Application Guide

Green Construction

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JULY 2016

PREFACE

Interest in green construction has increased substantially because of environmental, sustainability and financial concerns. All levels of government and building safety professionals recognize the need for a mandatory baseline of codes and standards addressing sustainable construction practices, providing a framework linking sustainability with safety and performance. To be viable, green construction practices need to address environmental concerns, but they cannot undermine the fundamental levels established for public safety.

UL is committed to the advancement of safe, sustainable construction by conducting the necessary research, developing standards, being involved in sustainable codes and rating system development and testing and certifying products to help society make a smooth and safe transition to sustainable construction methods. UL is an active participant in the development of model construction codes and standards, such as the International Green Construction Code (IgCC), the International Energy Conservation Code (IECC), the National Green Building Standard (ICC 700), Standard for the Design of High-Performance Green Buildings Except Low Rise Residential (ASHRAE 189.1), and CALGreen,. UL also participates on numerous U.S. Green Building Council (USGBC) technical groups and committees that help develop the Leadership in Energy and Environmental Design (LEED) rating system.

Five UL business units – UL Supply Chain & Sustainability, UL Product Safety, UL Verification Services, UL Life & Health, and UL Knowledge Solutions – provide services addressing various aspects of sustainable construction.

UL has developed this guide for use by code and inspection authorities, architects, system designers, contractors, installers, users, specifiers, and other interested parties to aid in understanding: (1) the basic components of sustainable construction systems, (2) the applicable codes, standards, and product and system certifications needed to facilitate a reasonably safe and code-compliant installation, and (3) UL's services related to sustainable construction.

UL Marking and Application Guides are updated as necessary due to new product development, changes in the codes and standards, or the need for clarification. To confirm the current status of any UL Marking and Application Guide, please consult the Code Authorities page of the UL Web site at www.ul.com/codeauthorities or www.ul.com/markingguides.

Your comments or suggestions are welcome and appreciated. They should be sent to:

Regulatory Services Department
UL LLC
333 Pfingsten Road
Northbrook, IL 60062
ulregulatoryservices@ul.com
www.ul.com/codeauthorities
800-595-9844

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GENERAL INFORMATION

SCOPE OF THIS GUIDE

This Guide is intended to assist regulatory authorities, designers, and installers in finding products and systems evaluated and certified for some aspect covered in a sustainably focused code. These certifications are intended to help achieve compliance with green construction codes and standards such as IgCC, IECC, ICC 700, ASHRAE 189.1 and CALGreen.

Many authorities having jurisdiction also require a certain level of LEED certification when buildings are built with public funds or to show compliance to a certain green code. As USGBC has stated their rating system is not built for use as a code, we will not be focused on it in this document. Many of the services and certifications that we talk about below do help a building obtain credit or meet prerequisites in the LEED rating system though. Much of that information is detailed at UL's LEED Toolkit which can be found at:
http://industries.ul.com/environment/green-building-specifying-and-purchasing/leed-toolkit

The product markings identified in this Guide are intended to provide general information on the types of certification markings that may appear on products, their packaging or related documentation. Refer to the specific Guide Information published for each product category for additional product marking information.

Additional information can be found at **www.ul.com** and **www.ul.com/environment.**

UL SERVICES

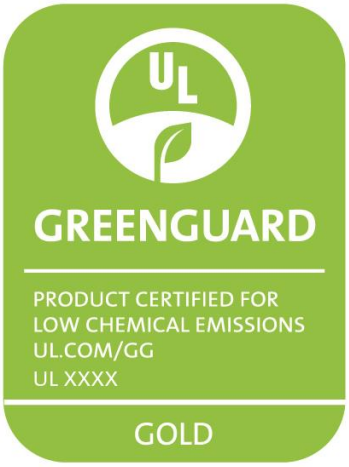
Third-party certifications, validations, verifications and testing help code officials and designers in determining compliance with green codes, such as the IgCC and CALGreen, without having to do exhaustive research and verification of data. There are several UL programs and services for various types of products and attributes.

Sustainable Product Certification Service

This service evaluates whether products meet UL or other sustainable product standards (such as BIFMA level or TCNA Green Squared^{SM}), which measure a product's performance throughout its entire lifecycle, from sourcing to disposal, reuse, and take-backs. These environmental certifications indicate that a product has undergone exhaustive auditing, to demonstrate its compliance with stringent, third-party environmental performance standards. These standards set metrics for a wide variety of criteria, including energy reduction, waste diversion, recyclability, salvaged material usage, site preservation, transportation reduction, human health impacts and natural resource conservation.

Product Emissions Certifications and Testing

The indoor air quality requirements in the green construction codes include maximum levels of volatile organic compound (VOC) emissions dispersed from specific products and materials. Products that have low chemical emissions, as determined by levels in the UL GREENGUARD Certification Programs, and bear the UL GREENGUARD Certification Mark, meet those code requirements.



Environmental Product Declarations (EPDs)

An EPD is a comprehensive, internationally harmonized report that documents the ways in which a product, throughout its lifecycle, affects the environment. EPDs enable manufacturers to disclose all of their products' impacts in a credible, streamlined, and universally understood manner. As a program operator, UL Environment also helps develop Product Category Rules (PCRs) for EPDs. The PCR is utilized as a common set of definitions and base information that each EPD for that product category has to disclose and how they should disclose it in the EPD.

Typically, an EPD will include information about a product's impact on global warming, ozone depletion, water pollution, ozone creation, and greenhouse gas emissions. An EPD can also include other impacts that are of particular interest to the discloser, such as human toxicity risk. EPDs act as neither product ratings nor ecolabels; rather, they help architects, designers, specifiers, and other purchasers better understand a product's sustainable qualities. Thus, EPDs are primarily used to make more informed purchasing decisions by providing additional transparency.

Energy Efficiency Certification
As an official EPA-recognized certification body, UL helps manufacturers comply with the latest requirements, conserve resources, reduce energy costs and deliver quality products. By offering premier qualification and verification testing on 30 ENERGY STAR® product categories and as an EPA-recognized CB for 35 product categories, UL is also providing product manufacturers, engineers and designers with various educational resources on the latest enhancements to the ENERGY STAR® program. As an approved certification body by the U.S. Environmental Protection Agency (EPA), UL provides a service to review all new product submissions from manufacturers participating in the ENERGY STAR® program, and to perform qualification testing under specific criteria. Certified products are authorized to bear the ENERGY STAR® label.

Additional Green Certifications
There are additional specific certification services for other sustainable products and systems, such as for cool roofs, used equipment, sound transmission, and renewable energy. Specific references to these certifications are provided later in this Guide.

Environmental Claim Validation
This service validates, through independent evaluation, one or more environmental claims made by manufacturers for specific products. UL validated products may bear the Environmental Claim Validated logo on their marketing materials and packaging. Also, validation can be provided for environmental claims that are new to the market or do not have an existing testing protocol. The typical process for nonstandard claims includes a preliminary assessment of the proposed environmental claim, an evaluation of the claim, and development of a protocol to test the product and validate the claim. Product attributes that are validated include **r**ecycled content, rapidly renewable materials, use of regional materials, VOC content, energy efficiency, water efficiency, hazardous or toxic substances, “absence of” claims, reclamation programs, mold resistance, degradability, and compostability

The UL EcoLogo Program identifies environmentally preferable products Founded in 1988, the EcoLogo Program awards its mark to products that demonstrate environmental leadership within their category. EcoLogo is an ISO 14024 Type 1 program. An audit process verifies that each product complies with the criteria established in EcoLogo standards. More than 11,000 EcoLogo-certified products are currently available on the market.

VALUE OF THIRD-PARTY CERTIFICATION

Environmental and public health claims should always be certified by an independent, third-party organization. This contributes rigor, stringency and credibility, protects manufacturers' and specifiers' reputation and reduces liability.

One helpful step in evaluating an eco-label is to consider the organization that stands behind it. Using these criteria, certifications will fall into one of the three basic categories as outlined below:

- First-party certification equates to a self-declaration. This type of certification is not based on verification by independent third parties. The rigor and credibility of such claims, therefore, is less certain than claims that have been independently certified.

- Second-party certification is performed by an industry, trade or special interest group that purchases or otherwise has a user interest in the products being certified, and has critical involvement in the certification, either through administration of the certification program, verification of the claims or creation of the standards and methods. Second-party certifications are very common and often confused as being third party.

- Third-party certification refers to certification programs in which declaration of conformance to requirements is made by a body that is independent of the body that provides that product and of user interests in that product.

Look for products that have undergone testing and analysis that is scientifically based and can be easily replicated. For more information on evaluating green product claims, see **http://sinsofgreenwashing.org/findings/the-seven-sins/**

UL CERTIFICATION MARKS AND DATABASES

UL has several third-party certification marks to identify those products that have been evaluated as meeting environmental test protocols and standards as required by various sustainable codes. UL certification databases provide a means for code officials and designers to readily find products that are third party certified by UL. These marks and databases are detailed below.

UL Sustainable Product Certification Mark

The UL Sustainable Product Certification Mark indicates that a product has been tested/audited by UL and found to comply with the terms of the standard used for evaluation. Examples of the types of products that will carry the Sustainable Product Certification Mark include multiple types of flooring, office furniture, information technology equipment, building products and consumer electronics. More products will be added as sustainable product standards become available.

UL Environmental Claim Validation

A UL Environmental Claims Validation (ECV) logo on a product's packaging indicates that the product meets UL Environment's claim-specific validation requirements.

Claims validated include: recycled content, recyclability, degradability, compostability, rapidly renewable materials, regional materials, volatile organic compounds (VOC) content, energy efficiency, energy audits, water efficiency, hazardous or toxic substances, reclamation and mold resistance.

Once the product claims have been validated, details are posted on UL Environment's Sustainable Product Guide (www.ul.com/spg) , an online tool that allows users to identify sustainable products by product category, company name, product name, type of claim, or code/rating system compliance criteria. Manufacturers may use the Environmental Claims Validated logo on marketing materials and packaging.

Information on validated and certified products is located in UL Environment's **Sustainable Product Guide**. To be included in this database, a product must have been validated through Environmental Claims Validation or certified through Sustainable Product Certification. This online tool allows users to quickly sort and identify products by product category, company name, product name or type of claim.

www.ul.com/spg

UL Energy Verification and Efficiency Marks

The UL Energy Mark appears on air conditioners, furnaces, refrigerators, freezers, dishwashers, washers, dryers, water heaters, cooking equipment, high tech equipment, lighting products and similar products evaluated to specific U.S. and Canadian energy efficiency standards. These products are already certified for safety by UL before earning the UL Energy Mark. These energy verified products can be found in the UL Online Certification Directory at **www.ul.com/database**.

This Mark appears on products and the packaging of products that meet energy efficiency requirements in regulations such as ENERGY STAR®, Natural Resources Canada (NRCan) and California Energy Commission (CEC). The mark incorporates a leaf encapsulating the familiar “UL” initials and includes the words “Energy Verified” in black text.

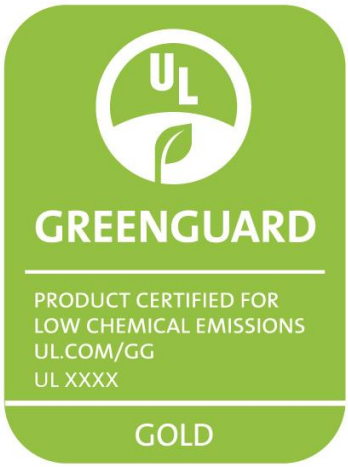
The results of products earning the EEC Mark appear in the UL Energy Efficient Product Database

http://www.ul.com/customer-resources/ul-energy-efficient-product-database/

UL GREENGUARD

This Certification Mark appears on products designed for use in office environments and other indoor spaces that have been tested/audited and found to meet strict chemical emissions limits.

UL GREENGUARD Gold



This Certification Mark shows compliance to all of the green code low-emitting product requirements for products intended for use in all indoor environments. More stringent than the indoor air quality certification, this certification was originally intended for products used around sensitive populations, and has now evolved into a primary certification program that is also applicable for building products, furniture, cleaning products, electronics and many other products. .

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For more information, or to view a complete list of certified products, visit http://industries.ul.com/environment

UL CERTIFIED PRODUCTS

Launched in mid-2013, the enhanced UL Certified Mark can be used on both UL Listed and Classified products and is intended to make it easier and simpler for stakeholders to understand the scope of UL's certifications of a specific product. The enhanced UL Certified Mark makes it possible to bundle multiple UL certifications for multiple geographies into a single Mark design. Today, this mark is used for products certified to U.S., Canadian, European and Japanese requirements. This Mark utilizes a unique identifier to enable stakeholders to search UL's Online Certifications Directory at www.ul.com/database to quickly to review detailed certification information.

All currently existing versions of UL's Listing and Classification Marks remain valid and should continue to be accepted as an indication of certification.

UL expects the transition to the enhanced Mark to happen over time, so you may not see it in the immediate future. For more information on this important development, please go to www.ul.com/markshub > Resources. Access to the Marks Hub is free and open to all regulators, but registration to use it is required.

Listed and Classified Products
Products are Listed or Classified (Certified) by UL under a variety of product categories that are identified by a four-letter UL category code. The category code is shown in parenthesis following every product category title in this guide.

- Information on products and systems Certified by UL for applications regulated by the IgCC and IECC, along with the applicable standard(s), can be found in Appendix A.

Information on products and systems Certified by UL for applications regulated by ICC 700, along with the applicable standard(s), can be found in Appendix B.
Each UL Product Category code in these Appendices provides a direct link to the Guide Information for the product category. The Guide Information typically includes (1) a description of the products covered, (2) the associated installation code, (3) a description of limitations or special conditions associated with the product, (4) the requirements or standards used to investigate the products, and (5) a description of the UL Mark used on certified products. Guide Information is also available in UL Product Spec at www.ul.com/productspec and UL's Online Certifications Directory at **www.ul.com/database**.

UL Listing Mark

The UL Listing Mark is one of the most common UL Certification Marks. If a product carries this Mark, it means UL found that representative product samples met UL's safety requirements. These requirements are primarily based on UL's own published Standards for Safety. This type of Mark is seen commonly on appliances and computer equipment, furnaces and heaters, fuses, electrical panel boards, smoke and carbon monoxide alarms, fire extinguishers and sprinkler systems, personal flotation devices, bullet resistant glass, and thousands of other products.

There are three variations of UL's Listing Mark: one used only in the United States, one used only in Canada, and one for both the United States and Canada. The C-UL Mark is applied to products for the Canadian market. The products with this type of Mark have been evaluated to Canadian safety requirements, which may be somewhat different from U.S. safety requirements. The optional C-UL-US Mark indicates compliance with both Canadian and U.S. requirements.

The UL Listing Mark appears on end products and complete components suitable for factory and field installation. All of the products carrying a UL Listing Mark are covered by UL's Follow-Up Services program to verify that end products and components carrying the UL Listing Mark continue

to be manufactured in compliance with UL's safety requirements. A UL Listing Marking typically consists of four required elements:

- The UL symbol
- "Listed"
- The product name
- An alphanumeric control or issue number

Additional elements and markings may be present for products that carry UL's EU Mark.

UL Classification Mark

This Mark appears on products that UL has evaluated with respect to specific properties, a limited range of hazards, or suitability for use under limited or special conditions. Typically, products Classified by UL fall into the general categories of building materials and industrial equipment. Examples of types of equipment Classified by UL include immersion suits, fire doors, protective gear for fire fighters and industrial trucks.

Just like the UL Listing Mark, there are also three variations of UL's Classification Mark: one used only in the United States, one used only in Canada, and one for both the United States and Canada. The C-UL Classification Mark is applied to products for the Canadian market. The products with this type of Mark have been evaluated to Canadian standards for a specific hazard or property. The optional C-UL-US Classification Mark indicates compliance with both Canadian and U.S. requirements.

All of the products carrying a UL Classification Mark are covered by UL's Follow-Up Services program to verify that products carrying the Mark continue to be manufactured in compliance with UL's safety requirements. A UL Classification Marking typically consists of four required elements:

- The UL symbol
- "Classified" and a qualifying statement as to the specific hazard or property
- The product name
- An alphanumeric control or issue number

Field Evaluations

You may encounter situations in which you are unable to determine if (1) a product has been listed by a third-party organization, (2) a product bearing a Certification Mark that was modified or rebuilt in the field still complies with the applicable standard, or (3) a used or rebuilt product is suitable for use in a new application. UL offers a field evaluation service that provides data to assist you in making your decision whether to accept the product and/or approve the installation. Anyone directly involved with a product – including manufacturers, owners, contractors and regulatory authorities – can request a Field Evaluation. Detailed information for this program can be found on UL's Web site at **www.ul.com/field.**

CODES AND STANDARDS

UL participates in the development and maintenance of model codes and sustainability standards/rating systems published by other standards development organizations and model code organizations, and develops additional standards as needed. A list of model codes and standards applicable for sustainable construction can be found in Appendix D. The numbering for code sections used in this document may change as the specific code is updated.

International Green Construction Code (IgCC)

The IgCC, published by the International Code Council (ICC) is a model code establishing minimum regulations for buildings and systems using prescriptive and performance-related provisions, working as an overlay to the other I-Codes. For example, the requirements of the 2012 *International Energy Conservation Code* were targeted as a baseline for the *International Green Construction Code* energy provisions that can be increased through the selection of "Jurisdictional Requirements" and "Project Electives." It is founded on the principle that a model code must address the market segments beyond those captured by rating systems or other evaluation guides, and therefore, must be enforceable, useable and adoptable. Starting in 2018 the technical requirements of the IgCC (Chapter 4 on) will be taken from ASHRAE 189.1.

National Green Building Standard (ICC 700)

ICC 700 is an ANSI residential green building rating system, published by the ICC and developed by the National Association of Home Builders and co-sponsored by ASHRAE. The standard defines green building for single- and multifamily homes, residential remodeling projects, and site development projects while still allowing for the flexibility required for regionally-appropriate best green practices.

International Energy Conservation Code (IECC)

The IECC is a model code published by ICC that regulates minimum energy conservation requirements for new buildings. The IECC addresses energy conservation requirements for all aspects of energy uses in both commercial and residential construction, including heating and ventilating, lighting, water heating, and power usage for appliances and building systems.

Standard for the Design of High-Performance Green Buildings Except Low Rise Residential, (ASHRAE 189.1)

ASHRAE has developed and published Standard 189.1 per their ANSI processes. The standard focuses on building sustainability designs and operational issues of sustainable buildings. From site location to energy use to recycling, this standard sets the foundation for green buildings by addressing site sustainability, water use efficiency, energy efficiency, indoor environmental quality, and a building's impact on the atmosphere, materials and resources. Standard 189.1 serves as a compliance pathway, chosen by the builder to the IgCC. Starting in the 2018 version, ASHRAE 189.1 will provide all of the technical requirements (Chapter 4 on) of the IgCC

CALGreen (Part 11 of Title 24)

Starting on January 1, 2011 every building in the State of California, whether residential or non-residential, had to meet a certain level of sustainable building practices as laid out in Part 11 of Title 24 (CALGreen). The code has mandatory measures and voluntary measures that can be adopted by each authority having jurisdiction (AHJ). The requirements range from efficiency, water requirements, indoor air quality measures, and sustainable building material requirements.

Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems (NFPA 3)
NFPA 3, published by the National Fire Protection Association (NFPA), provides building commissioning requirements and direction to confirm that active and passive fire protection and life safety systems function as they were intended.

UL Standards for Sustainability
UL Sustainability Standards are used to establish the basis for identifying environmentally preferable products, based on sustainability criteria associated with a product's manufacture, distribution, use, and eventual disposal. The requirements in UL Standards are developed based on the life cycle stages of the associated products.

All of UL's Sustainability Standards can be found at http://www.comm-2000.com/Catalog.aspx and are free to download. UL is seeking stakeholders to participate in the development of sustainability standards. Interested stakeholders should go to
http://ulstandards.ul.com/develop-standards/participation/
UL GREENGUARD Standards and Testing Methods
UL establishes standards and testing methods for the UL GREENGUARD certification programs to reduce human exposure to chemicals emitted from products and to improve indoor air quality. These standards are based on available standards and guidelines from national and international public health agencies. All UL GREENGUARD standards are publicly available, along with test protocols, and all public comments are considered. These standards include UL GREENGUARD IAQ Standard for Building Materials, Finishes and Furnishings, UL GREENGUARD Gold, and UL GREENGUARD test methodology. The certifications established using these standards, such as UL GREENGUARD Gold , qualify for all low-emitting criteria or credits in major sustainable codes, rating systems and standards, and can be found atwww.ul.com/environment.

Environmental test chambers and indoor exposure models are used to characterize emissions performance of products and their components. Achievement of test results requires rigorous sample selection procedures, defined sample collection and handling procedures, and implementation of precise and accurate analytical measurement systems and procedures. Additionally, a product manufacturer must have a production quality control system in place that is capable of assuring that products are manufactured consistently with similar emissions characteristics over time. Emission criteria are established for total VOC (TVOC), formaldehyde, total aldehydes, all individual chemicals with currently published Threshold Limit Values (TLVs), respirable particles, and certain odorants and irritants. In addition, all products are screened and reported for carcinogens and reproductive toxins as listed by key government and regulatory programs. Emission criteria may vary, based on the product formulation and its use.

ENERGY STAR®

Products can earn the ENERGY STAR® label by meeting the energy efficiency requirements set forth in ENERGY STAR® product specifications. EPA establishes these specifications based on the following set of key guiding principles:

- Product categories must contribute significant energy savings nationwide.
- Qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency.
- If the qualified product costs more than a conventional, less-efficient counterpart, purchasers will recover their investment in increased energy efficiency through utility bill savings within a reasonable period of time.
- Energy efficiency can be achieved through broadly available, nonproprietary technologies offered by more than one manufacturer.
- Product energy consumption and performance can be measured and verified with testing.

Labeling effectively differentiates products and is to be visible for purchasers. ENERGY STAR® product specifications can be found at **http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs**.

BUILDING DEVELOPMENT

Sustainable codes include requirements for the development and maintenance of buildings to minimize negative environmental impacts. The heat island effect of a building can be mitigated by installing cool roofs.

COOL ROOFS (SOLAR REFLECTANCE AND THERMAL EMITTANCE)

Roofing materials with solar reflectance and thermal emittance properties are sometimes referred to as “cool roofs.” A cool roof works by both absorbing the sun’s heat and reflecting (or radiating) it back to the sky instead of transferring it into the building structure. The effectiveness of a cool roof is measured by solar reflectance and thermal emittance. Both properties are measured individually from 0 to 1.0, with 1.0 being the material with the best performance.

Solar reflectance measurements, which evaluate temperatures and heat flows across surfaces exposed to solar radiation, are typically determined in accordance with ASTM C1549. Thermal emittance measurements, which evaluate temperatures, heat flows, and derived thermal resistances of materials, are typically determined in accordance with ASTM C1371.

UL certifies solar reflectance roof covering materials based on them meeting or exceeding the minimum initial solar reflectance measurements as specified in Product Specification Eligibility Criteria of the ENERGY STAR® Program Requirements for Roof Products, which includes a three-year weather exposure test. Materials evaluated for low-slope installations are intended for use on roof surfaces with an incline of 2-inch or less rise per horizontal foot. Materials evaluated for steep-slope installations are intended for use on roofs with an incline of greater than 2-inch rise per horizontal foot.

For Classification (certification) of field applied roof coatings, the products are investigated on a smooth light-gauge metal substrate at the intended application thickness. For information on varying thicknesses of coating and alternate substrates, refer to the detailed installation instructions accompanying the UL Certified product.

Roofing materials complying with these requirements are Classified under the Solar Reflectance, Roof Covering Materials product category (TGFE). Individual certifications include the manufacturer's name and material designation, along with the initial and maintained (three-year) solar reflectance and thermal emittance values. When "NA" is indicated in an individual Classification, the three-year weather exposure data is not available but is awaiting completion of the exposure period. Information concerning the specific initial solar reflectance values is provided in the detailed installation instructions accompanying the UL certified product.

The information included with these UL certifications makes it easy to determine compliance with code requirements. In addition, the UL Classification Mark appears on certified materials or their packaging, along with information on whether the material is suitable for a low-slope or steep-slope application as well as the initial and maintained (three-year) solar reflectance and thermal emittance values.

MATERIAL RESOURCE CONSERVATION AND EFFICIENCY

Sustainable codes contain requirements addressing the re-use of equipment, material properties including recycled content, and limitations on the amount of mercury in fluorescent lamps.

USED EQUIPMENT

One aspect of green construction practices involves recycling used equipment, including various degrees of rebuilding, remanufacturing, refurbishing, repairing or reconditioning of equipment. The result is commonly referred to as a "rebuilt" product.

Rebuilding Equipment Raises Safety Concerns

The UL Listing Mark on a newly manufactured piece of equipment is an indication that the product complies with nationally recognized safety requirements when the product was shipped from the factory, and that it is suitable for installation and use in accordance with specific model codes. However, if a product is rebuilt, UL cannot confirm that it continues to comply with appropriate safety requirements without an additional investigation.

A Field Evaluation is an effective way to determine if a rebuilt product continues to comply with UL safety requirements. However, a separate evaluation is needed to determine the acceptability of each rebuilt equipment installation.

To address situations where a company rebuilds equipment on a regular basis, UL has developed programs to determine the suitability of equipment rebuilt under a more structured equipment rebuilding program.

Rebuilt Equipment Certification Programs
UL's rebuilt equipment certification programs primarily address safety concerns, but also address green construction practices, since the rebuilt equipment can be reused, instead of disposed in a landfill. These programs cover specific types of products that can be fully evaluated to the same safety requirements used to evaluate newly constructed products. For a rebuilt product to be considered for certification, UL first needs to establish the feasibility of determining compliance of the product with all the applicable product safety requirements. Concerns that need to be addressed include the potential effects of deterioration due to normal use and aging or damage caused by fire, flood, seismic, wind or electrical faults.

UL has established rebuilt equipment certification programs when either an original manufacturer or another party has the necessary facilities, technical knowledge and manufacturing skills to rebuild products that continue to comply with UL safety requirements. These programs require the equipment rebuilder to comply with the following requirements:

- The original UL Mark must be removed from the equipment being rebuilt, or permanently defaced.
- The equipment can only be modified using materials and procedures that are suitable for the application.
- Production line testing may be conducted to verify that the rebuilt equipment complies with specified performance requirements.
- Rebuilt equipment complying with all program requirements is plainly and permanently marked with the name of the rebuilder and a UL Mark containing the term "Rebuilt" or other terminology suitable for the product category.
- The rebuilt equipment is to be subjected to the same requirements as newly constructed equipment.

There are types of products for which UL has chosen not to establish equipment rebuilding programs due to safety considerations that cannot be adequately addressed. For example, UL does not have a certification program for rebuilding or refurbishing molded case circuit breakers.

Over the years, UL has created certification programs for rebuilt cooking appliances, refrigerators, vending machines, uninterruptible power supplies, motor controllers, motors for use in hazardous locations, office furnishings and electric signs, to name a few. The Guide Information for each product category with a rebuilt certification program references the existence of such a program and identifies the applicable UL Mark for rebuilt products.

UL certified rebuilt products are marked "Rebuilt," "Remanufactured," or "Reconditioned." Product categories that include provisions for rebuilt equipment can be located in UL's Online Certification Directory by performing a keyword search for "rebuilt."

RECYCLED CONTENT
There has been discussion within the environmental and manufacturing communities about which materials can be claimed as recycled content. Are things pre-consumer or post-consumer helps define how much they count towards meeting certain code criteria. UL Environment has developed a procedure to provide clarity on interpreting existing guidelines to validate claims of pre-consumer recycled content and to serve as a reference for manufacturers. See**:**
http://services.ul.com/service/recycled-content/

Definitions of Key Recycled Content Terms
Many sustainable product consensus standards base their recycled content definitions on ISO 14021:2001. However, each standard has variations on key terms, and these differences create confusion in applying requirements to the waste products. In some instances, broad interpretation of existing terms may exclude any waste from being called “recycled content,” or may result in inconsistent applications of the definitions.

UL Environment has developed definitions for the most relevant terms associated with pre-consumer recycled content, as noted below. These key terms are based on publicly available definitions from various sources as well as UL Environment’s experience and insight.

By-Product (Co-Product) — A production material that is not waste and possesses characteristics that make it ready for further use in the marketplace without any further processing.

Post-Consumer Material — Material that has reached its intended end user which is no longer being used for its intended purpose.

Pre-Consumer (Post-Industrial) Material — Material diverted from the waste stream during a manufacturing process that has never reached the end user. Excluded is the reutilization of materials generated in a process and capable of being reused as a substitute for a raw material without being modified in any way.

Manufacturing Process — Sequence of interdependent and linked procedures or actions designed to convert inputs (material, parts, etc.) into outputs (waste, by-product, etc.) until an intermediate or final product is produced.

Unit Process — A single procedure or action designed to convert inputs (material, parts, etc.) into outputs (waste, by-product, etc.) resulting in an intermediate or final product.

Recovered (Reclaimed) Material — Material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and recovered (reclaimed) as a material input, in lieu of new virgin material, for a recycling or manufacturing process.

Recycled Content — The proportion of pre-consumer or post-consumer recycled material, by mass, in a product or packaging.

Recycled Material — Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product.

Waste — Material from a generator or holder that does not possess characteristics or meet technical specifications for use in the marketplace without further processing, and that the generator/holder intends or is required to discard or release to the environment.

Waste Stream — The total flow of solid waste from homes, businesses, institutions and manufacturing plants that is recycled, burned or disposed of in landfills or segments thereof.

MERCURY CONTENT IN COMPACT FLUORESCENT LAMPS (CFLS)
IgCC Section 506.3 requires single-ended pin-base and screw-base CFLs to contain no more than 5 milligrams of mercury per lamp, except lamps rated at 25 watts or greater are required to contain

no more than 6 milligrams of mercury per lamp. CFLs are required to be listed and labeled in accordance with UL 1993.

ASHRAE 189.1 requires screw-base compact fluorescent lamps of less than 25 watts and straight fluorescent T8 normal lifetime lamps to contain 4mg or less of mercury. Screw-base compact fluorescent lamps between 25 and 40 watts, pin-base compact fluorescent lamps all wattages, and straight fluorescent T5 and T8 long lifetime lamps to contain 5mg or less of mercury. Straight fluorescent T5 normal lifetime lamps should contain 3mg or less and T12 eight-foot straight fluorescent lamps are required to have 15mg or less of mercury.

Compact Florescent Lamps are listed under the Self-ballasted Lamps and Lamp Adapters product category (OOLR) in accordance with UL 1993. This category covers self-ballasted lamps consisting of a ballast, transformer or power supply, and an integrated or replaceable lamp, for direct connection to a lampholder. UL 1993 requires the CFLs that contain mercury to be marked in accordance with federal law. The smallest unit packaging, point-of-sale package, carton or "stuffer sheet" packed with each lamp additionally identifies lamps that contain mercury and provide information for their safe cleanup, disposal and recycling.

ENERGY CONSERVATION, EFFICIENCY AND CO_2E EMISSION REDUCTION

Sustainable codes contain requirements addressing energy metering and monitoring, building energy management and control systems, use of electric vehicles, energy efficient appliances and equipment, and renewable energy systems.

ENERGY METERING AND MONITORING

Sustainable codes require a means to be provided to measure, monitor, and report on the energy use, production and reclamation in a building. This includes the design of energy distribution systems so as to isolate load types, the installation of or ability to install in the future meters, devices and a data acquisition system, and the installation of or the ability to provide for public displays and other appropriate reporting mechanisms in the future.

UL lists this equipment under the Energy Usage Monitoring Systems product category (FTRZ). This category covers products intended for use in metering of utility and nonutility electric power. The primary function of these devices is to monitor power consumption on a building main supply or separate branch circuits. These devices may communicate with other devices by means of power line carrier, satellite/radio frequency, telephone, cable or other means. UL provides a service for the Classification of watt-hour meters for use in metering of utilities that not only meet the appropriate requirements of UL but also have been investigated in accordance with standards or parts detailed below from the American National Standards Institute (ANSI):

- ANSI/NEMA C12.1, Code for Electricity Metering
- ANSI/NEMA C12.10, Physical Aspects of Watthour Meters
- ANSI/ NEMA C12.11, Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
- ANSI/NEMA C12.20, Electricity Meters – 0.2 and 0.5 Accuracy Classes

ENERGY MANAGEMENT EQUIPMENT

Green codes require a building energy management and control system (EMCS) to be provided and integrated with building HVAC systems controls and lighting systems controls to receive an open and interoperable automated demand response (Auto-DR) relay or internet signal. Building HVAC and lighting systems and specific building energy-using components are required to incorporate preprogrammed demand response strategies that are automated with a demand response automation internet software client.

UL lists equipment that energizes or de-energizes electrical loads to achieve the desired use of electrical power under the Energy Management Equipment product category (PAZX) in accordance with UL 916. This equipment normally controls electrical loads by responding to sensors or transducers monitoring power consumption, sequencing, cycling the loads through the use of preprogrammed data logic circuits, or any combination thereof. Devices responding to signals from a utility company may receive the signals over the power lines or as radio signals. Typical loads controlled by this equipment include space heating, air conditioning and lighting.

ELECTRIC VEHICLE CHARGING EQUIPMENT

The IgCC and ASHRAE 189.1 requires parking spaces dedicated for electric vehicles to be provided for the occupants of green buildings. UL lists electric vehicle charging equipment under the product category Electric Vehicle Charging System Equipment (FFTG), in accordance with UL 2202, or electric vehicle supply equipment under the product category Electric Vehicle Supply Equipment (FFWA), in accordance with UL 2594. The FFTG category covers conductive charging system equipment, with a DC output, intended for use with electric vehicles. The equipment can be either off board or on board type equipment. Off-board equipment is intended for indoor or outdoor use; on board equipment is always considered outdoor use. This equipment is rated 600 V or less at the input. The FFWA category covers conductive supply equipment, with an AC output, that is intended to supply power to a vehicle's on board charger. This equipment is always off board and can be intended for indoor or outdoor use. In both categories, the off board equipment is intended to be connected to the vehicle by means of a flexible cable and an electric vehicle connector, and intended for installation in accordance with NFPA 70.

ENERGY EFFICIENCY

The IECC, IgCC, and ASHRAE 189.1 address the need for the effective use of energy through the use of energy efficient equipment. The IgCC requires certain products to comply with ENERGY STAR® requirements.

The ENERGY STAR® program is a voluntary labeling program jointly administered by the U.S. Environmental Protection Agency (EPA) and the Department of Energy (DOE). It was launched in 1992 to help consumers identify products that are more energy efficient.

Effective Jan. 1, 2011, the U.S. Environmental Protection Agency (EPA) requires that all new product submissions from manufacturers participating in the ENERGY STAR® program be reviewed by an EPA-recognized Certification Body (CB), and that qualification testing be performed

under specific criteria. Product qualification requires testing to be performed at EPA-recognized facilities.

UL was one of the first organizations to earn recognition by the EPA as an approved certification body. Recognized certification bodies are required to comply with ISO/IEC 17025 for testing, calibrations and sampling, if they perform those functions, as well as be accredited to ISO/IEC Guide 65 for bodies operating product certification systems.

UL also verifies various products, such as room air conditioners, packaged liquid chillers, refrigerated beverage vending machines, clothes dryers, dehumidifiers, exit signs, ceiling fans, fluorescent lamp ballasts, gas-fired furnaces, refrigerators, dishwashers, and clothes washers for energy efficiency in accordance with specific regulations or standards in the United States and Canada. These regulations and standards include specific test procedures established by AHAM, AHRI, ASHRAE, CSA, and U.S. Department of Energy (DOE). Certified products bear the UL Energy Mark and identify the regulation or standard used to verify compliance. A list of product categories for these verifications is in Appendix A.

Nonregulated electric motors are verified for energy efficiency in accordance with CSA, IEC and IEEE standards under the product category for Electric Motors Verified for Energy Efficiency (ENVR). Electric signs are verified for energy efficiency in accordance with the California Code of Regulations, Title 24, Part 6, Section 148 under the product category for Electric Signs Verified for Energy Efficiency (ENVS).

BUILDING ENERGY RENEWABLE ENERGY SYSTEMS

Some jurisdictions require each building or surrounding lot or building site to be equipped with at least one renewable energy system – solar photovoltaics, wind energy or solar water heating. UL's certifications and services related to renewable energy are covered in UL's **Alternate Energy Application and Marking Guide** at **www.ul.com/markingguides**.

WATER RESOURCE CONSERVATION AND EFFICIENCY

Sustainable codes require a means be established for conserving water used indoors, outdoors and in wastewater conveyance. Specific plumbing appliances are required to limit water consumption. Water treatment devices and equipment are required to limit water consumption and address quality and efficiency.

PLUMBING APPLIANCE ENERGY EFFICIENCY

Household clothes washers listed under the Household Clothes Washers Verified for Energy Efficiency product category (ZZSR) and household dishwashers listed under the Household Dishwashers Verified for Energy Efficiency product category (ZYHZ) are investigated to verify their energy efficiency, and their consumption and efficient use of water.

INDOOR ENVIRONMENTAL QUALITY AND COMFORT

Areas covered by indoor environmental quality and comfort requirements include material emissions and pollutant control, ventilation and filtration requirements, and fuel-fired appliances. .

MATERIAL EMISSIONS AND POLLUTANT CONTROL

An interior environment that is conducive to the health, well-being, and productivity of building occupants and construction personnel is what is intended by all sustainable codes. . People spend over 90 percent of their time indoors where they may be exposed to thousands of airborne pollutants. Products and materials indoors release volatile organic compounds (VOCs) and particles into the air that may negatively affect human health or result in unacceptable odors. VOCs are chemicals that at room temperature can emit from products easily get into the air.

Inadequate ventilation, incorrect filtration, high temperatures, and selection of high emitting products can increase concentrations of some pollutants, leading to indoor air pollution levels up to 1000 times higher than those outdoors. The United States Environmental Protection Agency (U.S. EPA), the American Lung Association, the World Health Organization, and other public health and environmental organizations view indoor air pollution as one of the greatest risks to human health. There may be anywhere from 50 to hundreds of individual VOCs in the indoor air of a building.

What Contributes to Poor Indoor Air Quality?

VOCs — The primary sources of indoor exposure to volatile organic compounds are products used in interior environments including furnishings, building materials, and other household and office products, that can emit thousands of VOCs and particles into the air. Of all the things that can affect indoor air quality, emissions can be the most harmful as they can contribute to a wide range of health effects.

Mold — Moisture problems are another common source of indoor air pollution as they can lead to indoor mold growth. Mold can also emit VOCs and particulates, compromising indoor air quality and leading to negative health effects. Since it is impossible to eliminate mold spores, the best way to reduce the impact of mold on indoor air quality is to prevent or promptly repair the moisture problems that enable mold growth.

Particulates — The particles emitted from products such as furnishings, building materials, and other household and office products are another source of indoor air pollution. Airborne particulates can also come from dirt and dust that is tracked in from outside. Particulates can trigger allergies and other respiratory problems in many people. Installing walk-off mats at doorways and changing air filters regularly are both good strategies to limit these pollutants.

Decreased Ventilation — Most of the buildings in which people spend the majority of their time are tightly sealed and insulated to keep out unconditioned outdoor air. Furthermore, most ventilation systems are designed to bring in very little outdoor air and instead recirculate the indoor air that has already been heated or cooled. While this strategy is effective for minimizing energy costs, it can have a negative impact on indoor air quality.

The Solution: Keep Pollutants Out in the First Place
Improving the quality of indoor air is vital for human health. The USEPA names source control as the best strategy to reduce indoor air pollution and limit chemical exposure. Source control can include selecting products that have been UL GREENGUARD Certified for low chemical emissions. Certified products are listed in the free UL Sustainable Product Guide at http://productguide.ulenvironment.com/QuickSearch.aspx

Using UL GREENGUARD Certified products is among the most effective and easiest ways to help create healthier educational, healthcare, office and home environments. UL Environment's IAQ Management Plan outlines requirements for managing indoor air quality during building construction. It can be used as a supplement to Master Specification Section One. This specification also provides instruction for selecting construction products, construction site management, construction sequencing, HVAC operation during construction, product installation, building flush-out and indoor air quality testing.

UL GREENGUARD Certification Types

UL **GREENGUARD** — A product certification program for low-emitting building materials, furniture, furnishings, finishes, cleaning products, electronics and consumer products. All UL GREENGUARD certified products meet stringent certification requirements and must undergo both annual re-certification and quarterly quality monitoring to ensure ongoing compliance. Certified products are showcased in the free UL Sustainable Product Guide

UL **GREENGUARD Gold**— A product certification program for low-emitting building materials, furniture, finishes, cleaning products, electronics and consumer products used in environments where children and other sensitive populations spend extended periods of time. All UL GREENGUARD Gold certified products meet the stringent UL GREENGUARD Gold certification requirements, including limits outlined in California's Department of Public Health Services Standard Practice for Specification Section 01350, and undergo annual re-certification compliance. Certified products are displayed in the free UL Sustainable Product Guide at http://productguide.ulenvironment.com/QuickSearch.aspx

Products are tested for emissions of formaldehyde, volatile organic compounds (VOCs), aldehydes, respirable particles, ozone and other pollutants using stringent environmental chamber protocols. Specific measurements may vary, based on the requirements of a specific certification program and type of product. Testing takes place in dynamic environmental chambers designed to simulate product use in typical indoor environments. Environmental chamber operation and testing protocols follow scientific principles established by the US Environmental Protection Agency (EPA) and its Environmental Technology Verification Program, the American Society of Testing Materials (ASTM), the state of Washington, Germany's Federal Environment Agency (Blue Angel Program), and other applicable government or industry programs. For technical details, visit the Testing Procedures as presented in the Technical Center at www.comm-2000.com

UL GREENGUARD Gold certified products meet and exceed the California Section 01350 materials emissions specification requirements. The California Section 01350 specification was originally written on behalf of the California Sustainable Building Task Force for the design and construction of the state's Capitol Area East End Complex in 2002 to 2003. Material testing for VOCs was a key element of this specification, requiring materials to meet exposure limits for VOCs

with chronic reference exposure level (CREL) values. The material testing methodology and criteria became known as the “Standard Practice.” UL GREENGUARD product handling, testing and analysis procedures have been harmonized with California Section 01350. In addition, any product certified to the UL GREENGUARD Gold standard meets health-based criteria including one-half of the CA CRELs called out in CA 01350. All UL GREENGUARD Gold certified products meet these requirements and are recognized as suitable for use in all major sustainable building rating systems or codes or any other building program recognizing California Section 01350.

FUEL-FIRED APPLIANCES

Gasketed Fireplace Doors

The 2012 IECC and the 2012 International Residential Code require gasketed doors on wood-burning fireplaces. Gasketed doors cannot be retrofit onto an already-installed factory-built fireplace unless this type of configuration is specifically indicated in the manufacturer’s instructions, as this changes the combustion chamber from an open to a closed type. To date, UL has not investigated and certified such an arrangement.

Some factory-built fireplaces have been evaluated and certified with factory-installed gasketed doors. However, the use of these doors may require a Type HT chimney system, which would be detailed in the manufacturer’s installation instructions.

Gasketed fireplace doors retain more heat within a firebox during the operation of the fireplace as compared to units with nongasketed doors. The increased heat raises the outside surface temperatures of a firebox, which may affect the clearances of the fireplace to combustible materials within walls and floor, and to trim and finish material, such as mantles. Only those fireplaces that have been evaluated with gasketed fireplace doors are identified in the installation instructions.

Factory-built wood-burning fireplaces are certified in accordance with UL 127, the Standard for Safety for Factory-Built Fireplaces, which is consistent with requirements in the International Mechanical Code and the Uniform Mechanical Code. These fireplaces are intended to be installed and used in accordance with the product Listing and the manufacturer’s installation instructions.

Biomass-Burning Appliances

Biomass and pellet stoves and inserts, as covered in IgCC Section 804.1.3, are listed under the Solid-Fuel Type Room Heaters product category (DGAW) in accordance with UL 1482. Solid-fuel-burning air heaters designed for connection to a supply-and-return air duct system are listed under the Solid-fuel-fired Central Furnaces product category (LBHZ) in accordance with UL 391.

Factory-built, manually and/or automatically fueled, solid-fuel-fired hydronic heating appliances and boiler assemblies that burn biomass are listed under the Solid-fuel-fired Hydronic Heating Appliances and Boiler Assemblies product category (KXBW). Biomass water heaters are listed under the Solid-fuel-fired Water Heaters product category (LVHO). Products under both of these product categories are listed in accordance with UL 2523.

ACOUSTICS (SOUND TRANSMISSION)
Some green codes require buildings and tenant spaces to comply with minimum sound transmission class and maximum sound level requirements.

In addition to the fire-resistance ratings, where indicated in the individual designs under the Fire Resistance Ratings product category (BXUV), the Sound Transmission Class (STC) rating is published for those designs where the sound transmission loss (STL) test was also investigated in accordance with ASTM E90. The STC rating applies to the assembly of materials as indicated in the individual designs.

The following products have been investigated by UL in accordance with ASTM E90 and/or ASTM E492, where indicated in the individual Classifications:

- Suspension systems for ceiling membrane materials, direct or indirect supporting members for surfacing materials and support members for glazing in the Framing Members product category (CIKV)
- Concrete units, blocks and panels in the Precast Autoclaved Aerated Concrete Blocks product category (CFMW)
- Noncombustible panels used as a combination subfloor and underlayment in the Structural Cementitious Floor-sheathing Panels product category (CIYX)

Precast autoclaved aerated concrete is a lightweight precast building material with a uniform cellular structure intended for use in floor, roof and wall assemblies. Structural cementitious floor-sheathing panels are intended to be installed over cold-formed steel framing in interior locations.

The Sound Transmission Class (STC) is determined by ASTM E90. The STC is published as a single number (such as 50) and is applicable to the assembly of materials noted in the designs in the individual Classifications.

The Impact Insulation Class (IIC) is determined by ASTM E492. The IIC is published as a single number (such as 28) and is applicable to the assembly of materials noted in the designs in the individual Classifications.

Where indicated in the individual Classifications of acoustical materials under the Acoustical Materials product category (BIYR), these Classified products have been investigated to ASTM E423, ASTM E1414, and/or ASTM E1111. The Classifications are confined to the materials themselves and to the methods of application indicated and do not pertain to the structures in which the materials may be installed.

The noise reduction coefficient (NRC) is determined by ASTM C423. The NRC is published as a single number, such as 0.60.

The ceiling attenuation class (CAC) is determined by ASTM E1414. The CAC is published as a single number such as 32.

The articulation class (AC) is determined by ASTM E1111. The AC is published as a single number such as 170.

APPENDIX A: UL PRODUCT CATEGORIES FOR THE IgCC AND IECC

UL certifies products and continues to develop new product categories to address sustainability issues, without compromising safety. Below is a list of product categories in which UL certifies products suitable for the IgCC and IECC. Each product category is tabulated with a UL Category Code or a link to a certification database. By clicking on the code, you will be linked to the UL Guide Information for the category and any Listings or Classifications under that Product Category in the UL Online Certifications Directory at **www.ul.com/database**. The UL Guide Information may provide information or a link to additional safety related UL Guide Information.

Information on validated and certified products addressing the requirements in Sections 304.1, 503.2.3, and 508.3 of the IgCC is located in UL Environment's Database of Validated and Certified Products, at **www.ulenvironment.com/database**. This online tool allows users to quickly sort and identify products by product category, company name, product name or type of claim. This database also includes products evaluated to ENERGY STAR® requirements.

For more information and to view a complete list of certified products for product emissions, visit **www.greenguard.org**.

Category Code	Category Name	Standard Used
	CONSTRUCTION	
TGFE	Roof coverings	ASTM C1549 & ASTM C1371
	MATERIAL RESOURCE CONSERVATION AND EFFICENCY	
SCKG	Commercial Refrigerant Recovery/Recycling Equipment	**UL 1963**, Clean Air Act, Title VI, Section 608
QVBC	Commercial Refrigeration Recovery/Recycling Equipment Certified for Performance Characteristics in Accordance with the United States Clean Air Act	40CFR82.158 Clean Air Act, Title VI, Section 608
YXMTC	Exhaust Cleaning and Recycling Assemblies for Commercial Kitchen Exhaust Systems	ULC-S647
SCIJ	Commercial Refrigerant Recovery Equipment	**UL 1963**, Clean Air Act, Title VI, Section 608
VBIE	Solvent Distillation Units	**UL 2208**
VBFY	Solvent Distillation Units for Use in Hazardous Locations	**UL 2208**
GLET	Halon Recovery/Recharge Equipment	**UL 2006**
OOLR	Compact fluorescent lamps (single-ended pin-base and screw-base) (Self-Ballasted Lamps and Lamp Adapters)	**UL 1993**

ENERGY CONSERVATION, EFFICIENCY AND ATMOSPHERIC QUALITY		
ENVR	Electric Motors Verified for Energy Efficiency, Nonregulated, Certified to IEEE, CSA or IEC Standards	CSA C390, CSA C747, IEC 60034-2-1, ANSI/IEEE 112, IEEE 114
ENVS	Electric Signs Verified for Energy Efficiency in Accordance with California Code of Regulations, Title 24, Part 6, Section 148	CCR, Title 24, Part 6, Section 148
ZWAA	Products Verified for Energy Efficiency in Accordance with United States Regulations or Standards	
ZWAT	Air Conditioners, Room Verified for Energy Efficiency	10CFR430 Appendix F
ZWBN	Packaged Liquid Chillers Verified for Energy Efficiency	AHRI 550/590
ZWHP	Dehumidifiers, Refrigeration Type Verified for Energy Efficiency	AHAM DH-1, 10CFR430 Appendix F
ZWKG	Electric Motors Verified for Energy Efficiency	US DOE 10CFR431
ZWKL	Electric Motors for Use in Hazardous Locations Verified for Energy Efficiency	US DOE 10CFR431
ZWMR	Fluorescent Lamp Ballasts Verified for Energy Efficiency	10CFR430 Appendix Q
ZWQL	Heating & Cooling Equipment Verified for Energy Efficiency	10CFR430 Appendix M
ZWRP	Ice Makers Verified for Energy Efficiency	AHRI 810, AHRI 820, and 10CFR431.136
ZXIX	Refrigerators, Commercial Verified for Energy Efficiency	AHRI 1200 and ASHRAE 72
ZXJL	Refrigerators, Freezers & Wine Chillers, Household Verified for Energy Efficiency	US DOE 10CFR430 Appendix A1 and ANSI/AHAM HRF-1
ZXTH	Water Heaters, Electric Storage Tank Verified for Energy Efficiency	US DOE 10CFR430 Appendix E
ZYAA	Products Verified for Energy Efficiency in Accordance with Canadian Regulations or Standards	
ZYAT	Air Conditioners, Room Verified for Energy Efficiency	CAN/CSA-C368.1
ZYBU	Packaged Liquid Chillers Verified for Energy Efficiency	CSA-C743
ZYDI	Beverage Vending Machines, Refrigeration Type Verified for Energy Efficiency	ASHRAE 32.1
ZYFX	Clothes Dryers, Household, Electric Verified for Energy Efficiency	CAN/CSA-C361
ZYHM	Dehumidifiers, Refrigeration Type Verified for Energy Efficiency	CAN/CSA C749
ZYKH	Electric Motors Verified for Energy Efficiency	CSA C390 or CSA C747
ZYKN	Electric Motors for Use in Hazardous Locations Verified for Energy Efficiency	CSA C390 or CSA C747
ZYLC	Exit Signs Verified for Energy Efficiency	CSA C860
ZYMA	Fans, Ceiling Suspended Verified for Energy Efficiency	CSA-C22.2 No. 9.0

ZYMV	Fluorescent Lamp Ballasts Verified for Energy Efficiency	CAN/CSA-C654
ZYOD	Furnaces, Gas- & Oil-fired Verified for Energy Efficiency	CGA-2.3
ZYQL	Heating & Cooling Equipment Verified for Energy Efficiency	CSA-C656
ZYRR	Ice Makers Verified for Energy Efficiency	CAN/CSA-C742
ZYWX	Lamps, General-service Fluorescent Verified for Energy Efficiency	CAN/CSA-C819
ZYXA	Lamps, Incandescent Reflector Verified for Energy Efficiency	CAN/CSA-C862
ZYXE	Lamps, Self-ballasted Compact Fluorescent & Ballasted Adapters Verified for Energy Efficiency	CAN/CSA-C861
ZZED	Transformers, Distribution, Dry & Liquid-filled Types Verified for Energy Efficiency	CSA C802.2
ZZKM	Ranges, Household Electric Verified for Energy Efficiency	CAN/CSA-C358
ZZLG	Refrigerators, Commercial Verified for Energy Efficiency	AHRI 1200 and ASHRAE 72
ZZLI	Refrigerators, Freezers & Wine Chillers, Household Verified for Energy Efficiency	CSA-C300
ZZTH	Water Heaters, Electric Storage Tank Verified for Energy Efficiency	CAN/CSA-C191
FTRZ	Energy metering and monitoring for electricity, gaseous fuels, liquid fuels, and renewable energy consumption	UL 916, NEMA C12 standards
PAZX	Energy management equipment	UL 916
FFTG	Electric vehicle charging equipment	UL 2202
FFWA	Electric vehicle supply equipment	UL 2594
GQHG	HVAC system controls	UL 1917
XAPX	Programmable thermostats	**UL 873**
LZTW	Energy recovery devices (Ducted Heat Recovery Ventilators)	UL 1812
LZUU	Energy recovery devices (Non-ducted Heat Recovery Ventilators)	**UL 1815**
WATER RESOURCES CONSERVATION AND EFFICIENCY		
FDQD	Drinking Water Treatment Units	NSF 42, NSF 44, NSF 53, NSF 55, NSF 58, NSF 62, NSF 177
ZZSR	Clothes Washers, Household Verified for Energy Efficiency	CAN/CSA-C360
ZYHZ	Dishwashers, Household Verified for Energy Efficiency	CSA-C373
INDOOR ENVIRONMENTAL QUALITY AND COMFORT		
AGGZ	Air filters (construction phase) (Electrostatic Air Cleaners)	**UL 867**
AJZV	Air filters (construction phase) (Air Filter Units)	**UL 900**
AKNT	Air filters (construction phase) (High-Efficiency, Particulate, Air Filter Units)	**UL 586**
ALEV	Air filters, mechanical	**UL 900**

AGGZ	Air filters. electrostatic	**UL 867**
AJZV	Air filters (ducted space conditioning)	**UL 900**
AKNT	Air filters, high efficiency	**UL 586**
DEAZ	Wood stoves and wood fireplace inserts (Solid-Fuel Type Room Heaters)	**UL 1482**
DEET	Factory-Built Fireplaces	**UL 127**
DEAQ	Fireplace chambers	**UL 127**
DGAW	Biomass stoves and inserts (Room Heaters, Solid Fuel Type)	**UL 1482**
DGAW	Pellet (biomass) stoves and furnaces (Solid-Fuel Type Room Heaters)	**UL 1482**
KXBW	Solid Fuel-Fired Hydronic Heating Appliances, Water Heaters, and Boilers	**UL 2523**
LVHO	Solid Fuel-Fired water heaters	**UL 2523**
LBHZ	Solid-fuel-fired Central Furnaces	UL 391
GREENGUARD Gold adhesives/ sealants	Adhesives and sealants	CDPD/EHLB/Standard Method V.1.1
GREENGUARD Gold paints and coatings	Architectural paints and coatings	CDPD/EHLB/ Standard Method V.1.1
GREENGUARD Gold flooring	Floor coverings	CDPD/EHLB/ Standard Method V.1.1
GREENGUARD Gold ceiling systems	Acoustical ceiling tiles and wall systems	CDPD/EHLB/ Standard Method V.1.1
GREENGUARD Gold insulation	Insulation	CDPD/EHLB/ Standard Method V.1.1
BXUV	Sound transmission (wall assemblies)	**UL 263,** ASTM E90 ASTM E492
CIKV	Sound transmission (wall assemblies) (Framing Members)	**UL 263**, ASTM E90 ASTM E492
CFMW	Sound transmission (wall assemblies) (Fire Tests of Building Construction and Materials)	**UL 263,** ASTM E90 ASTM E492
CIYX	Sound transmission (wall assemblies) (Fire Tests of Building Construction and Materials)	**UL 263**, ASTM E90 ASTM E492
BIYR	Acoustical Materials	ASTM C423, ASTM E1414, ASTM E1111

APPENDIX B: UL PRODUCT CATEGORIES FOR THE ICC 700

UL certifies products and continues to develop new product categories to address the requirements in ICC 700. Each product category is tabulated with a UL Category Code. By clicking on the code, you will be linked to the UL Guide Information for the category and any Listings or Classifications under that product category in the UL Online Certifications Directory at **www.ul.com/database**. These products also have typically been evaluated for safety.

Category Code	Category Name	Standard Used
TGFE	Roof coverings, Solar Reflectance	ASTM C1371 ASTM C 1549
GPRT	Ceiling fans	**UL 507**
UZUW	Solar water heater system (Outline of Investigation for Solar Collectors)	**UL Subject 1279**
UZVY	Solar water heater system Controllers (Outline of Investigation for Solar Collectors)	**UL Subject 1279**
UZWT	Solar water heater system (Energy Transfer Units)	**UL Subject 1279**
UZWW	Solar water heater system Thermal Storage Units (Outline of Investigation for Solar Collectors)	**UL Subject 1279**,
UZWZ	Solar water heater system Alternative-energy Water-storage Tanks and Multi-energy Water Heaters (Household Electric Storage Tank Water Heaters) (Electric Booster and Commercial Storage Tank Water Heaters)	**UL 174**, **UL 1453**
DEET	Factory-built, wood-burning fireplaces (Factory-Built Fireplaces)	**UL 127**
DEAZ	Wood stove and fireplace inserts (Solid-Fuel Type Room Heaters)	**UL 1482**
DGAW	Pellet (biomass) stoves and furnaces (Room Heaters, Solid Fuel Type)	**UL 1482**
CZHF	Carbon monoxide alarms (Single and Multiple Station Carbon Monoxide Alarms)	**UL 2034**
XAPX	Programmable thermostat (Temperature-Indicating and -Regulating Equipment) (Automatic Electrical Controls for Household and Similar Use)	**UL 873**, **UL 60730-1A**
OOLR	Luminaires (lighting fixtures) and lamps (light bulbs)(Self-Ballasted Lamps and Lamp Adapters)	**UL 1993**
SHZZ	Refrigerators, dishwashers, washing machines (Household Refrigerators and Freezers)	**UL 250**
DMIY	Refrigerators, dishwashers, washing machines (Household Dishwashers)	**UL 749**

ZCTT	Refrigerators, dishwashers, washing machines (Electric Clothes Washing Machines and Extractors) (Electric Commercial Clothes-Washing Equipment) (Combination washer-dryers) (Electric Clothes Dryers) (Electric Commercial Clothes-Drying Equipment)	**UL 2157, UL 1206**, **UL 2158**, **UL 1240**
GPWV	Exhaust fans (Electric Fans)	**UL 507**
ZACT	Exhaust fans (Power Ventilators)	**UL 705**
ALLU	Duct insulation materials (Factory-Made Air Ducts and Air Connectors)	**UL 181**
GREENGUARD Gold adhesives/sealants	Adhesives and sealants	CDPD/EHLB/Standard Method V.1.1
GREENGUARD Gold paints and coatings	Architectural paints and coatings	CDPD/EHLB/Standard Method V.1.1
GREENGUARD Gold flooring	Floor coverings	CDPD/EHLB/Standard Method V.1.1
GREENGUARD Gold ceiling systems	Acoustical ceiling tiles and wall systems	CDPD/EHLB/Standard Method V.1.1
GREENGUARD Gold insulation	Insulation	CDPD/EHLB/Standard Method V.1.1

APPENDIX C: SUSTAINABILITY-RELATED CODES AND STANDARDS

This appendix provides a list of the model green construction codes and installation standards, UL Standards and Outlines of Investigations related to green construction, and standards developed by other organizations that are used by UL to evaluate and certify products.

Green products must be installed in accordance with model codes and installation standards. These codes require these products to be listed and labeled in accordance with applicable product standards.

UL sustainability standards are typically identified as Standards for Sustainability and are designed to support a continuing effort to improve and/or maintain environmental quality by reducing energy and materials consumption and by minimizing the impacts of pollution generated by the production, use and disposal of goods and services. Limitations applicable to the products covered by the standard are delineated in the scope section of the Standard. UL Standards are intended to:

- Identify requirements for evaluation of products and provide consistency in the application of these requirements.
- Provide guidance for development of products by manufacturers.
- Provide requirements compatible with nationally recognized installation codes

UL Outlines of Investigation are documents that contain the construction, performance and marking criteria used by UL to investigate a product when the product is not covered by the scope of an existing UL Standard. Outlines are not consensus documents and do not require review by a UL Standards Technical Panel (STP) or other external group.

Comments or proposals for revisions on any part of UL Standards may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's Online Collaborative Standards Development System (CSDS) at **http://csds.ul.com**.

Model Green Construction Codes and Installation Standards	
ASHRAE 189.1	Standard for the Design of High-Performance Green Buildings Except Low Rise Residential
ICC 700	National Green Construction Standard
IECC	International Energy Conservation Code
IgCC	International Green Construction Code
NFPA 3	Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems
UL Standards and Outlines of Investigation	
UL 2821	GREENGUARD Certification Program Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes, and Furnishings
UL 2818	GREENGUARD Certification Program For Chemical Emissions for Building Materials, Finishes and Furnishings
ULE 100	Standard for Sustainability for Gypsum Boards and Panels

ULE 102	Standard for Sustainability for Door Leafs
UL 108	Environmental Claim Validation Procedure (ECVP) for Estimating Energy Savings for Energy Saving Power Strips
UL 126	Sustainability for Plastic Film Products
UL 391	Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces
UL 773	Plug-In Locking Type Photo controls for Use with Area Lighting
UL 773A	Nonindustrial Photoelectric Switches for Lighting Control
UL 916	Energy Management Equipment
UL 1482	Room Heaters, Solid Fuel Type
UL 1598B	Supplemental Requirements for Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires
UL SU 1615	Outline for Refrigerant Heat Recovery Units
UL 1812	Ducted Heat Recovery Ventilators
UL 1815	Nonducted Heat Recovery Ventilators
UL 1963	Refrigerant Recovery/Recycling Equipment
UL 1993	Self-Ballasted Lamps and Lamp Adapters
UL 2006	Halon 1211 Recovery/Recharge Equipment
UL 2523	Solid Fuel-Fired Hydronic Heating Appliances, Water Heaters and Boilers
UL SU 2735	Outline for Electric Utility Meters
UL 2760	Sustainability for Surface Coatings: Recycled Water-borne
UL 2761	Sustainability for Sealants and Caulking Compounds
UL 2762	Sustainability for Adhesives
UL 2763	Sustainability for Energy Efficient Harmonic Cancellation Transformers
UL 2764	Sustainability for Gas-Fired Condensing Hot Water Heating Boilers
UL 2765	Sustainability for Indirect Fired Domestic Hot Water Tanks
UL 2766	Sustainability for Energy Efficient Heating/Cooling Systems for Buildings
UL 2767	Sustainability for Paint and Varnish Remover
UL 2768	Sustainability for Architectural Surface Coatings
UL 2769	Sustainability for Corrosion Protection Control
UL 2770	Sustainability for Commercial Car Wash Services
UL 2777	Sustainability for Hard Floor Care Products
UL 2778	Sustainability for Products Made From Recycled Plastic
UL 2779	Sustainability for Dust Suppressants
UL 2780	Sustainability for Urinal Blocks
UL 2781	Sustainability for Pool and Spa Water Treatment Products
UL 2782	Sustainability for Solid Biofuels
UL 2789	Environmental Claims Validation Procedure for Calculation of Estimated Recyclability Rate
UL 2791	Sustainability for Drain and/or Grease Trap Additives: Biologically-based
UL 2796	Sustainability for Odor Control Products
UL 2799	Environmental Claim Validation Procedure (ECVP) for Zero Waste to Landfill
UL 7001	Sustainability for Household Refrigeration Appliances
UL SU 3200	Outline for Performance Testing of Engine and Turbine Generators

UL 61215	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval
UL 61646	Thin-Film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval
UL 62108	Concentrator Photovoltaic (CPV) Modules and Assemblies - Design Qualification and Type Approval
Other Standards Used for Evaluation	
10CFR430, Appendix A1	"Uniform Test Method for Measuring the Energy Consumption of Electric Refrigerators and Electric Refrigerator-Freezers," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products,"
10CFR430, Appendix E	"Uniform Test Method for Measuring the Energy Consumption of Water Heaters," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products."
10CFR430, Appendix F	"Uniform Test Method for Measuring the Energy Consumption of Room Air Conditioners," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products."
10CFR430, Appendix M	"Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products."
10CFR430, Appendix Q	"Uniform Test Method for Measuring the Energy Consumption of Fluorescent Lamp Ballasts," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products."
10CFR430, Appendix X	"Uniform Test Method for Measuring the Energy Consumption of Dehumidifiers," of U.S. Department of Energy (DOE) Test Procedure 10CFR430, "Energy Conservation Program for Consumer Products."
10CFR431	Energy Efficiency Program for Certain Commercial and Industrial Equipment
10CFR431.136	Energy Conservation Standards and Their Effective Dates
40CFR82.158	Standards for Recycling and Recovery Equipment
AHAM DH-1	Dehumidifiers
AHAM HRF-1	Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers
AHRI 550/590	Performance Standard for Rating of Water-Chilling Packages Using the Vapor Compression Cycle
AHRI 810	Automatic Commercial Ice Makers
AHRI 820	Ice Storage Bins
AHRI 1200	Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets
ASHRAE 32.1	Methods of Testing for Rating Vending Machines for Bottled, Canned, and Other Sealed Beverages
ASHRAE 72	Method of Testing Commercial Refrigerators and Freezers, "CGA-2.3, "Gas-Fired Central Furnaces
ASTM C423	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C1371	Standard Test Method for Determination of Emittance of Materials Near

	Room Temperature Using a Portable Emissometer
ASTM C1549	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E492	Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
ASTM E1111	Standard Test Method for Measuring the Interzone Attenuation of Ceiling Systems
ASTM E1414	Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
CCR, Title 24, Part 6, Section 148	California Building Standards Code; California Energy Code
CSA-C22.2 No. 9.0	General Requirements for Luminaires
CAN/CSA-C191	Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service
CSA-C300	Energy Performance and Capacity of Household Refrigerators, Refrigerator-Freezers, Freezers, and Wine Chillers
CAN/CSA-C358	Energy Consumption Test Methods for Household Electric Ranges
CAN/CSA-C360	Energy Performance, Water Consumption, and Capacity of Household Clothes Washers
CAN/CSA-C361	Test Method for Measuring Energy Consumption and Drum Volume of Electrically Heated, Household, Tumble-Type Clothes Dryers
CAN/CSA-C368.1	Performance Standard for Room Air Conditioners
CSA-C373	Energy Consumption Test Methods and Limits for Household Dishwashers
CSA C390	Energy Efficiency Test Methods for Three-Phase Induction Motors
CAN/CSA-C654	Fluorescent Lamp Ballast Efficacy Measurements
CSA-C656	Performance Standard for Split-System and Single-Package Central Air Conditioners and Heat Pumps
CAN/CSA-C742	Performance of Automatic Ice-Makers and Ice Storage Bins
CSA-C743	Performance Standard for Rating Packaged Water Chillers
CSA C747	Energy Efficiency Test Methods for Small Motors
CAN/CSA C749	Performance of Dehumidifiers
CSA C802.2	Minimum Efficiency Values for Dry-Type Transformers
CAN/CSA-C819	Performance of General Service Fluorescent Lamps
CSA C860	Performance of Internally Lighted Exit Signs
CAN/CSA-C861	Performance of Self-Ballasted Compact Fluorescent Lamps and Ballasted Adapters
CAN/CSA-C862	Performance of Incandescent Reflector Lamps
IEC 60034-2-1	Rotating Electrical Machines - Part 2-1: Standard Methods for Determining Losses and Efficiency from Tests (Excluding Machines for Traction Vehicles)
ANSI/IEEE 112	Standard Test Procedure for Polyphase Induction Motors and Generators
IEEE 114	Standard Test Procedure for Single-Phase Induction Motors
NSF 44	Cation Exchange Water Softeners
NSF 58	Reverse Osmosis Drinking Water Treatment Systems