refers to the screw base typically used in household incandescent lamps. There is also the medium bi-pin base commonly used in T12 and T8 fluorescent lamps.

Mercury Lamp

A high-intensity discharge light source operating at a relatively high pressure (about 1 atmosphere) and temperature in which most of the light is produced by radiation from excited mercury vapor. Phosphor coatings on some lamp types add additional light and improve color rendering.

Metal Cases

Case design used in both magnetic and electronic ballasts. These ballasts are grounded once they are mounted to the fixture. They meet all safety codes, some of which do not allow plastic in open plenum areas.

Metal Halide Lamp

A high-intensity discharge light source in which the light is produced by the radiation from mercury, plus halides of metals such as sodium, scandium, indium and dysprosium. Some lamp types may also utilize phosphor coatings. GE trade names include: Multi-Vapor®, ConstantColor® CMH®, PulseArc®, StayBright®, Watt-Miser®, ChromaFit™ and Arcstream®.

Mogul Base

A screw base used on larger lamps, e.g. many HID lamps.

Mortality Curve

Lamps have a rated or expected life but individual failures occur earlier and some lamps will last

Glossary of Terms

longer. The mortality curve depicts the expected percent surviving in a group of lamps at various points between zero hours and rated life or beyond. The curve starts with 100% at zero hours and goes to 50% surviving at the rated life (e.g. 3000 hours or 20,000 hours, etc.) However, the shape of the curve between these two end points can vary depending on the lamp type. LEDs have a very different mortality curve from traditional products. See L70, L85 etc. Well-manufactured LEDs are expected to have very little actual "failures" in the traditional sense.

Mounting Height

Distance from the bottom of the fixture to either the floor or work plane, depending on usage.

Multi-Vapor®

A GE brand name for metal halide lamps.

Nanometer

A unit of wavelength equal to one billionth of a meter.

National Energy Standards for Fluorescent Ballasts

A federal law enacted in 1988 that sets energy standards for ballasts consistent throughout the United States.

National Electric Code (NEC)

A nationally accepted electrical installation code to reduce the risk of fire, developed by the National Fire Protection Association.

National Stock Number

The standardized part number used by the U.S. Government for procurement.

NOM

Laboratory that sets safety standards for building materials, electrical appliances and other products for Mexico.

Non-PCB Capacitor

Capacitor used in ballasts to help provide power factor correction. Contains no polychlorinated biphenyls and meets EPA requirements.

Normal Power Factor

Ballasts with power factor less than .90 that do not incorporate any means of Power Factor Correction.

Open Circuit Voltage (OCV)

Open Circuit Voltage measured across the socket the lamp screws into, with the ballast powered on. It is dangerous to stick a voltmeter into such a socket without precise knowledge of the ballast because high voltages and voltage pulses could be present.

Operating Voltage

For electrical discharge lamps, this is the voltage measured across the discharge when the lamp is operating. It is governed by the contents of the chamber and is somewhat independent of the ballast and other external factors.

PAR Lamp

PAR is an acronym for parabolic aluminized reflector. A PAR lamp, which may utilize either an incandescent filament, a halogen filament tube or an HID arc tube, is a precision pressed-glass reflector lamp. PAR lamps rely on both the internal reflector and prisms in the lens for the control of the light beam. Today it is common to refer to LED replacement products for PAR lamps as "LED PAR Lamps" even though there may be no parabolic reflector in the package.

Parallel Lamp Operation/Parallel Wiring

Refers to ballasts that employ multiple output current paths from a single ballast to allow lamps to operate independent of one another, allowing other lamps operated by the ballast to remain lit should companion lamp(s) fail (see SERIES LAMP OPERATION).

PCB (Polychlorinated Biphenyls)

Chemical pollutant formerly used in ballast capacitors that were part of ballasts. It is now illegal to use PCBs and most such ballasts have been replaced over time.

Phosphor

An inorganic chemical compound processed into a powder and deposited on the inner glass surface of fluorescent tubes and some mercury and metal-halide lamp bulbs. Phosphors are designed to absorb short-wavelength ultraviolet radiation and to transform and emit it as visible light.

Photometry

The measurement of light and related quantities.

Photopic (see SCOTOPIC/PHOTOPIC).

Potting

Material used to completely surround and cover components of some magnetic and electronic ballasts. Potting compound fulfills functions of protecting components, dampening sound, and dissipating heat.

Power Factor (PF)

A measure of the phase difference between voltage and current drawn by an electrical device, such as a ballast or motor. Power factors can range from 0 to 1.0 with 1.0 being ideal. Power factor is sometimes expressed as a percent. Incandescent lamps have power factors close to 1.0 because they are simple "resistive" loads. The power factor of a fluorescent and HID lamp system is determined by the ballast used. "High" power factor usually means a rating of 0.9 or greater. Power companies may penalize users for using low-power-factor devices.

Power Factor Corrected

Ballasts that incorporate a means of Power Factor Correction yielding power factor of 90% or greater.

Precise™

The GE trade name for the compact MR-16 and MR-11 low-voltage halogen dichroic cool beam reflectorized spot and flood lamps.

Preheat Circuit

A type of fluorescent lamp-ballast circuit used with the first commercial fluorescent lamp products. A push button or automatic switch is used to preheat the lamp cathodes. Starting the lamp can then be accomplished using simple "choke" or reactor ballasts. A preheat fluorescent lamp is one in which the filament must be heated by use of a starter before the arc is created. These lamps are typically operated with electromagnetic ballasts.

Product Code

It is important to use this five-digit code when ordering to ensure that you receive the exact product you require.

Programmed Rapid Start

Lamp starting method which preheats the lamp filaments while not allowing the lamp to ignite and then applies the open circuit voltage (OCV) to start the lamp. The user may experience a half- to one-second delay after turning on the

lamps while the preheating takes place. This type of starting circuit keeps lamp end blackening to a minimum and improves lamp life performance, especially in applications where the lamps are frequently switched on and off.

PulseArc®

GE metal halide lamp that provides improved lumen maintenance for longer useful life and extended relamp cycles. These products are designed to operate on ballasts that have ignitors to help with lamp starting.

Pulse Start

A lamp that requires an HID ballast with a high-voltage ignitor to start the lamp.

Quartz

A name for fused silica or melted sand from which many high-temperature containers are fashioned in the lighting industry. Quartz looks like glass but can withstand the high temperatures needed to contain high-intensity arc discharges.

Quartz-Halogen Lamp (see HALOGEN LAMP).

Quartzline®

A GE registered trademark term for some types of halogen lamps.

Radiation

A general term for the release of energy in a "wave" or "ray" form. All light is radiant energy or radiation, as is heat, UV, microwaves, radio waves, etc.

Rapid Start

Lamp starting method in which lamp filaments are heated while open circuit voltage (OCV) is applied to facilitate lamp ignition. A Rapid Start fluorescent lamp has two pins at each end connected to the filament. Some rapid start lamps may be instant-started without filament heat, for example, the F32T8 lamp.

Rapid Start Circuit

A fluorescent lamp-ballast circuit that utilizes continuous cathode heating, while the system is energized, to start and maintain lamp light output at efficient levels. Rapid start ballasts may be either electromagnetic, electronic or of hybrid designs. Full-range fluorescent lamp dimming is only possible with rapid start systems.

Rare Earths

A family of natural elements in the Periodic table. Rare earth compounds form an important part of the modern phosphors used in fluorescent lamps and LEDs.

Rated Lamp Life

For most lamp types, rated lamp life is the length of time of a statistically large sample between first use and the point when 50% of the lamps have died. It is possible to define "useful life" of a lamp based on practical considerations involving lumen depreciation, color shift and also on the need to reduce lamp replacement costs (see GROUP RELAMPING).

Reflector Lamp (R)

A light source with a built-in reflecting surface. Sometimes, the term is used to refer specifically to blown bulbs like the "R" and "ER" lamps; at other times, it includes all reflectorized lamps like PAR and MR.

Room Cavity Ratio (RCR)

A shape factor (for a room, etc.) used in lighting calculations.
 $RCR = 5H(L+W) / L \times W$, or, alternately,
 $RCR = (2.5) \text{ Total Wall Area} / \text{Floor Area}$.

Where H = height, L = length and W = width of the room. A cubical room will have an RCR of 10; the flatter the room the lower the RCR.

RP

A series of "Recommended Practices" issued by the Illuminating Engineering Society for various lighting applications, e.g. RP 1 for Office Lighting, RP 8 for Roadway Lighting, RP 29 for Museum Lighting, etc.

Scotopic/Photopic (S/P) Ratio

This measurement accounts for the fact that of the two light sensors in the retina, rods are more sensitive to blue light (scotopic vision) and cones to yellow light (photopic vision). The Scotopic/Photopic (S/P) Ratio is an attempt to capture the relative strengths of these two responses. S/P is calculated as the ratio of scotopic lumens to photopic lumens for the light source on an ANSI reference ballast. Cooler sources (higher-color-temperature lamps) tend to have higher values of the S/P Ratio compared to warm sources.

Self-Ballasted Lamps

A discharge lamp with an integral ballasting device allowing the lamp to be directly connected to a socket providing line voltage (see CFL).

Series Lamp Operation

Refers to ballasts that employ a single current path passing through all lamps operated by the ballast. If one lamp should fail, companion lamps operated by the same ballasts will also extinguish or dim.

Spacing to Mounting Height Ratio

Ratio of fixture spacing (distance apart) to mounting height above the work plane; sometimes called spacing criterion. It is OK to have fixture spaced closer than the spacing criterion suggested by the manufacturer but not farther, or you will get dark spots in-between fixtures.

Specification Series (SP) Colors

Energy-efficient, all-purpose tri-phosphor fluorescent lamp colors that provide good color rendering. The CRI for SP colors is 70 or above and varies by specific lamp type. See Lamp Color Chart on inside back cover.

Specification Series Deluxe (SPX) Colors

Energy-efficient tri-phosphor fluorescent lamp colors that provide better color rendering than Specification Series (SP) colors. The CRI for SPX colors is 80 or higher and varies by specific lamp type. All GE CFL products use SPX phosphors. See Lamp Color Chart on inside back cover.

Specification Series Deluxe eXtreme (SPXX) Colors

A color designation for GE ceramic metal halide lamps with superior color rendering ~ 90.

Specular Reflection

Reflection from a smooth, shiny surface, as opposed to diffuse reflection.

Spectral Power Distribution (SPD)

A graph of the radiant power emitted by a light source as a function of wavelength. SPDs provide a visual profile or "fingerprint" of the color characteristics of the source throughout the visible part of the spectrum. Also called "spectral curve" or "spectrum."

Spiral® Lamp

GE trademark for its helical family of high-efficiency, long-life compact fluorescent lamps.

Starcoat®

GE's special barrier coating applied on the inside

of all GE T8 fluorescent lamps, as well as some other lamp types, to enhance lamp life and deliver superior lumen maintenance.

Starter

An electronic module or device used to assist in starting a discharge lamp, typically by providing a high-voltage surge (see IGNITOR).

Starting Temperature (Minimum)

The minimum ambient temperature at which the lamp will start reliably on the ballast.

T12, T8, T5

A designation for the diameter of a tubular bulb in eighths of an inch; T12 is 12 eighths of an inch, or 1-1/2 inches; T8 is 1 inch, and so on.

Task Lighting

Supplemental lighting provided to assist in performing a localized task, e.g. a table lamp for reading or an inspection lamp for fabric inspection.

Terminal-to-Terminal Starting Lamp Voltage (VRMS) (Minimum or Maximum)

The minimum or maximum voltage allowed into lamp from ballast under varying conditions as specified.

TCLP Test

The Toxicity Characteristic Leaching Procedure (TCLP) test, specified in the Resource Conservation and Recovery Act (RCRA) of 1990, is used to characterize fluorescent lamp waste as hazardous or nonhazardous waste. The TCLP test measures the ability of the mercury and/or lead in a lamp to leach from a landfill into ground water.

THD (see TOTAL HARMONIC DISTORTION).

TM21

Technical Memorandum developed by the Illuminating Engineering Society to provide method for projecting lumen maintenance of an LED source, array or module as a function of temperature. This will allow LED Luminaire manufacturers to predict lumen depreciation in their fixtures, based on the operating temperature of the LED in that package. See also, "L70, L85, etc."

Total Harmonic Distortion (THD)

A measure of the distortion of the input current on alternating current (AC) power systems caused by higher order harmonics of the fundamental frequency (60Hz in North America). THD is expressed in percent and may refer to individual electrical loads (such as a ballast) or a total electrical circuit or system in a building. ANSI C82.77 recommends THD not exceed 32% for individual commercial electronic ballasts, although some electrical utilities may require lower THDs on some systems. Excessive THDs on electrical systems can cause efficiency losses as well as overheating and deterioration of system components.

Transients

High voltage surges through an electrical system caused by lightning strikes to nearby transformers, overhead lines or the ground. May also be caused by switching of motors or compressors, as well as by short circuits or utility system switching. Can lead to premature ballast failure (see TVSS).

TRIAC

Genericized tradename for "Triode for Alternating Current," a device at the heart of many common residential dimmers. TRIACs reduce the current by "chopping off" portions of the AC waveform, and

may adversely affect ballasts and drivers that are not designed to accept such waveform inputs.

Troffer

A long, recessed lighting unit, usually installed in an opening in the ceiling.

Tungsten Halogen Lamp (see HALOGEN LAMP).

TVSS

Transient Voltage Surge Suppressors, which will protect ballasts and other electronic equipment from transient high-voltage spikes that may be present in the power line.

Two-Pin Compact Fluorescent Lamps

Type of lamps that have the glow bottle starter built into the base of the lamp. Traditionally 2-pin lamps are designed to work with electromagnetic ballasts (see FOUR-PIN COMPACT FLUORESCENT LAMPS).

Ultra

A common way of referring to high-efficiency GE T8 family of lamps and Ballast that performs better than standard T8 lamps. Also refers to the system.

UltraMax® Ballast

A family of high-efficiency GE instant-start electronic linear fluorescent ballasts designed to optimize GE's T8 Ultra lamps for enhanced system energy savings. UltraMax® ballasts have a low lamp current crest factor and virtually "read" and adapt to incoming voltage from 108V to 305V. Other features include UL Type CC Anti-Arc Rating and anti-striation control to eliminate lamp striations and spiraling. GE also has an UltraMax® HID ballast which can operate PulseArc® and CMH® lamps anywhere from 250 watts to 400 watts and provides greatly improved lumen maintenance.

UltraStart® Ballast

A family of high-efficiency GE Program Start electronic linear fluorescent ballasts designed to optimize GE's T8 Ultra lamps in frequently switched applications. Instant-start ballast provides 10,000 starts. UltraStart® provides 100,000 to 200,000 starts. Use program start ballast to ensure long lamp life when turning lamps on and off more that twice a day.

Ultraviolet (UV) Radiation

For practical purposes, any radiant energy within the range of 100–380 nanometers. It is beyond the blue or violet region of the spectrum, and is invisible to the eye just like the silent "ultrasound" dog whistle is inaudible to the ear.

UV is divided into 3 regions:

UVC.....	100 to 280 nm
UVB.....	280 to 315 nm
UVA.....	315 to 400 nm

Some wavelengths (180–220) produce ozone, some (220–300) are bactericidal, some (280–320) erythema (reddening human skin); others (320–400) cause secondary luminance (black light).

Ultra Watt-Miser®

GE's family of energy-saving T8 fluorescent lamps.



Underwriters Laboratories (UL)

A private organization which tests and lists electrical (and other) equipment for electrical and fire safety according to recognized UL and other standards. A UL listing is not an indication of overall performance. Lamps are not UL listed except for compact fluorescent lamp assemblies – those with screw bases and built-in ballasts.

Glossary of Terms

Uniform Product Code (UPC)

The 12-digit code on the saleable unit that is used for scanning at the register.

Veiling Reflection

Effective reduction in contrast between task and its background caused by the reflection of light rays; sometimes called "reflected glare." You might have dealt with veiling reflections when you have to tilt a shiny magazine to avoid glare so as to read it, or struggled with reading a computer monitor because of the reflection of a window or a light fixture.

Visual Comfort Probability (VCP)

For a given lighting scheme, VCP is a ratio expressed as a percent of people who, when viewing from a specific location and in a specified direction, find the system acceptable in terms of glare (see GLARE).

Volt

A measure of "electrical pressure" between two points. The higher the voltage, the more current will be pushed through a resistor connected across the points. The volt specification of an incandescent lamp is the electrical "pressure" required to drive it at its designed point. The "voltage" of a ballast (e.g. 277 V) refers to the line voltage it must be connected to.

Voltage

A measurement of the electromotive force in an electrical circuit or device expressed in volts. Voltage can be thought of as being analogous to the pressure in a waterline.

Voltage Surge

Transient spikes in line voltage that can be harmful to electronic equipment like computers and electronic ballasts. Surge suppressors are often used to protect against such transients.

Wall Temperature (Maximum Bulb)

The maximum operating bulb wall temperature in Celsius.

Warm-Up Time

HID lamps typically take a few minutes to warm up to full brightness after starting.

Warm-Up Time to 90%

The time it takes for a High Intensity Discharge lamp to reach 90% of light output after being turned on.

Warm White

Refers to a color temperature around 3000K, providing a yellowish-white light.

Watt

A unit of electrical power. Lamps are rated in watts to indicate the rate at which they consume energy (see KILOWATT HOUR).

Wattage Indicator Reduced

Indicates that this is a reduced wattage option for lamps normally used in this application. Be sure to check wattage, lumens and life to determine which lamp is best suited to your needs.

Watt-Miser®

A Watt-Miser® lamp is a term used by GE to indicate a reduced-wattage lamp with performance characteristics (life, light output, etc.) such that it can usually directly replace a higher-wattage product. Watt-Miser® lamps are available in a wide range of incandescent, fluorescent and HID lamp types.

Wavelength

The distance between two neighboring crests of a traveling wave. The wavelength of light is between 400 and 700 nanometers.

The Value of Lighting Upgrades

About 35% of the electricity bill of commercial and industrial buildings is lighting. Upgrading to more energy-efficient lighting is an easy way to significantly reduce the overhead costs of running a business. Additional savings can be realized from using long-life lamps that reduce maintenance costs. Further, energy-efficient lighting also reduces the air-conditioning load on the HVAC system and provide greater energy savings.

Users need to be reminded that energy is usually the highest portion of the cost of lighting. A single T12 lamp will use about \$100 of energy over its life; a single 400W metal halide lamp will use over \$1000 in energy over life.

Remember, the products currently used in many buildings today are using products that are effectively obsolete due to technology improvements that have occurred over the last few years. There are several additional reasons to consider lighting upgrades today.

- 1) Legislation: many less-efficient products are being phased out by Government regulation. In each case there are better, more efficient, longer life replacements available that bring benefit both to the end-user and to the national economy because of energy savings.
- 2) Energy Reduction, both direct and indirect HVAC
- 3) Improvements in ambiance, productivity and user-satisfaction
- 4) Maintenance savings from longer life products
- 5) Environmental benefits from reduced energy consumption leading to reduced emissions, reduced or no-mercury, longer life.
- 6) Rebates offered by many utility companies. These rebates may go away as more and more inefficient products are eliminated
- 7) Tax deduction provisions of the Energy Policy Act (EPASCT) for lighting upgrades completed by end of 2013

Upgrades can involve something as simple as unscrewing the old bulb and screwing in the new bulb. However, in many cases ballasts and lamps are replaced in the existing fixture, or a retrofit kit is used to insert new holders and reflectors. Sometimes it is economically justified to replace the entire fixture with a new fixture.

Affected products that have been eliminated by legislation or are facing elimination in the immediate future based on efficiency requirements are listed in the next column:

Products Eliminated by Legislation

Incandescent Bulbs: Incandescent bulbs convert only 4% to 7% of the electrical energy into light; the rest is wasted as heat. Legislation in the US and many other countries is progressively banning the use of incandescent bulbs in most regular applications. A single incandescent 100-watt bulb operated for an entire year (8760 hrs.) will require the burning of over 1000 pounds of coal in a coal-fired power plant to generate the electricity it uses. Replacing it with an efficient LED or CFL (Compact Fluorescent Lamp) will cut energy consumption and greenhouse gas emission by 75% in addition to saving over \$70 per socket at the prevailing average national energy rate of 11 cents per kWh. These products also last 10 times to 30 times longer!

Halogen Reflector Lamps: Although more efficient than standard incandescent lamps, halogen lamps are still using a hot tungsten filament to generate light. The latest HIR+ products from GE use an infra-red reflecting film in the filament tube, and silverized reflectors to increase performance. Upgrading to these HIR+ products or to significantly more efficient, long life LED products provide significant energy savings. In many cases CMH (ceramic Metal Halide) reflector lamps can be considered, either with integral ballasts or with external ballasts. Halogen floods can be replaced with CFLs.

T12 Linear Fluorescent Lamps and some lower-performing T8s: These have been legislated away since very efficient, high-performance T8 systems are available. Also, LED fixtures are becoming a viable option to be considered for offices and classrooms. It is possible to obtain up to 45% energy savings with out loss of light when upgrading from T12 systems.

Standard Metal Halide lamps and ballasts: The old "probe start" metal halide lamps on magnetic ballasts are now eliminated by legislation for new construction, although replacement products for existing installations are still available. Upgrade options include Pulse-Start or CMH (Ceramic Metal Halide) on magnetic or electronic ballasts. For Industrial and High-bay attractive financial returns can be obtained by going to multi-lamp T8 or T5/HO fixtures. In outdoor lighting applications like parking lots and roadway, many users are upgrading from HID to LED fixtures for energy and maintenance savings.

Contact your GE distributor or GE sales rep for a simple lighting audit and a financial analysis of the benefits of lighting upgrades at your facility.

LEDs for General Lighting

LED (Light Emitting Diode) is a semiconductor chip that emits visible light when energized. LEDs are also referred to as solid state lighting (SSL) devices.

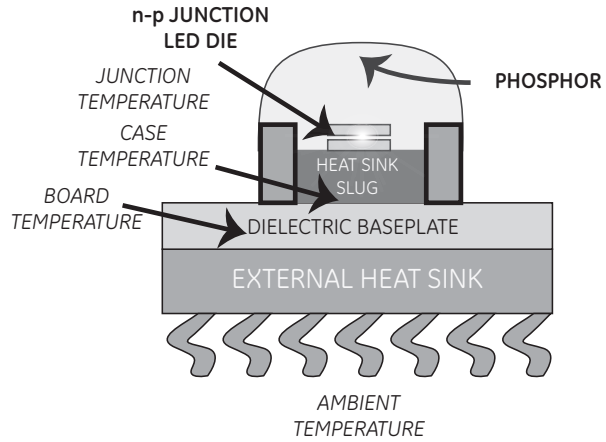
One of the first references to LEDs came in 1907 when Marconi's assistant Henry Round reported it in a letter to *Electrical World* after observing light emission from carborundum (silicon carbide, SiC). Round was experimenting with cat's whisker detectors, a device used in early crystal radios. Later, in 1920 the Russian scientist Oleg Losov studied the phenomenon in greater detail, publishing a number of papers on the current-voltage characteristics of SiC.

However the modern father of visible LEDs is considered to be Nick Holonyak who invented a red LED in 1962 while working at a GE lab in Syracuse, NY. Later, he moved to the University of Illinois at Urbana and a student of his, George Craford went on to invent yellow, orange and green LEDs. Finally, in the 1990s, several researchers at Nichia laboratories in Japan found ways to make efficient blue LEDs and the modern white LED was born.

Light emission from LEDs

LEDs are made of semiconducting material, not unlike what is found in transistors and computer chips. Electrons from the "n" or negative material flow into the "p" or positive material across a junction, where they encounter "holes". When an electron falls into a hole a photon is emitted corresponding in energy to the energy lost by the electron.

If this primary photon is in the blue region of the spectrum, it is possible to add phosphors that absorb the high energy blue photon and re-emit lower energy photons of green, yellow, orange or red colors. Based on the thickness and composition of the phosphor, the color of the LED source can be changed from blue to cool white to very warm white. In general, the higher color temperature LEDs (cool color) have less phosphors and are more efficient with higher lumens per watt (LPW). Warm LEDs have to use more phosphor and pay a small price in LPW if the warmer color is desired.



Schematic of an LED Device

Key determinants of performance

Long-term performance of LEDs is critically determined by the junction temperature of the LED—the junction being the layer where most of the primary light emission is occurring. Even though each individual LED generates only about a watt of heat, this heat can destroy the semiconductor material if it is not rapidly conducted away.

The LED chip manufacturer will often rate the LED at 100,000 hours based on the junction temperature being kept below a specified point. If overheated, a 100,000 hour LED can easily die in 10,000 hours or 1000 hours, or even 100 hours.

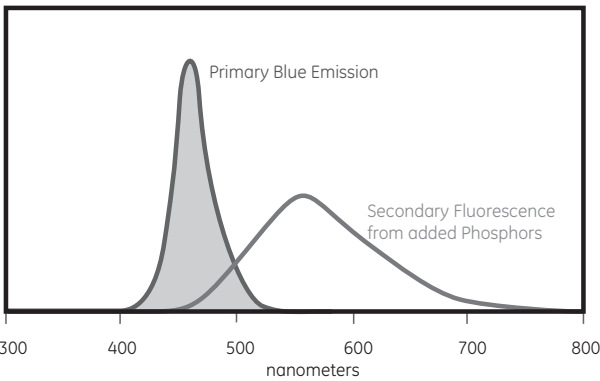
Thermal management of the LED, achieved through well designed heat-sinks and conduction paths is the key factor that determines LED longevity. Reliable life testing of LEDs in the finished configuration under field conditions is the only way to determine how long an actual lamp or fixture is likely to last. ANSI standard TM21 specifies how to test and rate LED life and all reputable LED manufacturers will refer to this document to validate their life ratings.

Sorting (binning) of LEDs

LED manufacturers constantly work to manage process variation and maximize yield. To this end, LEDs are sorted by three criteria—forward voltage, light output and color—and placed in appropriate "bins." ANSI requirements call for roughly a "seven step" equivalent cell, each step being the minimum color difference perceptible to the human eye. However, for more demanding applications, it is possible to pay a little more and require tighter binning, e.g. to three-steps.

The Future of LEDs

LEDs are the most promising breakthrough in Lighting in half a century. The boundaries of efficiency and life are being extended almost on a daily basis. The US Department of Energy says, "... Light Emitting Diodes (LEDs), has the potential to revolutionize the efficiency, appearance, and quality of lighting as we know it." Some experts estimate that LEDs might approach 200 lumens per watt within a few years.



Obtaining white light from blue LEDs

Ballast cross reference matrix

Prod Code	Description	Advance P/N	Universal P/N	OSI P/N
T8 Fluorescent Ballasts				
T8 INSTANT START BALLASTS				
UltraMax® Instant Start Multi-Voltage High Efficiency				
72258	GE132MAX-L/ULTRA	IOP-1P32LW-SC	B132IUNVEL-A	
72259	GE132MAX-N/ULTRA	IOP-1P32-SC	B132IUNVHE-A	QHE 1X32T8/UNV ISN-SC-1
73190	GE232MAX-H/ULTRA	IOP-2P32HL-SC	B232IUNVHEH-A	
72262	GE232MAX-L/ULTRA	IOP-2P32LW-SC	B232IUNVEL-A	
72266	GE232MAX-N/ULTRA	IOP-2P32-SC	B232IUNVHE-A	QHE 2X32T8/UNV ISN-SC-1
71421	GE232MAX-N+			
71714	GE332MAX-H/ULTRA	IOP-3P32HL-90C-SC	B332IUNVHEH-A	
71717	GE332MAX-L/ULTRA	IOP-3P32LW-SC	B332IUNVEL-A	
71719	GE332MAX-N/ULTRA	IOP-3P32-SC	B332IUNVHE-A	QHE 3X32T8/UNV ISN-SC-1
71422	GE332MAX-N+			
71723	GE432MAX-H/ULTRA	IOP-4P32HL90CG		
71725	GE432MAX-L/ULTRA	IOP-4P32LW-SC	B432IUNVEL-A	
71727	GE432MAX-N/ULTRA	IOP-4P32-SC	B432IUNVHE-A	QHE 4X32T8/UNV ISN-SC-1
74117	GE632MAX-H90			
71423	GE432MAX-N+			
72261	GE159MAX-N/ULTRA	IOP-2P59-SC		
73199	GE259MAX-L/ULTRA		B259I120HPL/B259I277HPL	QHE 2x59T8/UNV-ISI-SC
49767	GE259MAX-N/ULTRA	IOP-2P59-SC		QHE 2x59T8/UNV ISN-SC-B
UltraMax® Instant Start 347V High Efficiency				
74093	GE232MAX347-N	GOPA-2P32-SC		QHE2X32T8/347 ISN-SC
74094	GE332MAX347-N	GOPA-3P32-SC		QHE3X32T8/347 ISN-SC
74095	GE432MAX347-N	GOPA-4P32-SC		QHE4X32T8/347 ISN-SC
74096	GE232MAX347-L	GOPA-2P32-LW-SC	B232I347L-A, B232I347HPL	QHE2X32T8/347 ISL-SC, QT2X32T8/347 ISL-SC
74097	GE332MAX347-L	GOPA-3P32-LW-SC	B332I347L, B332I347HPL	QHE3X32T8/347 ISL-SC
74098	GE432MAX347-L	GOPA-4P32-LW-SC	B432I347L, B432I347HPL	QHE4X32T8/347 ISL-SC, QT4X32T8/347 ISL-SC
74109	GE232MAX347-H			QT2X32T8/347 ISH-SC
74111	GE332MAX347-H		B332IHRVH-E, B332IHRVH-E	
74113	GE432MAX347-H			
UltraMax® Instant Start 480V High Efficiency				
62718	GE232MAX480-H			
62719	GE332MAX480-H		B332IHR VHB-E	
62720	GE432MAX480-H			QHE4X32T8/347-480 ISH-HT
ProLine® T8 Multivolt 120V – 277V				
72269	GE-132-MV-N	ICN-1P32-SC/IOPA-1P32-SC	B132IUNVHP-B	QTP 1X32T8/UNV ISL-SC/ QHE 1X32T8/UNV ISN-SC
74803	GE-232-MV-H	REL-2P32-HL-SC/VEL-2P32-HL-SC/ IOPA-2P32-HL	B232I120RHH-A/B232I277RHH-A	QTP 2X32T8/UNV ISH-SC/ QHE 2X32T8/UNV ISH-SC
72273	GE-232-MV-L	ICN-2P32LW-SC/IOPA-2P32LW	B232I120L-A/B232I277L-A	QTP 2X32T8/UNV ISL-SC/ QHE 2X32T8/UNV ISL-SC
72275	GE-232-MV-N	ICN-2P32-SC/IOPA-2P32-SC	B232IUNVHP-B	QTP 2X32T8/UNV ISN-SC/ QHE 2X32T8/UNV ISN-SC
74461	GE-332-MV-H	REL-3P32-HL-SC/VEL-3P32-HL-SC/ IOPA-3P32-HL	B332I120RHH-A/B332I277RHH-A	QTP 3X32T8/UNV ISH-SC/ QHE 3X32T8/UNV ISH-SC
74459	GE-332-MV-L	ICN-3P32LW-SC/IOPA-3P32LW	B332I120L-A/B332I277L-A	QTP 3X32T8/UNV ISL-SC/ QHE 3X32T8/UNV ISL-SC
74456	GE-332-MV-N	ICN-3P32-SC/IOPA-3P32-SC	B332IUNVHP-B	QTP 3X32T8/UNV ISN-SC/ QHE 3X32T8/UNV ISN-SC
74463	GE-432-MV-H	REL-4P32-HL-SC/VEL-4P32-HL-SC/ IOPA-4P32-HL	B432I120RHH-A/B432I277RHH-A	QHE 4X32T8/UNV ISH-SC
74466	GE-432-MV-L	ICN-4P32LW-SC/IOPA-4P32LW	B432I120L-A/B432I277L-A	QTP 4X32T8/UNV ISL-SC/ QHE 4X32T8/UNV ISL-SC
30193	GE-432-MV-N	ICN-4P32-SCIOPA-4P32SC	B432IUNVHP-B	QTP 4X32T8/UNV ISN-SC/ QHE 4X32T8/UNV ISN-SC
30195	GE-159-MV-N	REL-2P59-SC/VEL-2P59-SC		
74469	GE-259-MV-N	REL-2P59-SC/VEL-2P59-SC	B259IUNVHP-B	QTP 2X59T8/UNV ISN-SC/ QHE 2X59T8/UNV-ISN-SC
ProLine® T8 Multivolt High Output 120V – 277V				
63888	GE-286-HO-MV-N	ICN-2S86	B286I120RH/B286I277RH	QHE 2X86T8HO/UNV-PSN-HT-SCL/ QHE2X59T8/UNV-ISH
ProLine® T8 Instant-Start High-Performance 120V				
23680	GE-132-120-N	REL-1P32-SC	B132I120RH-A	QT1X32T8/120/ISN-SC
23681	GE-132-277-N	VEL-1P32-SC	B132I277RH-A	QT1X32T8/277/ISN-SC
23671	GE-232-120-N	REL-2P32-SC	B232I120RH-A	QT2X32T8/120/ISN-SC
23673	GE-332-120-N	REL-3P32-SC	B332I120RH-A	QT3X32T8/120/ISN-SC
23674	GE-332-277-N	VEL-3P32-SC	B332I277RH-A	QT3X32T8/277/ISN-SC
23675	GE-432-120-N	REL-4P32-SC	B432I120RH-A	QT4X32T8/120/ISN-SC
23677	GE-259-120-N	REL-259-SC		QT2X59/120IS

Ballast cross reference matrix (cont.)

Prod Code	Description	Advance P/N	Universal P/N	OSI P/N
T8 Fluorescent Ballasts - Continued				
T8 INSTANT START BALLASTS - CONTINUED				
ProLine® T8 Instant-Start High-Performance 347V				
74101	GE132-N-347		B132I347HP, B132I347RH	QHE1X32T8/347 ISN-SC, QTP1X32T8/347/ISN-SC
74103	GE232-N-347		B232I347HP-A, B232I347RH-A	QTP2X32T8/347 ISN-SC
74105	GE332-N-347		B332I347HP	QT3X32T8/347 ISN-SC
74107	GE432-N-347		B432I347HP, B432I347RH	QT4X32T8/347 ISN-SC
74099	GE259-N-347		B259I347HP	QT2X59/347 IS
Residential Grade ProLine® T8 120V				
97782	GE232-120-RES	REB232-SC	B232I120RES-A	QTR 2x32T8/120 ISN-SC
97783	GE432-120-RES	REB4P32-SC	B432I120RES-A	QTR 4x32T8/120 ISN-SC
Electromagnetic T8 Ballasts				
87125	GEM232T8RS120	R-2P32-TP	M232SR120C	
87130	GEM232T8RS277	V-2P32-TP	M232SR277C	
T8 PROGRAM START BALLASTS				
UltraStart® T8 Program Rapid Start				
75952	GE132-MVPS-L	IOP-1S32-LW-SC		QTP 1x32T8/UNV PSX-TC
75953	GE132-MVPS-N	IOP-1S32-SC	B132PUNVHP-A	QTP 1X32T8/UNV PSN-TC
75954	GE132-MVPS-H			
96714	GE232-MVPS-N	IOP-2S32-SC	B232PUNVHP-A	QTP 2X32T8/UNVPSN-TC
96720	GE232-MVPS-L	IOP-2S32-LW-SC		QTP 2X32T8/UNV PSX-TC
29675	GE-232-MVPS-H			QHE2x32T8/UNV-PSH-HT
29671	GE-232-MVPS-XL			
29676	GE-332-MVPS-H			
96715	GE332-MVPS-N	IOP-3S32-SC	B332PUNVHP-A	QTP 3X32T8/UNVPSN-SC
96721	GE332-MVPS-L	IOP-3S32-LW-SC		QTP 3X32T8/UNV PSX-SC
29672	GE-332-MVPS-XL			QHE3x32T8/UNV-PSH-HT
96716	GE432-MVPS-N	IOP-4S32-SC	B432PUNVHP-A	QTP 4X32T8/UNVPSN-SC
71832	GE432-MVPS-L	IOP-4S32-LW-SC		QTP 4X32T8/UNV PSX-SC
29678	GE-432-MVPS-H			QHE4x32T8/UNV-PSH-HT
T8 Bi-Level Switching & Load Shed 0-10V Dimming				
73233	GE232MAX90-S60			
73234	GE232MAX90-V60			
73231	GE332MAX90-S60			
73232	GE332MAX90-V60			
73229	GE432MAX90-S60			
73230	GE432MAX90-V60			
71497	GE632MAX-H90-S60			
71731	GE632MAX-H90-V60			
T8 Dimming 0-10V				
75379	GE132MVPS-N-V03	IZT-132-SC	B132R120V5/B132SR277V5	
75380	GE232MVPS-N-V03	VZT-2S32/IZT-232-SC/ILV-2S32-SC	B232SR120V5/B232SR277V5	
75381	GE332MVPS-N-V03	VZT-3S32/IZT-332-SC	B332SR120V5/B332SR277V5	
75382	GE432MVPS-N-V03	VZT-4S33V/IZT-432-SC/ILV-4S32-G	B423SR120V5/B432SR277V5	QTP 4x32T8/277 DIM PLUS-TCL
75383	GE232MVPS-H-V03			
75384	GE332MVPS-H-V03			
75385	GE432MVPS-H-V03			
T5 Fluorescent Ballasts				
T5 ELECTRONIC PROGRAMMED START BALLASTS				
UltraStart® T5 Programmed Rapid Start				
99653	GE228MVPSH-A		B228PUNV115-D	QTP2X28T5/UNVPSN NL
99655	GE228MVPS-A	ICN-2S28	B228PUNV95-D	QTP2X28T5/UNVPSN-E
47534	B224PUNV-C	ICN-2S24	B224PUNV-D	QTP2X39-24T5HO/UNVPSN NL
47540	B239PUNV-D	ICN-2S39	B239PUNV-D	QTP2X39-24T5HO/UNVPSN NL
67562	GE254MVPS90-A	ICN-2S54-90C	B254PUNV-D	QTP 2X54T5HO/UNV PSN HT
72279	GE254MVPS-D	ICN-2S54	B254PUNV-D	QTP2X54T5HO/UNVPSN NL
73192	GE454MVPS90-G	ICN455490C2LSG	B454PUNV-E	QTP 4X54T5HO/UNV PSN HTW NL
77114	GE454MVPS90-E	ICN455490C2LS		QTP 4X54T5HO/UNV PSN HT
72280	GE180MVPS-D	ICN-1S80-120V/ICN-1S80-277V	ES4515K	QTP1X80T5HO/UNVPSN NL
UltraStart® T5 Programmed Rapid Start 347-480V				
62728	GE254PS347/480-F	HOP2PSP54L/347-480V	B254PHRVHB-E	QHE2x54T5HO/347-480PSN-HT
62729	GE254PS347-F	HOP2PSP54L/347V		
62730	GE454PS347/480-E	HOP4PSP542LSG/347-480V		QHE4x54T5HO/347-480PSN-HT-SCL
62731	GE454PS347-F	HOP4PSP542LSG/347V		

Prod Code	Description	Advance P/N	Universal P/N	OSI P/N
T12 Fluorescent Ballasts				
T12 ELECTRONIC BALLASTS				
ProLine® T12 Multivolt 120V – 277V				
74472	GE-240-RS-MV-N	ICN-2S40-N	B240R120HP/B240R277HP	QTP2X40T12/120RSN-SC/ QTP2X40T12/277 RSN-SC
97498	GE240RS120	REL-2S40-SC/RELB-2S40-SC	B234SR120M-A	QTP2X40T12/120RSN-SC
75672	GE140RS120	REL-1S40-SC	B134SR120M-A	QTP1X40T12/120/277RSN-SC
24109	GE-340-RS-MV-N	R-3S34-TP/V-3S34-TP	B340R120HP/B340R277HP	QTP3X40T12/120/277RSN
74474	GE-260-IS-MV-N	R2E75STP	B260IUNVHP	QT2x96/120IS/QT2x96/277IS
75671	GE296HO-MV-N	REL/VEL-2P60-S-A/REL/VEL-2S110	B295SRUNVHP/120HP/277HP	QT2x96/120HO/QT2x96/277HO
T12 MAGNETIC BALLASTS				
89720	GEM1FC16T9RS120	RMS-3240-TP-W	726VLHWSTCP	
86227	GEM1FC8T9RS120IP	RLQS-122-TP-W	547RSWSTCP	
89717	GEM1FC12T9RS120	RS-22-32-TP-W	449LRWSTCP	
80819	GEM220TS120DIY	RS-2SP20-TP	447LRVLHTCP	
80644	GEM230RS120	RM-2SP30-TP	573LTCP	
T12 ELECTRONIC FOR MAGNETIC				
75672	GE140RS120	LC-14-20-C-TP/HM1P30TPI	200H2	
75672	GE140RS120	RLQ-120-TP	546BTCP	
75672	GE140RS120	R-140-TP	412LSLHTCP	
75672	GE140RS120	RL-140-TP	413CTCP	
97498	GE240RS120	R2S34-TP/RS240TPI	420LTCP	
97498	GE240RS120	RM2SP30TPI	446LSLHTCP	
74472	GE-240-RS-MV-N	V2S40TP/V2S34TP/V140TPI	443LSLHTCP	
74472	GE-240-RS-MV-N	MTM-2S40-TP	754LTCP	
74474	GE-260-IS-MV-N	RSM175STP/SM140STPI/SM2E40STPI	822BRTCP	
74474	GE-260-IS-MV-N	VSM175STP	828BRTCP	
74474	GE-260-IS-MV-N	R2E75STP	806SLHTCP	
74474	GE-260-IS-MV-N	V2E75STP	827SLHTCP	
75671	GE296HO-MV-N	R-2S110-TP/RC2S85TPM	480SLHTCP	
75671	GE296HO-MV-N	V-2S110-TP/VC2S85TPM	487SLHTCP	
Sign Ballasts				
72103	GESB-0412-12-IP	ASB-0412-12-BL-TP	USB-0412-12-IP	MSB-12-0412-TP
72104	GESB-0620-24-IP	ASB-0620-24-BL-TP	USB-0816-14-IP	MSB-24-0620-TP
72105	GESB-1224-24-IP	ASB-1224-24-BL-TP	USB-1024-14-IP	MSB-24-1224-TP
72106	GESB-1240-46-IP	ASB-1240-46-BL-TP	USB-2036-46-IP	MSB-46-1240-TP
72107	GESB-2040-46-IP	ASB-2040-24-BL-TP	USB-1632-24-IP	MSB-24-2040-TP
72108	GESB-2448-46-IP	ASB-2448-46-BL-TP	USB-2048-46-IP	MSB-46-2448-TP
Compact Fluorescent Ballasts				
CFL ELECTRONIC				
63091	GEC213-MVPS-BES	ICF-2S13-BS	C213UNVBS	QTP1/2X13CF/UNVBS
63092	GEC213-MVPS-SE	ICF-2S13-LD	C213UNVBES	QTP1/2X13CF/UNVTS
63089	GEC213-MVPS-3W	ICF-2S13-H1-LD-K	C213UNVME00K	QTP 1/2x13CF/UNV
63094	GEC218-MVPS-BES	ICF-2S18-BS	C218UNVBS	QTP1/2X18CF/UNVBS
63096	GEC218-MVPS-SE	ICF-2S18-LD	C218UNVBES	QTP1/2X18CF/UNVTS
63093	GEC218-MVPS-3W	ICF-2S18-H1-LD-K	C218UNVME000K	QTP 1/2x18CF/UNV
63098	GEC226-MVPS-BES	ICF-2S26-BS	C2642UNVBES-IP	QTP2X26CF/UNVBS
63099	GEC226-MVPS-SE	ICF-2S26-LD	C2642UNVSE-IP	QTP2X26CF/UNVTS
63097	GEC226-MVPS-3W	ICF-2S26-H1-LD-K		QTP 1/2x26CF/UNV
63101	GEC242-MVPS-BES	ICF-2T42-M5-BS	C2642UNVBE	QTP2X26/32/42CF/UNVPM
63102	GEC242-MVPS-SE	ICF-2T42-M5-LS	C2642UNVSE	QTP2X26/32/42CF/UNVTM
63100	GEC242-MVPS-3W	ICF-2T42-M5-BS	C2642UNVSE	QTP2X26/32/42CF/UNVTM
75948	GEC140MAX-A	ICN-1TTP40		
75950	GEC225MVPS-A			
71437	GEC240MVPS-A	REL-2TTS40	C240PUNVHP-B-IP	QHE 1x40/UNV DL ISN-SC
71435	GEC240MAX-A	RCN-2TTP40-SC / VCN2TTP40-SC / ICN-2TTP40-SC	C240SI120RH-IP / C240SI277RH-IP	QHE 2x40/UNV DL ISN-SC
71436	GEC340MAX-A	RCN-3TTP40-SC / VCN-3TTP40-SC / ICN3TTP40-SC	C340SI120RH-IP/C340SI277RH-IP	QHE 3x40/UNV DL ISN-SC
87533	GEM1CF13PH120	LC-13-TP	4111H2P	
87655	GEM2CF13PH277	VH-2B13-TP-BLS	4214PBES	

Ballast cross reference matrix (cont.)

Prod Code	Description	Advance P/N	Universal (Vossloh Schwabe)	OSI P/N
HID Electronic Ballasts				
87490	GEMH20-MLF-120	RMH-G20-K	M2012CK-7EUN-F	QTP1X20MH/UNV F
74115	GEMH20-MC-120	RMH-G20-K	M2012CK-7EUN-F	
63042	GEMH20-MSJ-MV	IMH-G20-G	M2012-27CK-6EU-J	
63043	GEMH20-MSF-MV	IMH-G20-G	M2012-27CK-5EU-F	
75378	GEMH39-MCM-120	RMH-39-K	M3912CK-7EUN	
74116	GEMH39-MC-120	RMH-39-K	M3912CK-6EUN-F	
63044	GEMH39-MSJ-MV	IMH-39-G	M3912-27CK-5EU	
63045	GEMH39-MSF-MV	IMH-39-E	M3912-27CK-6EU-F	
87531	GEMH70-MSF-120	IMH-70-G	M7012CK-6EUN-F	QTP1X70MH/UNV F
87546	GEMH70-SLJ-MV	IMG-70-G	M7012-27CK-5EU	QTP1X70MH/UNV J
87561	GEMH100-SLJ-MV	IMG-100-A-BLS	M10012-27CK-5EU-F	QTP1X100MH/UNV J
87576	GEMH150-SLJ-MV	IMG-150-H-BLS	M15012-27CK-5EU-J	
29377	GE-MH-250-400-MA	I2TEMH4003PS		QHE1XxxxMH 208-277V
89646	GEMH250-400M-V50		EPXXXMRVASE	
HID Electromagnetic Ballasts				
Metal Halide				
63073	GEM50MLTLA3D-5	71A5181-500D	M50MLTLC3M500K	M50/MULTI-KIT
86847	GEM70MLTLA3D-5	71A5280-500D	M70MLTLC3M500K	M70/MULTI-KIT
78517	GEM70TRILC3-5	71A52A2-001D	M70TRILC3M502K	
67337	GEM7048TLA3D-5	NA	M7048TLC3M500K	
86675	GEM100MLTLA3D-5	71A5390-001D	M100MLTLC3M500K	M100/MULTI-KIT
78519	GEM100TRILC3-5	71A53A0-001D	M100TRIL3M502K	
67333	GEM10048TLA3D-5	71A5340-500DT	M10048TLC3M500K	
86718	GEM150MLTLA3D-5	71A5492-500D	M150MLTLC3M500K	M150/MULTI-KIT
78520	GEM150TRILC3-5	71A54A2	M150TRIL3M502K	
86711	GEM15048TLC3D-5	71A5442-500DT	M15048TLC3M500K	
63078	GEM175ML5AA3-5	71A3042-001D	M175ML5AC3M500K	
78521	GEM175TRIA3-5	71A55A0-0001D	M175TRIA30502K	
86741	GEM175MLTAA3-5	71A5570-001D	M175MLTAC3M500K	M175/MULTI-KIT
87211	GEM250ML5AC3-5	71A5750-001D	M250ML5AC3M500K	
63077	GEM250MLTAA3-5	71A3542-001D	M250MLTAC3M500K	M1250/MULTI-KIT
78522	GEM250TRIA4-5	71A56A0-001D	M250TRIA4M502K	
87212	GEM250ML5AA4-5	71A5750	M250ML5AC4M500K	
72300	GEM400ML5AA4-5	71A6051-001D	M400ML5AC4M500K	
72149	GEM400MLTAA4-5	71A6071-001D	M400MLTAC4M500K	M400/MULTI-KIT
78523	GEM400TRIA4-5	71A60A1-001D	M400TRIA4M502K	
63070	GEM40048TAA4-5	71A6042-500DT	M40048TAC4M500K	
78524	GEM1000TRIA5-5	71A67A2-001	M1000TRIA5M502K	
63069	GEM100048TAA5-5	71A6542-001	M100048TAC5M500K	M1000/480-KIT
87213	GEM1000ML5AA5-5	71A6552-001	M1000ML5AC5M500K	
86655	GEM1000MLTAA5-5	71A6572-001	M1000MLTAC5M500K	M1000/MULTI-KIT
86693	GEM150048TAC5-5	71A6742-001	M150048TAC5M500K	M1500/480-KIT
86698	GEM1500MLTAC5-5	71A6772-001	M1500MLTAC5M500K	M1500/MULTI-KIT
Pulse Start				
67335	GEP175MLTAA3-5	71A5593-001D	P175MLTAC3M500K	
78525	GEP175TRIA3-5	71A55A3	P175TRIA3M502K	
67334	GEP17548TAA3-5	71A5543-500DT	P17548TAC3M500K	
78526	GEP200TRIA3-5	71A56A2	P200TRIA3M502K	
67344	GEP250MLTAA4-5	71A5792-001D	P250MLTAC4M500K	M250/MULTI-PS-KIT
78527	GEP250TRIA4-5	71A57A2	P250TRIA4M502K	
67336	GEP25048TAA4-5	71A5742-500DT	P25048TAC4M500K	M250/480-PS
86959	GEP320MLTAC4-5	71A5892-001D	P320MLTAC4M500K	M320/MULTI-PS-KIT
78528	GEP320TRIA4-5	71A59A2	P320TRIA4M502K	
67342	GEP32048TAA4-5	71A5842-500DT	P32048TAC4M500K	M320/480-PS-KIT
86968	GEP320TRIA4-5	71A5837-001D	P320TRIA4M502K	
78529	GEP350TRIA4-5	71A59A3	P350MLTAC4M500K	
67346	GEP350MLTAA4-5	71A5993-001D	P350MLTAC4M500K	
78530	GEP400TRIA4-5	71A60A2	P400TRIA4M502K	
67341	GEP40048TAA4-5	71A6042-500DT	P40048TAC4M500K	M400/480-PS-KIT
67347	GEP400MLTAA4-5	71A6092-001D	P400MLTAC4M500K	M400/MULTI-PS-KIT
86839	GEP750TRIA5-5	71A64F0-T	P750TRIA5M502K	M750/120/277/347/480-PS-KIT
67347	GEP75048TAA5-5	71A64F2-500DT	P75048TAC5M500K	
67350	GEP750MLTAA5-5	71A64E2-500D	P750MLTAC5M500K	
78532	GEP1000TRIA5-5	71A65F1-T		M1000/120/277/347/480-PS-KIT
67348	GEP1000MLTAA5-5	71A6593-500	P1000MLTAC5M500K	
67349	GEP1000ML5AA5-5	71A6553-500	P1000ML5AC5M500K	

Prod Code	Description	Advance P/N	Universal (Vossloh Schwabe)	OSI P/N
HID Electromagnetic Ballasts - Continued				
High Pressure Sodium				
87152	GES50MLTLA3D-5	71A7801-001D	S50MLTLC3M500K	LU50/DUAL-KIT
78533	GES50TRILC3-5			
86587	GES70MLTLA3D-5	71A7971-001D	S70MLTLC3M500K	LU70/MULTI-KIT
78534	GES70TRILC3-5	71A79A1-001D	S70TRILC3M502K	
67340	GES7048TLA3D-5	71A7941-001D	S7048TLC3M500K	
87074	GES100MLTLA3D-5	71A8001-001D	S100MLTLC3M500K	LU100/MULTI-KIT
78535	GES100TRILC3-5	71A80A1-001D	S100TRILC3M502K	
67338	GES10048TLA3D-5	71A8041-001D	S10048TLC3M500K	LU100/480-KIT
87094	GES150MLTLA3D-5	71A8172-001D	S150MLTLC3M500K	LU150/MULTI-KIT
78536	GES150TRILC3-5	71A81A2-001D	S150TRILC3M502K	
67339	GES15048TLA3D-5	71A8142-001D	S15048TLC3M500K	LU150/480-KIT
87214	GES250ML5AA4-5	71A8251-001D	S250ML5AC4M500K	
78537	GES250TRILAC4-5	71A82A1-001D	S250TRILAC4M502K	
87121	GES250MLTAA4-5	71A8271-001D	S250MLTAC4M500K	LU250/MULTI-KIT
63066	GES400ML5AA4-5	71A8453-001D	S400ML5AC4M500K	
87164	GES400MLTAA4-5	71A8473-001D	S400MLTAC4M500K	LU400/MULTI-KIT
78539	GES400TRILAC4-5	71A84A3-001D	S400TRILAC4M502K	
87198	GES40048TAA4-5	71A8443-001D	S40048TAC4M500K	LU400/480-KIT
78540	GES1000TRILAC5-5	71A87A3-001	S1000TRILAC5M502K	
67351	GES100048TAA5-5	71A8743-001	S100048TAC5M500K	LU1000/480-KIT
87218	GES1000ML5AA5-5	71A8753-001	S1000ML5AC5M500K	
67352	GES1000MLTAA5-5	71A8773-001	S1000MLTAC5M500K	LU1000/MULTI-KIT
HID Lamp - Ballast Kits				
71701	GEM175ML5AC3-55	77L5570-001D		
71702	GEM250ML5AC3-55	77L5770-001D		
71703	GEM400ML5AC4-55	77L6051-001D		
71704	GEM1000ML5AC4-55	77L6552-001		
71705	GES100MLTLC3D-55	77L8071-001D-MED		
71706	GES250ML5AC4-55	77L8251-001D		
71707	GES400ML5AC4-55	77L8453-001D		
F-Can & Post Mount Metal Halide				
63046	GEMH50MVR-F	72C5181-NP	1120236CTC	
86576	11210277CTC000C	72C5280-NP	11210277CTC	
63047	GEMH70MVR-F	72C5282-NP	11210277CTC	
86578	11210506CTC000C	72C5282-NP	11210506CTC	
63048	GEMH100MVR-F	72C5381-NP	11210239CTC	
63049	GEMH150MVR-F	72C5482-NP	11210539CTC	
63050	GEMH175MVA-F	72C5581-NP	1110245SCTC	
63051	GEMH250MVA-F	72C5782-NP	1110246CTC	
63052	GEMH400MVA-F	72C6082-NP	1111-247SCTC	
80728	1111-247SCTC000I	72C6082-NP	1111-247SCTC	
F-Can & Post Mount HPS				
86605	1233142U000I	71A7907-001DB	1233142U000I	
86596	12210237CTC000I	72C7984-NP	12210237CTC000I	
86606	1233154U000I	71A8107-001DB	1233154U000I	
HID Ignitors				
75440	MH350-1A	LI553-H4-IC		
75441	MH750-1B	LI573-H5-IC		
86606	HPS150-3A	LI551-J4-IC		
86607	HPS400-3A	LI501-H4-IC		
HID CAPACITORS				
75434	GECAP-15/440V-O	7C150P40-R		
75435	GECAP-24/400V-O	7C240P40-R		
75668	GECAP-24/480V-O	MD2409-00		
75669	GECAP-12/280V-O			
75422	GECAP-35/240V-O	7C350P24RA		
75423	GECAP-5/240V-O	7C550P24RA		
75437	GECAP-12/280V-O			

Discontinued Catalog Products

Prod Code	Description	Suggested Replacement	Prod Code
23672	GE-232-277-N	GE-232-MV-N	72275
23674	GE-332-277-N	GE-332-MV-N	74456
23676	GE-432-277-N	GE-432-MV-N	74463
23678	GE-259-277-N	GE259MV-N	74469
23681	GE-132-277-N	GE-132-MV-N	72269
23939	GE132MAX-N-DIY	NA	
23940	GE232MAX-N-DIY	NA	
23942	GE432MAX-N-DIY	NA	
24162	GE-132-277-N-84T	GE-132-MV-N-42T	72240
24164	GE-232-277-N-84T	GE-232-MV-N-42T	72276
24166	GE-332-277-N-84T	GE-332-MV-N-42T	74457
24168	GE-432-277-N-84T	GE-432-MV-N-42T	74464
24170	GE-259-277-N-84T	GE-259MV-N-42T	74470
24774	GE340RS-MV-N-DIY	NA	
29621	GE-232-120-PS-N	GE-232-MVPS-N	96714
29622	GE-232-277-PS-N	GE-232-MVPS-N	96714
29623	GE-332-120-PS-N	GE-232-MVPS-N	96714
29624	GE-332-277-PS-N	GE-332-MVPS-N	96715
29625	GE-432-120-PS-N	GE-432-MVPS-N	96716
29627	GE-432-277-PS-N	GE-432-MVPS-N	96716
29630	GE-232-120PS-N-T	GE-232-MVPS-N	96714
29632	GE-232-277PS-N-T	GE-232-MVPS-N	96714
29633	GE-332-120PS-N-T	GE-332-MVPS-N	96715
29634	GE-332-277PS-N-T	GE-332-MVPS-N	96715
29635	GE-432-120PS-N-T	GE-432-MVPS-N	96716
29650	GE-432-277PS-N-T	GE-432-MVPS-N	96716
29656	GE-332-MV-PS-H-T	GE332-MVPS-H-84TS	72753
29665	GE-232-MVPS-XL-T	GE-232-MVPS-XL	29671
29666	GE-332-MVPS-XL-T	GE-332-MVPS-XL	29672
29717	GE454MVPSN1-B	GE454MVPS90-G	73192
29726	GE454MVPSN1	GE454MVPS90-G	73192
30187	GE-286-HO-MV-N-P	GE-286-HO-MV-N-P	30176
30189	GE-132-MV-N	GE-132-MV-N	72269
30191	GE-232-MV-N	GE-232-MV-N	72275
30219	GE432MV-H	GE432MV-H	78629
30247	GE-232-MV-L	GE-232-MV-L	72272
30268	GE-132-MV-N-42T	GE-132-MV-N-42T	72240
30269	GE-232-MV-N-42T	GE-232-MV-N-42T	72276
30303	GE-432-MV-H-42T	GE-432-MV-N-42T	74464
30308	GE-232-MV-L-42T	GE-232-MV-L-42T	72274
31052	GE232MAX-N-42T	GE232MAX-N-42T	72267
31053	GE332MAX-N-42T	GE332MAX-N-42T	71721
31054	GE432MAX-N-42T	GE432MAX-N-42T	71729
31055	GE332MAX-L-42T	GE332MAX-L-42T	71718
42670	1110-247SC-TC	NA	
42692	P350277RCSEM500K	GEP350MLTAC4-5	86984
47532	B132PUNVHP-A	GE-132-MV-N	72269
47536	B228PUNV-COG1C	GE228MVPS-A	99655
47546	GE232MAX-L-42T	GE232MAX-L-42T	72274
47547	GE432MAX-L-42T	GE432MAX-L-42T	71726
47549	GE332MAX-H-42T	GE332MAX-H-42T	71715
47550	GE432MAX-H-42T	GE432MAX-H-42T	71724
49706	GE132MAX-L/ULTRA	GE132MAX-L/ULTRA	72258
49707	GE232MAX-L/ULTRA	GE232MAX-L/ULTRA	72262
49708	GE332MAX-L/ULTRA	GE332MAX-L/ULTRA	71717
49709	GE432MAX-L/ULTRA	GE432MAX-L/ULTRA	71725
49771	GE132MAX-N/ULTRA	GE132MAX-N/ULTRA	72259
49772	GE232MAX-N/ULTRA	GE232MAX-N/ULTRA	72262
49773	GE332MAX-N/ULTRA	GE332MAX-N/ULTRA	71719
49774	GE432MAX-N/ULTRA	GE432MAX-N/ULTRA	71727
49776	GE332MAX-H/ULTRA	GE332MAX-H/ULTRA	71714
49777	GE432MAX-H/ULTRA	GE432MAX-H/ULTRA	71723
71281	GE232MAX-N/AMP	GE232MAX-N/AMP	72264

Prod Code	Description	Suggested Replacement	Prod Code
71424	GE332-MVPS-HSL84	GE332-MVPS-H-84TS	72753
71425	GE432-MVPS-HSL42	GE432MVPS-H-42T	74477
71426	GE432MAX-HSL84T	GE432MAX-H-42T	71724
71502	GE632MAXH90-S60T	GE632MAX90-S60	71497
71714	GE332MAX-H/ULTRA	GE332MAX-H/ULTRA	78619
71715	GE332MAX-H-48T	GE332MAX-H-48T	78620
71717	GE332MAX-L/ULTRA	GE332MAX-L/ULTRA	78621
71718	GE332MAX-L-48T	GE332MAX-L-48T	78622
71719	GE332MAX-N/ULTRA	GE332MAX-N/ULTRA	78623
71721	GE332MAX-N-48T	GE332MAX-N-48T	78624
71725	GE432MAX-L/ULTRA	GE432MAX-L/ULTRA	78625
71726	GE432MAX-L-48T	GE432MAX-L-48T	78626
71727	GE432MAX-N/ULTRA	GE432MAX-N/ULTRA	78627
71729	GE432MAX-N-42T	GE432MAX-N	78628
71732	GE632MAXH90-V60T	GE632MAX90-V60	71731
72260	GE132MAX-N-DIY	NA	
80136	B332I347HP	GE332-N-347	74105
80148	B259I120RHH	NA	
80149	B259I277RHH	NA	
80162	B295SR120HP	GE296HO-MV-N	75671
80163	B295SR277HP	GE296HO-MV-N	75671
80277	B332I347HPL 347	NA	
80353	B132R120V5	GE132MVPS-N-V03	75379
80355	B232SR120V5	GE232MVPS-N-V03	75380
80356	B232SR277V5	GE232MVPS-N-V03	75380
80357	B332SR120V5	GE332MVPS-N-V03	75381
80358	B332SR277V5	GE332MVPS-N-V03	75381
80362	B232SR277S50	GE232MAX90-S60	73233
80630	480XLHTCP-CON 120	GE296HO-MV-N	75671
80631	487XLHTCP-CON	GE296HO-MV-N	75671
80633	487SLHTCP-CON	GE296HO-MV-N	75671
80635	822BRTCP-CON	GE-260-IS-MV-N	74474
80637	420LTCP-CON	GE-240RS-MV-N	74472
80640	447LRVLTCP-CON	GE-240RS-MV-N	74472
80644	GEM230RS120DIY	GE-240RS-MV-N DIY	74473
80664	493B2	NA	
80669	C213UNVBE-IP	GEC213-MVPS-SE	71429
80671	C213UNVBES-IP	GEC213-MVPS-BES	71428
80672	C213UNVSE-IP	GEC213-MVPS-SE	71429
80673	C218UNVBEIP	GEC218-MVPS-SE	71433
80677	C218UNVBES-IP	GEC218-MVPS-BES	71432
80679	C218UNVSE-IP	GEC218-MVPS-SE	71433
80680	C240SI120RH-IP	GEC240MAX-A	71435
80681	C240SI277RH-IP	GEC240MAX-A	71435
80683	C240PUNVHP-B-IP	GEC240MVPS-A	75950
80685	C2642UNVBE-IP	GEC226-MVPS-SE	71444
80687	C2642UNVBES-IP	GEC226-MVPS-BES	71443
80689	C2642UNVSE-IP	GEC226-MVPS-SE	71444
80690	C340SI120RH-IP	GEC340MAX-A	71436
80691	C340SI277RH-IP	GEC340MAX-A	71436
80824	480XLHTCP-DIY	GE296HO-MV-N	75671
86071	200CSP-IP	GE-240RS-MV-N	74472
86073	200H2-IP	GE-240RS-MV-N	74472
86078	202BTCP-IP	GE-240RS-MV-N	74472
86080	202SBTCP-IP	GE-240RS-MV-N	74472
86085	213TCP-IP	GE-260-IS-MV-N	74474
86101	412LSLHTCP-IP	GE-240RS-MV-N	74472
86105	413CTCP-IP	GE-240RS-MV-N	74472
86110	420LTCP-IP	GE-240RS-MV-N	74472
86123	443LSLHTCP	GE-240RS-MV-N	74472
86124	GEM240RS277IP	GE-240RS-MV-N	74472
86132	445RSWSTCP-IP	GE240RS120	97498
86137	446LSLHTCP	GE-240RS-MV-N	74472

Prod Code	Description	Suggested Replacement	Prod Code	Prod Code	Description	Suggested Replacement	Prod Code
86139	GEM240RS120IP	GE-240RS-MV-N	74472	90019	GE259MAX-N/CTR	NA	
86144	447LRTCP-IP	GE-240RS-MV-N	74472	96717	GE232-MVPS-N-42T	GE-232-MVPS-N	96714
86158	458LSLHTCP-IP	GE-240RS-MV-N	74472	96718	GE332-MVPS-N-42T	GE-332-MVPS-N	96715
86164	GEM296HORS120IP	GE296HO-MV-N	75671	96719	GE432-MVPS-N-42T	GE-432-MVPS-N	96716
86167	480XLHTCP-IP	GE296HO-MV-N	75671	97656	GE232MAX-N/CTR	GE232MAX-N/CTR	72265
86171	GEM296HORS277IP	GE296HO-MV-N	75671	97657	GE332MAX-N/CTR	GE332MAX-N/CTR	71720
86173	487XLHTCP-IP	GE296HO-MV-N	75671	97658	GE432MAX-N/CTR	GE432MAX-N/CTR	71728
86176	490XLHTCP-IP	GE296HO-MV-N	75671	97709	GE-232MV-N-DIY	GE-232MV-N-DIY	72277
86185	502ATCP-IP	GE232MVPS-N-VO3	75380	97713	GE332MAX-HSL84T	GE332MAX-HSL84T	72752
86206	532BRTCP-IP	GE-260-IS-MV-N	74474	99654	GE228MVPSHA-T42	GE228MVPS-A	99655
86208	537LTCP-IP	GE-240RS-MV-N	74472	99656	GE228MVPS-A-T42	GE228MVPSH-A	99653
86222	546BTCP-IP	GE140RS120	75672				
86231	548H2-IP	NA					
86240	554LTCP-IP	NA					
86243	562LTCP-IP	NA					
86245	564LTCP-IP	GE-240RS-MV-N	74472				
86251	573LTCP-IP	GE-240RS-MV-N	74472				
86253	588LTCP-IP	GE-240RS-MV-N	74472				
86264	627LHTCP-IP	GE296HO-MV-N	75671				
86287	697LTCP-IP	GE-240RS-MV-N	74472				
86341	GEM240RS220IP	NA					
86351	798XLHTCP-IP	GE296HO-MV-N	75671				
86359	806SLHTCP	GE-260-IS-MV-N	74474				
86360	GEM296IS120IP	GE-260-IS-MV-N	74474				
86372	GEM196IS120IP	GE-260-IS-MV-N	74474				
86378	827SLHTCP	GE-260-IS-MV-N	74474				
86379	GEM296IS277IP	GE-260-IS-MV-N	74474				
86381	GEM196IS277IP	GE-260-IS-MV-N	74474				
86396	881BRTCP-IP	GE-260-IS-MV-N	74474				
86402	930KTCP-IP	NA					
86411	937KTCP-IP	NA					
86430	957STCP-IP	NA					
86432	960VLHTCP-IP	NA					
86519	H100MLTAC3M500K	GEM100MLTLC3D-5	86675				
86527	H175MLTAC3M500K	GEM175MLTAC3-5	86741				
86542	H400MLTAC4M500K	GEM400MLTAA4-5	72149				
86624	2BMB1000C	NA					
86808	M400ML5AC4M500K	GEM400ML5AA4-5	72300				
86814	M400MLTAC4M500K	GEM400MLTAA4-5	72149				
86968	P320TRIAC4M502K	GEP320MLTAC4-5	86959				
87175	S400MLTAC5M500K	GES400ML5AC4-5	87215				
87206	S40048TAC5M500K	GES40048TAC4-5	87198				
87217	S400ML5AC5M500K	GES400ML5AC4-5	87215				
87516	GEMH50-MSF-120	NA					
87621	GE-454-MV-PS-NL	GE454MVPS90-G	73192				
87634	GEM1CF579PH277	NA					
87651	GE-454-MV-PS-NLB	GE454MVPS90-G	73192				
87666	GE-254-MV-PS-NLB	GE254MVPS-D	72279				
87700	GEM2CF24PH277	NA					
88918	USB-0218-16-IP	NA					
88931	USB-0816-14-IP	GESB-620-24-IP	72104				
88934	USB-1632-24-IP	GESB-2040-46-IP	72107				
88936	USB-1024-14-IP	GESB-1224-24-IP	72105				
89707	GEM240RS120DIY72	GE240RS120-DIY	97499				
89708	GEM296IS120DIY48	GE-260-IS-MV-N-DIY	74475				
89709	GEM140RS120DIY	GE140RS120-DIY	72110				
89710	GEM240HRS120DIY	GE240RS120-DIY	97499				
89714	GEM140HRS120DIY	GE140RS120-DIY	72110				
89716	445RSWSTCP-DIY	GE240RS120-DIY	72110				
89723	213TCP-DIY	GE-260-IS-MV-N-DIY	74475				
89724	458LSLHTCP-DIY	GE240RS-MV-N-DIY	74473				
89725	532BRTCP-DIY	GE-260-IS-MV-N-DIY	74475				
89726	487SLHTCP-DIY	GE296HO-MV-N-DIY	72109				