UL 2161

This is the current Underwriters Laboratories safety standard which details the minimum requirements for Neon Transformers and Electronic Neon Power Supplies, in conjunction with UL 48 (the standard for signs) needed to comply with the 1999 National Electrical Code.

In order to comply with UL 2161 requirements for Secondary Ground Fault Protection (SGFP), certain types of neon transformers must incorporate a Secondary Ground Fault Interrupter (SGFI), which will detect a secondary ground fault and interrupt the high voltage output.

One feature in UL 2161 is the provision that an "automatic reset" is permitted. If included, it may attempt to reset up to three times within a ten second period. A service bypass button is also permitted. This feature will aid the service technician in trouble shooting secondary side installation problems by temporarily disabling the SGFI protection for up to 30 minutes.

UL 2161 permits the following SGFI exemptions: electrode housing style transformers (PBKM type); isolated output transformers with a maximum output voltage of 7,500 volts; all transformers with maximum outputs of 15 mA or less; 30 mA rated neon transformers with an output voltage to ground of less than 3,001 volts at 100 hertz or less (your typical 6,000 V. transformer or smaller); neon power supplies rated 30 mA with an output voltage to ground of less than 2,001 volts greater than 100 hertz. Note: All 60 mA products must have SGFI regardless of output voltage unless they are PBKM type.

Transformer Application Data

There are many factors affecting transformer life. The two most important are heat (temperature) and moisture. This operating temperature, in turn, depends on the correct selection of size and current, load, and its proper mounting and installation.

The following are some common sense recommendations intended to minimize heat buildup and extend service life:

- Transformer boxes or sign enclosures should be well ventilated. As long as minimum electrical spacing requirements are met, the transformer should be mounted directly to the metal bottom of the enclosure with one or more flat surfaces touching against the sides of the metal enclosure so as to promote heat dissipation through conduction.
- When installed in an outdoor exposed (wet) location, provide drain holes and elevate the transformer from the bottom.
- Do not place a transformer enclosure in a location where it is subject to standing water or flooding.
- Do not "double nut" the transformer.
- Long lengths of high voltage cable (GTO) should be avoided.
- Use a currently published luminous tube footage chart recommended by the transformer manufacturer being used. Follow their recommendations and avoid over or under sizing transformers.
- Only one high voltage cable (GTO) should be placed in a single conduit.
- Make sure the sign (sign enclosure) and the transformer itself, are properly grounded.

Power Consumption

Neon transformer power consumption is measured in a number of ways. The most useful are primary input "amps" and "watts".

Watts

Wattage consumption is based solely on secondary voltage and current (milliamps). It does not change whether the primary input voltage is 120V or 277V, nor does it change if the transformers are normal power factor (NPF) or high power factor (HPF).
The formula to derive watts = V x A x power factor where high power factor is ≥ 95% and normal power factor is approximately 54%.

Amps

Circuits that supply signs and outline lighting systems generally do not exceed 20 amperes (amps). Code restricts the total amount of amps per circuit from exceeding 80%; therefore, a 20 amp circuit cannot have a load to exceed 16 amps.

Upfront cost savings can be realized by using HPF transformers or 277 V. primary input. Line amperage is effectively reduced by half thus cutting the number of circuits required by that percent. For example, a 15,000 V. 30 mA transformer at 120 V. is approximately 4.10 amps, but in 277 V. is 1.78 amps and HPF is 2.10 amps. The reduced load amps allows more transformers per circuit thus fewer circuits overall.

Cost to Operate**

Sec. Volts	mA	Watts*	Hour	Day	Year
15,000	30	243	$0.019	$0.233	$ 85.15
12,000	30	194	0.016	0.186	67.98
9,000	30	146	0.012	0.140	51.16
7,500	30	122	0.010	0.117	42.75
15,000	60	486	0.039	0.467	170.29
12,000	60	389	0.031	0.373	136.31
9,000	60	292	0.023	0.280	102.32
7,500	60	243	0.019	0.233	85.15

*Wattage per brand may vary.

**Cost to operate based on the following assumptions:
1) a day is 12 hours; 2) a year is 365 days; 3) cost per kilowatt/hour $0.08/average.