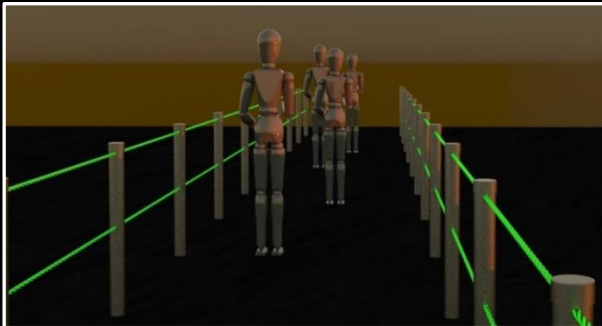


【 Specification 】

Item	Specification
Solar Cell Module	Using double-sided light receiving solar cell (Rated voltage 5 V, rated output 3.15 W)
LED	3 per span (1 per emitter) Standard luminous color: Green (Other colors are also available)
Battery	Lithium ion battery
Operation	Flashing synchronization control: Radio controlled clock system Lighting control: illuminance sensor (200 lx or less) or timer Lighting time: blinks for 12 hours (3 days with no charge when fully charged) Flashing interval: ON / OFF = 0.5s / 0.5s
Luminous Body	Material :Core part Acrylic resin, clad part Fluorine resin
Rubber Cap	Material : EPDM
Winding Jig	Material : ASA

【 Application Example 】



Pedestrian guidance fences such as promenade and earthquake disaster area



Safety measure for road shoulder blocks in overseas



Wire rope type protective fence for overseas expressway road shoulders
 ・ As visual guidance of road,
 2,500 km provisional two-lane guard fences nationwide,
 Guide path guidance at earthquake disaster,
 Overseas highway guard fences,
 Road shoulder blocks in developing countries



Other uses than visual guidance. For example as illuminations

-As other uses
 Animal entry fence, closed gate,
 ETC gate, visual guidance of snow fence
 and soundproof fence
 Monuments such as bridges and buildings
 in tourist area,
 Indoor and outdoor decoration

Delineators For Guard Cable / Wire rope Snowstorm And Night Life Line

Patent No. 6368449 "Manufacturing method of wire rope with resin wire, resin wire winding type and wire rope with resin wire" (has been registered to International patent PCT)

Japanese Patent Application No. 2017-019569 "Rotary moving body and rope material connecting tool using this rotary moving body, power generation device, visual guidance device, device for removing snow lees, and method for manufacturing rope material"

Design No. 1598723 "Luminous resin coated zinc-plated winding die for wire rope"

Design No. 1605446 "Luminous resin coated galvanized steel wire with wire rope"

Design No. 1617533 "Delineators"

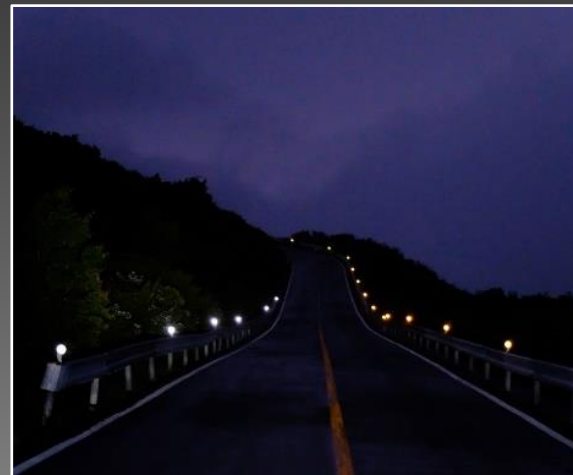
Design No. 1617534 "Delineators"

Wish to register 2018-13487 "Colored wire rope with wire"

【 Sustainable Development Goals (SDGs) Target 】

As a manufacturer of road traffic safety products, We are working on product development targeting
 "3.6 halve road traffic casualties""9.1 Develop sustainable and strong infrastructure to support economic development and welfare""11.2 Improving Traffic Safety Provides Access to Sustainable Transportation Systems"

To secure safer driver's driving use wire rope of guard fence to recognize driver's visual from "point" recognition to "line"



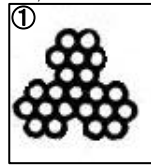
2 New Technologies to Realization The Totally New Visual Guidance That Never Before

What is "RIKEN spindle" that wraps a luminous body around a wire rope

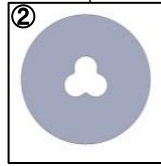
I. Basic Structure

Japanese Patent Application No. 2017-019569 "Rotary moving body and rope material connecting tool using rotary moving body, power generation device, visual guidance device, device for removing a snow bale, and method for manufacturing rope material"

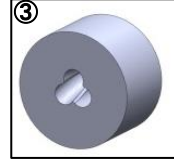
Wire ropes are manufactured by bundling several wires and twisting them in a spiral. A groove is formed between wire ropes, and this shape can be regarded as a bolt with a long pitch. On the other hand, rotary moving body that corresponds to nut is the "RIKEN spindle". If this rotating body is not rotated, it will not move when pushed or pulled.



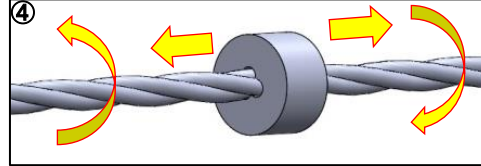
① Create wire rope cross section



② Make wire rope as male shape and make a cross section of its female shape



③ Create a structure in which ② is moulded in same twisting direction and pitch as the wire rope

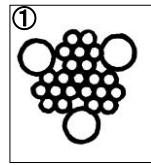


④ Move wire rope up and down by rotating this structure

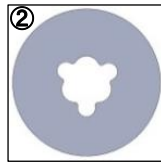
II. Luminescent body winding structure

Patent No. 6368449 "Method for manufacturing wire rope with resin wire, resin wire winding type and wire rope with resin wire" Design No. 1598723 "Luminous resin coated galvanized steel wire wound mould for wire rope"

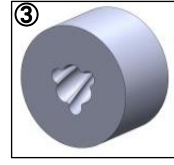
By applying the basic structure, light emitter can be wound in a short time in wire rope groove.



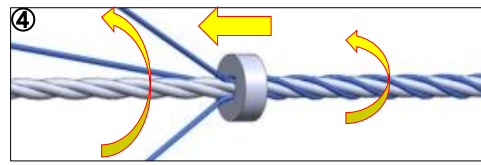
① Create a cross-sectional view with light emitters wrapped around wire rope.



② Create a cross-sectional view of female shape with ① as male shape.



③ Create a rotary moving body ② moulded in the same twisting direction and pitch as wire rope

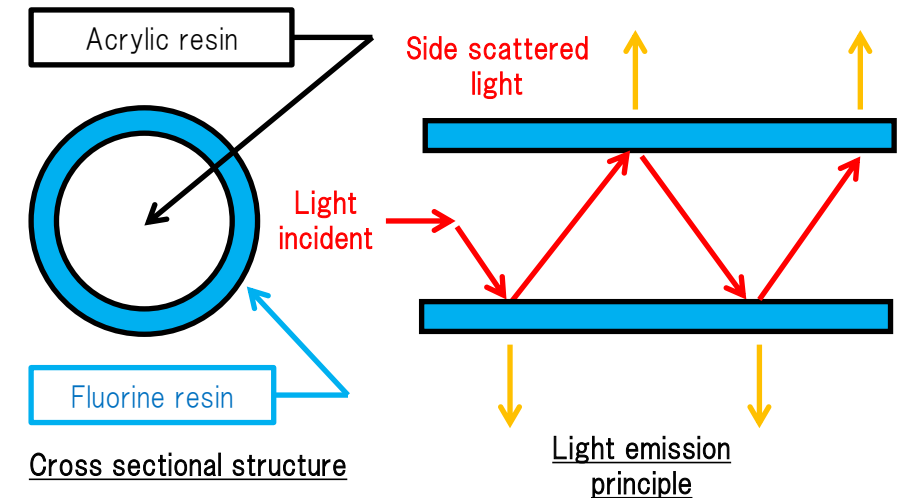


④ Light emitter is moved and wound by rotating the rotating body.

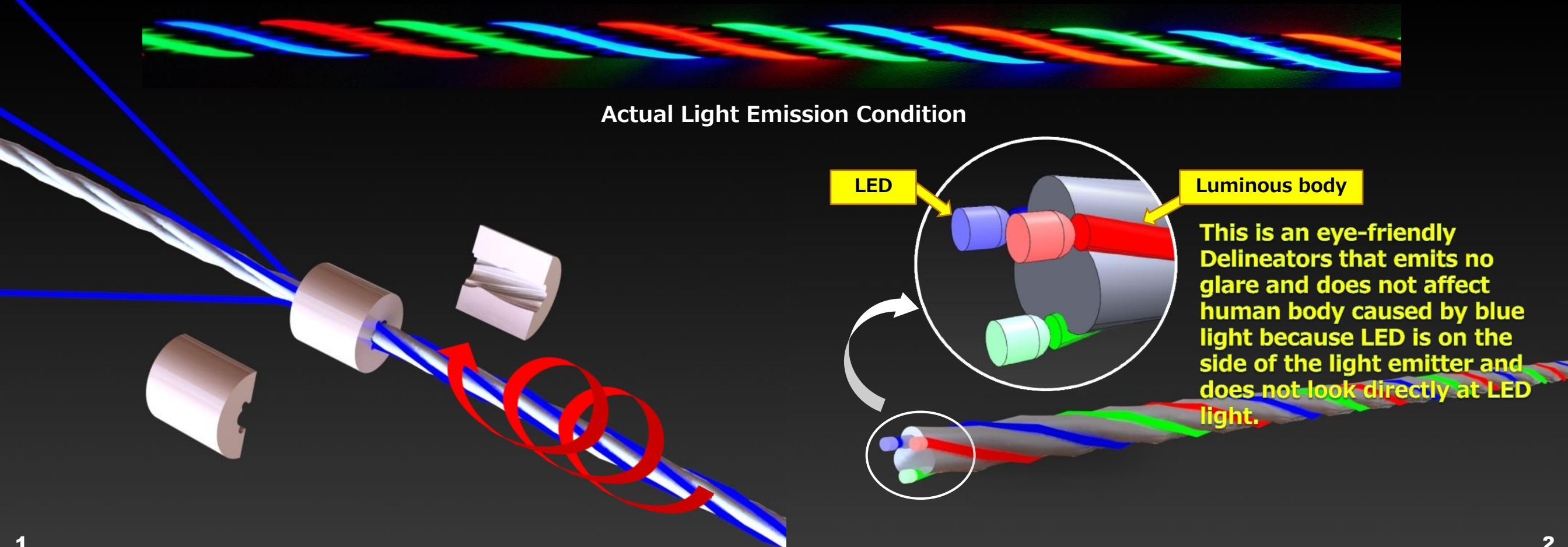
About "Linear high brightness light emitter"

Structure and principle of light emitter

It has a two-layer structure consisting of an acrylic resin core (inside) and a fluorine resin cladding (outside). The light incident from light emitter end is reflected between core and cladding, and part of the light is emitted from light emission part side while reaching the end, we will obtain linear uniform high brightness light emission along the shape.



Actual Light Emission Condition



Light Emitter Performance Test

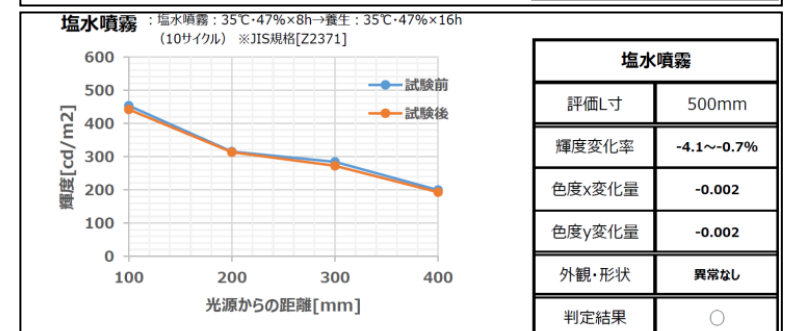
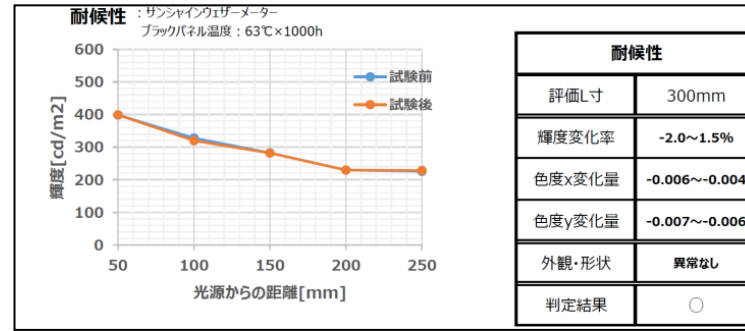
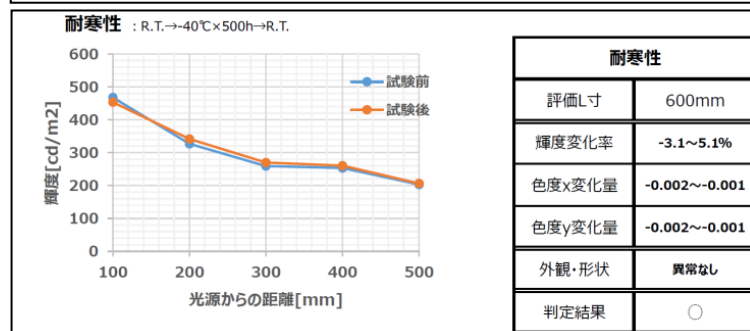
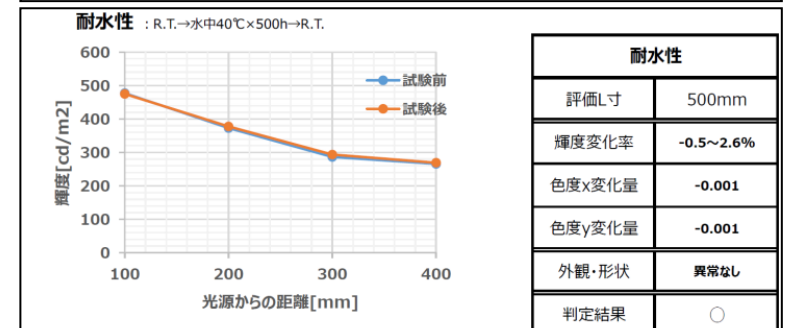
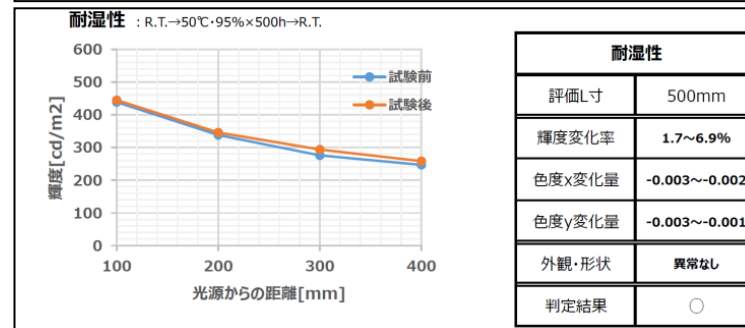
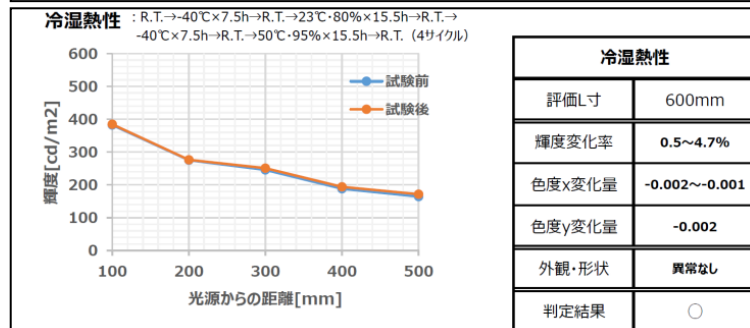
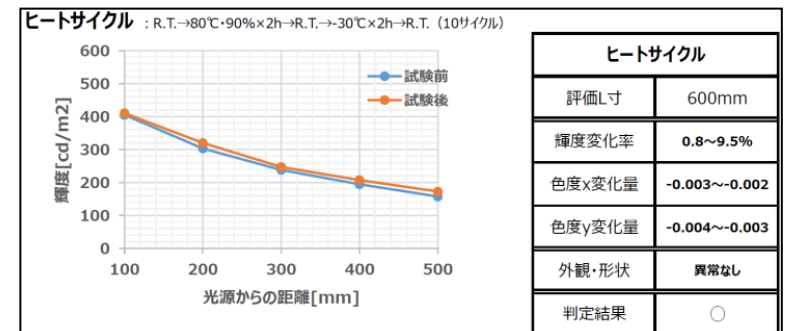
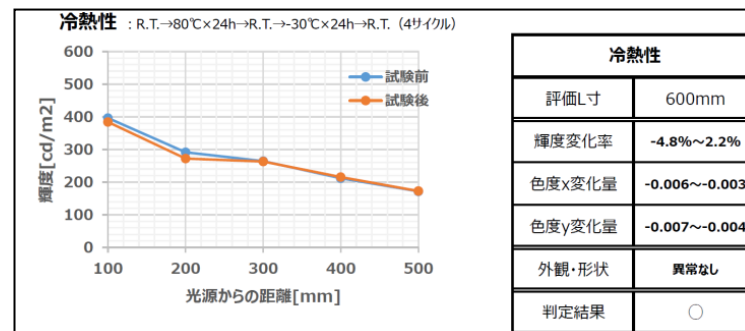
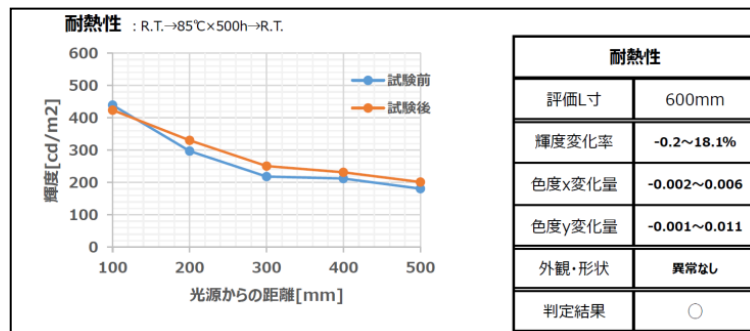
【 Test Item 】

Test Name	Test Conditions
Heat Resistance	R.T.→ 85℃ × 500h → R.T.
Coolness	R.T.→ 80℃ × 24h → R.T. → -30℃ × 24h → R.T. (4 cycle)
Heat Cycle	R.T.→ 80℃・90% × 2h → R.T. → -30℃ × 2h → R.T. (10 cycle)
Cold And Heat Resistance	R.T.→ -40℃ × 7.5h → R.T. → 23℃・80%RH × 15.5h → R.T. → -40℃ × 7.5h → R.T. → 50℃・95% × 15.5h → R.T. (4 cycle)
Moisture Resistance	R.T. → 50℃・95% × 500h → R.T.
Water Resistance	R.T. → In water 40℃ × 500h → R.T.
Cold Resistance	R.T. → -40℃ × 500h → R.T.
Weatherability	Sunshine weather meter 2,000 h Black panel temperature 63 ° C → can be used outdoors for 10 years
Salt Spray	Salt spray: 35 ° C・47% × 8h → curing: 35 ° C・47% × 16h (10 cycles) ※ JIS Z2371

Test sample: Wire rope 3x7 G / O 18 18 mm with three luminous elements Φ 3.5 mm
 Evaluation method: Comparison of luminance and chromaticity before and after test and appearance evaluation
 Measure the evaluation position at a pitch of 100 mm (only weather resistance 50 mm)
 Light source 1W white LED
 Measuring equipment: Konica Minolta Spectroradiometer "CS-2000"
 Evaluation standard: Luminance change rate ± 20% before and after test, within chromaticity change (x, y) = (± 0.02, ± 0.02)

【 Test Result 】 No abnormalities in all tests. Judgment Result ○

【 Test Equipment 】



※記載データは実測の一例であり、規格値および保障値ではありません。

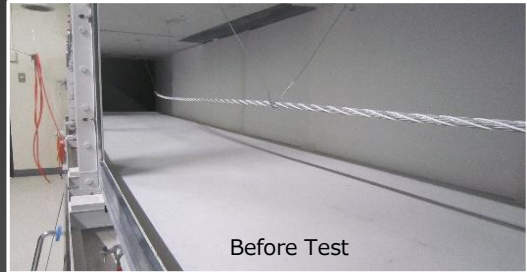
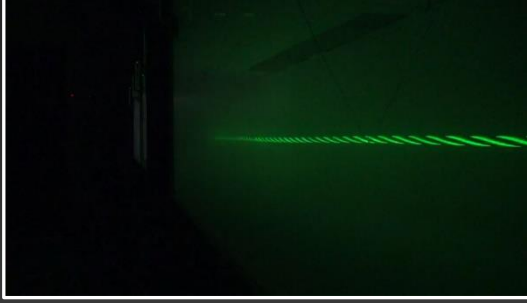
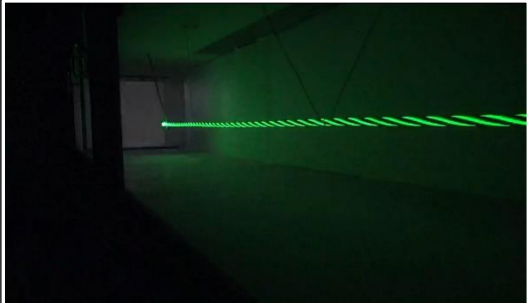
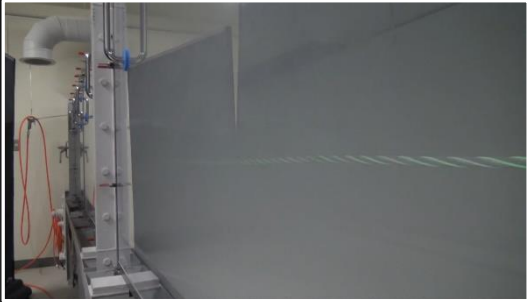
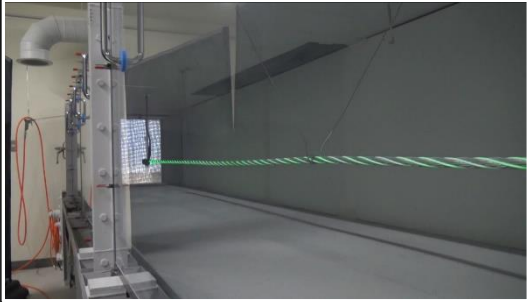
Visibility Test In Wind Tunnel Test

Experiment was conducted with model snow (activated white soil) in which three light emitters (ϕ 3.5 mm) were wound around a full size wire rope (ϕ 18 mm, L = 4.0 m), a wind tunnel, in order to verify the visibility in blowing snow. In the experiment, assuming daytime and night time of winter and night time, that luminous body emitted green light, then evaluate the visibility in blowing snow presence and absence environment.

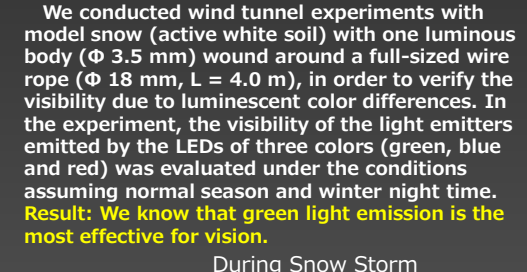
Result: Even at the time of blowing snow during daytime and night, there was a reduction effect of ambient illumination and light diffusion effect, and we know that the luminous body could be confirmed regardless of the occurrence of blowing.

No Snow Storm

During Snow Storm



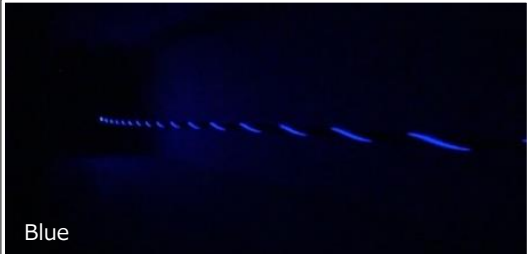
Before Test



During Snow Storm



Green



Blue

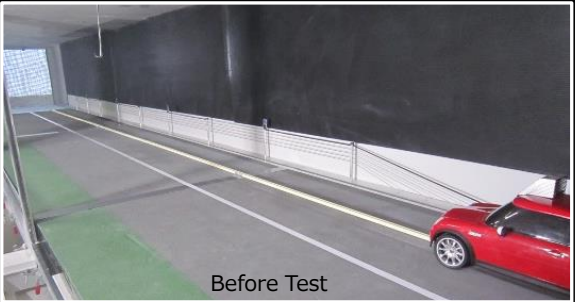


Red



We conducted wind tunnel experiments with model snow (active white soil) with one luminous body (ϕ 3.5 mm) wound around a full-sized wire rope (ϕ 18 mm, L = 4.0 m), in order to verify the visibility due to luminescent color differences. In the experiment, the visibility of the light emitters emitted by the LEDs of three colors (green, blue and red) was evaluated under the conditions assuming normal season and winter night time.

Result: We know that green light emission is the most effective for vision.



Before Test

Side Wind



Light OFF



Light ON



During Snow Storm

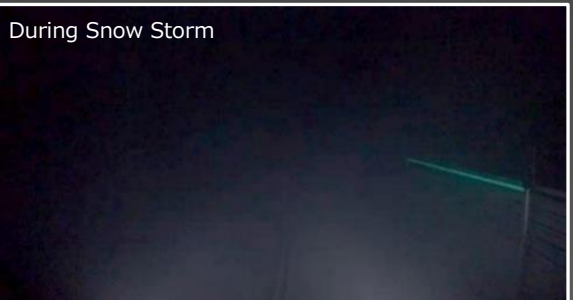
Head Wind



Light OFF



Light ON



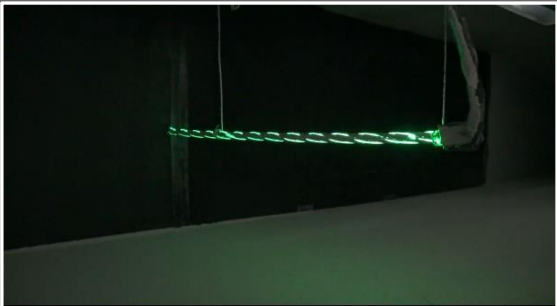
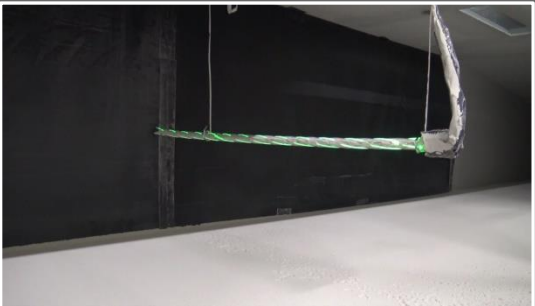
During Snow Storm

We conducted wind tunnel experiment with model snow (active white soil) using a road model that was reduced to a range that can be verified by wind tunnel equipment, in order to verify the visibility seen from the eyes of the traveling vehicle. In the experiment, a road and a wire rope type guard fence and a green light emitter are reproduced at a scale of 1/8, and running on the road with a small electric camera equipped with a small video camera causes snowfall to occur during winter night. We evaluated the visibility in the environment and in the direction of blowing snow (headwind, crosswind) .

Result: Although the verification was based on scale, we know that light emitter could be confirmed, and we assume it also could be confirmed during actual driving.

We conducted wind tunnel experiment with model snow (active clay) with three luminous bodies (ϕ 3.5 mm) wound around a full-size wire rope (ϕ 18 mm, L = 1.0 m), in order to verify the relationship between snowfall on the wire rope and visibility at the time of snowstorm. In the experiment, we assumed winter daytime and night time, and we evaluated green light emitting body at the time of the occurrence of the snowstorm due to the crosswind.

Result: A lot of adhesion of model snow was seen in the stranding groove of the wire rope, but the part where the illuminant was wound was in a convex state and it was difficult to adhere the coating layer. It is evaluated that the effect of preventing light emission is small by transmitting light.



Collision Experiment

First

This product has LED control board, battery, and solar module built-in a rubber cap, and this rubber cap is attached to column top. Rubber cap should not be scattered in a vehicle collision, so it is connected with a "RIKEN spindle" and "rubber wire", which is used in emitting body winding. We conducted a collision experiment in our parking lot, in order to make sure that this rubber cap, light emitting part and "RIKEN spindle" did not scatter in vehicle collision. Since the rubber wire length may affect rubber cap behaviour at vehicle collision, experiment was conducted with changing the rubber wire length.



Rubber wire length 30 cm



Rubber wire length 20 cm



Rubber wire length 10 cm

Experiment result : succeed

- ① Confirmed that rubber cap does not come off from spindle and does not fly away.
- ② Confirm that there is no damage in rubber part.
- ③ Because light emitting part is spirally wound, confirmed that it is compressed and solidified like a spring and does not scatter as it is pushed by the "RIKEN spindle".

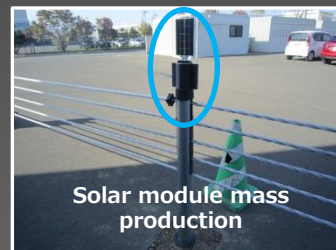


Taken with a high speed camera



Second

We used dummy solar module in our first collision experiment, so we conducted second collision experiment on a mass-produced solar module. The solar module has a sealing material (EVA) sanded with an acrylic plate. The sealing material is flexible and has an adhesive role, so it is hard to break even if it receives an impact, but it was confirmed that it did not scatter. As a comparison target, an experiment was simultaneously conducted with an acrylic single plate.



Solar module mass production



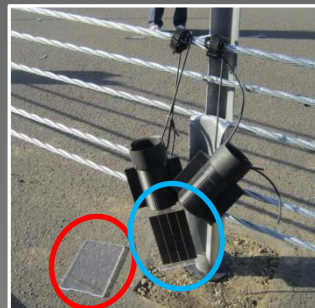
Acrylic single plate (for comparison)

Experiment Result : Succeeded

- ① Confirmed that rubber cap does not come off from spindle and does not fly away.
- ② Confirm that solar module does not scatter. (blue circle)
- ③ The acrylic single plate to be compared is broken and scattered. (Red circle)



Taken with a high speed camera



Solar Cell Module Impact Test

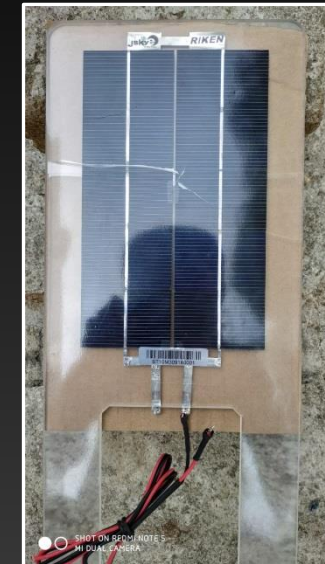
Impact Test With Steel Ball Drop

Test conditions

- Steel ball weight: 1.7 kg, steel ball diameter 75 cm
- Falling height: 1.0 m
- Steel ball speed at impact: 4.427 m / s (15.937 km / h) Impact force: 16.66 J



Test condition



Solar module mass production

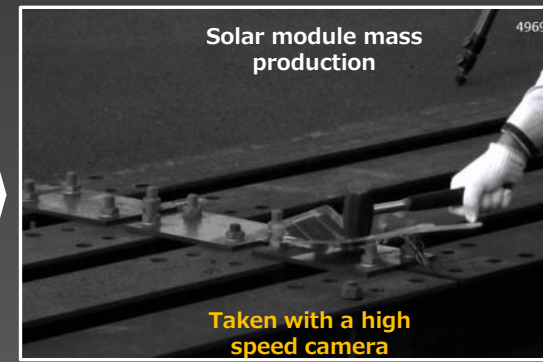


Acrylic single plate (for comparison)

Impact Test With Hammer



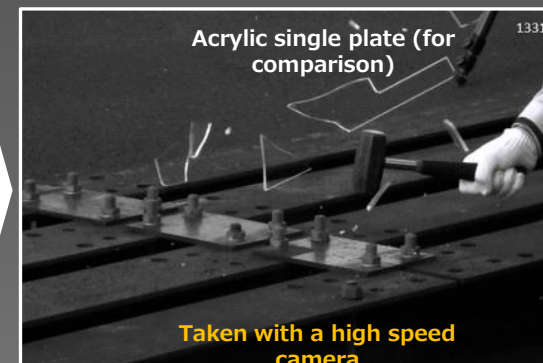
Solar module mass production



Taken with a high speed camera



Acrylic single plate (for comparison)



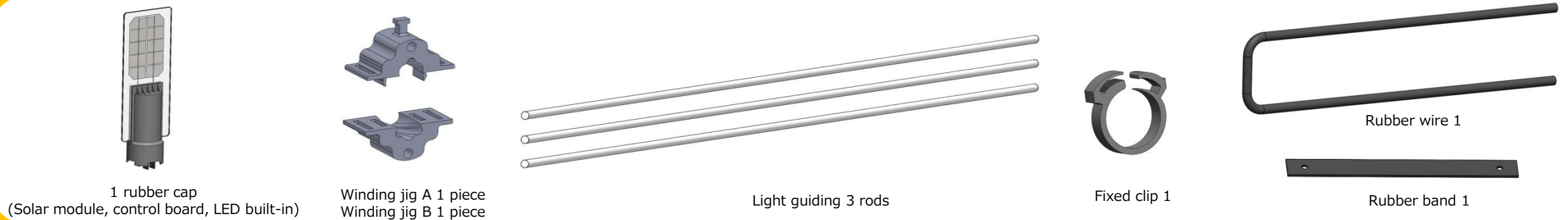
Taken with a high speed camera



Experiment Result : Succeeded

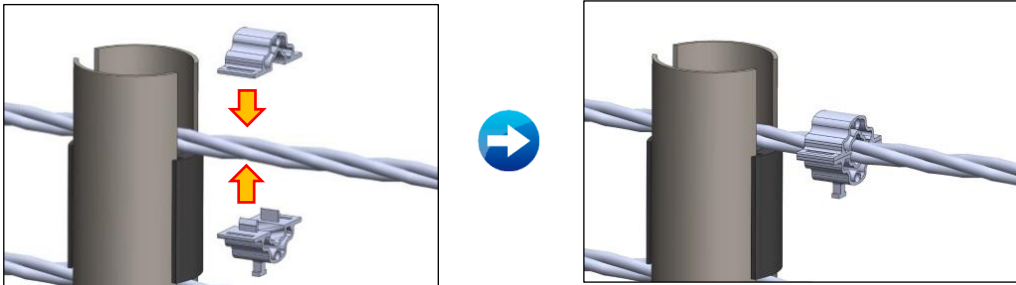
- ① Confirm that the solar module is damaged but there is no scattering.
- ② Confirm that the acrylic single plate to be compared is broken and scattered.

Materials To Use (Per Span)

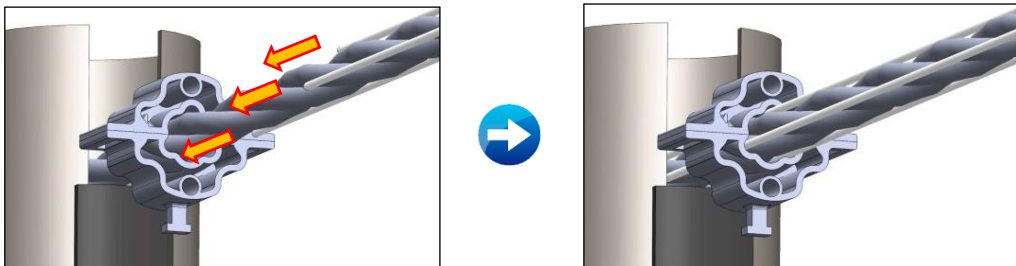


Construction Method

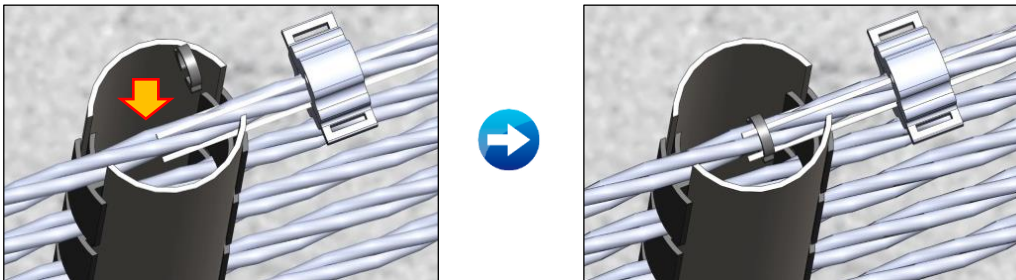
① Set winding jig on wire rope



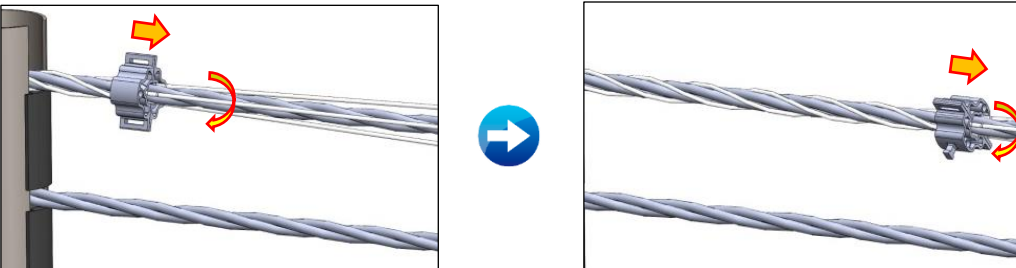
② Insert 3 light guide rods into winding jig groove



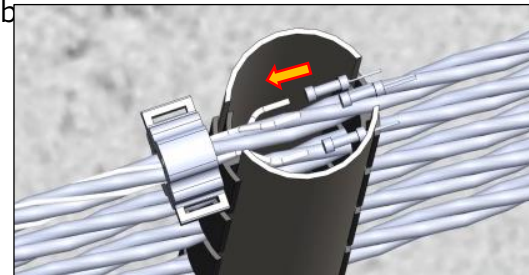
③ Fix light guide rod end with a fixing clip



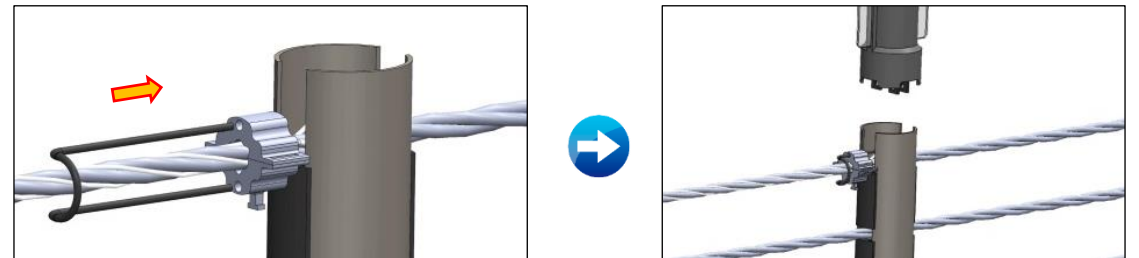
④ Rotate winding jig and wind the light guide bar



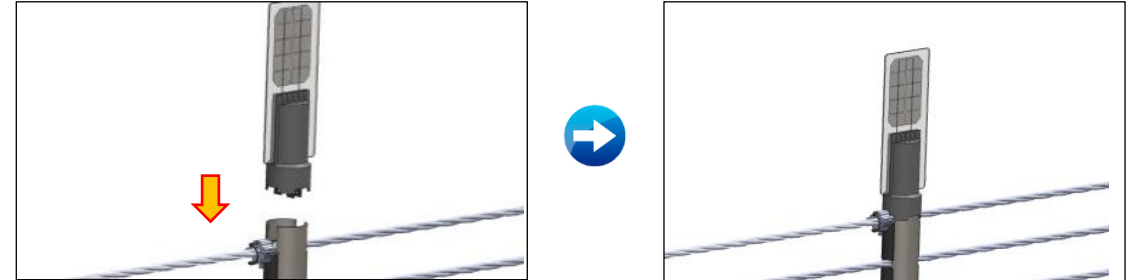
⑤ Insert LED at the end of light guide



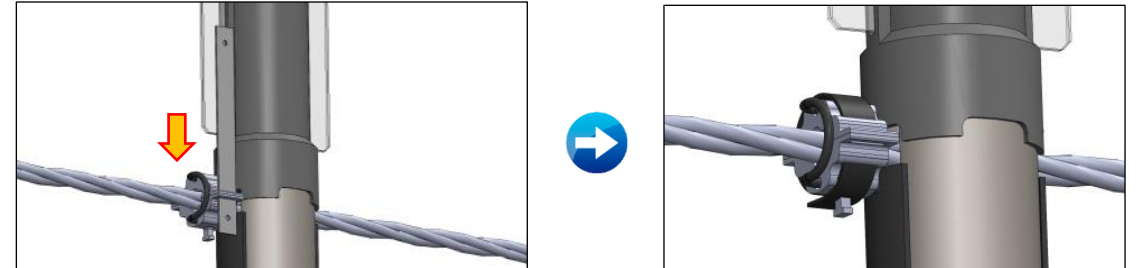
⑥ Connect winding jig and rubber cap with rubber wire



⑦ Insert rubber cap into post



⑧ Wrap the metal fitting around rubber band



- ① Construction staff
Normal worker: 2 people
- ② Construction time **8 minutes / span**
 - Fixing of winding jig: 1 minute
 - Light guide rod end clip fixing: 1 minute
 - With light guide rod winding: 2 minutes
 - Rubber cap installation: 2 minutes
 - Others: 2 minutes
- ③ Construction volume: **240 m / day**
- ④ construction yardstick: **512 yen/span**