

WHITE PAPER

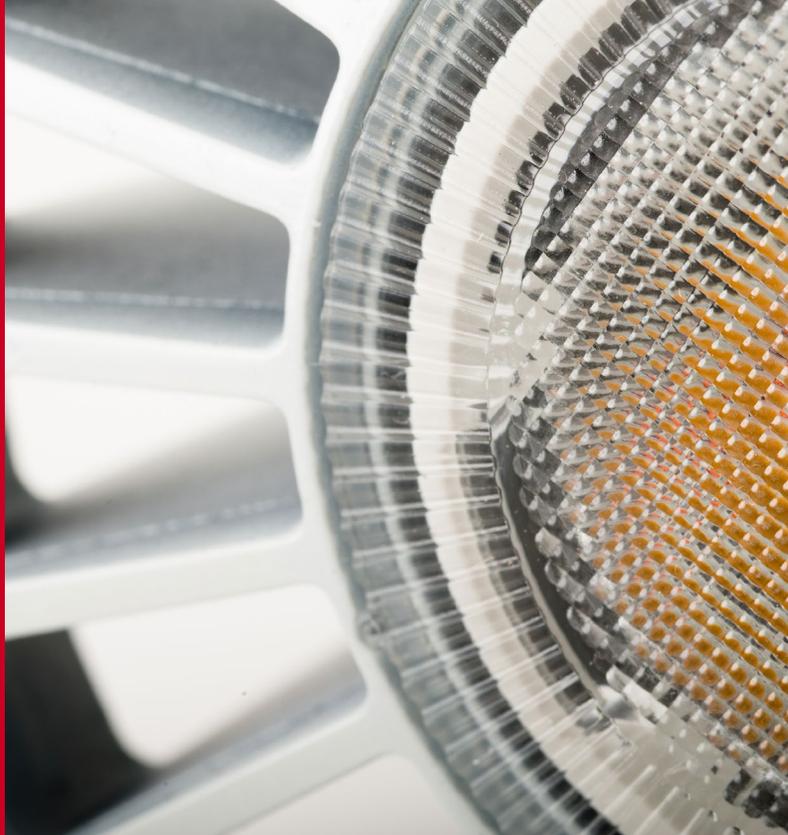
Safety Compliance of Luminaire Retrofits

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Luminaire retrofit kits are simple in concept but complicated in practice due to variable luminaire and kit designs as well as safety considerations. This white paper will provide an overview of the UL Solutions certification programs for luminaire retrofit kits, as well as guidance on the steps that facility owners and operators can take to ensure an efficient and safe luminaire retrofit program.



Understanding luminaire retrofits

As innovation brings new technologies to market, it is often necessary or advisable to introduce retrofit programs as a cost-efficient method of extending the useful life of previously installed equipment. This adaptive approach is exemplified by the emergence of new lighting technologies and the introduction of retrofit kits to upgrade existing lighting fixtures and luminaires.

For example, exit signs have evolved from incandescent to fluorescent lighting technology and then to light-emitting diodes (LEDs), the current dominant technology for most electrical exit signs. The same evolution can be found in luminaires, and, in both cases, retrofit kits have provided facility owners and operators with a path to upgrade lighting technologies through these transitions without the need to abandon existing lighting infrastructure investments.

Predictably, lighting industry stakeholders have different points of view regarding the advantages and disadvantages of lighting and luminaire retrofit kits and programs. Original equipment manufacturers (OEMs) may prefer to sell new equipment rather than have the original equipment modified, considering the rapid advancement in LED lighting capabilities. On the other hand, independent electrical contractors sometimes prefer retrofit programs since they provide customers

access to reliable and efficient LED lighting technologies at lower costs. Facility owners likewise gain flexibility from retrofit programs that allow them to upgrade their properties with minimal workspace disruption. And code authorities, such as local building and electrical inspectors, may prefer simpler retrofit programs that offer fewer variables that require fewer modifications to existing equipment and limit the number of responsible parties involved.

Overall, retrofitting can be an effective method to obtain more time and value out of the existing infrastructure, save on energy costs and reduce the impact on the environment. Retrofitting existing fixtures also provides an opportunity to evaluate the potential benefits of a new technology prior to making a more substantial investment. While changing over from one technology to another can introduce compatibility issues between drivers, arrays and controls, the savings that can be achieved make retrofit programs worthwhile for many facility owners and operators.

Certification of luminaire retrofit kits

One of the most common questions related to the retrofitting of installed luminaires has to do with the certification listing status of previously installed equipment and whether the process of retrofitting an existing fixture voids its prior listing. Retrofitting an installed luminaire with an appropriate UL Certified Retrofit Kit does not impact the original luminaire's Listing. The original UL Certified Mark was applied by the luminaire manufacturer, or OEM, as their attestation that the product met the appropriate UL Standard when it was shipped. The UL certification Mark on the retrofit kit indicates that a representative sample of the kit — including its components and the accompanying installation instructions — has been tested and certified against the applicable UL Standard for use with the identified luminaires. It also indicates that when the kit is installed in accordance with its markings and instructions, the converted luminaire complies with the UL Standard for luminaires. In other words, a lighting retrofit essentially “refreshes” the certification status of a luminaire since any retrofit kit that is installed must be compliant with the current set of applicable product safety requirements and standards.

The more important question to ask is whether a retrofitted product complies with the applicable product safety standards and provisions of the local electrical code. Even the simplest modification to an installed luminaire can create potential noncompliance issues that can significantly affect safety.

The 2014 version of the National Electric Code® (NEC) has adopted a formal definition for retrofit kits and a requirement that retrofit kits for lighting equipment shall be listed. It is important to note that the NEC definition of the term “listing” is different from that used by UL Solutions and other certification organizations. The NEC definition of the term means that an independent agency or testing laboratory has put the product on a “list” that can be referenced as a means of validating a product's compliance with applicable safety standards.



Table 1 provides details on our existing retrofit certification programs for the lighting industry. Note that some retrofit kits are evaluated to the same standard that is applicable to the original lighting product, while others are evaluated according to the requirements of different standards. However, all retrofit kit certification programs take into account compatibility with an installed host luminaire, the interoperability of controls, the reuse of existing components, ongoing maintenance of the retrofitted product and the approval of the retrofitted luminaire by code authorities.

Table 1

Retrofit kit type	Retrofit kit standard	Retrofit kit category	Host luminaire type	Host luminaire standard
Sign conversions, retrofit	UL 879A	UYWU	Electric signs	UL 48
Exit sign retrofit kit	UL 924	GGET	Exit signs	UL 924
Exit sign conversion kit	UL 924	FWCF	Exit fixtures or exit lights	UL 924
Exit fixture to exit light conversions, retrofit	UL 924	FWCN	Exit fixtures	UL 924
Luminaire conversions, retrofit (reflector kits)	UL 1598B	IEUQ	Luminaires	UL 1598
LED luminaire retrofit kit	UL 1598C	IFAR	Luminaires	UL 1598
Luminaire retrofit kit, marine	UL 1598A, UL 1598B	IGSU	Marine luminaires	UL 1598, UL 1598A
LED luminaire retrofit kit, marine	UL 1598A, UL 1598C	IGRR	Marine luminaires	UL 1598, UL 1598A
LED luminaire retrofit kit	UL 1598C	IFAR	Stage and Studio Luminaires	UL 1573
Retrofit low-voltage-luminaire conversion kit	UL 2108, UL 1598B	IFES	Low Voltage Lighting Systems	UL 2108
LED luminaire retrofit kit	UL 1598C	IFAR	Low Voltage Lighting Systems	UL 2108
LED retrofit luminaire conversion kit for commercial refrigerators and freezers	UL 1598C	IFAS	Refrigeration Luminaires	UL 471, or UL 60335-1 and UL 60335-2-89

Safety Standards for luminaire retrofit kits

The first step to help ensure that a retrofit installation is compliant with applicable codes and standards is to make sure that the existing luminaire, as installed, complies with the applicable requirements of the host luminaire standard, such as UL 1598, the Standard for Luminaires. Some retrofit kit installation instructions guide an installer through a basic inspection of a luminaire to determine if any modifications have been made to the fixture or damage occurred that could compromise the compliance of the retrofitted product. In most cases, the presence of an appropriate certification Mark on the luminaire is sufficient to establish that the luminaire has been evaluated for compliance with the appropriate host luminaire standard and incorporates the basic safeguards required for protection against fire, electric shock and mechanical hazards.

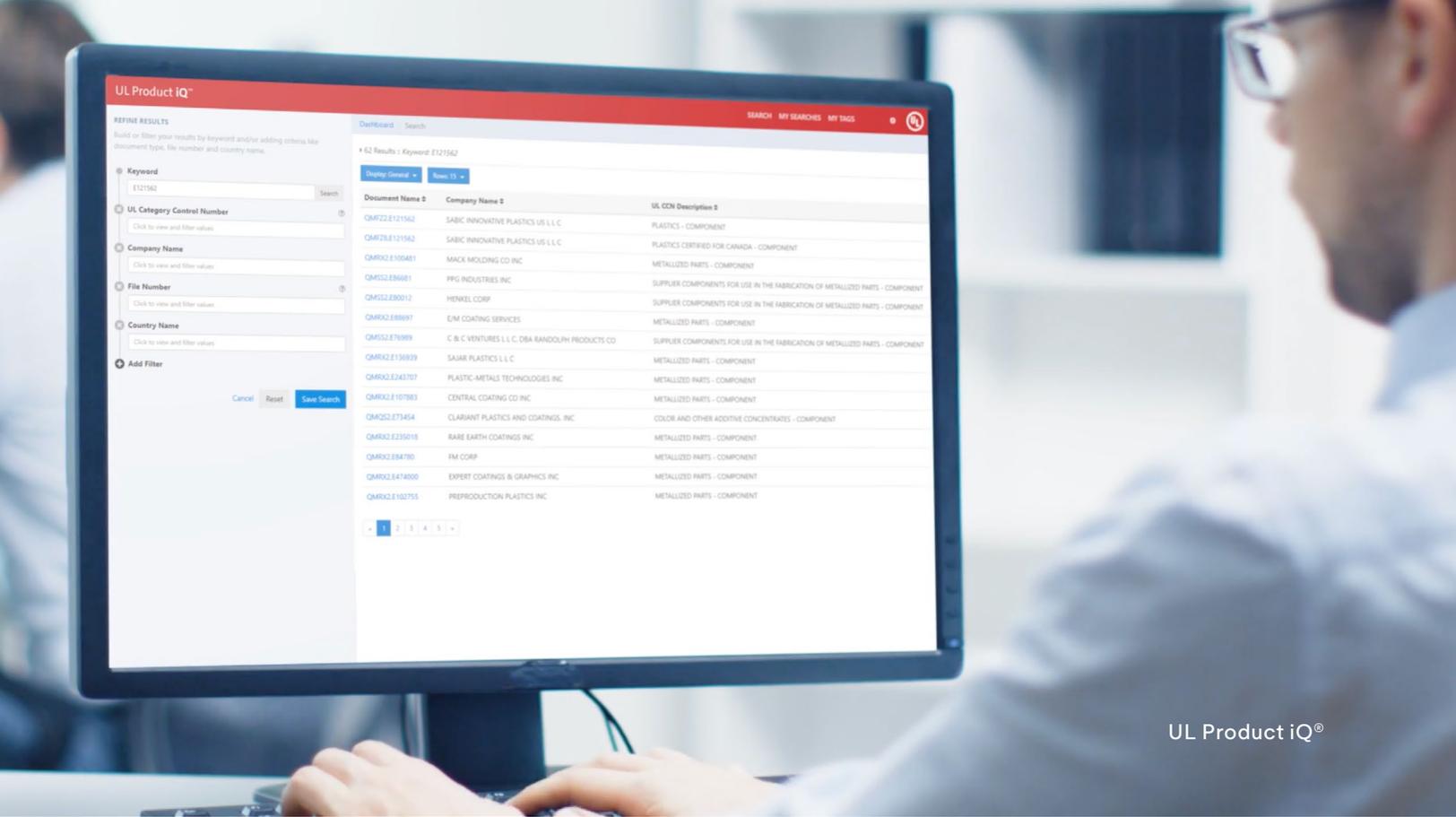
The primary Standard for LED retrofit luminaire retrofit conversion kits, UL 1598C, the Standard for Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits, was initially published on Jan. 16, 2014. It details the safety requirements for a variety of LED luminaire conversion retrofit kits, including retrofit kits for recessed, or can lights, and fluorescent luminaires. UL 1598C also identifies other standards applicable to components used in LED retrofit kits. LED retrofit kit components include but are not limited to LED lamps and arrays, LED control modules, LED drivers, LED power supplies, wiring, lamp holders, brackets, wire connectors, reflectors, diffusers and other associated mechanical, electrical or optical devices. The second edition of UL 1598C was published on Sept. 8, 2023. It further expands the scope to cover more host luminaire types, e.g., low-voltage luminaires, commercial refrigerators and freezers. It also covers LED retrofit kits that facilitate component replacement and/or upgrade of existing LED luminaires. This includes, for example, converting the LED luminaires from non-dimmable to dimmable or from nonconnected to connected; upgrading LED drivers in the luminaires; and adding additional components, e.g., sensors, controllers and emergency battery packs, to achieve additional functions.

The LED lamps included in UL Certified luminaire retrofit kits are evaluated to UL 1993, the Standard for Self-Ballasted Lamps and Lamp Adapters. This Standard includes requirements specific to LED tubular lamps. This Standard differentiates among three different types of LED tube lamps: Types A, B and C.

Type A lamps are the most versatile since they are rigorously tested to determine their compatibility with a wide range of installed fluorescent ballasts that vary in output voltage and frequency. Because this type of lamp does not require any modification to the installed luminaire, it is not a “kit” but instead a Listed device suitable for field installation. However, one downside of Type A lamps is that they are powered from the luminaire’s existing ballast. The age and electrical design of the ballast can lower the potential energy efficiency and reliability of the system.

Type B lamps are very common and retrofitting them typically involves simply bypassing the existing fluorescent ballast and connecting the branch circuit to the existing lamp holders. These lamps are certified as a component only, and certain restrictions regarding their general suitability may exist.

Type C lamps are powered from a remote LED driver that is installed in the luminaire as part of its conversion. Type C lamps are also certified as components only, and typically, some restrictions on their use exist.



UL Product iQ®

Certified retrofit kit selection and installation

UL Solutions maintains a comprehensive online database (productiq.ulprospector.com) that allows visitors to search for Certified LED luminaire retrofit kits. Searches can be qualified based on various luminaire features, such as electrical ratings, install location — e.g., dry, damp — and whether the luminaire is dimmable. Currently, the database lists over 700 companies offering UL Certified LED luminaire retrofit kits, with each company providing detailed information about available retrofit kits and their intended applications.

In addition to the database, UL Solutions also provides additional guidance on luminaire retrofit kits that describes the scope and requirements applicable to the LED luminaire retrofit kits certification category, as well as the certification Mark requirements that identify the types of luminaires for which a given retrofit kit is intended.

Once a visitor has identified specific retrofit kits, they should visit the website of the manufacturer(s) to obtain more detailed information about specific retrofit kits, including access to the installation instructions. Reviewing the installation instructions for a retrofit kit can prove to be an invaluable since it can provide insight into how simple or complex the retrofit installation process may be. This is especially important since differences in the time required to retrofit an existing luminaire can be significant in retrofit projects involving dozens or hundreds of luminaires.

Under UL 1598C, installation instructions must address the following requirements:

Qualified installer

Installation instructions accompanying a retrofit kit must include a specific declaration that the retrofit kit is intended to be installed only by a “qualified” installer who is familiar with the construction and operation of the product and the hazards involved.

Limits of applicability

Installation instructions must state that the retrofit kit is intended for use only with those luminaires described in the installation instructions and that have an electrical rating not less than the retrofit kit itself. This requirement helps to prevent installations in which the original branch circuit is overloaded by the change in the electrical load.

Shunted lamp holders

Installation instructions must specify when the retrofit kit is not intended for use with luminaires with shunted lamp holders.

Illustrations

UL 1598C requires that installation instructions include step-by-step descriptions and illustrations and/or pictures where appropriate.

Parts list

Installation instructions must include a complete list of the parts required to install the retrofit kit.

Examination of original fixture

Finally, installation instructions accompanying luminaire retrofit kits must advise the installer to carefully examine the original fixture and any remaining parts for signs of damage or excessive wear and to replace those parts as needed.

In addition to evaluating a kit’s retrofit instructions, retrofitters should consider the impact of current and planned lighting controls on a retrofitted fixture. Most lighting technologies subject to retrofitting are designed to support the lighting controls in place at the time of their installation. Therefore, confirming that a prospective retrofit kit is compatible with the currently installed or planned daytime controls, dimmers and other devices is important. Look for specific claims of compatibility, known as a “matched pair” relationship, in which the manufacturer and model number of the luminaire, the controller or both are specifically referenced in the retrofit specification sheet.



Lighting Performance

One final consideration in the selection of an appropriate retrofit kit is the required or preferred lighting performance of the retrofitted fixtures. In addition to improving overall energy efficiency or allowing the use of more sophisticated lighting controls, retrofitting luminaires presents an ideal opportunity to balance the overall lighting of a given space. This could mean having a broader light beam spread to provide more balanced and even illumination throughout or a narrower beam spread that can help to reduce light leakage into areas that don't require illumination. Therefore, evaluating whether a given retrofit kit will provide the required photometric performance is important. (Note that UL Solutions safety certification of luminaire retrofit kits does not include an evaluation of its photometric performance.)

UL Solutions retrofit certification programs do not include specific requirements regarding the qualifications of the electrician or technician who is installing a retrofit. Instead, the programs assume that the installer is able to:

- Read and follow the instructions accompanying the retrofit kit
- Follow guidelines established by the National Electrical Contractors Association (NECA) to protect themselves from injury during the installation process
- Understand and apply as appropriate the applicable provisions of the NEC

Therefore, although some locations do impose specific requirements regarding an installer's qualifications, the qualifications of a retrofit installer are usually self-declared.

In the end, the proper and safe installation and operation of a luminaire retrofit kit is primarily a function of following a three-pronged approach that includes:

1. The safety of the original luminaire as confirmed by its UL 1598 certification
2. The safety of the retrofit kit as confirmed by its UL 1598C certification
3. The installer's compliance with the instructions accompanying the retrofit kit, knowledge and application of provisions of the NEC and appropriate practices for de-energizing and locking out lighting circuits before beginning kit installation

Field-applied markings for retrofitted luminaires

Important safety markings are required to be placed on a retrofitted luminaire so that they are readily observable during maintenance. The first is a label that clearly states that the luminaire “has been modified to operate LED lamps.” The purpose of this label is to reduce the likelihood of a user installing a non-LED lamp into a converted luminaire. While such a possibility is not likely to result in a serious electrical incident, it could produce a noise or burst of light that could startle the person installing the incorrect replacement lamp, potentially leading to a secondary injury, such as a fall from a ladder.

The second required label must provide information on the specific type and model of the replacement lamp that has been installed, as well as the manufacturer of the lamp and information on how to obtain lamp replacements.

In addition to these safety markings, instructions are provided that describe the correct electrical supply connections for the lamp holders. These instructions can be provided on an instruction sheet or on a tag affixed to the lamp for use by the installer and are intended to ensure that the converted luminaire has the correct electrical connections to properly power the new LED light source.

The final step: Code authority approval

Commercial retrofit projects are usually subject to a local or state permitting process that involves an inspection by a code authority — typically a local electrical inspector. This inspection usually involves checking for the use of appropriately certified electrical equipment and whether this equipment has been installed in accordance with its ratings and instructions. The use of a UL Certified luminaire retrofit kit will meet the expectations of most parties conducting an inspection. And the use of retrofit kits that have been UL Certified also provides the installer and the code authority with direct access to UL Solutions to answer any questions or resolve any uncertainties in connection with their installation.

Alternatives to using Certified retrofit kits

In some cases, the permitting of luminaire conversion may be delayed due to the use of a non-certified retrofit kit or unaddressed concerns on the part of the code authority. In these cases, UL Solutions can provide a field evaluation of the installed retrofits to assess overall safety or to address code authority concerns. Luminaire retrofits that successfully undergo field evaluation are labeled with a special Field Evaluated Product Label as evidence of compliance with applicable safety requirements.

UL Solutions also offers manufacturers that are authorized to produce UL Certified fluorescent luminaires the option of using all or part of a UL Certified LED retrofit kit to produce certified LED luminaires without the need for additional testing. This option provides luminaire manufacturers with an efficient and cost-effective path to entering the LED luminaire market and provides retrofit kit manufacturers with an additional base of potential customers.

Summary and conclusion

The market for luminaire retrofits will continue to grow as facility owners and operators seek ways to leverage LED and lighting control technologies to reduce energy and maintenance costs. The use of certified luminaire retrofit kits in retrofit projects is required to meet the requirements of code authorities and to help ensure the continuing safety of retrofitted luminaires. UL Solutions maintains a comprehensive publicly available database of luminaire retrofit kits that have been evaluated and found compliant with the requirements of UL 1598C, easing the process of identifying retrofit kits appropriate for specific applications that may also address the requirements of code authorities.

For further information about lighting standards and certification programs for luminaire retrofit kits, visit www.UL.com/lighting or contact the UL Solutions Lighting team at lightinginfo@ul.com.



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