UL and CSA Requirement for LED Tubes and LED Bulbs



Version and Validation

- UL effective date: December 4, 2012
- UL transition period to: December 4, 2015



Association of Standardization and Certification NMX-J-578/1-ANCE Second Edition



CSA Group CSA C22.2 No. 1993-12 Second Edition



Underwriters Laboratories Inc. UL 1993 Fourth Edition



Enclosure Requirement

- Opening < 2mm wide, unless no live parts is accessible
- No opening is allowed for lamps for wet location
- Complied with UV test if use in wet location
- A device with a polymeric enclosure and marked for use in wet locations shall comply with the cold impact test (-35 °C)
- Glass is OK to use if pass the drop test
- LED driver for tubes needs to apply to FKSZ2 if it is manufactured by separate manufacturer
- LED driver needs not to comply with Class 2 or LVLE if the enclosure material is adequate



Enclosure Requirement

No live parts to be touched by test finger





Enclosure Requirement

CTIC HWId HAIe Flammability Environmental classification^b rating PLCf PLCf PLCf Minimum Minimum Minimum volts seconds seconds 5-VA, 5-VB, Dry location 4 100 _ _ V-0 Damp location 5-VA, 5-VB, 175 3 _ _ _ _ V-0 5-VA, 5-VB, 2 Wet location 250 _ _ _ V-0 5-VA, 5-VB 2 15 3 30 Any _ _ V-0, VTM-0 7 4 15 3 Any _ _

Flammability and other indexes for enclosure:

LED lens and diffuser flammability ratings:

Power Source	Class 2 ^a	Isolated, non-Class 2 ^b	Direct connected
Enclosure type needed	None	Fire	Fire and electrical
Integral LED Lens	Not defined	V1	V1
Other lenses and diffusers	Not defined	V0 ^c	V0



Constructional Requirement

- Transformer above Class 105 shall complying with UL 1446 insulation system requirement.
- If the transformer is Class B or above, and the power has epoxy inside, the epoxy needs to be in the insulation system as well.

Device base	Maximum weight, ^{a,c}	Maximum moment, ^{a,b}
	kg (lbs)	N·m (in-lbs)
E12 (Candelabra)	0.50 (1.15)	0.60 (5.54)
E17 (Intermediate)	0.75 (1.63)	0.09 (7.85)
E26 (Medium), GU10, GU24	1.15 (2.5)	1.35 ^c (12)
E39 (Mogul)	1.70 (3.75)	2.05 (18)

Weight and moment limitations of bulbs :



Constructional Requirement

Weight of tube:

- 0.2 kg (7 oz or 0.44 lbs) when using a G5 base
- 0.5 kg (17.6 oz or 1.1 lbs) when using a G13 base

Length of tubes:

Lamp diameter in 1/8 inch (mm) / length feet	Common wattage designation	Base Designation	Lamp Length - base face to
(inch (mm)
T12 (38 mm)			
2	24	G13	23.2 (590)
3	30	G13	35.2 (895)
4	40	G13	47.2 (1199)
T8 (25 mm)			
2	17	G13	23.2 (590)
3	25	G13	35.2 (895)
4	32	G13	47.2 (1199)
5	40	G13	59 (1500)
T5 (16 mm)			
1	8	G5	11.3 (288)
1.5	15	G5	17.2 (437)
2	18	G5	21.6 (549)
T5HO (16 mm)			
2	24	G5	21.6 (549)
3	39	G5	33.4 (849)
4	54	G5	45.2 (1149)
5	80	G5	57 (1449)

Constructional Requirement

If two unused contacts are in a single lamp base, the contacts shall not be connected (short-circuited) together.

Conflicting with TUV requirement

LED used in bulb shall not be provided with shunt devices that would handle the current in the event the LED had open-circuited.



Electrical Requirement

- Safety voltage limit:
 - 30Vac or 42.4Vp or 42.4Vdc
 - Half of the values above for wet location
 - But UL accept 60Vdc for both usUL and ULc
- For LED bulbs or tubes with input of 150V or above, shall be provided with protective earthing or be double insulated





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Electrical Requirement

Safety voltage limit:

• 30Vac or 42.4Vp or 42.4Vdc

Single input:



Spacing Requirement

- The spacing between Class 2 circuit to enclosure is no need to check
- Spacing between live parts and enclosure:

Location Type	Potential, V ^a	Minimum spacing, mm (in)	
		Through air or over surface	
Dry or damp	300 or less (425)	1.2	(0.046)
Dry or damp	301 - 600 (426 - 846)	3.2	(0.125)
Wet	Less than 600 (848)	4.8	(0.187)

Spacing on PCB (can be replaced by Hipot Test):

	Maximum voltage between parts, Vrms (Vpeak=1.4 Vrms) [through air/over surface distance]				
	0 - 50	51 – 150	151 – 300	301 – 450	451 - 600
Locations	Dimensions in millimeters (inches)				
For Dry and Damp Locations: Live parts reliably positioned AND insulator CTI < 600 (PLC = 3 or 4); examples: adjacent foils on printed wiring board or lead wires of a transistor or diode to its mounting ^d	0.2/1.2 (0.008/0.045)	0.5/1.6 (0.020/0.065)	1.5/3.0 (0.060/ 0.120)	2.25/4.5 (0.090/ 0.175)	3.0/6.1 (0.120/ 0.250)
For Wet Locations: Live parts reliably positioned AND insulator CTI < 600 (PLC = 3 or 4); examples: adjacent foils on printed wiring board or lead wires of a transistor or diode to its mounting ^f	0.2/1.9 (0.008/0.075)	0.5/2.7 (0.020/0.110)	1.5/4.7 (0.060/ 0.185)	2.25/7.1 (0.090/ 0.280)	3.0/9.5 (0.120/ 0.375)



Input Test

- Input current: <110% of rated current
- Input power (if mark): <110% of rated power plus 0.5W</p>
- Input power factor (if mark): > rated P.F.

P.F. = (input voltage) x (input current)



Safety for LED Tubes and Bulbs Ы

Leakage Current Test

Limit and Test Method:

Type of ballast	Maximum measured voltage ^a	Maximum leakage current, Meter Indication Units (MIU) ^b
AC	150 volts or less	0.5 MIU
AC	greater than 150 volts	0.75 MIU _c





Dielectric Voltage-Withstand Test

- Input to accessible non-current-carrying metal
 - 2U +1000V for 1 minute
 - Twice if Double Insulated
- For Low Voltage Lamp (<30V)</p>
 - 500V for 1 minute



Temperature Test

- Bulb test with base up, unless otherwise specified
- Tubes tested in both a horizontal and vertical orientation

Limit:

Item	Components	Maximum °C, thermocouple method	Maximum °C, rise of resistance method
1.	Capacitor	a,b	
2.	Fuses	90	
3.	Coil insulation systems	b, e	
	Class 105 insulation systems	90/95 ^f	95
	Class 130 insulation systems	110/120 ^f	120
	Class 155 insulation systems	135/140 ^f	140
	Class 180 insulation systems	150/165 ^f	165
4.	Potting compound	С	
5.	Printed-wiring boards	a, b	
6.	Internal wiring	а	
7.	Soldered joint of a resistance ballast	150	
8.	Lamp base without an integral starter	150	
9.	$\forall \mbox{ulcanized fiber employed as electrical insulation for other than coil systems}$	90 ^d	
	Surfaces		
10.	Any outer polymeric surface	a, b	

f: For coil assemblies weighing 250 g (0.5 lbs) or less

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Temperature Test

Test box for bulbs:

- A device exceeding the diameter of the test box shall have temperatures measured with the device mounted on a draft-free bench.
- Cover with a 3mm thick lens unless otherwise marked



203 mm (8 NCH) DIAMETER AND

280 mm (11 INCH) DEEP

Temperature Test

- Test box for tubes:
 - Test with glass completely closed





Abnormal Test

Misapplication of supply connections test:

- From either side of lampholder
- Test voltage: 120Vac, 277Vac, 347Vac (for Canada), 24Vdc
- Single component fault tests
- Supply AC voltage to DC lamp



Dimming Test

If marked with suitable for dimming:

- Comply with Temperature Test when dimmer is used
- No risk when connecting to half-wave rectified supply
- No risk when connecting to a phase-cut type dimmer:





Mechanical Test

Drop test

- Drop 0.91 m onto a hardwood surface for 3 times
- Glass break is OK if no live part is accessible
- Glass break is Not OK for wet location product

Deflection test

- Apply a force of 89 N (20.0 lbf) by a 12 mm (0.472 in) diameter rod with a hemispherical end
- Only for devices having enclosures consisting of two molded pieces that snap together.



Thanks a lot.....

