

LEDline® Cut Sheet

April 2020

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Request to Everyone: Global Warming is forcing everyone to rethink energy efficiencies. All projects must be evaluated as to their effect on Global Warming. Those that significantly add to Global warming need to be re-thought and other solutions proposed. **(Note:** Canada and the Arctic are warming up twice as fast as the rest of the world and, apparently, recent United Nations and other estimates **now only give us some 20 years to come up with solutions** to prevent the average world warming temperature rising by more than 1.5°C (2.7°F) and causing major climate issues).

At Anchorage International: Standard green FAA/ ICAO incandescent taxiway lights (left) and yellow, linear, LED semi-directional LEDlineDV™ with (6 x LEDs) both in deep snow; both are highly visible and both melt snow without needing any additional heating elements!



LEDline® at Vancouver International De-icing Pads (Installed January 2010)



**LEDline® Used for Helipad Visual Aids:
USA Helipad (Copyright Bruce Lomesky).**



Australia Helipad (Copyright Peter Simpson of PSNK Aeronautical Services).



LEDline® Being Snow Ploughed on a Freeway in Ontario Canada;
(Taken from the video, the picture quality is low. Full video at www.ledline.net).



Product Description:

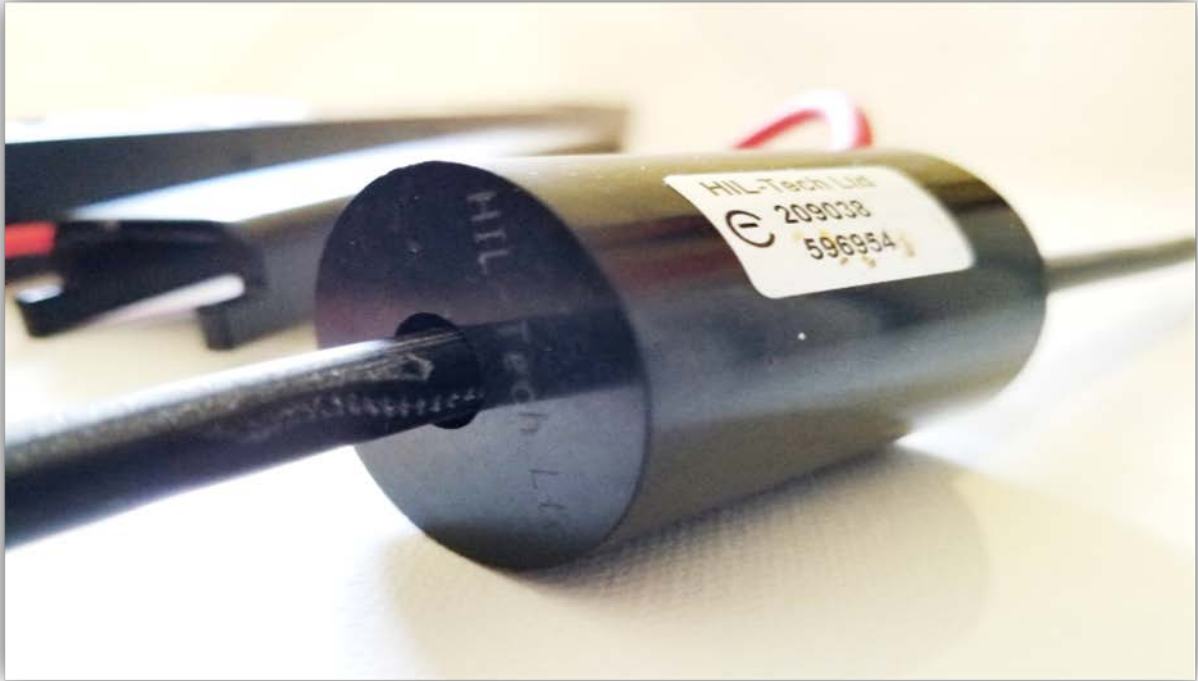
LEDline® is linear visual aid guidance lighting system, able to indicate the direction to travel. It consists of linear arrays of high intensity (daylight visible) light emitting diodes ("LEDs"). The unique, proprietary design incorporates a heat sink and may include optics, depending on the application requirements. All of these components are fully encapsulated in a clear, durable, solid plastic, a formulation specifically engineered to withstand the challenges of a variety of extreme harsh environments, which also makes it submersible. For more details, see www.ledline.net

Whilst LEDline® can be powered via solar arrays or Dc current, for in-pavement applications, LEDline® is usually mains powered, 90 – 220VAC 50/60Hz, via an induction, non-contact, (no hard wired), low powered series circuit.

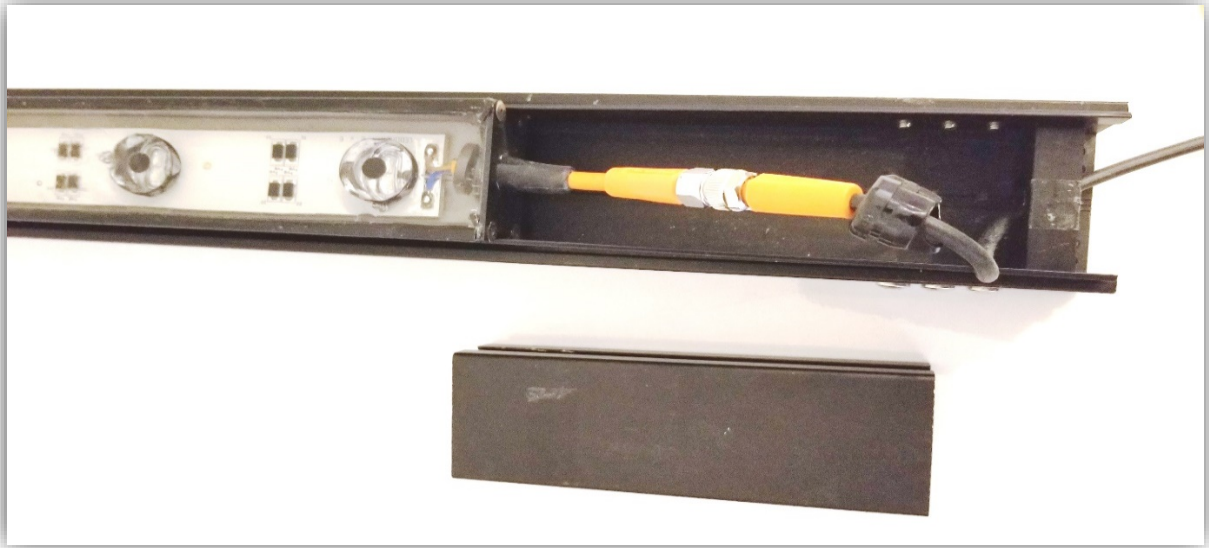
With the LEDline® induction power pick up, it makes no difference if the environment is wet, salt laden, or if the product is covered with chemicals like glycol or other airfield de-icing fluids, since the non-contact power connectors are completely submersible. With a low powered AC series circuit, power is induced into the lamps via the completely sealed induction connector.

The direct burial power line bringing power to the lights is never cut or spliced. As such, it continues to have all the manufactures full cladding and protection, extending its life, and preventing corrosion.

Energy Efficient Non-Contact Induction Power Connectors:



End of Unlit LEDline® Omni-directional Unit with IP69K Connector



Top of the Line IP69 Connector:

Waterproof Connector: For easy lamp maintenance, each LEDline® lamp comes with a **quick disconnect**, stainless steel or nickel plated brass locking, (male) IP69 waterproof connector. (IP69K = Protected against ingress of dust; close-range high pressure, high temperature spray downs). This connector allows the non-contact induction power connector to be buried in the glue, yet, when a replacement lamp is required to be easily accessible through the highest rating IP69K quick disconnect connector for replacement of the LEDline® lamp unit.

(Please Note: The IP69K locking mechanism with the red gasket. This must be present for the quick disconnect connector to be fully rated to provide the IP69K protection).



LEDline® Product Specifications:

LEDline® was designed to meet the needs of extreme environments like the transportation industry, by enhancing the visibility of pavement markings in all conditions that pilots or motorists find challenging. When illuminated, any LEDline® system can be seen; at night; at dusk under intense rain; with the wash of headlamps; under some +178mm (7") of snow; and in full sunlight. The twelve (12) embedded LED system, particularly the semi-directional LEDlineSunDV™ lamp, which focuses most of its light towards the viewer so is highly visible in daylight / sunlight, especially when flashed on and off.

LEDline® products come in a variety of standard LED colours for airfields, helipads, roads, or the military. **Custom IR (Infrared) or UV (ultra violet) spectrum LEDline® can also be special ordered.** Please contact HIL-Tech Ltd. for such orders.

There are a number of alternative LEDline® visual aid products;

- LEDlineDV™ (semi-directional) with six (6) embedded LEDs, with embedded precision optics, which focusses most of the light towards the viewer.
- LEDlineHB™ (Omni-directional) with six (6) embedded LEDs, with embedded precision optics, which sprays out the light 360 degrees.

In addition, the LEDlineSun™ product family (sunlight visible) has up to twelve (12) x embedded LEDs within the clear solid matrix. These are by far the brightest systems and are suitable for sunlight visible in-pavement applications. LEDlineSun™ comes in two types;

- LEDlineSunDV™ (Semi-directional) with twelve (12) x embedded LEDs with embedded precision optics which focusses most of the light towards the viewer.
- LEDlineSunHB™ (Omni-directional) with twelve (12) x embedded LEDs, with embedded precision optics, which sprays out the light 360 degrees.

Dimension of a LEDline® Unit:

LEDline® Unit Alone: Nom. Size: See drawings HT-6252

Length: 578mm (22.8") or which the lit section is some 406mm (16").

Width: 40mm (1.6")

Height: 23.5mm (0.93")

LEDline® Unit with Mounting Plate: Nom. Size: See Drawing HT-6353

Length: 625mm (24.6")

Width: 48mm (1.9")

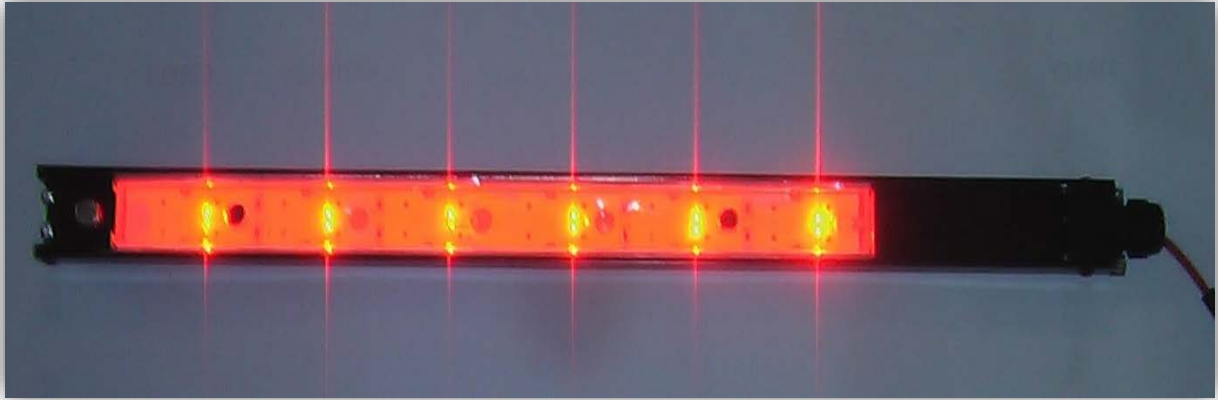
Height: 28.5mm (1.16")

Weight:

LEDline® Mounting Plate and Lamp: 1.36 kilograms (3 lbs.)

LEDline® Lamp: 0.77 Kilograms (1.7 lbs.)

LED Colour Options: Any colour of LEDs can be used within LEDline®, including Infra-Red

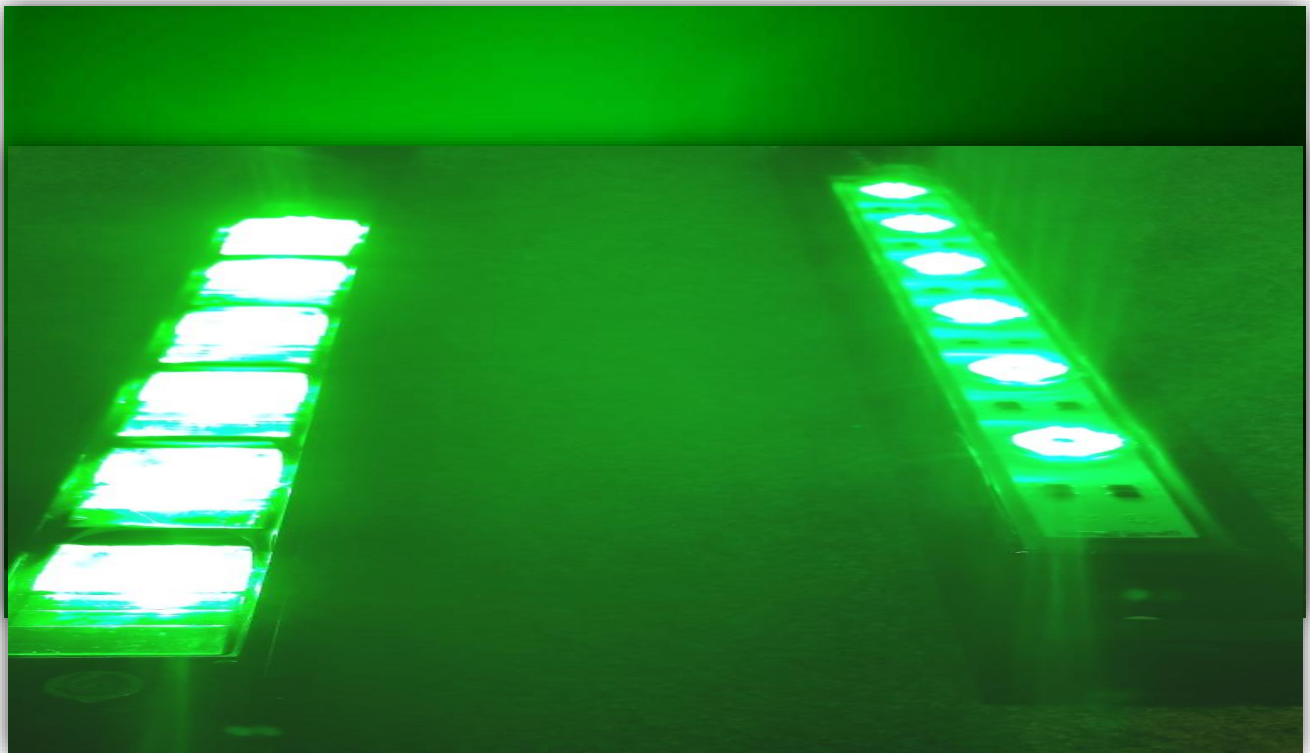


(IR) or Ultra Violet (UV), although the latter two colours are special custom order units.

Below are Illustrations of the Basic Two Types of LEDline®, with 6 or 12 Embedded LEDs: All LEDline® units are sunlight visible, however, the 12 x LED semi-directional or omni-directional units are brighter and more noticeable in sunlight. When viewers are expected to see the units mainly from one direction, the 12 LED Semi-directional is the brightest.

(Note: Because of the unit's brightness, it is difficult to obtain clear pictures of the lit products.)

Below are low angle pictures illustrating the differences. On the left is the brightest LEDlineSunDV™ (semi-directional), with 12 LEDs and their embedded precision optics, focusing most of the light towards the viewer. On the right is LEDlineSunHB™ (omni-directional) product, again with 12 LEDs.



Lit LEDlineSunHB™ Omni-directional and Mounting Plate, with IP69K Quick Disconnect and Cover Plate



The LED arrays within the solid plastic matrix are organized into a series / bypass circuit. As such, should one fail prematurely, the others will continue to function normally.

Survivability: LEDline® is embedded within the pavement, flush with the surface, so snow ploughs do not damage it as they pass over. In addition, the LEDs and their optional precision optics are completely embedded within HIL-Tech's custom plastic, as such, LEDline® is extremely tough, impact resistant, submersible and thus completely waterproof. (Please see our web site for a demonstration of how tough and impact resistant LEDline® is at www.ledline.net)

Chemical Resistance: LEDline® has a wide range of chemical resistance, particularly to de-icing pad solutions like glycol. Please contact HIL-Tech Ltd. for any required specific chemical resistance.

Temperature: Previous LEDline® fixtures have been tested from -55C° (-67° Fahrenheit) to +65C° (+149° Fahrenheit) with no effect on the fixtures.

Early Submergibility Tests by the Canadian Navy: Since April 2014, early LEDline® products are still being used at the Canadian Naval Engineering Test Establishment in Montreal on the submarine escape test bed. As of 28th April 2014, they had done thousands of high and low pressure cycles, (well over +5000 times) at up to 300m (1000ft.) seawater depths. Included in these tests was an accidental explosive decompression. The units are used as lighting within the pressurization vessel and we believe, continue to function, so who knows how many pressurizations and de-pressurization cycles the units have now undergone?

Provided that they have the right high pressure electrical connection system, present day LEDline® units should be equally submersible and tough.

Base Materials Properties: Custom proprietary crystal clear plastic resin, specifications not provided.

Energy Efficient: The use of LEDs as the light source ensures that the system is energy efficient, long lasting and requires minimal maintenance, provided the LEDs are properly powered. Since the encapsulating material was formulated to be tough and resistant to a variety of chemicals (e.g. jet fuel and other contaminants in the transportation industry) and is; submersible, highly corrosion resistant, and weather resistant, LEDline® may be used in a host of outdoor, industrial, or resource-industry environments. It is also suitable for a variety of indoor and commercial uses and if required, may be surface-mounted on vertical surfaces, such as barriers, tunnel roofs or sides etc..

Complete LEDline® Assembly: Specifications were developed by HIL-Tech. **At this time, many of these parameters are based on tests performed on the previous generations of encapsulated LEDline® products.**

Electrical:

LEDline® lamp units are RoHS certified and are usually induction powered (no hard wiring of the connections) and are low powered. The 12 LED system uses only some 19 - 20VDC (depends on LED colour) at 700mA, whilst the 6 LED system uses 19 – 20 VDC at 350mA.

Power Supplies: LEDline® units can be powered by any type of power from mains, VDC power, or wind generators and / or solar power with batteries as the units work with either AC or VDC power.

Master Controller: With five (5) out of a possible six (6) Power Modules.



Power Module: Each Power Module, runs its own individual circuit and contains a custom pulse width power supply which takes power from 90 – 220VAC 50/60Hz and turns it into the correct low voltage series circuit, suitable for LEDline® induction power pickup connectors.

For surface mounted LEDline®, there are VDC and other types of power supplies, which vary with application. (Please contact HIL-Tech Ltd. for details).

Note: All power supplies, including the induction Master Controller, are individually CSA inspected and certified to conform to electrical standards for US (UL), and / or Canadian (CSA).

Induction Power Supply, with Induction Non-Contact Power Connectors: Induction powered and connected lamps are required for all in-pavement applications where vehicle are driving over the lamps. The induction system is by far the most robust electrical connector, since it function regardless of any vehicle vibration, water or moisture. In addition, since there is no hard wiring or connecting required, it allows the direct burial wire, bringing power to the lamps, to remain pristine and uncut, to continue to have all of its factory cladding intact, thus preventing corrosion.

Each LEDline® lamp requires one (1) completely sealed induction power connector unit with its attached IP69 (female part) connector system.

DC Power Supply: For surface mounting or possible other applications, where corrosion is not a

factor, a HIL-Tech DC power supply can be used. For hard wired DC powered LEDline®, all connections need to go through a HIL-Tech Power Equalizer, to counteract the VDC line voltage drop, so that the last light on the circuit is as bright as the first. In addition, with each lamp being hard wired, such connections can also have DMX signal computer controls, so individual computer control of the LEDline® lamps can be achieved.

Renewable Energy Power Supply: LEDline® can be powered via solar panels; wind power and batteries. For northern climes it is recommended that a propane backup generator is included to top up the batteries when solar or wind fail.

LEDline® End Connectors (electrical): Each LEDline® lamp comes with one (1) sealed (male) IP69K locking, quick disconnect connector. The IP69K connector has a locking steel or nickel coated brass screw and is the highest possible IP rating connector available. There are stronger, deep-sea high-pressure connectors available, should these be required, please contact HIL-Tech for details.

IP69K Connector Information: Copyright Ifm; M8 Male and Female Pico DC Cordsets and Field Wirable Connectors EVC141 (Rated IP69K)



	Technical Specs– Cordsets (ifm)
Operating voltage:	50 V AC / 60 V DC
Current rating:	3A
Protection rating:	IP69K = Protected against ingress of dust and high temperature and close-range high pressure, Temperature spray downs.
IP69 Test	(On a rotating turntable, with a speed of 5 ± 1 revolutions per minute, the test requires a spray 4 “- 6 ” (101mm-152mm) from the product of 4 gallons/16 liters per minute with water pressure of between 1160-1450 psi, at a temperature of 176°F/80°C. The heat and spray must not cause damage. The IP69K rating is the highest protection available, unless custom deep sea connectors are required. Please contact HIL-Tech for technical specs. on any required deep sea connectors).
Tightening torque	0.3...0.5 Nm
Ambient temperature	-25...90 °C
Flex rating	> 5 million cycles
Material body	TPU housing, Viton O-ring

Material coupling nut	Nickel- plated brass or Stainless Steel
Cable	PUR, halogen-free, 24 AWG conductors, Ø 3.7 mm
Approvals	cURus and RoHS standards
	Technical Specs– Field Wirable Connectors
Operating voltage	60 V AC / 75 V DC
Protection rating	IP69
Ambient temperature	-25...90 °C
Material body	Nickel-plated brass (L33600, L33601, E18216, 18218) PA (L33602, L33603, E18217, E18219)
Material Coupling Nut	Nickel-plated brass

Cord Set Features:

- Cordsets feature a “Lock-in-Place” coupling nut that resists high levels of shock and vibration
- Cordsets offer high-flex PUR-jacketed cable rated for over 5 million flex cycles
- A special insert design includes a mechanical end stop preventing damage to Viton O-ring from over-tightening
- Cordsets are designed and tested to resist harsh conditions in industrial automation



Please Note: For those requiring connectors for submersible deep sea applications, there are other custom connectors available. Please contact HIL-Tech for details.

Direct Burial Wire: For the induction wire, a direct burial wire type should be used #8 (USA) RWU gauge wire (= #35 metric wire gauge MAX O.D. of insulation 7.9mm (0.31”)) suitable for direct burial. According to local codes, measure off the complete wire run distance, (not forgetting to add in the amount to reach the power supply) and then double this distance to have sufficient wire to create a complete unbroken loop over the entire distance. (i.e. if the distance is 200m, (656ft) plus another 10m (32ft) to cross the road to the power supply, then the wire loop distance needed would be 420m (1377ft.)).

Glue: Please contact HIL-Tech for suggestions.

Note: Each wire run must start and end at a particular Power Module. (i.e. the wire must be continuous, without breaks, joints or connections of any kind in order to avoid corrosion). The wire loop must also be closely tied together with plastic ties every 30cm (12”), to minimize any impedance / EMI emissions.

A Mechanical Installation Preparation Checklist (Aug. 2017): This is available from HIL-Tech Ltd.

Intellectual Property of HIL-Tech Ltd.: HIL-Tech Ltd. is a leader in developing LED-based illuminated in-pavement, barrier, and sign markings, for airports, roadways, the marine, mining, and the military and other markets. Responding to the demands of the transportation industry, HIL-Tech has developed a design and process to encapsulate the brighter and more powerful daylight visible LEDs into solid plastic.

All LEDline® products are the intellectual property of HIL-Tech. There are patents and patents pending in respect of this innovative addition to the family of LED-based linear guidance lighting systems.

LEDline® is a registered trademark of HIL-Tech Ltd.

Product Status: Based on the Company's previous experience LEDline® should meet the technical specifications provided herein.

Specifications May Change: All information contained herein indicates the preliminary specifications for LEDline® products and accessories. Specifications related to the plastic encapsulation material are derived from those determined from tests conducted on other LEDline® products that use the same material. Specifications of component materials are provided by the manufacturer(s) of the particular component. Any of this information may be changed at any time without notice.

Limited Warranty (extract only): If the product has been fully paid for, LEDline® has a standard Limited Warranty of 1-year on parts only from the date of the delivery shipment. All returns must have and be accompanied by a pre-authorized return goods authorization (RGA) number obtained from HIL-Tech Ltd., prior to such return, or the returned goods will not be accepted. Credit for any goods returned AND accepted under the Limited Warranty, may, once the goods have been inspected, be granted. **Under no circumstances will HIL-Tech Ltd. or its successors be responsible for any collateral, consequential or installation damages. For a complete copy of the Limited Warranty details, please contact HIL-Tech Ltd.**

Additional Years of Limited Warranty: An additional one (1); two (2); or three (3) years **Limited Warranty, above the company's original one (1) year, is available if purchased at order time.** Please contact HIL-Tech Ltd. for details.

No Liability:

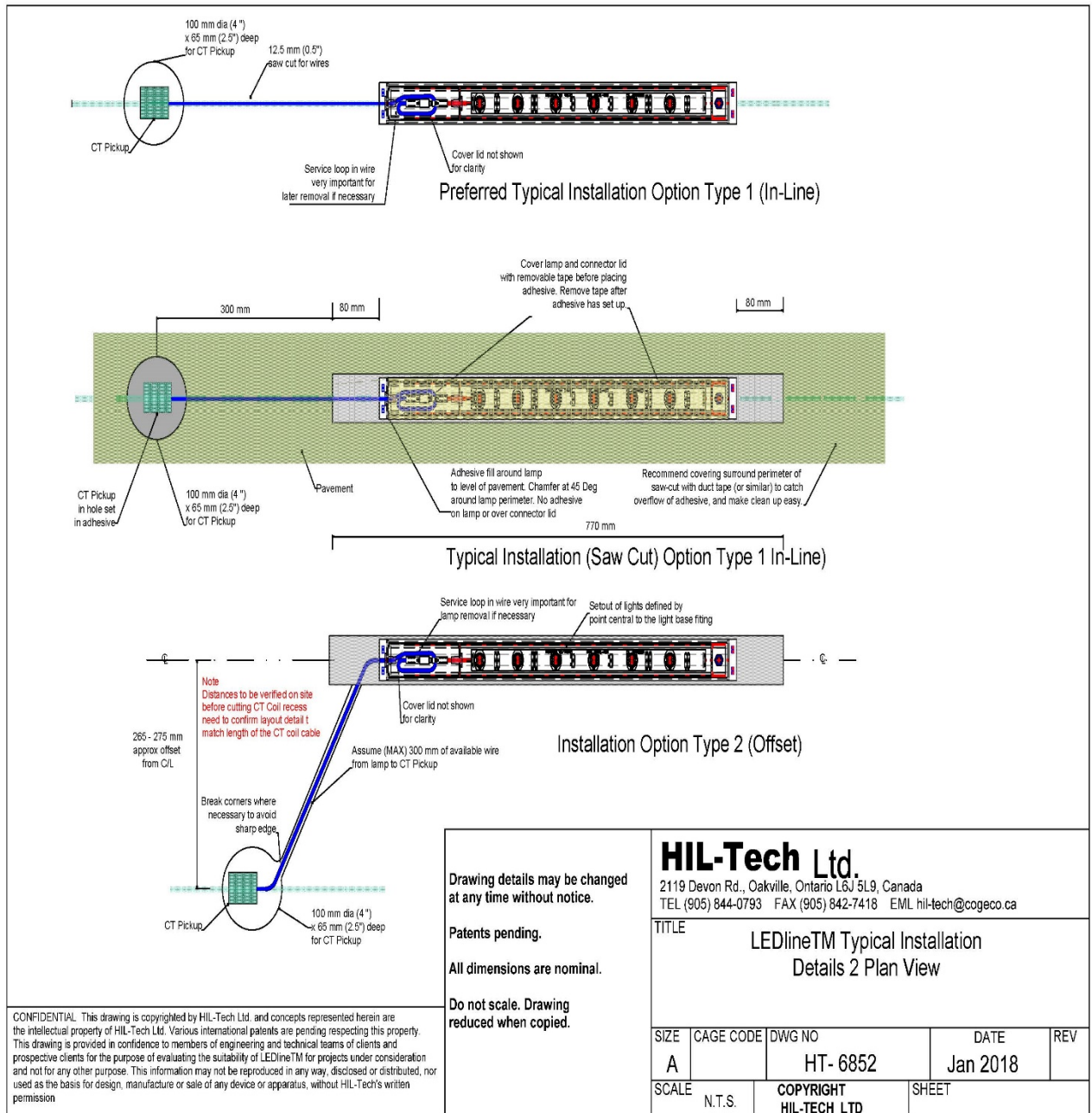
No Liability: Notwithstanding that HIL-Tech has, to the best of its knowledge and belief, provided accurate information herein, HIL-Tech assumes no responsibility for the accuracy or completeness of representations made, nor the

accuracy or completeness of representations made by component manufacturers or for any expressed or implied recommendations concerning LEDline® products. Before utilizing the any LEDline® systems, products, accessories, or ancillary equipment, all prospective users should evaluate the suitability of said systems, products, accessories, and ancillary equipment for their own intended uses or purposes and should draw their own conclusions. The user assumes all risks and liabilities in connection with such use or uses.

Appendix 1: Installation Drawings:

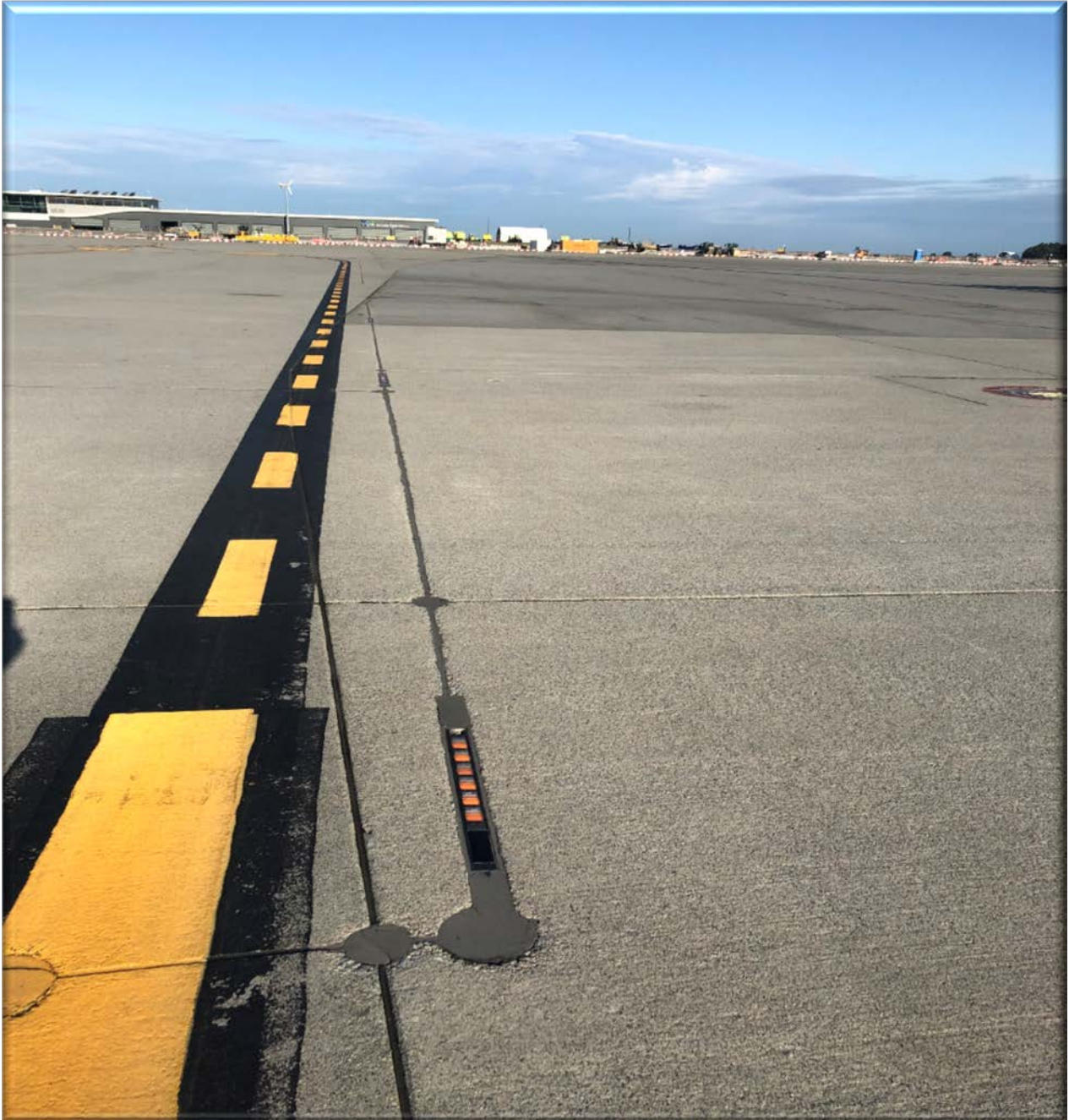
There are separate more detailed installation guideline write-ups, so please ask HIL-Tech Ltd. for a copy.

HT-6852 Typical Installation Details 1. (Drawing Not to Scale):



In the picture below, the preferred installation method of having a single saw cut, with the lights following the saw cut and the direct burial wire buried beneath the LEDline® was followed.

Note: The enclosed picture is of the **2010 LEDline® installation at Vancouver International's asphalt and concrete de-icing pads**. This picture, July 2019, was taken by Tim Holtz of Vancouver's Airfield Maintenance Engineers and illustrates that **despite the 500 or so yearly earth tremors and winter frequent freeze / thaw conditions**, how well the LEDline® there has lasted.

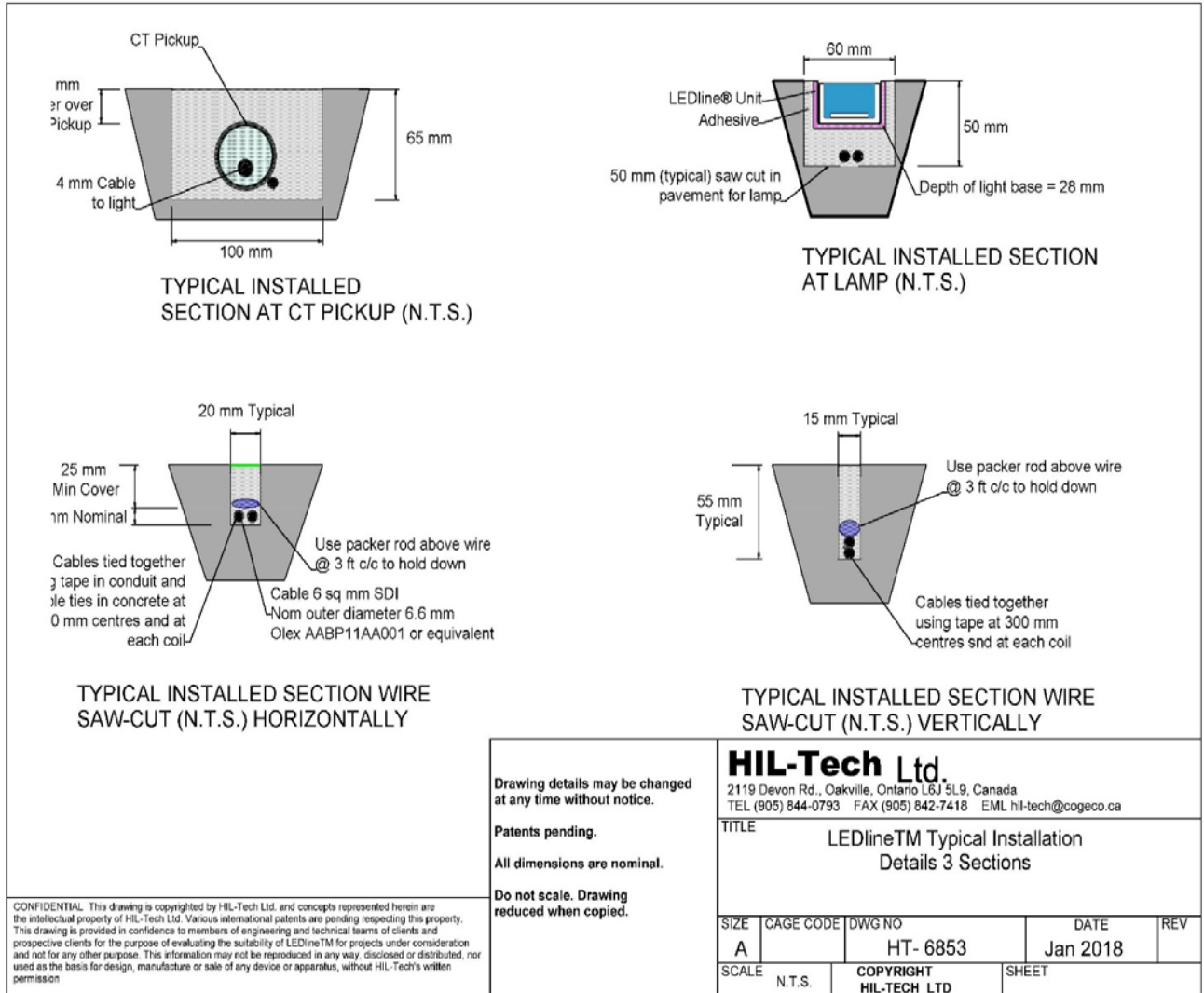


Here, the induction power cables and induction power pick up connectors are in the middle, separated from the lamps. Please see the more comprehensive details and explanations in our Suggested Installation Guidelines.

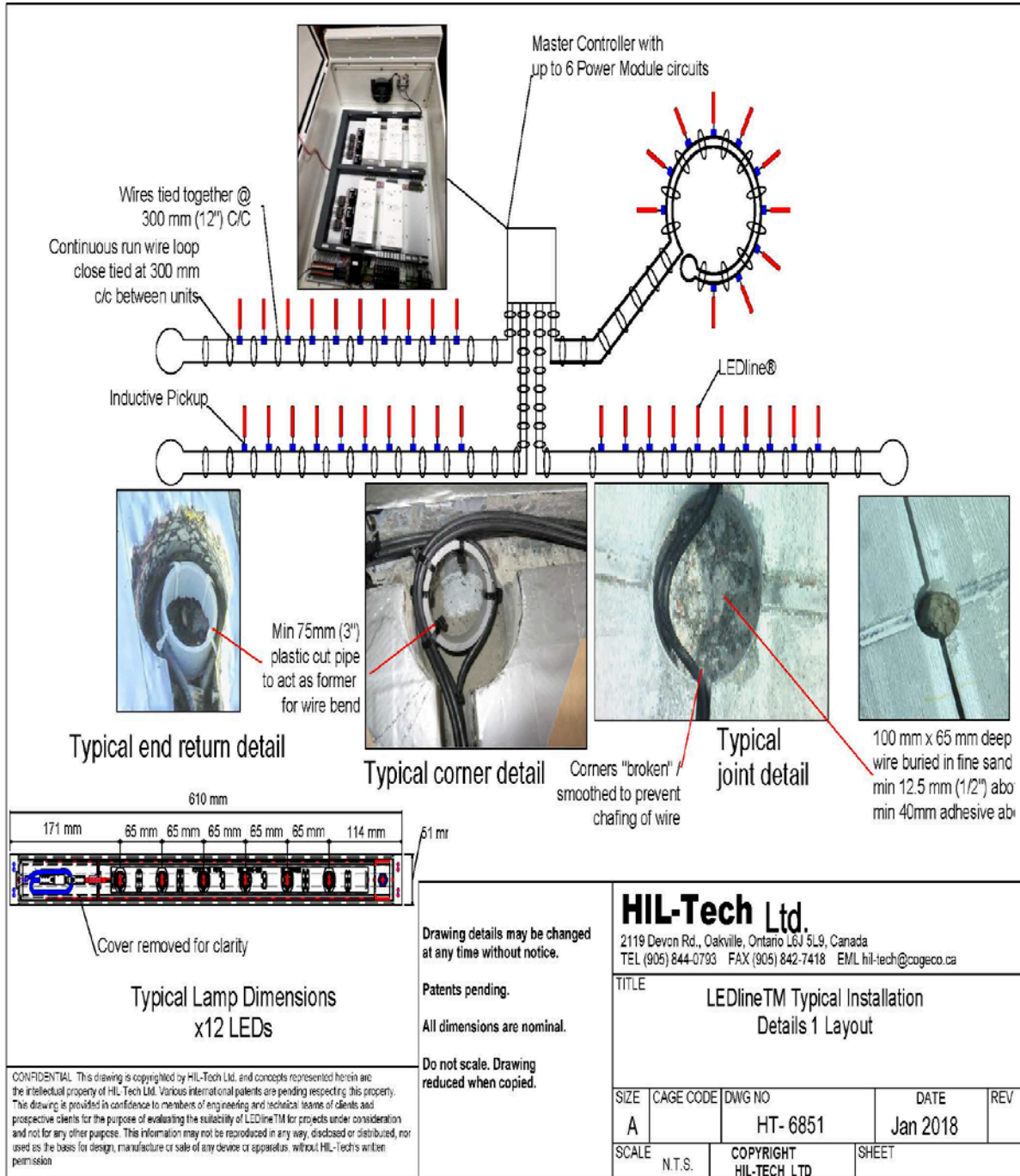


Typical saw cut depths for the induction power distribution cables, induction power pickup connectors and LEDline® lights are available below:

HT-6853 Typical Installation Details 2. (Drawing Not to Scale):



HT-6853 Typical Installation Details 3. An Induction Circuit:



Appendix 2: LEDline® PART NUMBERS

Part Number Format for Ordering:

(**Note** All LEDline® lamps come with IP69K quick disconnect. If the old IP68 plastic connector or kits to change an IP68 to IP69K connector is required please contact HIL-Tech Ltd.)

The part numbers for LEDlineDV™ and LEDlineSunDV™ (semi-directional) and LEDlineHB™ and LEDlineSunHB™ (omni-directional) are detailed here including optical specifications:

Colour — Representing available LED colour choices {R - red, A – airport yellow / amber, G - green, B - blue, W - white}
 Optics — For the LEDlineHB™ and LEDlineSunHB™ systems, there are embedded precision omni-directional optical systems.
 — For the LEDlineDV™ and LEDlineSunDV™ styled systems all (DV) designations include an embedded precision optical system, focusing most of the light at low angles towards the viewer. Therefore the product becomes semi-directional and especially at night, can still be seen from other angles. However LEDs with optics, (semi-directional) are much brighter if approached from the correct direction, no matter the ambient light condition.

Lamps

Example: **LL – DV00 – 0004-W-12** =
 LL = LEDline® -
 DV00 = Direction Visibility with embedded directional optics revision No 00
 0004 = Lamp Series version.
 W = Colour
 12 = Number LEDs (6 = high brightness; 12 = daylight visible)

1st Section = LEDline® identifier;
2nd Section = Choice of Optics; DV = Directional Visibility, **with embedded precision directional optics**; or
 HB = High Brightness, **with embedded precision Omni-directional optics**
3rd Section =Lamp Series revision 0003 with old style IP 68 Connector (for existing lamp replacement only)
 0004 with new style IP 69K Connector
4th Section = Colour Code. It is possible to have two colors specified in one LEDlineSun™ unit 6 x LEDs of one colour and 6 x LEDs of another.
 W = White
 Y = Yellow
 B = Blue
 R = Red
 G = Green
 (note Infra-Red or UV available by special order request)

Power System: **LL-PSxx-xxxx-xx**

1st Section = designation LEDline®
2nd Section; Type Power Supply = PSMC = Master Controller.
 PSDC = DC Power
 PSPM = Power Modules (from 1-6 are possible within an MC).
 PSBS = Boost Package for extended circuit length
3rd Section; 00xx = Power System / Module System Configuration Series Number 02
4th Section; xx = Special Configurations
 PM01 = Compact Master Controller c/w one PM only
 SS = Stainless Steel Cabinet

Induction Connectors **LL-CT00-xx**

1st Section = designation LEDline®
2nd Section; = CT Series Number
3rd Section; xx = 06 for 6 x LEDs
 = 12 for 6 x LEDs with Boost
 = 12 for 12 x LEDs
 = 24 for 12 x LEDs with Boost