

HAZARDOUS LUMINAIRE SELECTION CONSIDERATIONS

TO SATISFY THE LIGHTING NEEDS OF AN AREA HAVING A HAZARDOUS, POTENTIALLY HAZARDOUS, OR AN ADVERSE ENVIRONMENT, **THE OWNER, RESPONSIBLE INSURANCE COMPANY, AND THE AUTHORITY HAVING JURISDICTION** MUST HAVE CERTAIN KNOWLEDGE AND MUST USE THAT KNOWLEDGE TO DEFINE THE NEEDS OF THE AREA BEFORE SPECIFYING A LUMINAIRE.

Included in this knowledge should be a full understanding of National Electrical Code® (NEC®), National Fire Protection Association (NFPA), Factory Mutual (FM), Underwriters Laboratories Listings (UL Listing), National Electrical Manufacturers Association (NEMA), and other governing body codes and standards and testing procedures. Also, this knowledge must include an awareness and understanding of testing methods and local codes, the physical and chemical properties of the environments, and the testing procedures applicable to the application and product.

With this knowledge, a qualified individual can then begin to determine the proper code(s) and code requirements that a luminaire system for a hazardous or adverse location must meet. Here's a step-by-step summary of certain considerations that the qualified individual should include when making the decision.

CONSIDER THE APPLICABLE CERTIFICATIONS/STANDARDS

Of all the certifications and standards from the organizations mentioned above, the most commonly used are UL Listings. When used in connection with the NEC Classifications of Hazardous Locations, the UL Listing is the key to specifying and selecting the correct luminaire for a hazardous or adverse location. Here is a summary of the tests required by applicable UL Listings and the NEMA 4X Rating.

COMPARISON OF TESTS REQUIRED BY UL

TEST	UL1598	UL1598	UL1598	UL844				NEMA 4X
	(WET LOCATIONS)	(OUTDOOR SALT WATER)	(OUTDOOR SALT WATER)	NEC CLASS AND DIVISION	CLASS I DIVISION1	CLASS I DIVISION2	CLASS II DIVISION1	
HEAT RUN—measures temperatures of ballast, capacitor, socket, customer wire.	X	X	X	X	X	X	X	X
HEAT RUN—measures temperature of lamp.					X			
HEAT RUN—measures temperatures of all external surfaces: without dust with dust				X			X	X
RAIN EXPOSURE—(Wet Locations)		X	X	X	X	X	X	X
EXPLOSION PRESSURE—minimum of 15 explosions using vapor from Group(s) desired.				X				
FLAME PROPAGATION—minimum of 15 explosions using vapor from Group(s) desired.				X				
HYDROSTATIC—pressure of four(4) times max. measured explosion pressure.				X				
DUST PENETRATION—(magnesium dust). 30 hours with 6 heating cycles 10 hours with 2 heating cycles						X		X
DUST BLANKET—(grain dust) measures temperatures of external surfaces.						X	X	
VIBRATION—35 hours				X	X	X	X	
GASKET ACCELERATED AGING—temperature and time equivalent to 50-year life.						X	X	
CORROSION RESISTANCE OF MATERIALS			X					
MOISTURE RESISTANCE—hose down			X					X
DUST BLAST OR ATOMIZED WATER								X
EXTERNAL ICING								X
SALT FOG—corrosion test			X					X

The various UL Listings and NEMA 4X rating cover the following:

- **UL1598—Standard for Safety for High Intensity Discharge Lighting Fixtures**—covers general use in ordinary locations.
- **UL1598, Suitable for Wet Locations**—is for fixtures suitable for installation in rain, locations subject to salt spray, and similar situations.
- **UL1598, Outdoor Salt Water**—requires all UL1598 testing plus other testing for many fixture classifications: Inside type fixtures, Inside dripproof-type fixtures, Inside recessed-type fixtures, Inside dripproof recessed-type fixtures, Outside-type fixtures (freshwater), and Outside-type fixtures (salt water).
- **UL844, Electric Lighting Fixtures for Hazardous Locations**—is used in conjunction with National Electrical Code Classes, Divisions, and Groups of atmospheres for the selection of fixtures for normally and not normally hazardous locations where volatile flammable liquids, flammable gases, and combustible materials may be present in the atmosphere. The **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE** defines the NEC Classes, Divisions, and Groups by Atmospheres and Temperatures.

NEMA 4X Electric Lighting Fixtures for Installation Aboard Ship in Accordance with U.S. Coast Guard Electrical Regulations—indicates that luminaires provide protection from windblown dust and rain, splashing water, external icing, and hose-directed water.

For hazardous locations, the **UL844 Listing is the key to luminaire selection and procedure as follows:**

SELECTING UL844 LISTED LUMINAIRES

If the **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE** calls for the luminaire to be UL844 Listed, the selection process is critical. **THE CLASSIFICATION OF A GIVEN AREA AS TO CLASS, DIVISION, AND GROUP IS SOLELY THE JUDGEMENT OF THE OWNER, RESPONSIBLE INSURANCE COMPANY, AND THE AUTHORITY HAVING JURISDICTION.** And the process of specifying a luminaire type, lamp wattage, lamp type, etc., is an exacting job that requires **THEM** to take the following steps:

- STEP 1.** Determine the normally hazardous or not normally hazardous atmosphere(s) present in the area to be lighted.
- STEP 2.** Use the information from STEP 1 and the **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE** to determine:
 - NEC Class, Division, and Group
 - Location of temperature (exterior and interior) measurement on the luminaire.
 - Limiting temperature value (if specified) in °C.
 - General type of GE luminaire suitable for the application.
- STEP 3.** Determine the maximum ambient temperature in the area to be lighted.
- STEP 4. For NEC Class I, Division 1, Groups C & D, All Class II Divisions and Groups and All Class III Divisions:** Determine the Limiting Value Temperature from the **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE.**

For **NEC Class I, Division 2, Groups A, B, C, and D:** Consult the **TABLE OF COMMONLY ENCOUNTERED HAZARDOUS MATERIALS** to determine the **AUTOIGNITION TEMPERATURES** for any materials that are normally or may be present in the atmosphere of the area to be illuminated.

Note: National Electrical Code® and NEC® are Registered Trademark of the National Fire Protection Association, Inc. Quincy, MA 02269.

STEP 5. Consult the **LUMINAIRE TEMPERATURE PROFILE DATA TABLES** to determine the maximum operating temperature of the luminaire that is UL844 listed for the appropriate NEC Class, Division, and Group. Also make sure that the temperature is measured at the appropriate location stipulated in the **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE** for the applicable NEC Class, Division, and Group.

The importance of this decision cannot be overstated and merits further clarification before proceeding to the next step.

For instance, for Class I, Division 1, All Groups and for All Class II Divisions, and Groups and All Class III Divisions, the maximum temperature, as indicated in the table by "Maximum exterior temp...", is measured on the exterior of the luminaire. The maximum temperature that a given combination of lamp wattage, optical configuration and ballast housing produces while operating in a specific ambient temperature environment **MUST BE LESS** than the Limiting Value specified for that Class, Division and Group.

For Class I, Division 2, Groups A, B, C, and D, the maximum temperature of the luminaire is measured inside the luminaire (usually on the lamp wall surface) as indicated in the table by "Maximum interior temp...". This is because the gases in the area could infiltrate the luminaire, contact the lamp wall, and could ignite or explode if their autoignition temperatures are below that of the lamp wall. These luminaires are not designed to contain the ignition and it could propagate out into the surrounding atmosphere.

THE OWNER, RESPONSIBLE INSURANCE COMPANY, AND THE AUTHORITY HAVING JURISDICTION have the responsibility of selecting a luminaire that has a maximum operating temperature (measured at the appropriate location and in the specified ambient temperature of normal luminaire operation) that is lower than the lowest autoignition temperature of any combustible material in the atmosphere of the area being lighted. Note that different luminaire optical configurations have different maximum temperatures and this should be taken into consideration when making the luminaire selection.

STEP 6. Specify the luminaire type—including lamp type and wattage, optical configuration, and mounting arrangement—that meets the temperature requirements and NEC Class, Division, and Group restrictions; and is listed for that NEC Class.

Now determine the number of luminaires needed to produce the desired lighting level.

Here are some examples of how the OWNER, RESPONSIBLE INSURANCE COMPANY, AND THE AUTHORITY HAVING JURISDICTION (the "Authority") can use the STEP-BY-STEP method to specify a luminaire having a UL844 listing for lighting a hazardous location.

EXAMPLE 1. LIGHT A STORAGE SHED CONTAINING PROPANE TANKS.

STEP 1. Because the propane is stored in closed containers and will not be used in the area, the Authority, absent other factors, might classify the area as "Not Normally Hazardous" under the NEC.

STEP 2. Given the Authority's classification, the area fits the NEC Class I, Division 2, Group D with a maximum ambient of 40°C and the maximum operating temperature is measured on the interior of the luminaire.

—GE H2 Filtr•Gard® luminaires are suitable

STEP 3. The maximum ambient temperature in the shed is 40°C.

STEP 4. Autoignition Temperature of Propane is 450°C

STEP 5. From the Luminaire Temperature Profile Data, the maximum luminaire operating temperature measured on the interior of the luminaire is Temperature Code T2A/300c for 175 watt metal halide in a large globe and guard (Type **FG**) and Temperature Code T2A/280°C for 150 watt high pressure (HPS) in a large globe (Type **FG**).

STEP 6. Because the maximum interior temperature of the luminaire with applicable lamp type or wattage is below the autoignition temperature of propane, Filtr•Gard luminaire with a globe and guard and the reflector designated in the Luminaire Temperature Profile table might be specified for use in the storage building.

All that now needs to be done is to specifically select the lamp type, lamp wattage and optical configuration for the H2 Filtr•Gard luminaire that will light the area to the desired level in the most cost effective manner.

EXAMPLE 2. LIGHT A COVERED GASOLINE PUMPING AREA.

STEP 1. Because the gasoline is pumped in the area, it could be present in the atmosphere and therefore the Authority might classify the area as "Normally Hazardous" under the NEC.

STEP 2. Given the Authority's classification, the area fits the NEC Class I, Division 1, Group D with a maximum ambient of 40°C and the maximum operating temperature is measured on the exterior of the luminaire.

STEP 3. The maximum ambient temperature in the shed is 40°C. GE Powr•Gard® H9 luminaires are suitable

STEP 4. Note the Limiting Value from **SUMMARY OF HAZARDOUS ATMOSPHERES TABLE** is 280°C.

STEP 5. From the Luminaire Temperature Profile Data, the maximum luminaire operating temperature as measured on the exterior of the luminaire is 160°C (Temperature Code T3C) for 250 watt metal halide in a globe and guard (Type JJ) with or without specific reflectors and 160°C (Temperature Code T3C) for 250 watt high pressure sodium (HPS) in a globe and guard (Type JJ) with or without specific reflectors.

STEP 6. Because the maximum exterior temperature of the luminaire with any applicable lamp type or wattage up to 250 watts is below Limiting Value, any Powr•Gard luminaire with up to 250 watt lamps and the reflector designated in the Luminaire Temperature Profile table can be specified for use in the pumping building.

All that needs to be done is to specifically select the lamp type, lamp wattage and optical configuration for the H9 Powr•Gard luminaire that will light the area to the desired level in the most cost effective manner.

SELECTING UL1598 LISTED AND NEMA 4X LUMINAIRES.

If an application calls for lighting systems with UL1598, UL1598 Suitable for Wet Locations, luminaire selection is relatively easy. Just look in this lighting catalog to see which luminaire has the appropriate listing or certification and place the order.

Where non-hazardous corrosive atmospheres are present, luminaires must meet UL1598 Outdoor Salt Water (formerly UL595) Listing and/or NEMA 4X Rating. Typical corrosive atmospheres can include: acids (nitric, hydrochloric, sulfuric, etc.), bases (soda caustic, caustic potash), gases (chlorine, sulfur dioxide, etc.), salts, and other adverse atmospheres such as steam, salt water, and dust which are common by-products of many chemical and manufacturing facilities such as refining, ceramic making, metal finishing, plating, fertilizer production, paper and pulp plants, ore conversion operations, etching, etc.

For these applications, a luminaire constructed of reinforced non-metallic materials having no exposed exterior metal surfaces is the best choice. Consider the GE Perma•Gard® luminaire, which combines these features and the appropriate UL1598 Listing and NEMA 4X Rating.