

Why LEDline® Should Be Used Instead of Standard Inset Lights?

Series Circuit Electrical Inefficiency and Dangers:	LEDline®
<p>Flat airfields collect a lot of water and often being close to the sea, usually have high water tables. And, traditional series circuit lights need to be within armoured steel cans, to protect the lights from aircraft and snow ploughs; given these conditions;</p> <ul style="list-style-type: none"> • They are not waterproof, so are often fill with water; • They corrode, adding to the electrical power drain as the series circuit increases the voltage to overcome such conditions; • It is not uncommon for the water to use the electrical conducts and inset lights to drain away. • Their electrical connection causes much maintenance, since they are not that waterproof they corrode. 	<p>LEDline® is totally submersible and needs no such protection as;</p> <ul style="list-style-type: none"> • The LEDline® is installed below the pavement level so avoids aircraft and snow ploughs; • The LEDs are embedded in solid plastic, so they are completely sealed and there is nowhere for water / de-icing fluids to get into to cause corrosion or electrical power drain. • Its IP68 plastic locking connector is similarly waterproof and non corrodible. • Its induction connector is submersible and has no hard wiring to its power supply line so there is nowhere for water / corrosion to go. <p>Note: (Previous LEDline® has been tested to seawater depths of 300m (approx. 1000ft.), and is used for the escape chambers of submarines).</p>
<p>Has a sealed isolation transformer at each light source, however the whole system is not waterproof and is prone to corrode and cause maintenance issues;</p> <ul style="list-style-type: none"> • Although there is a waterproof isolation transformer between the series circuit and lights, their supposed water proof connectors, to and from the series circuit, are a major source of electrical inefficiency and when the connectors and the steel cans become water logged and fail, are precisely why the high powered series circuits were designed to overcome these shorts and why these series 	<p>LEDline's® locking plastic IP68 connectors connect it to its induction (non-contact no hard wiring) power pickups are;</p> <ul style="list-style-type: none"> • all made of plastic so cannot corrode; • IP68 connectors have a locking mechanism, so don't just pull apart; • are IP68 rated (tested to 6 weeks in seawater at depths of 20m (approx. 65ft.). • Induction power pickups are sealed, waterproof and submersible to great

<p>circuits are so dangerous. And, is why maintenance people are killed or severely injured every year, when someone accidentally shorts them.</p>	<p>depths and have no moving parts, so have a long life.</p>
<p>High powered series circuits are hazardous;</p> <ul style="list-style-type: none"> • Again, every year serious injuries and deaths occur because of accidents with the series circuits. These accident happen both in the developed and undeveloped world, since because of its nature, being designed to overcome electrical shorts, the series circuit is dangerous if someone accidentally becomes the ground through which the energy flows. Since in series circuits, the amperage is fixed but the voltage is allowed to go up to the maximum a CCR is designed for, therefore, many thousands of volts can be generated to overcome a short which is often fatal when an accident happens. 	<p>LEDline® is a low voltage series circuit system with each light needing;</p> <ul style="list-style-type: none"> • approx. 21VAC at 350mA for the 6 x LED system operating; • approx. 21VAC at 700mA for the 12 x LED system. • The power distribution wire is variable and is dependent on the number of LEDline® units to be found on a circuit. The smart Master Controller knows how many lights are on a circuit and only puts out sufficient power to light these units. • There is a max. limit of 60VAC allowed on the power distribution circuit. • No matter what the power is in the distribution wire, even if there is a lightning strike, the magnetic induction power pickups will only allow a small amount of current through before they becoming saturated and so stop any more power coming through, LEDline® is safe.
<p>19th Century Light Bulb technology and Inefficiencies in Global Warming Times: Due to Global warming issues, many countries have;</p> <ul style="list-style-type: none"> • Banned the production and sales of incandescent bulbs. (19th Century technology) • This means that eventually, all series circuit lights must be changed. However, if new efficient LED lights are still powered via the old CCRs and old high powered series circuits, there is very little or no energy savings. • In addition, if these LED lights need heaters to melt the snow, as the old incandescent bulbs do, it would be more efficient to keep the old 	<p>Light Bulb Efficiency: LEDline® is 21st Century technology;</p> <ul style="list-style-type: none"> • It is more efficient than incandescent bulbs, or LED bulbs run on high powered series circuits, particularly when such LED bulbs are required to melt ice and snow, so have heaters built into them. • LEDline® melts ice and snow without any additional heaters!

<p>incandescent heater bulbs as the LED combination with heaters causes more energy to be used.</p>	
<p>Energy Efficiency:</p> <ul style="list-style-type: none"> • Incandescent bulbs produce mainly heat, (some 60% - 70%), not light. For airfields with winter conditions, the heat is useful to melt snow and ice, but at only + - 30% generation of light, these bulbs are very inefficient. • Quartz Halogen sources are slightly better at producing light, but their main output is still heat, as such, they are not energy efficient. • Incandescent and halogen bulbs have large filaments, so their reflectors are inefficient. Scattering the light in unwanted directions. • Like the heat, much of the light they produced is wasted. • Fluorescent tubes and compact fluorescents are more efficient at producing light, however being relatively large, there are difficulties and inefficiencies in coupling efficient reflectors to them. They also need ballasts and are difficult to dim and in cold weather, they are difficult to start. • Metal halides are relatively efficient at producing light approx. 60% and, as they are an arc lamp, have quite efficient reflectors, however, small metal halides are difficult to manufacture, need special ballasts and are difficult to dim. They are also difficult to start in cold weather and if they are turned off take a while restarting. • High pressure sodium lamps have similar advantages and disadvantages as metal halides; however, their light spectrum output is not as good as the light tends to be orangey. • Other light efficiency indicators for point sources are also specified; how much candela output there must be at specific angles; and how many such lights must be viewed simultaneously to provide safe taxiing. • ICAO Annex 14 and the FAA's lighting requirements deal with specific light output at specific angles, all based on incandescent point sources. 	<p>Energy Efficiency: LED Light:</p> <ul style="list-style-type: none"> • LEDs are small point sources so they can be efficiently coupled to reflectors. • LEDline® is an efficient LED, linear /area source, which relies for its visibility on its intensity / luminance area. • Similar to traffic signs, where visibility is based on; lettering contrast ratio with the background; its font, (its height and letter width stroke). The visibility of LEDline® is based on; the size / area of the light; its width and length, as well as its intensity. • Each LEDline® unit is linear, so each provides both positional and directional guidance, obviating the need for pilots to be able to see the mandated 4 or 3 light units ahead of them. Therefore, for safe taxiing, a single LEDline® unit will provide the direction pilots need. • At Anchorage International (a Cat111C airport), in low visibility conditions, 100% of pilots there, daily using both ICAO / FAA certified taxiway lights and LEDline®, preferred LEDline® as their guidance, over standard ICAO / FAA green taxiway lights. (Please see pilot reports). • Is efficient, particularly when powered via its low powered induction power supply and its non-contact (no hard wiring) induction connectors. • If powered via a high powered

<p>To assist point source directional visual aid guidance, (as individually point sources provide no directional guidance), for safe taxiing; a number of these lights are mandated as being necessary to be viewed together, by ICAO (4) and the FAA (3) so as to provide pilots with the required directionality point sources lack. This requirement feeds back into and is behind the reasons for the specific point source lighting requirements, for so many candelas at specific angles.</p> <p>However, at night, with snow whiteouts; rain squalls; fog; and dust storms, all low visibility Category 111 C conditions, weather can unpredictable and suddenly change whilst an aircraft is taxiing. In this situation, pilots may only be able to see a single light source ahead of them and so receive no directional guidance.</p> <p>This slows taxiing aircraft down, as pilots feel their way to or from a terminal; drastically slows operations; thus adding to the bad weather delays, even after the bad weather is over, since stranded planes and passengers still have to reach their original destinations; and in general increasing costs and inefficiencies for everyone.</p>	<p>series circuit, LEDline® efficiencies suffer like other LED lights, because all of the needed electronics designed to protect the LEDs from the high powered series circuit.</p> <ul style="list-style-type: none"> • If powered via renewable resources, the efficiency of LEDline® would be further increased since; there is no need for mains power; there is no need for large backup generators; and there is no need for ICAO / FAA mandated two separate mains power supply lines for the airfield.
<p>Incandescent bulbs are point sources, as such;</p> <ul style="list-style-type: none"> • Again, whilst they provide positional information to pilots, <u>they provide no directional information</u>. • To overcome this deficiency Annex 14 specifies that; to be safe, taxiing pilots must be able to see at least 4 of these light sources ahead of them, the FAA specifies 3 lights so as to get the proper directional information to pilots. However, at night, in bad weather, low visibility conditions, such as; fog; snow whiteouts; very heavy rains, etc., taxiing pilots may only be able to see one of these point light sources, so receive no directional guidance. • Pilots without any directional references to guide a taxiing aircraft, will slow down the taxiing 	<p>LEDline® is linear / area light source;</p> <ul style="list-style-type: none"> • Which provides both positional and directional guidance, as being linear, each light point indicates in the direction to go. • Therefore, in severe low visibility conditions, even if only one light were visible, pilots would still know in which direction to proceed to get to the next light source. (Please see the 2008 Anchorage International Chief Pilot Alaska and Northwest Airline reports, of all pilots using, in identical weather conditions, both green

<p>aircraft, increasing the bad weather delays and ensuing that the backlog chaos will last long after the bad weather has gone.</p> <ul style="list-style-type: none"> • The lack of directional guidance will also add to aircraft operating costs in added time and wasted fuel, and reduce an airport’s profit as fewer aircraft use the gates during the bad weather and in the ensuing delays. • Can cause pilot confusion even in clear weather, since the lights have no directionality. At night the potential for causing confusion is increased. 	<p>ICAO / FAA Taxiway lights and LEDline®. 100% of all pilots surveyed judged LEDline® to provide superior guidance, especially in low visibility conditions).</p> <ul style="list-style-type: none"> • With linear directional guidance, direction is intuitive and obvious. Therefore, there is less potential to cause pilot confusion any time.
<p>Linear, the painted taxiway guidance markings are;</p> <ul style="list-style-type: none"> • Supposed to help the point source lights in providing pilot guidance, however, as anyone who drives at night knows, painted markings tend to disappear in bad weather, so are unreliable, which means that at night, the pilots primary guidance system are the inset lights. 	<p>According to the pilot reports from Anchorage International;</p> <ul style="list-style-type: none"> • LEDline® provides for better visual aid guidance, especially in low visibility conditions.
<p>Versatility:</p> <ul style="list-style-type: none"> • Standard series circuit lights are only used for airfield lighting, since they are installed in steel cans, which penetrate some 460m (18”) below the pavement. As such, • they can provide a water path to the pavement’s structure weakening it with freeze thaw conditions. • if placed in close proximity without the pavement being strengthened, they will structurally weaken the pavement. 	<p>Versatility:</p> <p>LEDline® is very versatile as it is installed in a 40mm (1.5”) deep x 50mm (2”) wide x 930mm 36”) long groove, so is only a surface installation and does not penetrate to the pavement sub structure;</p> <ul style="list-style-type: none"> • it is used for airfields and roads for guidance lighting; • for creating larger in-pavement multiple unit compound lights; • for lit in-pavement signage and symbols; • for tunnel roof traffic guidance; • for barrier highlighting; • for sign highlighting; • for marine, mining and military applications, (tested to 300m (approx. 1000ft), it is used for the emergency lighting in submarine escape chambers); • and for aesthetics for outlining structures.

<p>Cost: Series Circuits: Being high powered; their controls; their lights (especially the LED ones); their maintenance; operations and most of all installation are very expensive since;</p> <ul style="list-style-type: none"> • The materials and in their installation are expensive, so they cost a lot; • Because of the high power the series circuits are installed some + / - 2m (6.6ft.) depth, below the pavement in conduits and the steel cans of the lights are installed some 460mm (18") into the pavement, so heavy digging equipment are require to install the system; • Installing standard series circuits and lights take weeks and months to install; • The heavy construction equipment, being too large to remove each night, when work stops, causes major airfield disruptions. Because it is left on the airfield it is a hazard and a potential obstruction for aircraft and serious accidents and crashes have been cause by such equipment; • Large equipment provides for major operational disruptions to the airfield and its operations, for the full construction time; • Any open tranches and equipment on the construction site must be clearly sealed off, pilots notified, and aircraft routed away from the site because of the potential hazards and dangers to the aircraft and passengers. 	<p>Cost: LEDline®: LEDline® uses low power so everything costs much less; to buy; to operate; to maintain; and is far, far less expensive to install;</p> <ul style="list-style-type: none"> • LEDline's® materials are less to purchase and its installation is far, far less. • Installed in a 40mm (1.5") deep x 50mm (2") wide x 930mm 36") long groove LEDline® only needs a small saw cut machine and one operator to cut all the grooves for both the light units, their induction power pickups and the power distribution wire. • LEDline® is installed in days not weeks or month. At anchorage International 230 LEDline® units were installed by a contractor unfamiliar with the product with 1 saw cut machine and 5 workers in 5 days. • Usually all saw cuts are made on the first day after which the saw cut machine is removed from the airfield, so there is no equipment left on the airfield to cause possible hazards to aircraft. • The open saw cut grooves are not a hazard to aircraft since they are only 40mm (1.5") deep x 50mm (2") wide x 930mm 36") long, so pose no danger to taxiing aircraft which can easily drive over them. As such, using LEDline® minimizes any operational problems, disruptions and procedures and is much safer for all concerned.
<p>According to Vancouver International's Engineers Hatch, Mott and Macdonald;</p> <ul style="list-style-type: none"> • In 2009 in the Vancouver area, a series circuit installation was 4-7 times more expensive per installed linear meter (3.28084ft.) compared to LEDline®. 	<p>According to Vancouver International's Engineers Hatch, Mott and Macdonald, in the Vancouver area;</p> <ul style="list-style-type: none"> • In 2010, after the recession, (hence the 4 - 7 times cost per liner meter

	<p>installed for the standard series circuit lights), the LEDline® cost was approx. \$110.00 per m. installed, whilst standard series circuit lights varied from 2009's high of \$700.00 per m. to 2010 estimate (due to the recession and contractors being more hungry) of some \$430.00 per m installed.</p> <p>(Note: I believe that; since Vancouver International already had CCR and their controls, none of the CCR or controls costs for the standard series circuit lights were included in the costing for the series circuit lights, so for new installations the cost differences between LEDline® will be even greater.)</p> <p>(Please contact HIL-Tech Ltd for Vancouver costing.)</p>
<p>Any Warranty is dependant of the company supplying the lights.</p>	<p>LEDline® comes with;</p> <ul style="list-style-type: none"> • a 1 year Limited Warranty (limited to replacement parts only) and • at the time of purchase customers may purchase additional years/s of the Limited Warranty. (Please see HIL-Tech Ltd for details.)
<p>ICAO Certification;</p> <ul style="list-style-type: none"> • Series circuit lights are certified, provided they follow the 60 years ago ICAO Annex 14 which was specifically written around inefficient point source incandescent bulbs. Therefore, lights that comply with these may be ICAO certified. • New LED lighting systems are being forced to follow the old guidelines, but if they are installed on old high powered series circuits, due to major electronic requirements to protect the LEDs from the high power, there is little or no energy savings. 	<p>ICAO:</p> <p>Not yet because it is an area / linear light source, not a point source.</p> <ul style="list-style-type: none"> • Point sources provide no directional guidance; linear ones do, so are better. • The ICAO Visual Aids committee has seen LEDline® and is familiar with it. • All major Civil Aviation Authorities (CAA) will allow trials in movement areas. • The FAA Tech Centre has been tasked to find the equivalency between standard ICAO / FAA

<ul style="list-style-type: none"> • Annex 14 also specifies that; • An airport must have at least two independent separate mains power lines supplying the airport. • A backup generator is available in case these main lines fail. As such, in case of mains failure, because of the large present power requirements, standby generators have to be large and complex to provide the necessary power, so are expensive. This is costly to provide and is maintenance heavy and is a particularly heavy burden for developing countries, where even the fuel and spare parts for the backup generators may be in short supply. 	<p>taxiway certified lights and linear lights.</p> <p>LEDline®</p> <p>Because LEDline® uses so much less power; In areas with a lot of sun, LEDline® could be powered via infield solar arrays, with buried batteries, and so mains access could be completely unnecessary and could be dispensed with, as would be the need for any backup generator system.</p> <p>If the LEDline® airfield lights are mains powered, then Annex 14 mains requirements are still required and LEDline® would still need the standby generators. However, being a low powered system, these generators would be much smaller; easier to look after; and require cheaper spare parts; and therefore, be much less expensive.</p>
<p>Series Circuit Lights can be installed Anywhere on Airfields.</p>	<ul style="list-style-type: none"> • LEDline® can be installed on airfields in non-movement areas and, with CAA permission, in movement areas. • LEDline® can also be used for roads, tunnels, barriers and signs to improve highway safety and increase highway capacity, reducing traffic congestion, <u>without needing to build new roads.</u> (Please contact HIL-Tech Ltd).