

AN ELECTRONIC PL LAMP

FIELD OF INVENTION

- 5 The present invention relates to the field of electronic lamps.

BACKGROUND

10 Currently, all 2-Pin G24 PL compact fluorescent lamps (CFLs) are typically low wattage fluorescent lamps which incorporate a starter and use low power factor magnetic ballast to power the lamps. Magnetic ballasts, which are normally installed onto down-light fitting above a false ceiling, are used to regulate and power the flow of current through the CFLs. These combinations of lamp and ballasts are commonly used in either a horizontal or vertical down-light lamp
15 fitting on high false ceilings.

Single or double 2-Pin PL lamps are mounted on or inside a bell reflector in either the horizontal or vertical down-light fitting, and are connected with conventional magnetic ballasts usually mounted at a top of the lamp fitting.
20 Each down-light fitting with the magnetic ballast of power factor of between 0.35 to 0.45 typically consumes high current and generates a lot of heat when the lamps are operational and such magnetic ballasts need to be coupled with an appropriately rated 2-Pin PL CFL lamp to avoid instances of the ballast either over powering or under powering the PL lamp.

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When the PL lamp was first introduced as an energy saving lamp, it was created to replace high energy consumption in incandescent lamps used in down light lamp fittings. Even though the PL lamp used magnetic ballast which had a low power factor of between 0.35 to 0.45, it was still considered as energy
30 saving, and was a commercial success. However, when electronic ballast was introduced and integrated into the commonly used E27 base, down-light fitting also started to use such energy saving lamp which has power factor of about

0.50. However, a shortcoming of using such an energy saving lamp is that it is unable to accommodate multiple lamps in one down-light fitting. The big spiral fluorescent tubes of energy saving bulbs used for down-light bell fitting could not be used for small diameter sized bell reflectors.

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An increase in environmental awareness has led to widespread adoption of energy saving practices. However, replacing the G24 lamp base in a down light fitting with a E27 or GU24 socket is not easy, as the down light is normally installed within a high false ceiling. It is also a costly endeavour to replace the

10 G24 lamp base.

Moreover, it is not feasible to produce a lamp for the E27 or GU24 lamp base with a power factor of between 0.60 to 0.80 due to space constraints when adding components in the lamp housing. In addition, additional components

15 added to a lamp design are likely to adversely affect reliability and cost of the lamp.

Another disadvantage of conventional 2-Pin PL lamps stems from the CFLs having built-in starters which cause such lamps to flicker when in operation with

20 a magnetic ballast and not have instant start capability. Existing magnetic ballasts are usually rated at a power factor of between 0.35 to 0.45, and correspondingly consume high current and generate a lot of heat. This is especially so if energy supply providers supply power at a higher end of the allowable voltages. Additionally, the high current and heat shortens an

25 operational lifespan of the lamps and also causes degradation of wires, connectors, lamp bases and lamp sockets over time.

Existing 2H/2U/3U and full spiral CFLs unfortunately provide poor light luminance distribution on the bell or down-light reflector as the fluorescent tubes

30 obstruct each other during operation since each tube is in a configuration which has portions that run parallel to each other and prevents full transmission of light from the illumination area of each CFL.

Moreover, the 2H/2U/3U fluorescent tubes are also difficult to install and remove due to difficulty in grasping the tubes which have smooth surfaces. The tubes also break easily if not handled properly during removal or installation due
5 to a presence of joints of the 2H/2U/3U tubes near the lamp base which gives rise to an undesirable cantilever effect.

Finally, if only electronic ballast instead of magnetic ballast is used, only a 4-pin PL lamp without starter can be used, as 2-Pin PL CFLs with built-in starter will
10 not function with electronic ballast. This incompatibility causes a lot of undesirable confusion to consumers.

SUMMARY

15 There is provided an electronic PL lamp capable of being mounted to a PL lamp holder. The lamp includes a case able to be mounted to the PL lamp holder at a first end; a case cover able to be affixed to a second end of the case; an electrical circuit mounted to a first face of the case cover, the electrical circuit being able to function as an electronic ballast; and a half spiral fluorescent tube
20 detachably mounted to a second face of the case cover.

The electronic PL lamp may further including a plurality of power connector pegs at the first end of the case. The plurality of power connector pegs may be either 2 or 4 pegs.
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The electrical circuit may be either a printed circuit board assembly or an IC chip. The electrical circuit may also enable electronic starting of the lamp.

Preferably, the half spiral fluorescent tube includes a first coupling portion able
30 to be coupled to a recess which includes a catch on the second face of the case cover. It is preferable that the half spiral fluorescent tube is joint-less. The half spiral fluorescent tube advantageously provides lateral light distribution as the

fluorescent tube has spacings of between 3 to 5 mm. The half spiral fluorescent tube may have a diameter of less than 32 mm as measured from a central axis of the half spiral fluorescent tube.

- 5 It is preferable that the electronic ballast has a power factor greater than 0.6.

The printed circuit board assembly may further include a printed circuit board, power supply wire contacts, electrical components mounted on the printed circuit board, and a second coupling portion for the half spiral fluorescent tube.

- 10 The printed circuit board assembly is preferably located within the case when the case cover is affixed to the case.

The electronic PL lamp may be mounted to the PL lamp holder including a magnetic ballast.

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It is advantageous that a total power factor when using both the electronic PL lamp and the PL lamp holder (either with or without magnetic ballast) is increased compared to using a typical PL lamp together with magnetic ballast. It is also advantageous that current consumption and correspondingly, heat generated is reduced compared to using a typical PL lamp together with magnetic ballast.

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DESCRIPTION OF DRAWINGS

- 25 In order to ensure that the invention may be fully understood and readily put into practical effect, there is provided, by way of non-limitative example-only exemplary embodiments, the following illustrative figures which are referenced by the foregoing description.
- 30 Figure 1 shows an exploded view of a preferred embodiment of an electronic lamp of the present invention.

Figure 2 shows a schematic diagram of a printed circuit board assembly of the electronic lamp of Figure 1.

Figure 3 shows a circuit diagram when the electronic lamp of Figure 1 is connected to a lamp holder without a magnetic ballast.

- 5 Figure 4 shows a circuit diagram when the electronic lamp of Figure 1 is connected to a lamp holder with a magnetic ballast.

DESCRIPTION OF PREFERRED EMBODIMENTS

- 10 There is provided an electronic PL lamp which includes an electronic ballast and has a detachable half spiral fluorescent tube. Such an electronic PL lamp will be described in greater detail together with all advantages which such a lamp provides in the paragraphs that will follow.
- 15 Referring to Figure 1 which shows an exploded view of a preferred embodiment of the electronic PL lamp 20, there is provided the electronic PL lamp 20 capable of being mounted onto a PL lamp holder. The PL lamp holder may have a bell/hemispherical shaped down light fitting and are typically used in either vertical or horizontal configurations in false ceilings. The PL lamp holder
- 20 may be in a configuration of either with or without magnetic ballast.

The lamp 20 includes a case 22 which is able to be mounted onto the PL lamp holder at a first end 24 of the case 22. The case 22 is hollow. A cross-sectional shape of the case 22 as viewed from a second end 26 is shown to be

25 substantially rectangular, but it may also be, for example, substantially circular, substantially polygonal, substantially elliptical, and so forth. The case 22 is made from a thermoset plastic which does not substantially deform subsequent to undergoing high temperature conditions which is possible during use of the lamp 20. The case 22 may include a flared edge 32 at the second end 26 of the

30 case 22. The case 22 also includes a plurality of power connector pegs 44 at the first end 24 of the case 22. The plurality of power connector pegs 44 are for connecting the electronic PL lamp 20 to an electrical power supply via the PL

lamp holder. It should be appreciated that the power supply is in a form of an AC power supply which may pass through a magnetic ballast. The plurality of power connector pegs 44 is either 2 or 4.

- 5 There is also a case cover 28 able to be affixed to the second end 26 of the case 22. The case cover 28 has a shape which corresponds substantially with the cross-sectional shape of the case 22 as viewed from the second end 26. The case cover 28 may have a lip 30 located along the perimeter shape of the case cover 28. The lip 30 of the case cover 28 couples in a snap-fit manner with
10 the flared edge 32 of the case 22 when the case cover 28 is affixed to the second end 26 of the case 22. The case cover 28 may be de-coupled from the case 22 using either a flat-head screwdriver or any object which is able to be wedged in between the case cover 28 and the case 22.
- 15 Alternatively, when the case 22 does not include a flared edge 32 at the second end 26, the lip 30 of the case cover 28 may be where a layer of adhesive is applied such that the case cover 28 may be affixed to the second end 26 of the case 22. In addition, the case cover 28 is also made from a thermoset plastic which does not substantially deform subsequent to undergoing high
20 temperature conditions which is possible during use of the lamp 20. The case cover 28 includes a pair of holes (not shown) for passage of wires. The wires which pass through the holes will be described in greater detail in a subsequent section.
- 25 The lamp 20 also includes a printed circuit board assembly 34 mounted on a first face 35 of the case cover 28. The printed circuit board assembly 34 may be viewed to be an electrical circuit and may be replaceable by an IC chip. Figure 2 shows a schematic diagram of the printed circuit board assembly 34. The printed circuit board assembly 34 includes a printed circuit board 36, a power
30 supply wire contacts 38, a second coupling portion 40 for a half spiral fluorescent tube 46 and electrical components 42 mounted on the printed circuit board 36. The electrical components 42 mounted on the printed circuit board 36

ensure that the lamp 20 operates in a desired manner. The electrical components 42 may include, for example, resistors, capacitors, inductors, and so forth. It should be appreciated that the printed circuit board assembly 34 is able to function as an electronic ballast.

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The printed circuit board assembly 34 is located within the case 22 when the case cover 28 is affixed to the case 22. The printed circuit board assembly 34 includes either additional inductance or additional capacitance which increases a power factor of the printed circuit board assembly 34 when the printed circuit board assembly 34 functions as an electronic ballast. The printed circuit board assembly 34 may have a power factor greater than 0.6. It should be noted that the printed circuit board assembly 34 also enables electronic starting of the lamp 46.

15 In Figure 1, the power supply wire contacts 38 is shown to comprise 2 wires. It should be noted that the power supply wire contacts 38 can also comprise more than 2 wires. When the case cover 28 is affixed to the case 22, the power supply wire contacts 38 form a connection with the plurality of power connector pegs 44 and allows the printed circuit board assembly 34 to be powered when
20 the lamp 20 is connected to an AC power supply.

The printed circuit board assembly 34 is able to be powered by either 99V to 121V for a 110V AC supply (with frequency 60Hz) or 198V to 242V for a 220V AC supply (with frequency 50Hz). The printed circuit board assembly 34 is also
25 able to be used with existing PL lamp fittings which are typically installed with magnetic ballast having a rating of between 6W to 30W. The printed circuit board assembly 34 can also operate with a magnetic ballast of either lower than 8W or higher than 26W by varying the aforementioned parts of the printed circuit board assembly 34.

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The lamp 20 further includes the half spiral fluorescent tube 46 which is detachably mounted on a second face 48 of the case cover 28. The half spiral

fluorescent tube 46 is joint-less and the half spiral tube configuration provides lateral light distribution. The half spiral tube is stronger and ensures a desirable grasp of the tube. As the half spiral fluorescent tube 46 does not include any joint, the installation and removal of the lamp will not cause breakage due to the joint or cantilever effect. The luminance of the lamp is also optimized for lateral light distribution as illumination from the tube 46 is not completely blocked due to the half spiral tube configuration, particularly due to spacings 47 for the tube 46 of between 3 to 5 mm. During production, the half spiral fluorescent tube 46 provides two corner spaces on the case cover 28 and this provides users with a contact area 27 on the case cover 28 to push the lamp 20 into the lamp holder.

The half spiral fluorescent tube 46 is detachably mounted using a first coupling portion 50 of the half spiral fluorescent tube 46 and a recess 52 which includes a catch on the second face 48 of the case cover 28. When the half spiral fluorescent tube 46 is mounted onto the second face 48 of the case cover 28, fluorescent wires 54 of the half spiral fluorescent tube 46 extend through the pair of holes of the case cover 28 such that the fluorescent wires 54 connect to connection contacts of the second coupling portion 40 of the printed circuit board assembly 34 using for example, direct soldering. Alternatively, the fluorescent wires 54 are soldered to over-molded pins 33 of the case cover 28 or pins epoxy cemented to the case cover 28 (not shown). The over-molded pins 33 can then be connected to the second coupling portion 40 using connecting clips. The half spiral fluorescent tube 46 may have a diameter of less than 32 mm as measured from a central axis of the half spiral fluorescent tube.

It should be appreciated that the half spiral fluorescent tube 46 is structurally stronger than 2H/2U/3U tubes and accidental breakage is less likely. In addition, given that an incidence of accidental breakage of the tube is minimised, the occurrence of electrical fires is also minimised. Correspondingly, production yield is also improved when the structurally stronger half spiral fluorescent tubes 46 are used. In addition, the half spiral fluorescent tube 46 is coated with tri-

phosphor which improves a brightness of illumination generated by the half spiral fluorescent tube 46. It should be noted that the detachable half spiral fluorescent tube 46 allows the lamp 20 to be repairable (only in relation to the half spiral fluorescent tube 46).

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In an alternative embodiment where the half spiral fluorescent tube 46 is not detachable from the lamp 20, the first coupling portion 50 of the half spiral fluorescent tube 46 is cemented to the catch 52 on the second face 48 of the case cover 28. In addition, the fluorescent wires 54 extending through the pair
10 of holes of the case cover 28 are soldered to connection contacts of the second coupling portion 40 of the printed circuit board assembly 34. In such an alternate embodiment, the lamp 20 would not be repairable (only in relation to the half spiral fluorescent tube 46).

- 15 The lamp 20 can be connected directly to the AC power supply as the printed circuit board assembly 34 functioning as an electronic ballast can directly power up the half spiral fluorescent tube 46. The lamp 20 can also be connected to a magnetic ballast in an existing PL lamp fitting, and will correspondingly increase the power factor of the lamp 20 to a higher power factor. When the lamp 20 is
20 connected to the PL lamp holder with magnetic ballast, the lamp 20 functions in a manner akin to an inductor.

The lamp 20 is capable of attaining a higher power factor when connected to the magnetic ballast. The lamp 20 is capable of attaining a power factor of more
25 than 0.80. Moreover, the lamp 20 is usable even if the magnetic ballast is rated for higher wattage lamps. In this regard, the lamp 20 is able to replace existing PL lamps used in a typical PL down lamp fitting with magnetic ballast. There are no compatibility issues with regard to the use of the lamp 20 even without changing wire connections/connectors. It should be noted that the high power
30 factor and reduced wattage also prolongs an operational lifespan of the lamp 20 and reduces an amount of heat generated by the magnetic ballast. This

increase in power factor also helps to optimise the power supply provided by the energy supply providers.

Moreover, since the lamp 20 is able to be used without magnetic ballast, there is elimination of a common problem which occurs when magnetic ballasts are used pertaining to how the connector of such ballasts and lamp holder are often degraded/damaged by heat produced by the magnetic ballasts. Doing away with the use of magnetic ballasts minimises the heat being generated and correspondingly reduces air-conditioning loading and consequently, minimises consumption of electricity due at least to a lighter heat load on air-conditioners. In addition, while doing away with the use of magnetic ballasts causes PL lamps with built-in starters to be obsolete, the lamp 20 is able to replace the PL lamps with built-in starters without any compatibility issues.

The printed circuit board assembly 34 functioning as an electronic ballast in the lamp 20 prolongs an operational lifespan of the lamp 20 and reduces waste disposal. As such, the lamp 20 has less of an adverse effect on the environment compared to existing PL lamps.

For normal 10W and 18W PL lamps used with compatible magnetic ballasts, the actual wattage consumed includes power consumed by the magnetic ballast, which has been tested to add up to 12.7W and 19.5W respectively.

During tests for the lamp 20, the wattages produced by a 10W version of the lamp 20 via a direct connection to a 220V AC power supply (without any intermediate magnetic ballast) is 9.2W (with current of 0.065A). In addition, the wattages produced by the 10W version of the lamp 20 when used with 10W and 18W magnetic ballasts amount to 7.7W (with current of 0.041A) and 8.1W (with current of 0.042A) respectively.

Furthermore, the wattages produced by the 15W version of the lamp 20 via a direct connection to a 220V AC power supply (without any intermediate

magnetic ballast) is 14.3W (with current of 0.099A). In addition, the wattages produced by the 15W version of the lamp 20 when used with 10W and 18W magnetic ballasts amount to 10.4W (with current of 0.059A) and 11.4W (with current of 0.061A) respectively. Based on the above test results, it should be appreciated that the lamp 20 consumes less power compared to lamps without the printed circuit board assembly 34 used with magnetic ballast and that the lamp 20 is usable with magnetic ballasts of any rating. It should be noted that the requisite readings as presented above were obtained using a power meter when the various lamps were connected to a power supply. It should also be noted that even though an 18W version of the lamp 20 was not tested, a key aspect of the test results demonstrate that the lamp 20 consumes less power than its rated wattage.

Referring to the test results in the preceding paragraphs, it should be noted that power factor exceeds 0.6 when the lamp 20 is used regardless of whether magnetic ballast is used. When magnetic ballast is used, the power factor can exceed 0.7. It should be appreciated that an increase in power factor consequently reduces current consumption which correspondingly reduces heat generated by lamp 20.

Referring to Figure 4, specifically the circuit diagram, the printed circuit board assembly 34 functioning as an electronic ballast is connected across the fluorescent lamp wires 54 and is capable of being connected in series to existing magnetic ballast 88 in PL lamp fittings at the same wattage but with an increased power factor and with significant reductions in drawn current and heat generated compared to lamps without the printed circuit board assembly 34 used with the magnetic ballast 88. It should be noted that upgrading down-lamp fittings to accommodate the lamp 20 of different power ratings is now possible without any constraints from a rating of the magnetic ballast. It should be noted that Figure 3, specifically the circuit diagram, shows the lamp 20 being connected to a down-lamp fitting without a magnetic ballast. Thus, it should be

appreciated that the lamp 20 is able to be used in a manner as shown in either Figure 3 or Figure 4.

5 It should be noted that the lamp 20 is usable with a power supply circuit disclosed in US 5,578,907, whereby test results indicate that the combination of the lamp 20 and the power supply circuit of US 5,578,907 is able to produce a power factor of greater than 0.99 (using actual multimeter parameter readings).

10 Finally, it should be noted that a typical PL lamp includes a starter circuit in the lamp.

Whilst the foregoing description has described exemplary embodiments, it will be understood by those skilled in the technology concerned that many variations in details of design, construction and/or operation may be made
15 without departing from the present invention.

CLAIMS

1. An electronic PL lamp capable of being mounted to a PL lamp holder, the PL lamp holder being in a configuration of either with or without magnetic ballast,
5 the lamp including:

a case able to be mounted to the PL lamp holder at a first end;

a case cover able to be affixed to a second end of the case;

an electrical circuit mounted to a first face of the case cover, the electrical circuit being able to function as an electronic ballast;

10 a half spiral fluorescent tube detachably mounted to a second face of the case cover;

wherein the electrical circuit is either a printed circuit board assembly or an IC chip.

15 2. The electronic PL lamp of claim 1, further including a plurality of power connector pegs at the first end of the case.

3. The electronic PL lamp of claim 2, wherein the plurality of power connector pegs is either 2 or 4 pegs.

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4. The electronic PL lamp of claim 1, wherein the half spiral fluorescent tube includes a first coupling portion able to be coupled to a recess which includes a catch on the second face of the case cover.

25 5. The electronic PL lamp of claim 1, wherein the electronic ballast has a power factor greater than 0.6.

6. The electronic PL lamp of claim 1, wherein the half spiral fluorescent tube is joint-less.

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7. The electronic PL lamp of claim 1, wherein the half spiral fluorescent tube provides lateral light distribution as the fluorescent tube has spacings of between 3 to 5 mm.

5 8. The electronic PL lamp of claim 1, wherein the printed circuit board assembly further includes a printed circuit board, power supply wire contacts, electrical components mounted on the printed circuit board, and a second coupling portion for the half spiral fluorescent tube.

10 9. The electronic PL lamp of claim 1, wherein the printed circuit board assembly is located within the case when the case cover is affixed to the case.

10. The electronic PL lamp of claim 1, wherein the electronic PL lamp is mounted to the PL lamp holder including a magnetic ballast.

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11. The electronic PL lamp of claim 1, wherein the electrical circuit enables electronic starting of the lamp.

12. The electronic PL lamp of claim 1, wherein the half spiral fluorescent tube has a diameter of less than 32 mm as measured from a central axis of the half spiral fluorescent tube.

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13. The electronic PL lamp of claim 1, wherein a total power factor for both the electronic PL lamp and the PL lamp holder is increased compared to using a typical PL lamp together with magnetic ballast.

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14. The electronic PL lamp of claim 1, wherein current consumption is reduced compared to using a typical PL lamp together with magnetic ballast.

15. The electronic PL lamp of claim 1, wherein heat generated is reduced compared to using a typical PL lamp together with magnetic ballast.

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