

Stadium and Arena

Best Practice Photoluminescent Path Marking Solution



 **ecoglo**[®]

VISIBLY BETTER

V21.2

System Design and Product Specification of Photoluminescent Markings for use in Stadia and Arenas



Benefits

- Failsafe emergency lighting increases safety and security preparedness
- Provides aisle lighting and wayfinding for low light and dark events
- Improves orientation and wayfinding for the visually impaired
- Step edge contrast helps reduce everyday slips and falls

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Ecoglo International, established in 1997, designs and manufactures highly durable photoluminescent products using High Temperature Curing (HTC) technology to meet international performance based building codes. These products include step edging, handrail markers, path markers and exit signage.

Serious about sustainability, all Ecoglo products (except the Hybrid sign*) utilise ambient light and therefore require no electricity, lamps or batteries, need only minimal maintenance, and can be readily recycled, making them extremely cost effective building solutions. The solutions are failsafe, operate immediately and will last the life of a building. These products are warranted for 30 years when installed indoors, and 15 years when installed outdoors. Using no batteries and being recyclable means no waste goes to landfill.

*The Ecoglo Hybrid sign is an LED/Photoluminescent system which is effective in all lighting scenarios. Designed to be used in situations where there is insufficient ambient light to charge standard Ecoglo signs. Requires no batteries.



Ecoglo products include:

- Step Edge Contrast Strips and Nosings
- Handrail Markers
- Guidance Strips
- Path Markers
- Exit Signage
- Aisle and Seat Markers

In Stadia and Arenas, Ecoglo photoluminescent (PL) products can be used for the following purposes:

1. Emergency visibility whether standalone or to enhance electrical emergency lighting.
2. Aisle lighting and wayfinding for low light and/or dark events.
3. Everyday reduction of slips and falls through the provision of step edge contrast.

Ecoglo products can be used in a variety of locations.

Recommended locations and products below:

Bowl Area	Step Edge Products, Handrail Markers, Guidance Strips, Path Markers, Exit Signage, Aisle and Seat Markers
Scissor Ramps	Guidance Strips, Path Markers, Exit Signage
Access Stairs	Step Edge Products, Handrail Markers, Exit Signage
Corporate Suites	Step Edge Products, Exit Signage
Parking Structures	Step Edge Products, Guidance Strips, Path Markers, Exit Signage



Ecoglo Hybrid sign

For general products and product codes see Appendix 1.

For more detailed information about all our products visit our website, www.ecoglo.com

High Durability

Product used in stadia and arenas must have high durability due to the demands of high foot traffic. To provide the necessary durability the Ecoglo patented manufacturing process involves High Temperature Curing (HTC) technology to integrally bond the active ingredients into an aluminium substrate. The products have passed internationally accredited tests for durability, UV resistance, weather resistance, flammability, toxicity and radioactivity.



High Performance Photoluminescence

Ecoglo products contain photoluminescent pigment phosphors that absorb light energy and re-emit this as a bright glow when the lights dim or go out. To achieve the greatest luminosity possible, Ecoglo products incorporate a Purpose Designed Polymer (PDP), customised specially for the demanding requirements of international building codes. Ecoglo emergency visibility products, including S5 signs, are UL 1994¹ tested confirming their high visibility, while Ecoglo S20 pictogram signs have been tested in accordance with UL 924² to confirm their high visibility.

Ecoglo products are activated by either natural or artificial light and will glow for many hours following activation. The duration of visibility indoors will depend upon the charging source and the length of time of exposure to this light source (see Appendix 2). Outdoors the natural light will fully charge Ecoglo photoluminescent material, even on the most overcast day. When fully charged outdoors, Ecoglo products have luminance that will last all through the night.



High Performance Slip Resistance

Ecoglo anti-slip components are produced using hard wearing silicon carbide and the same HTC technology used for the photoluminescent components. They can be used indoors or outdoors as they are UV and weather resistant. They have passed the following tests: UL410 Standard for Slip Resistance for Floor Surface Materials; AS/NZS 4586-2004 Classification: Dry: F Wet: V Ramp: R12; AS 4586-2013 Classification: P5 which is the highest classification achievable.

Make sure it's Ecoglo!

With our reputation for quality, it's no surprise that other companies try to pass off their product as Ecoglo or Ecoglo quality. There are many imitations out there, but it quickly becomes apparent that they're not Ecoglo. Within no time at all, the product starts to break down. The photos to the right are some examples of recent copycat products that failed.

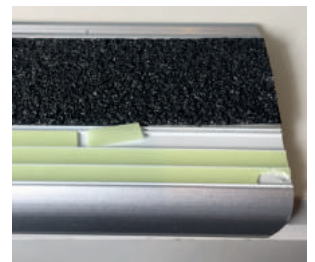
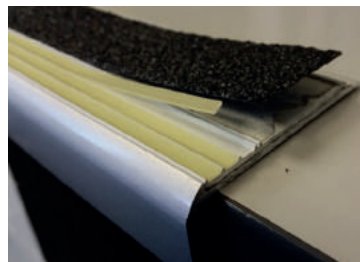
¹ UL 1994 Standard for Luminous Egress Path Marking Systems

² UL 924 Standard for Emergency Lighting and Power Equipment



Ecoglo Step Nosing

Imitation Failures



**Only Ecoglo uses HTC and PDP and warrants the product for 30 years indoors.
Contact us for an Ecoglo Specification for your Stadia and Arenas installation.**

Photoluminescent markings can be used to:

- Provide a standalone emergency visibility system
- Enhance existing emergency lighting systems

Emergency lighting systems must be completely reliable and operate immediately on failure of the main lighting system.

Traditional battery backup or generator systems can suffer from the following:

- partial or total failure to operate;
- delays in start up times;
- limited operating durations;
- installation difficulties;
- maintenance issues.

Photoluminescent systems can overcome these shortcomings as they are failsafe and operate immediately. For these reasons, even where traditional emergency systems are in place a photoluminescent system will greatly improve safety³.

Functional Requirements

The functional requirements of a photoluminescent emergency visibility system is that critical escape route elements are visible from 10 metres. These critical escape route elements are defined to be stairs and landings, corridors and ramps, handrails, direction indicators, obstructions and doors in the escape route. Photoluminescent products can also be used for emergency egress signage.

Ecoglo markers are UL 1994 tested to ensure that they are visible from 10 metres by a person with normal vision. This criteria is based on the New Zealand Building Code⁴ which is the most stringent international code available, therefore providing for the safest outcome. The independent testing also verifies that the products are visible from 10 metres when emitting a luminance output of 5mcd/m².

Ecoglo S5 emergency visibility signs have been tested to UL 1994 specifications.

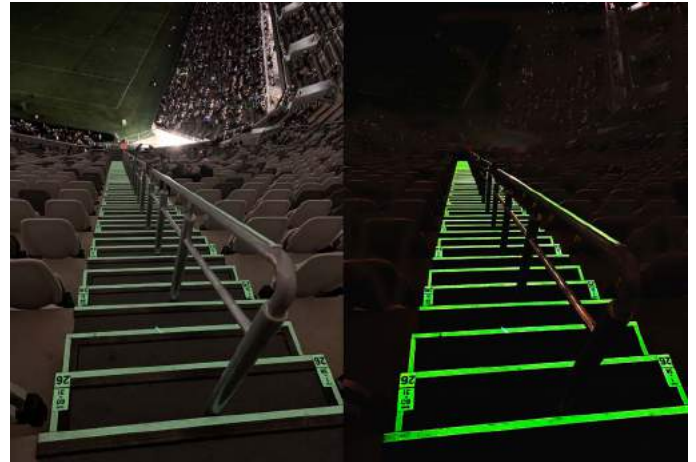
Ecoglo S20 exit signage is UL 924 tested but can also be designed to meet local emergency requirements.

Electrical light can be used to charge photoluminescent products.

Appendix 2 shows fluorescent light charging Ecoglo S10 grade photoluminescent material for 20 minutes at 100 lux has a luminance output of above 15mcd/m² at 120 minutes after the main lighting has been turned off. This easily exceeds the design level of 5mcd/m² providing a robust safety margin. A longer duration of visibility can be achieved by charging for a longer duration and/or charging with a brighter source.

Outdoor daylight provides much greater charging of Ecoglo emergency visibility markings than building interiors, even in heavy overcast conditions. So electric lighting is not needed to charge up Ecoglo markings that are installed in locations exposed to outdoor daylight.

See Appendix 3 for luminance output of different grades of Ecoglo photoluminescent material.



³ National Research Council of Canada field study 2007 authors stated that "Photoluminescent wayfinding systems appear as a cost effective addition to, or even a potential replacement for, traditional emergency lighting." G Proulx, N Bechou, JK Hum and KN Restivo.

⁴ New Zealand Building Code Clause F6 Visibility in Escape Routes has a 10m (32.8 ft) requirement. In comparison the International Building Code Chapter 10 'Means of Egress' has a 25 ft (7.52 m) requirement.

Design Philosophy

The philosophy of the design is to make building elements visible using Ecoglo photoluminescent markers in areas where safe movement can be guided by simple path markings and emergency egress instructions. Examples of areas utilising photoluminescent markers include stairways, corridors, ramps and landings.

When movement requires complex decision-making or where there is no clear path, visibility should be provided by other lighting systems. Examples of areas that may require other lighting systems include open concourses.

System Design

The marking of the specified building features in escape routes has been modelled on the design criteria of the International Building Code⁵.

Building features in an escape route shall have photoluminescent markings as follows:

Steps in Aisles and Stairways

The horizontal leading edge of all steps should be marked including the landing step at the top of any flight of steps.

Handrails

The top surface of all handrails is marked with a strip. The strip extends along the entire length of the handrail to within 100mm of the ends. Where a handrail bends or turns corners there is a gap of no more than 100mm.

Stairway Landings

The perimeters of the stairway landing are marked either on the floor within 100mm of the wall or on the wall within 100mm of the floor.

Corridors

The perimeters of the corridor are marked either on the floor within 100mm of the wall or on the wall within 100mm of the floor. Markings continue across the floor of all doors that do not form part of the escape route. If the perimeter markings are on the wall they continue across the surface of any door that does not form part of the escape route.

Ramps

Ramps of less than 3 metres wide are marked on the perimeters only. If a ramp is between 3 metres and 6 metres in width, the centre of the ramp should also be marked with path markers every 3 metres along the ramp. If a ramp is wider than 6 metres, create evenly spaced lines of photoluminescent path markers with a maximum space between each line of 3 metres.

Open Spaces

Where there is an obstacle free path through an open space, the perimeter of that path is marked. Concourses generally have multiple paths from vomitories intersecting therefore a clear path may not exist and other emergency lighting must be used in areas such as this.

Obstacles

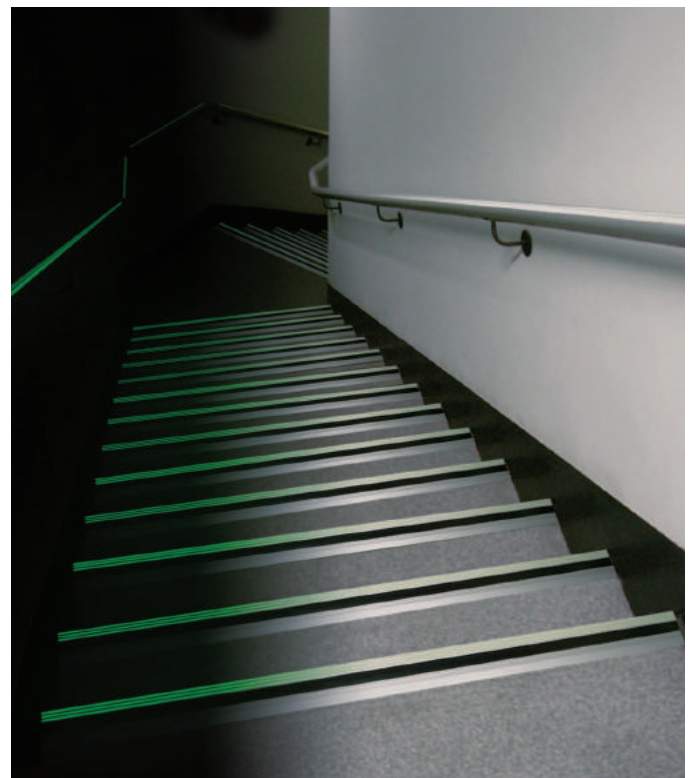
Obstacles at or below 2 metres in height and projecting more than 100mm into an escape route are identified with hazard marking.

Escape Doors and Entries to a Safe Place

Door frames have a solid continuous stripe. Door handles and panic bars have markings installed behind, immediately adjacent to, or on the hardware.

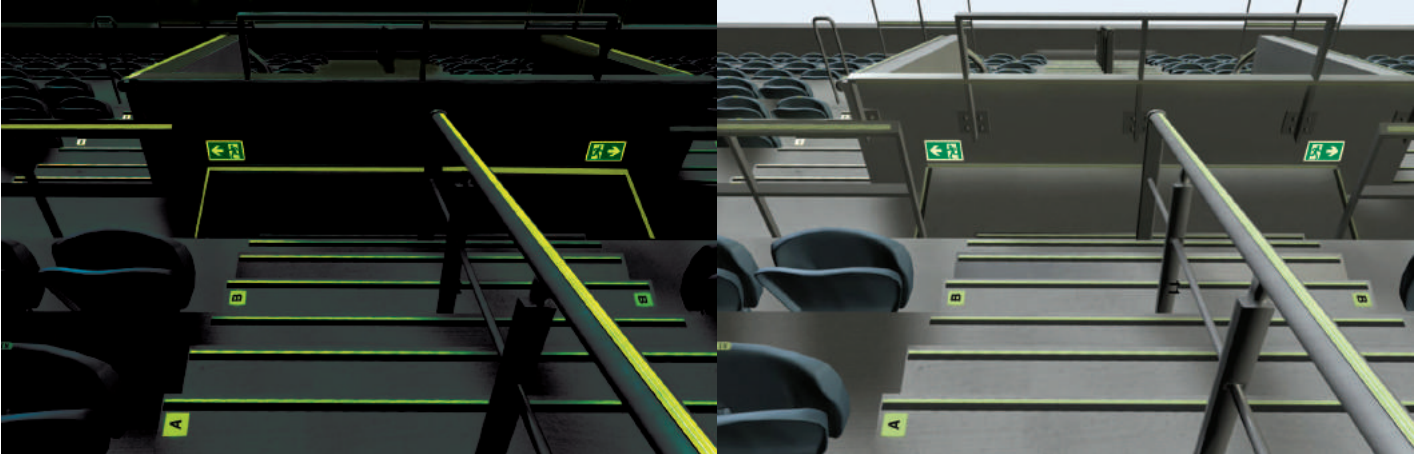
Signage

Directional signage of 100mm x 100mm minimum is installed not more than 457mm above the finished floor to clearly indicate direction changes. Emergency exit signage is designed to meet the requirements of the particular jurisdiction.



⁵ International Building Code Section 1025 Luminous Egress Path Markings

Aisle Lighting and Signage



Photoluminescent markings can be used to:

- Provide aisle lighting for low light or dark events
- Provide high visibility signage for direction and row marking

Modern day stadia and arenas are often required to be multipurpose, for example, they may be used for a sporting event requiring high light levels or a concert requiring low light levels. Although concert performers may wish to keep the lighting very low, stadium managers must provide safe access to concession stands and toilets/restrooms. Latecomers must also be provided for. Consideration must therefore be given to aisle lighting and signage that allows for these conflicting demands. Photoluminescent systems will provide sufficient visibility for patrons under low light conditions while at the same time they will not create a visual distraction for performers.

Functional Requirements

The functional requirement of an aisle lighting system is that aisle features are clearly visible under all light conditions. The aisle features are defined to be steps, aisle landings, ramps, handrails and row markers. High visibility signage providing directions and labelling, e.g. toilets/restrooms, accessibility routes, fire hydrants, etc can also be advantageous.

Design Philosophy

The philosophy of the design is to make aisle elements visible using Ecoglo photoluminescent markers so that accessing seats is both easy and safe. Directional and facility signage aids in the ease of movement of patrons around the facility.

System Design

The recommended photoluminescent markings are as follows:

Aisle Steps

The horizontal leading edge of all steps are marked.

Aisle Landings

The perimeters of aisle landings are marked either on the floor within 100mm of the wall or on the wall within 100mm of the floor.

Ramps

The perimeters of ramps are marked either on the floor within 100mm of the perimeter or on the wall within 100mm of the floor.

Handrails

The top surface of all handrails is marked with a strip. The strip extends along the entire length of the handrail to within 100mm of the ends. Where a handrail bends or turns corners there is a gap of no more than 100mm.

Row Markers

The rows are labelled with photoluminescent row markers to identify the row and range of seats accessed from the aisle. These can either be attached to the seats or installed on the floor.

Signage

Wherever directional decisions need to be made photoluminescent signs showing an arrow and/or running man are used. Photoluminescent labelling of facilities such as toilets/restrooms, accessibility routes, fire hydrants, etc can also be advantageous.



Ecoglo's highly visible row markers enhance the orderly movement of people to and from their seats. Working equally well in light, dark and dim conditions they reduce disruption to others, increase the efficiency of ushers, and allow customers to easily visit concessions and other facilities.

Step Edge Contrast

Photoluminescent markings can be used to provide step edge contrast to:

- Prevent slips and falls
- Improve accessibility for patrons with impaired vision
- Aid in wayfinding in low light or dark environments

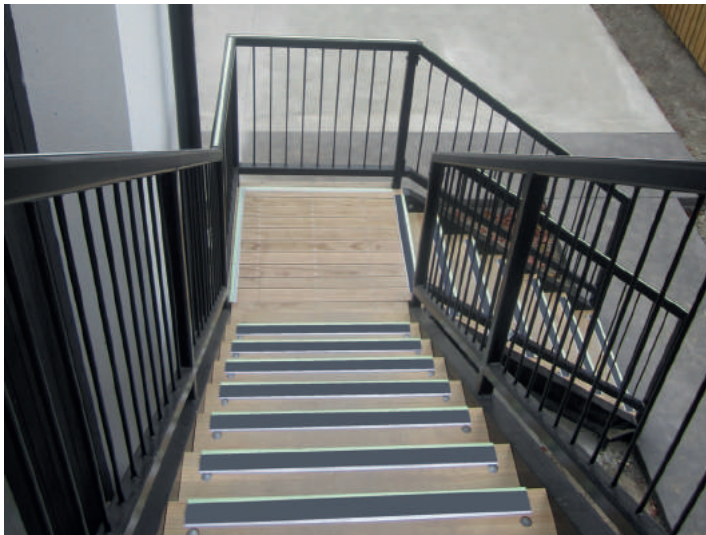
Steps should allow for safe, fast and orderly movement of patrons in both emergency and non-emergency situations. Poor visibility is a leading cause of slips and falls on steps. The costs to facilities from claims for slips and falls can be an excessive, but avoidable expense.

Glare in the environment, visual reflectance and specular properties of a stair tread can contribute to daytime visibility difficulties. Photoluminescent systems can provide step edge contrast that overcomes these issues and ensures good contrast in light, dark and dim conditions.

Step edge contrast is important for all patrons but particularly important for those with impaired vision.

Functional Requirements

In order to prevent slips and falls the step edge strips are slip resistant, provide visual contrast to define the edge and are highly durable to ensure that they are not worn out by high foot traffic, rendering them ineffective.



All steps including landing step at top of flight of steps must be marked.

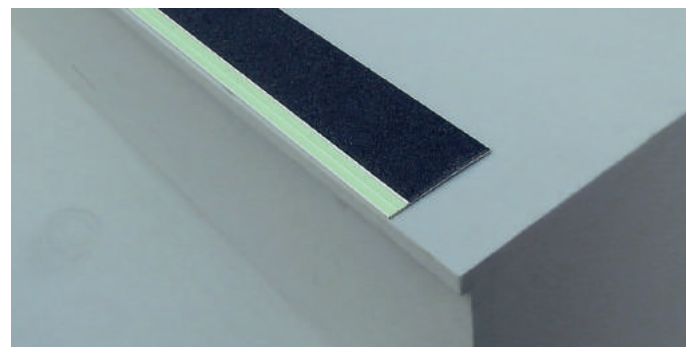
System Design

The horizontal leading edge of all steps should be marked including the landing step at the top of any flight of steps.

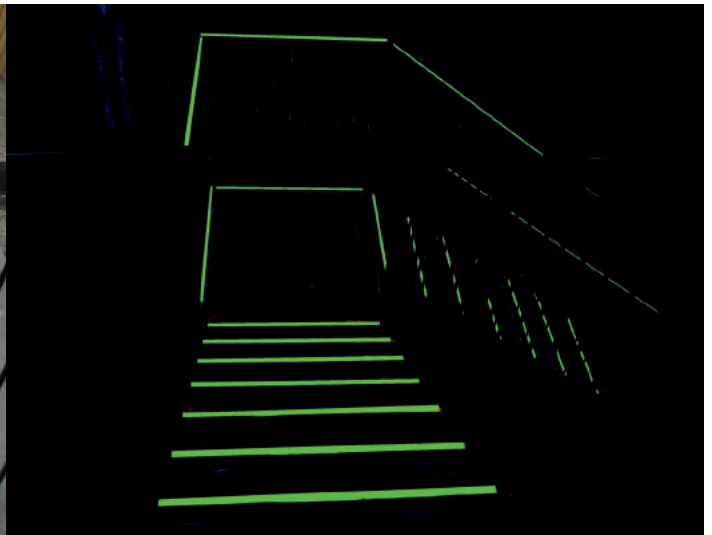
When the products are being used to meet accessibility codes the width of the strip will be determined by the code requirement in the particular jurisdiction.

Design Philosophy

The philosophy of the design is to make step edges visible using Ecoglo's high durability photoluminescent markers. Ecoglo photoluminescent markings have two components – a photoluminescent strip and an anti-slip strip. These two components create internal visual contrast thus ensuring the step edge contrast is independent of the tread surface (see image). This internal contrast also ensures that visibility is good even under conditions of glare and visual reflectance.



Step edge contrast should be on the tread of a stair, not the riser, because when either ascending or descending stairs the tread provides the visual information required to negotiate stairs safely.



Ecoglo products provide visual definition of the step edge not only in dark 'lights-out' conditions, but also in everyday conditions, as Ecoglo products provide contrast between the step edge and the rest of the tread. This helps direct people to an exit while also reducing slips and falls. The anti-slip material integrated into Ecoglo Step Edge products is key to preventing everyday slips and falls on steps and makes for safe and swift evacuation in an emergency.

A periodic evaluation of the photoluminescent markings should be undertaken to ensure that:

All products are still configured as at installation and there is no material damage to any of the products.
All products are clean from general dust build up and any other specific obscuring deposits.
All products are clearly visible and have not been covered up by carpet or other materials.
All products mark a clear path and have not been obstructed by physical hazards such as trolleys, machinery, partitions, etc.
All products can be used to provide clear escape path marking and there has been no change to the configuration of the building which renders the escape path unusable.
All lights within 4m of Ecoglo markings have been checked that the positions have not altered from design.
All lights within 4m of Ecoglo markings are in working order and clean.
All light switching controls are operational as per the design.

Safety and Durability Tests

Independent testing of Ecoglo photoluminescent products in accordance with ASTM G155-2004⁶ has determined that there is no material degradation of luminance output due to exposure to weathering by ultra violet light.

The Ecoglo system has also met the following New York City RS6-1A tests for safety and durability.

- 5.0 Flame Spread
- 4.0 Radioactivity
- 3.0 Toxicity
- 2.0 Washability
- 6.0 UV degradation

Ecoglo maintains an ISO 9001: 2015 Quality Assurance system to ensure products are manufactured to specification.

⁶ ASTM G 155-2004 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non Metallic Materials

Appendix 1

Ecoglo Stadium and Arena Products

For advice on which products best suit your project please contact Ecoglo

STEP EDGE PRODUCTS

PRODUCT CODE	PRODUCT NAME	WIDTH	DEPTH	LENGTHS (in 100mm increments)
E2-071	Step Edge Contrast	37.3mm	1.8mm	800mm – 1500mm
E14-075	Step Edge Contrast	63.6mm	2.2mm	800mm – 1500mm
E15-073	Step Edge Contrast	64.0mm	2.2mm	800mm – 1500mm
F14-175	Step Nosing	74.8mm	9.7mm	800mm – 1500mm
F15-175	Step Nosing	75.2mm	33.2mm	800mm – 1500mm
F14-173	Step Nosing	75.0mm	10.0mm	800mm – 1500mm
F15-173	Step Nosing	75.0mm	33.0mm	800mm – 1500mm

HANDRAIL MARKERS

PRODUCT CODE	PRODUCT NAME	WIDTH	DEPTH	LENGTHS
H3-001	Handrail Marker	15.5mm	2.0mm	1 and 3.06 metres
H5-001	Handrail Marker	27.0mm	1.5mm	1 and 3.06 metres
MS-26	Handrail Wall Strip	27.0mm	2.2mm	1 metre

GUIDANCE STRIPS AND PATH MARKERS

PRODUCT CODE	PRODUCT NAME	WIDTH	DEPTH	LENGTHS
G3-001	Guidance Strip	15.5mm	1.8mm	1 and 3.06 metres
G6-003	Guidance Strip	26.0mm	1.6mm	1 and 3.06 metres
T5-101	Path Marker	51mm	3.4mm	1 metre
T6-101	Path Marker	37mm	3.4mm	1 metre
G7-100 Solaris	Path Marker	50mm	3.0mm	100mm (10 pieces per pack)

EMERGENCY VISIBILITY SIGNS/UL 1994 SIGNS

PRODUCT CODE	PRODUCT NAME	SIGN DEFINITION	SIGN SIZE
S5-RM2010	Pictogram	Exit straight on from here	200 x 100mm
S5-RMUA2010	Pictogram Up Arrow	Exit straight on from here	200 x 100mm
S5-RMDA2010	Pictogram Down Arrow	Exit down from here	200 x 100mm
S5-RML2010	Pictogram Left Arrow	Exit left from here	200 x 100mm
S5-RMR2010	Pictogram Right Arrow	Exit right from here	200 x 100mm
S5-RMUL2010	Pictogram Up Left Arrow	Exit up left from here	200 x 100mm
S5-RMDL2010	Pictogram Down Left Arrow	Exit down left from here	200 x 100mm
S5-RMUR2010	Pictogram Up Right Arrow	Exit up right from here	200 x 100mm
S5-RMDR2010	Pictogram Down Right Arrow	Exit down right from here	200 x 100mm

MISCELLANEOUS PRODUCTS

PRODUCT CODE	PRODUCT NAME	WIDTH	HEIGHT/LENGTH
S20-SQ-60	Door Handle Marker	60mm	60mm
UL-DHM3840	Door Push Bar Marker (vinyl)	407mm	38mm
UL-HZ2518	Hazard Tape (vinyl)	25mm	18 metres
S20-AC1616	Accessible	162mm	162mm

See www.ecoglo.com for more detailed information about Ecoglo products

Appendix 1 (Cont.)

For advice on which products best suit your project please contact Ecoglo

AISLE AND SEAT MARKERS

PRODUCT CODE	PRODUCT NAME	SIGN SIZE
SQ63R	Row Marker	63mm x 63mm
SQ63RSP	Row and Seat Marker	63mm x 63mm
SQ90R	Row Marker	90mm x 90mm
SQ90RSP	Row and Seat Marker	90mm x 90mm
SQ90RSN	Row and Seat Marker Black Panel	90mm x 90mm
RE16045-RS	Row and Seat Marker	160mm x 45mm
EL187567	Ellipse Seat Marker	18.7mm x 56.7mm

EMERGENCY EXIT SIGNS

PRODUCT CODE	PRODUCT NAME	SIGN DEFINITION	SIGN SIZE	MAXIMUM VIEWING DISTANCE
S20-RM1616-16m	Pictogram Uni	Exit straight on from here	162mm x 162mm	16 metres
S20-RM2323-24m	Pictogram Uni	Exit straight on from here	230mm x 230mm	24 metres
S20-RM2916-16m	Pictogram	Exit straight on from here	290mm x 162mm	16 metres
S20-RM4223-24m	Pictogram	Exit straight on from here	420mm x 230mm	24 metres
S20-RML2916-16m	Pictogram Left	Exit left from here	290mm x 162mm	16 metres
S20-RML4223-24m	Pictogram Left	Exit left from here	420mm x 230mm	24 metres
S20-RMR2916-16m	Pictogram Right	Exit right from here	290mm x 162mm	16 metres
S20-RMR4223-24m	Pictogram Right	Exit right from here	420mm x 230mm	24 metres
S20-RMRL2916-16m	Double Arrow	Exit right or left from here	290mm x 162mm	16 metres
S20-RMRL4223-24m	Double Arrow	Exit right or left from here	420mm x 230mm	24 metres
S20-AR1313	Arrow	Travel in this direction	133mm x 133mm	-
S20-AR1616	Arrow	Travel in this direction	162mm x 162mm	-
S20-AR2323	Arrow	Travel in this direction	230mm x 230mm	-
S20-EX2313	Exit	Exit straight on from here	230mm x 133mm	16 metres
S20-EX2916	Exit	Exit straight on from here	190mm x 162mm	24 metres
S20-NE4113-16m	No Exit	Do not use this door to exit in an emergency	410mm x 133mm	16 metres

See www.ecoglo.com for more detailed information about Ecoglo products

Appendix 1 (Cont.)

For advice on which products best suit your project please contact Ecoglo

UL 924 EXIT SIGNS				
PRODUCT CODE	PRODUCT NAME	SIGN DEFINITION	SIGN SIZE	MAXIMUM VIEWING DISTANCE
S20-UL-EX353183-50	Exit	Exit straight on from here	535mm x 183mm	50 feet (15.24m)
S20-UL-EX481249-75	Exit	Exit straight on from here	481mm x 249mm	75 feet (22.86m)
S20-UL-EXR353183-50	Exit Right	Exit right from here	535mm x 183mm	50 feet (15.24m)
S20-UL-EXR481249-75	Exit Right	Exit right from here	481mm x 249mm	75 feet (22.86m)
S20-UL-EXL353183-50	Exit Left	Exit left from here	535mm x 183mm	50 feet (15.24m)
S20-UL-EXL481249-75	Exit Left	Exit left from here	481mm x 249mm	75 feet (22.86m)
S20-UL-EXRL353183-50	Exit Double Arrow	Exit right or left from here	535mm x 183mm	50 feet (15.24m)
S20-UL-EXRL481249-75	Exit Double Arrow	Exit right or left from here	481mm x 249mm	75 feet (22.86m)
S20-UL-RMR392223-50	Pictogram Right Arrow	Exit right from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMR480280-75	Pictogram Right Arrow	Exit right from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RML392223-50	Pictogram Left Arrow	Exit left from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RML480280-75	Pictogram Left Arrow	Exit left from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMUA392223-50	Pictogram Up Arrow	Exit straight on from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMUA480280-75	Pictogram Up Arrow	Exit straight on from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMDA392223-50	Pictogram Down Arrow	Exit down from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMDA480280-75	Pictogram Down Arrow	Exit down from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMUR392223-50	Pictogram Up Right Arrow	Exit up to the right from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMUR480280-75	Pictogram Up Right Arrow	Exit up to the right from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMDR392223-50	Pictogram Down Right Arrow	Exit down to the right from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMDR480280-75	Pictogram Down Right Arrow	Exit down to the right from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMUL392223-50	Pictogram Up Left Arrow	Exit up to the left from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMUL480280-75	Pictogram Up Left Arrow	Exit up to the left from here	480mm x 280mm	75 feet (22.86m)
S20-UL-RMDL392223-50	Pictogram Down Left Arrow	Exit down to the left from here	392mm x 223mm	50 feet (15.24m)
S20-UL-RMDL480280-75	Pictogram Down Left Arrow	Exit down to the left from here	480mm x 280mm	75 feet (22.86m)



See www.ecoglo.com for more detailed information about Ecoglo products

Appendix 1 (Cont.)

For advice on which products best suit your project please contact Ecoglo

HYBRID EMERGENCY EXIT SIGNS			
PRODUCT CODE	PRODUCT DESCRIPTION	GRAPHICS INCLUDED	MAXIMUM VIEWING DISTANCE
HYU1.2	Single Sided Hybrid Sign	1 x RM, 1 x RMR, 1 x RML	16 metres
HYU1.2-RMRL	Single Sided Hybrid Sign	1 x RM Double Arrow	16 metres
HYU1.2-RMB	Single Sided Hybrid Sign	1 x RM Low Light Black	16 metres
HYU1.2-EXB	Single Sided Hybrid Sign	1 x Exit Low Light Black	24 metres
HYU1.2-EX	Single Sided Hybrid Sign	1 x Exit	24 metres
HYU1.2-EXR	Single Sided Hybrid Sign	1 x Exit Right	16 metres
HYU1.2-EXL	Single Sided Hybrid Sign	1 x Exit Left	16 metres
HYU2.2	Double Sided Hybrid Sign	2 x RM, 1 x RMR, 1 x RML	16 metres
HYU2.2-RMRL	Double Sided Hybrid Sign	2 x RM Double Arrow	16 metres
HYU2.2-EX	Double Sided Hybrid Sign	2 x Exit	24 metres
HYU2.2-EXRL	Double Sided Hybrid Sign	1 x Exit Right, 1 x Exit Left	16 metres
HYU2.2-EXCB	Double Sided Hybrid Sign	2 x Exit Low Light Black	24 metres

Ecoglo International Ltd
77 Kingsley Street, Christchurch
New Zealand www.ecoglo.com



17 May 2019

Ecoglo in-house test report.

Ecoglo runs an in-house luminance test facility, which is validated by comparative testing with independent test laboratories. The in-house test facility enables the efficient testing of multiple charging brightness, time, lamp type, and product variations. Ecoglo has carried out over 3000 in-house tests since 2003.

The attached data and chart are extracted from Ecoglo records for the following in-house tests:

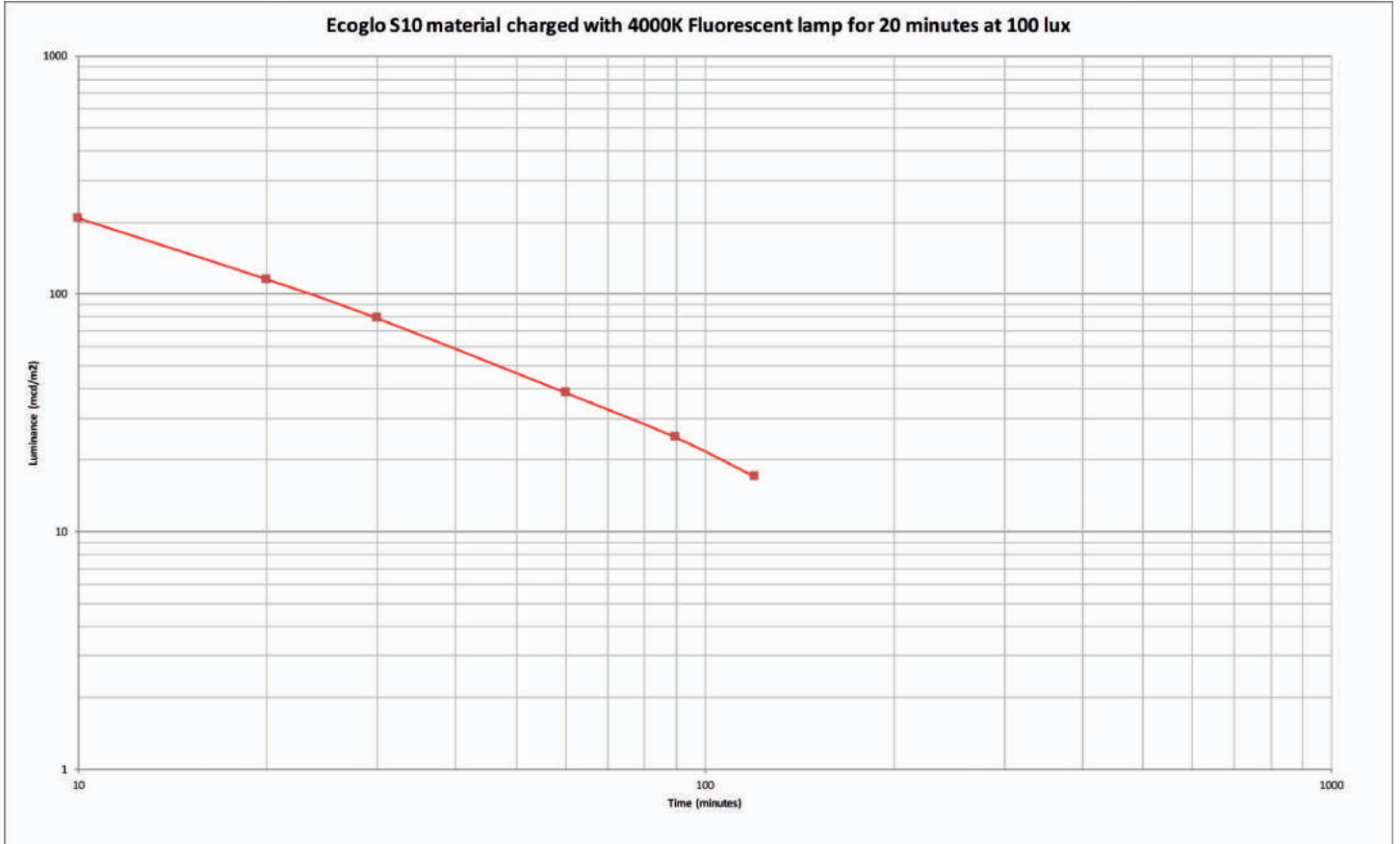
Test ID	Date	Test sample	Charging lamp type	Illuminance on sample	Charging time
E904	15 May 2019	Ecoglo S10 material	Fluoro 4000K	100 lux	20 minutes

Time (minutes)	10	20	30	60	90	120
Ecoglo S10 (mcd/m ²)	208	115	79	38.3	24.8	17.0



Mark Watson BE, CMEngNZ, CPEng, IntPE(NZ), RPEQ (Fire, Mechanical)
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Appendix 2 (Cont.)



Appendix 3

Luminance of Different Grades of Ecoglo Photoluminescent Material (PLM)

The results displayed in Tables 2 and 3 were collected via independent luminance testing carried out on different grades of Ecoglo PLM in September 2018, while the information in Table 1 is from the Photoluminescent Safety Products Association's (PSPA) latest material classification system (with Class A being the minimum requirement).

TABLE 1 PSPA Classification Table showing luminance of different classes of PLM after being exposed to 1000 lux for a period of 5 minutes

AFTER NUMBER OF MINUTES	LUMINANCE mcd/m2						
	CLASS						
	A	B	C	D	E	F	G
2	108	210	690	1100	1800	2300	3000
10	25	50	140	260	400	520	650
30	7	15	45	85	120	155	190
60	3	7	20	35	55	70	80

Note: Class A is minimum requirement with Classes B – G having increasingly superior levels of luminance and decay times.

TABLE 2 Showing luminance of different grades of Ecoglo PLM after exposure to 1000 lux for a period of 5 minutes.

TIME AFTER REMOVAL OF CHARGING SOURCE (Mins)	LUMINANCE mcd/m2				
	GRADE				
	S5	S10	S15	S20	S25
2	2179	2559	3505	4284	4861
5	860	1019	1468	1794	2160
10	413	491	714	871	1087
20	192	227	3344	405	517
30	120	142	210	252	327
60	52.4	62.0	93.4	107.5	144.4
120	22.4	25.8	39.8	44.6	61.1
180	13.7	15.5	23.3	26.6	36.5
240	9.1	10.7	16.3	18.8	25.1
300	6.9	8.0	12.2	14.1	18.7
480	3.7	4.3	6.5	7.5	10.3
600	2.7	3.0	4.8	5.7	7.8

Conditions:

Charging source:

150W Xenon Lamp

Exposure:

1000 lux for period of 5 minutes

The results show the following:

Ecoglo S5 Grade PLM easily exceeds PSPA Class D.

Ecoglo S10 Grade PLM easily exceeds PSPA Class E.

Ecoglo S15 Grade PLM easily exceeds PSPA Class F.

Ecoglo S20 and S25 Grade PLM easily exceed PSPA Class G.

TABLE 3 Showing luminance of different grades of Ecoglo PLM after exposure to 5000 lux for a period of 60 minutes

TIME AFTER REMOVAL OF CHARGING SOURCE (Mins)	LUMINANCE mcd/m2				
	GRADE				
	S5	S10	S15	S20	S25
2	2058	2504	3930	4971	6556
5	794	944	1522	2006	2772
10	379	452	725	956	1362
20	178	212	339	453	656
30	114	136	216	289	422
60	52.3	62.2	98.5	132.9	195.3
120	23.0	27.8	43.4	60.0	89.2
180	14.0	17.2	26.5	35.8	55.9
240	9.7	11.6	18.8	25.5	38.7
300	7.3	8.5	14.4	19.5	28.9
480	4.1	5.0	8.3	10.8	15.8
600	3.2	3.8	6.5	8.5	12.1

Conditions:

Charging source:

20W Fluorescent Lamp

Exposure:

5000 lux for period of 60 minutes

Note: 5000 lux equates to the least amount of daylight PLM is likely to be exposed to. These luminance results show the minimum performance that can be expected of these Ecoglo materials when installed outdoors, even if covered by a roof overhang of up to 4 metres.

Appendix 3 (Cont.)



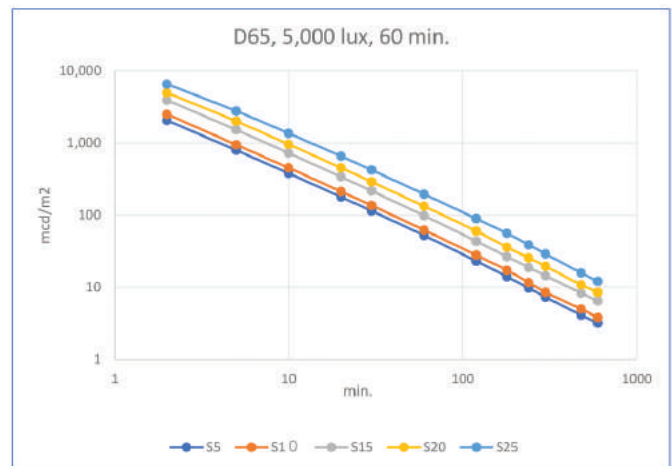
Brightness Analysis of Photoluminescent Rigid Sheet Manufactured by Ecoglo International Ltd.

Reporting date: September 26, 2018

Analyzer: Topcon BM-5AS
Excitation Source: TOSHIBA 20W Fluorescent Lamp FL20S-D-EDL-D65
Excitation Condition: D65 5,000 lux, 60 minutes

(mcd/m²)

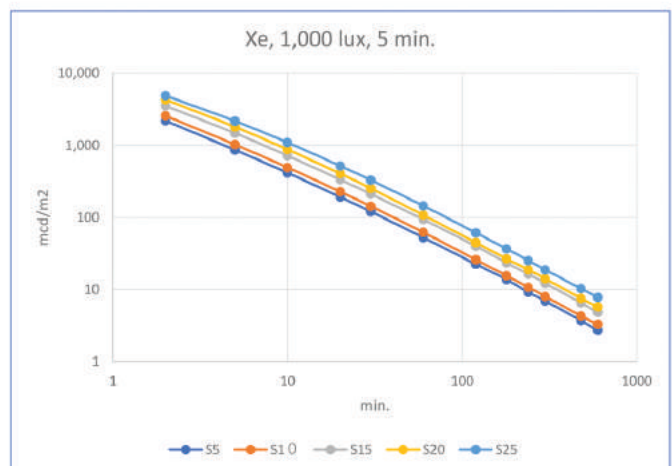
Time after removal of ex. (min.)	S5	S10	S15	S20	S25
2	2,058	2,504	3,930	4,971	6,556
5	794	944	1,522	2,006	2,772
10	379	452	725	956	1,362
20	178	212	339	453	656
30	114	136	216	289	422
60	52.3	62.2	98.5	132.9	195.3
120	23.0	27.8	43.4	60.0	89.2
180	14.0	17.2	26.5	35.8	55.9
240	9.7	11.6	18.8	25.5	38.7
300	7.3	8.5	14.4	19.5	28.9
480	4.1	5.0	8.3	10.8	15.8
600	3.2	3.8	6.5	8.5	12.1



Analyzer: Topcon BM-5AS
Excitation Source: Hamamatsu Photonics 150W Xenon lamp L2175
Excitation Condition: Xe 1,000 lux, 5 minutes

(mcd/m²)

Time after removal of ex. (min.)	S5	S10	S15	S20	S25
2	2,179	2,559	3,505	4,284	4,861
5	860	1,019	1,468	1,794	2,160
10	413	491	714	871	1,087
20	192	227	334	405	517
30	120	142	210	252	327
60	52.4	62.0	93.4	107.5	144.4
120	22.4	25.8	39.8	44.6	61.1
180	13.7	15.5	23.3	26.6	36.5
240	9.1	10.7	16.3	18.8	25.1
300	6.9	8.0	12.2	14.1	18.7
480	3.7	4.3	6.5	7.5	10.3
600	2.7	3.3	4.8	5.7	7.8



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