



LEDs-ONTM
www.ledson.eu

AquaFlex12 & AquaFlex5

MATERIAL TESTS AND DURABILITY

LEDs-ON™

www.ledson.eu

This is a new technology with a new nanotechnology polymer. This booklet collects all possible tests performed on this Technology.

The purpose was to check the materials behavior in any difficult conditions.

As you will read, presented technology successfully passed all tests proving that our technology can be suitable for internal as well as external applications.

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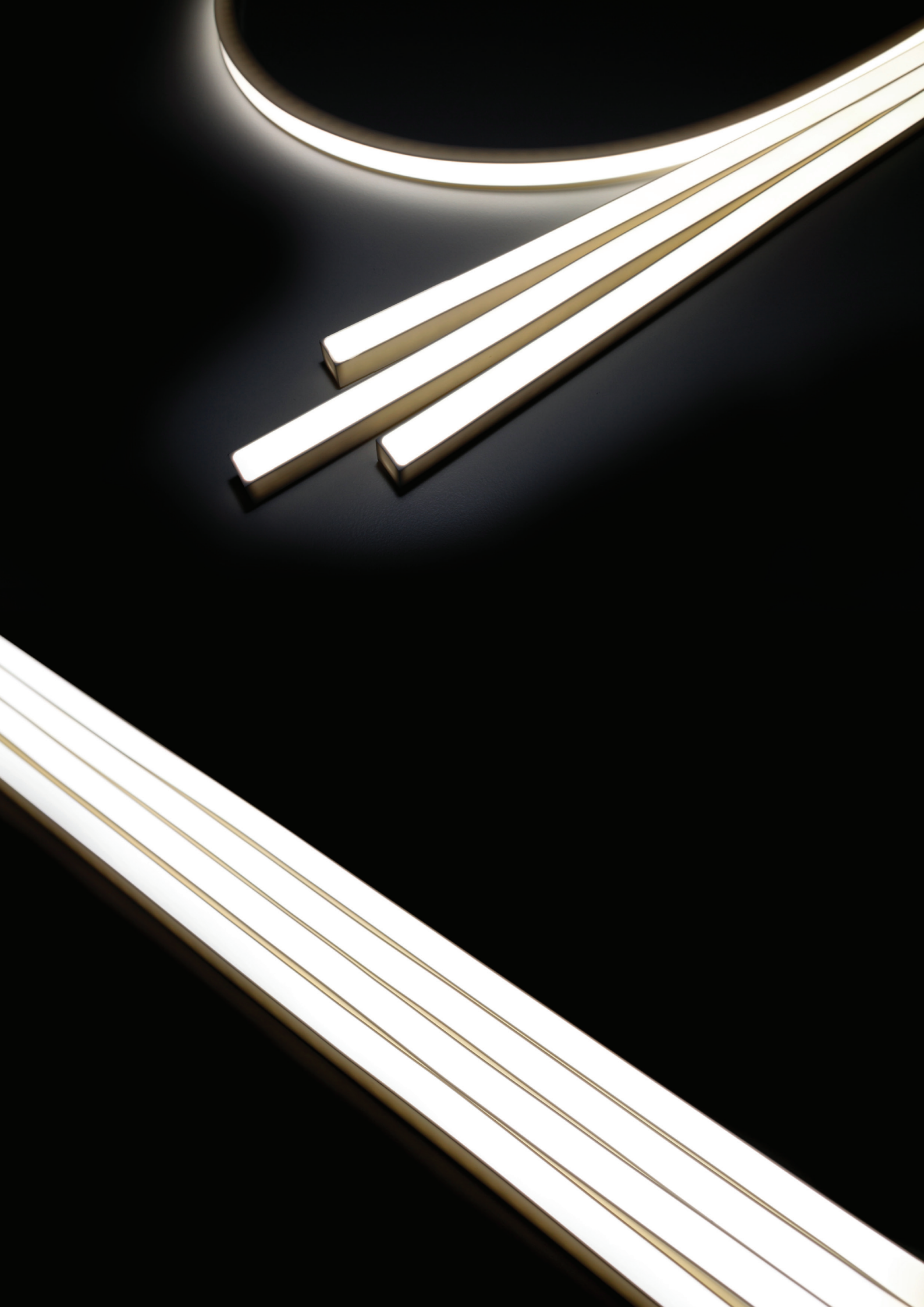
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OUTDOOR RESISTANCE



NATURAL WEATHERING RESISTANCE

FLORIDA TEST

This test has the aim to check the resistance of this new technology to the exposure to external agents, by focusing on very wet environments with possible molds formation and bacterial attacks.

ARIZONA TEST

This test has the aim to check the resistance of the recent technology to the exposure to external agents, focusing on very hot and sandy environments with abrasive effect on the material.

Conditions

High humidity
High temperature

Very dry
Very high temperature

Exposure Time

2 year exposure

2 year exposure

Result



NO YELLOWING - NO LOSS OF GLOSS

OUTDOOR RESISTANCE



ACCELERATED WEATHERING TESTS

XENOTEST

It is a laboratory test with the aim to simulate exactly the action of salt and rain on the material.

This test accelerates the normal exposure conditions allowing to check the resistance of the material extended in time.

It can even simulate a 10-year-exposure period.

QUV-A TEST

It is a laboratory test with the aim to simulate exactly the action of sun and condensation on the material.

This test accelerates the normal exposure conditions allowing to check the resistance of the material extended in time.

It can even simulate a 10-year-exposure period.

Conditions

UV / water spray

UV Lamp = 340 nm

Cycle

65 °C (149 °F), 102 min UV + 18 min

8 h @ 70 °C (158 °F), UV +
4 h @ 50 °C (122 °F), condensation

Exposure Time

2000 h
*(corresponds to 6 to 8 year
outdoor natural exposure)*

2000 h
*(corresponds to 6 to 8 year
outdoor natural exposure)*

Result



NO COLOR CHANGE - NO GLOSS CHANGE



ACID RAIN RESISTANCE ASTM G87

ACID RAIN TEST

Extended exposure to heavy industrial air pollution can cause severe damage to surfaces. This test is carried out in a special sulfur dioxide (Kesternich) cabinet and has the aim to predict the long term performance of the recent technology by simulating the effect of acid rain or other acidic environments.

Conditions

Samples are placed in a chamber exposed to atomized SO₂ and distilled water solution (600 ppm SO₂)

Cycle

8 h @ 1.67 °C (35 °F)

Result



NO YELLOWING - NO LOSS OF GLOSS

CHEMICAL RESISTANCE



DETERGENTS RESISTANCE

SPOT TEST

This test has the aim to check the resistance of the innovated technology to the direct contact of common de-tergents used for housekeeping (kitchen/bathroom).

Conditions

Product used:

- Lysol
- Downy
- Spray & Wash
- Cleaner 409
- Bleach (ipochlorite 2%)

Cycle

2 h direct contact wet

Result



NO MARKS



DISINFECTANTS RESISTANCE

IMMERSION TEST

This test has the aim to check the resistance of the new technology in particular environments such as swimming pools, saunas, wellness centers, where different disinfectants are used into the water in variable concentrations.

Conditions

Product used:

- Hydrogen Peroxide
- Na Ipochlorite
- (2 % chlorine)

Cycle

2 h direct contact wet

Result



NO MARKS

CHEMICAL RESISTANCE



BOILING WATER RESISTANCE

BOILING WATER TEST

This test has the aim to simulate the led stripe applied near cooking fires or steam baths, where both temperature and steam can be very intense.

Cycle

30 min @ 12,5 cm distance (5")

Result



NO CHANGE IN APPEARANCE AND HARDNESS



WATER IMMERSION RESISTANCE

WATER IMMERSION TEST

This test has the aim to check the resistance of the recent technology when immersed into the water at high temperatures. Those conditions can be found in thermal environments, spas, etc.

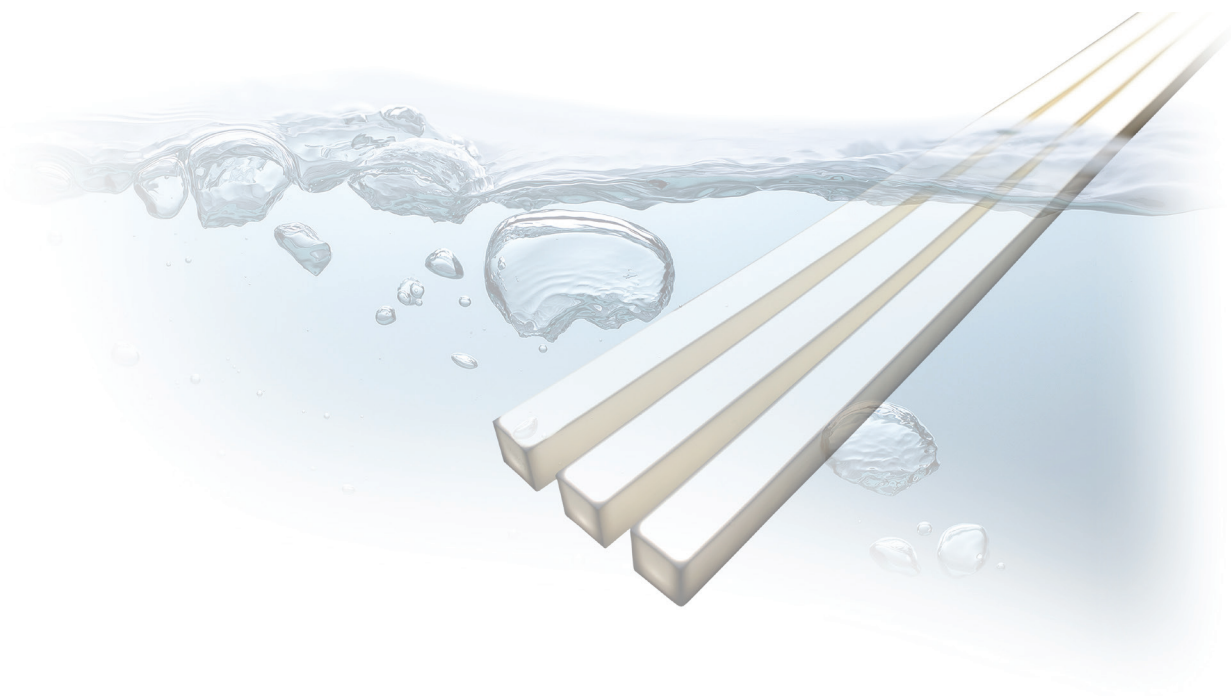
Cycle

Immersion in water @ 45 °C (133 °F)

Exposure Time

240 h

Result



NO CHANGE IN APPEARANCE AND HARDNESS



SALT SPRAY RESISTANCE

SALT SPRAY TEST

This test has the aim to check the resistance of the recent technology on particular applications such as the naval industry and marine environments.

Conditions

Waterspray 5% NaCl

Cycle

@ 38 °C (100.4 °F)

Exposure Time

1000 h

Result



NO CHANGE IN APPEARANCE AND HARDNESS

TEMPERATURE RESISTANCE



THERMAL CYCLES

THERMAL CYCLES TEST

This test has the aim to check the resistance of the presented technology at low-high temperatures and high humidity.

Those conditions can be found in very cold or very hot climates where LED produced by using our technology could be exposed to thermal shocks up to 80 °C (176 °F).

These cycles also simulate the temperature transition from -40 °C (-40 °F) to +80 °C (176 °F), by giving a very high thermal stress.

Cycle

For **10 times**:

- 4 h @ 23 °C (73,4 °F) >>>>
- 4 h @ -40 °C (-40 °F) >>>>
- 4 h @ 23 °C (73,4 °F) >>>>
- 4 h @ 95% RH 50 °C (122 °F) >>>>
- 4 h @ 23 °C (73,4 °F) >>>>
- 4 h @ 80 °C (176 °F)

Result



NO CHANGE IN APPEARANCE - NO DEFORMATION - NO LOSS OF GLOSS

TEMPERATURE RESISTANCE



THERMAL SHOCKS

THERMAL SHOCKS TEST

This test has the aim to check the resistance of the recent technology to the quick passage from very low to very high temperatures.

This phenomenon is particularly frequent in Nordic countries where they use to pour hot water or steams on icy surfaces.

Cycle

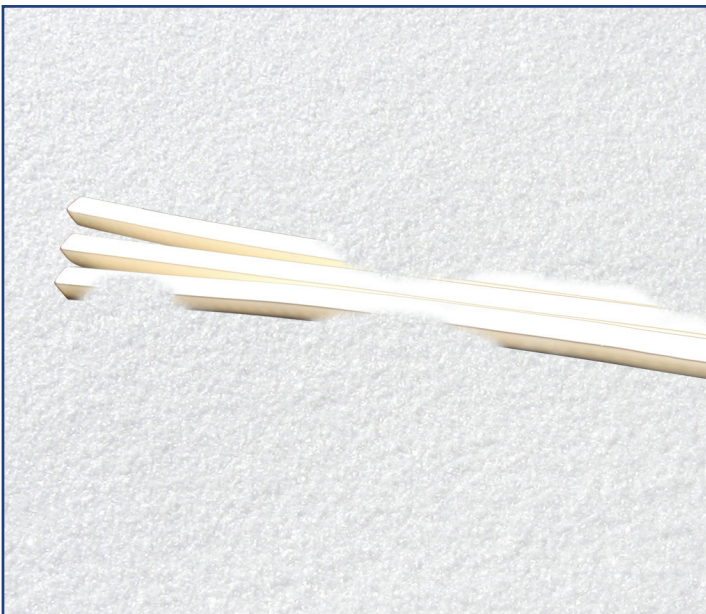
For **10 times**:

16 h @ -40 °C (-40 °F) »»» water @ 70 °C (158 °F)



Passage in 10"

Result



NO CHANGE IN APPEARANCE - NO DEFORMATION - NO LOSS OF GLOSS

TEMPERATURE RESISTANCE



HEAT RESISTANCE

HEAT RESISTANCE TEST

This accelerated test has the aim to check the durability of the new technology to very high temperatures, which are higher than those you can normally find. Those conditions can be found for instance in desert areas where temperatures can exceed 50 °C (122 °F).

Cycle

250 h @ 80 °C (176 °F)

Result



NO CHANGE IN APPEARANCE - NO DEFORMATION - NO LOSS OF GLOSS



ABRASION RESISTANCE

TABER TEST ASTM D1044

This test has the aim to check the resistance of the recent technology to abrasion (drive / walk over - steps). It is performed by applying an abrasive wheel and a weight for 1000 cycles.

Conditions

Wheel = CS 10
Weight = 500 g

Cycle

1000 times

Result



MINIMAL WEIGHT LOSS



ABRASION RESISTANCE

CROCKMETER TEST ASTM D6279

This test has the aim to check the wearing of the innovated technology to the continuous passage of cleaning material such us cloths, mops, sponges etc.

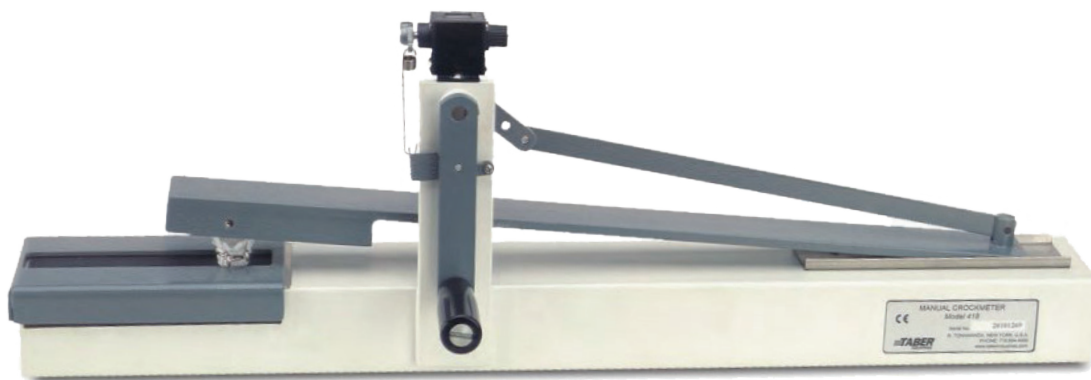
Conditions

White cloth = Crock Cloth
Felt = M238C4 Green Felt

Cycle

200 times

Result



NO ABRASION MARKS - NO COLOR CHANGE



IMPACT RESISTANCE

STONE CHIPPING TEST - ACCORDING TO ISO 20567-1

This test has the aim to check the resistance of the presented technology to impacts like for instance gravels against the LED surface.

Conditions

500 g chilled iron grit at a pressure of 2 bar

Impact Angle = 90°

Test temperature = 23 °C and -25°C

Result



AVERAGE SIZE OF BREAKS = 0 MM - RATING 1 (NO VISIBLE DAMAGE)

HIGH PRESSURE WASHING RESISTANCE



HIGH PRESSURE WASHING TEST

This test has the aim to check the resistance of the new technology to the washing by high-pressure hot water. It simulates the cleaning usually made on external façades, canopies, undereaves and demonstrates how it's extremely resistant to the pressure impact.

Conditions

Water Temperature 50 °C (122 °F)

Nozzle Tip Water Pressure: 7 MPa (1015 psi)

Distance: 45 cm (17.72 inches)

Exposure Time

30 s

Result



FREE FROM DEFORMATION, LIFTING, PEELING, WRINKLING, CRACKING, SMEARING AND OTHER CHANGES DETRIMENTAL TO USE

FLAME RESISTANCE



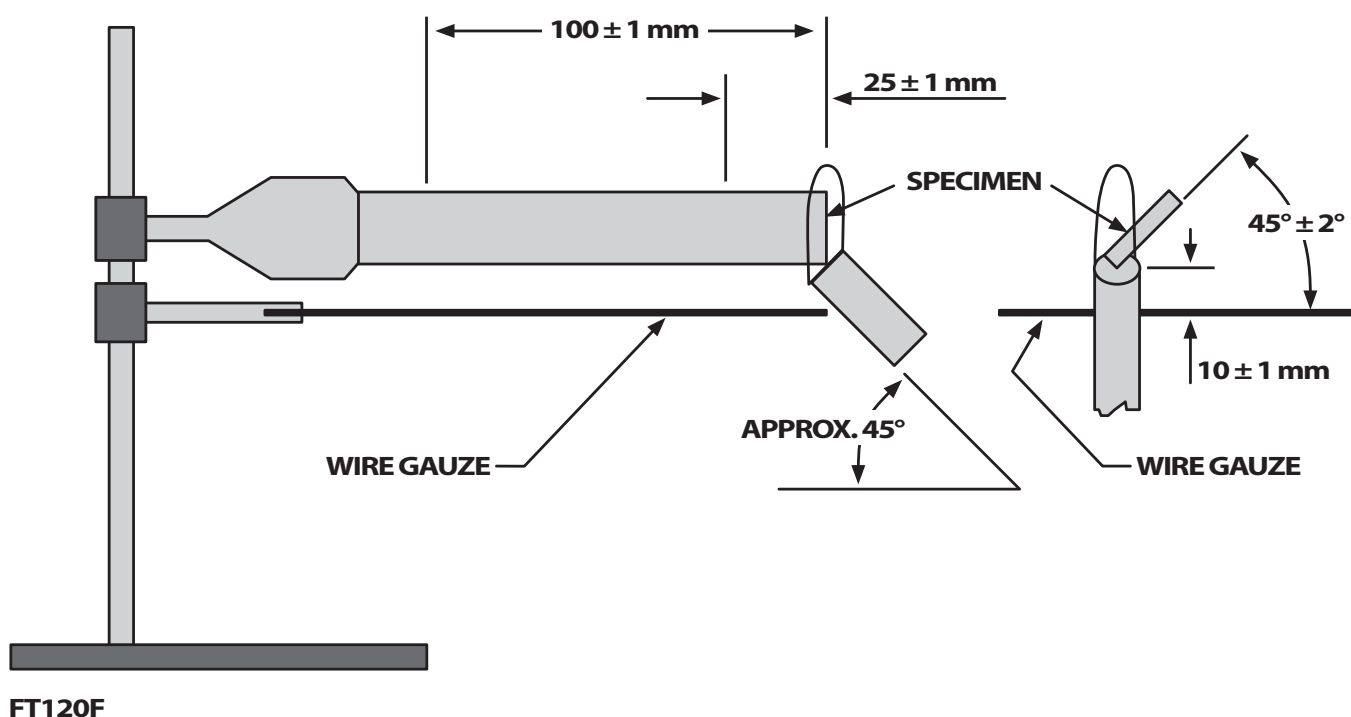
IGNITION TO DIRECT FLAME

These tests have the aim to check the resistance of the presented technology to the flame as well as the self-extinguishing degree according to the most restrictive international standards. Any product used for public areas must be **SELF-EXTINGUISHING** and provide **NO RELEASE OF TOXIC SMOKE**.

COMPLIANT WITH: **IGNITION TO DIRECT FLAME - UL 94**

Conditions

HORIZONTAL BURNING TEST FOR HB CLASSIFICATIONS



Result

DEMAKLED = SELF-EXTINGUISHING = RATE HB



FLAMMABILITY RESISTANCE

These tests have the aim to check the resistance of the new technology to the flame as well as the self-extinguishing degree according to the horizontal specimen.
Any product used for public areas must be **SELF-EXTINGUISHING** and provide **NO RELEASE OF TOXIC SMOKE**.

COMPLIANT WITH: **FMVSS 302**

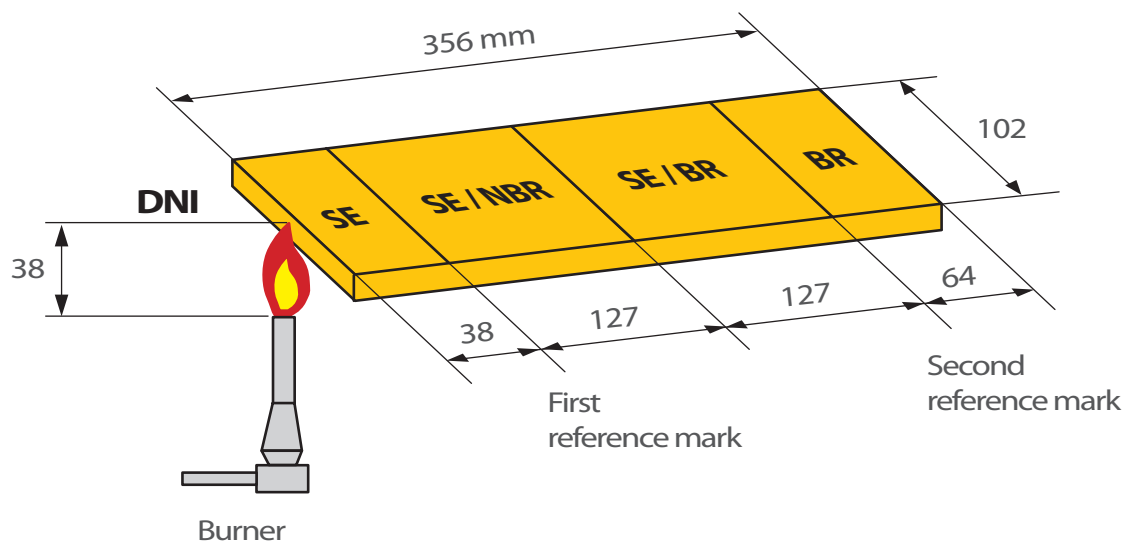
Conditions

Thickness of test specimen as in application

Horizontal specimen

Flame application using a Bunsen burner (15 sec)

Requirements: Maximum rate of flame spread: 102 mm/mi



DNI = does not ignite

SE = self-extinguishing / no burn rate





SE/BR = self-extinguishing with burn rate

BR = burn rate

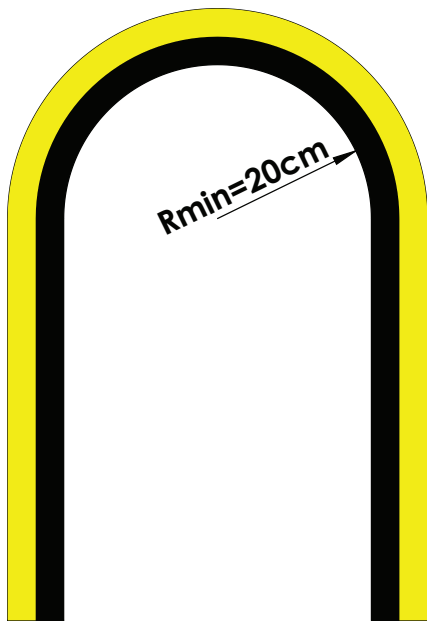
Result

SE = SELF EXTINGUISHING (ON HORIZONTAL SPECIMEN)

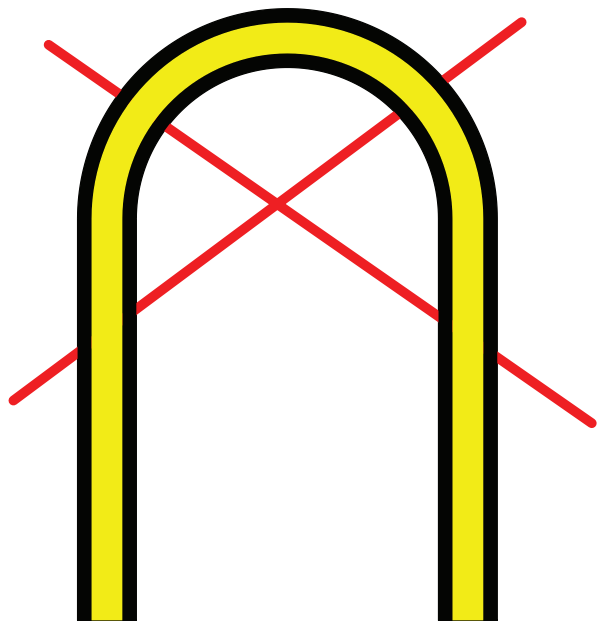
DIRECTIVE AND LAW COMPLIANCE

| | DIRECTIVE/ LAW | DESCRIPTION | ISSUED BY | LIMITS OF USE FOR |
|--|--|--|------------------------------|--|
|  | REACH Regulation no. 1907/2006-2013 | Registration, Evaluation, Authorization for Chemical Substances | Europe | SVHC List (aromatic amines, phthalates and other substances causing cancer or reproductive damages) |
| | RoHS II Directive no. 2011/65/EC (Directive no. 2002/95/EC) | Restriction of use of certain hazardous substances in Electrical/Electronics Equipment | Europe | Lead, Cadmium, Hexavalent Chromium, Mercury, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE) |
| | ELV Directive no. 2000/53/EC | End of Life Vehicles - restriction of use in Automotives for certain substances, due to recycling purposes | Europe | Heavy Metals, other organic substances (see GADSL – Global Automotive Declarable Substances List – 2009) |
|  | WEEE Directive 2002/96/EC | Waste Electrical and Electronic Equipment | Europe | |
| | UNI EN 71-3 | Safety of Toys | Europe | Migration Limits for Heavy Metals |
| | ASTM F963 | Safety of Toys | U.S.A. | Migration Limits for Heavy Metals |
| | Directive no. 2005/84/EC | Phthalates in Toys | Europe | Phthalates (plasticizers) |
|  | CPSIA 2008 (Consumer Product Safety Improvement Act) | Children's products Safety | U.S.A. | Referring to ASTM F963-07 (Heavy and Toxic Metals- Phthalates- Bisphenol A) |
| | EC-Directives 89/109; 02/72;97/48; 82/711; 85/572; 76/769 German § 30-§ 31 LMBG (Lebensmittel-und Bedarfsgegenständegesetz) | Contact with food | Europe | Migration Tests and taste related trials |
|  | Directive no. 2005/69/EC | Content of PAHs | Europe | PAHs (polycyclic Aromatic Hydrocarbons) |
| | Chemical Substances Control Law 2006 | Benzotriazole – Class I Specified Chemical Substances | Japan | Benzotriazole (UV Stabilizer) |
| | Proposition 65 | Content of Chemicals causing cancer or reproductive toxicity | State of California (U.S.A.) | See List Sept.11,2009 |
| | Directive no. 2006/122/ECOF | restrictions on the marketing and use of certain dangerous substances and preparations | Europe | PFOS (perfluorooctane sulfonates) |

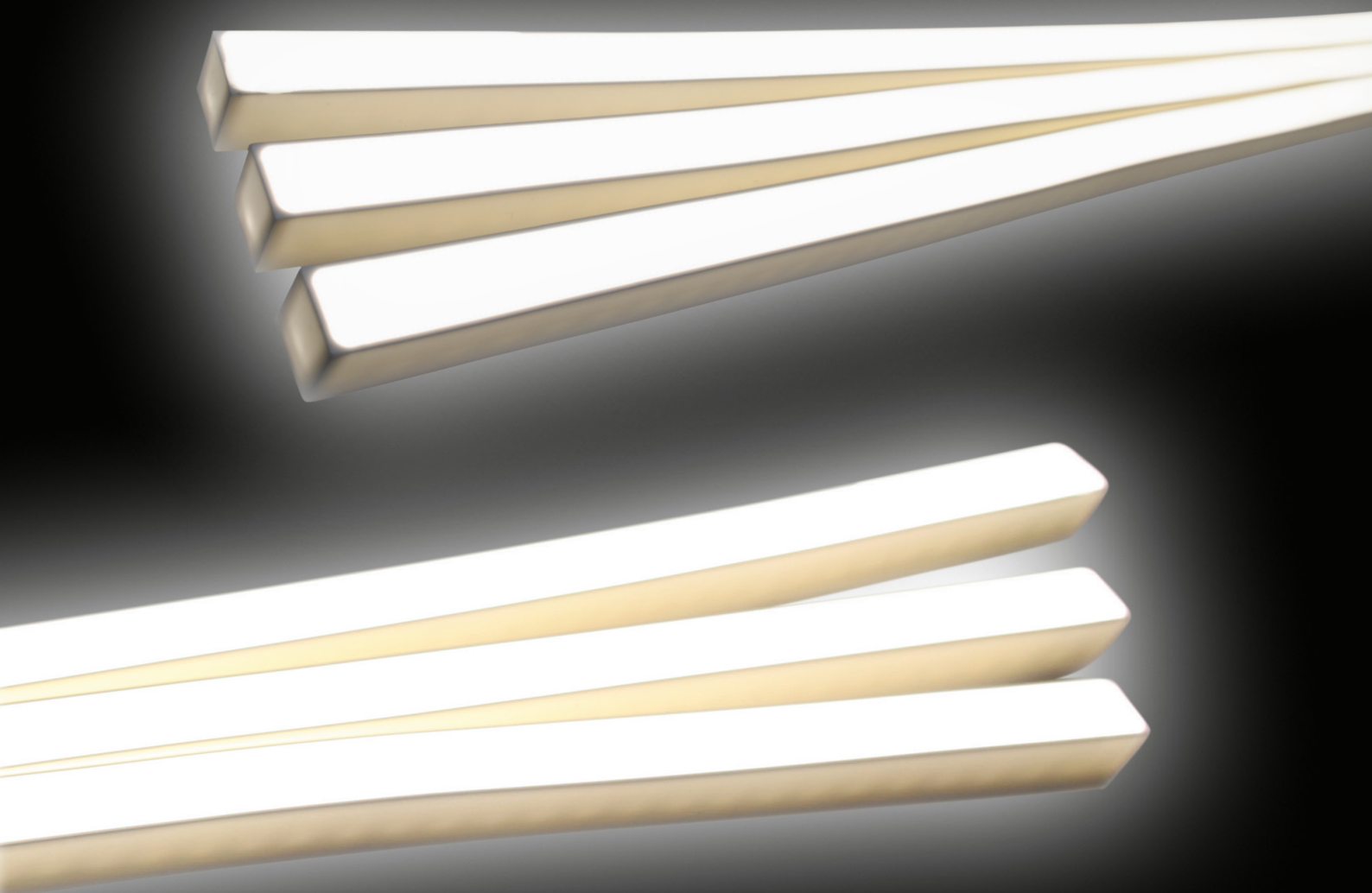
BENDING DIRECTIONS



Bending in this direction is
ALLOWED
minimum radius = 20cm



Bending in this direction is
NOT ALLOWED
will damage led PCB
and result loss of warranty



Castaldi
group



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