

External Exposure to Fire Classification Report

Name of client: ENNOGIE ApS
Product name: Ennogie Solar Roof, ERS-0191
File no.: PCA10814A
Date: 2022-07-12 **Revision no.:** 0
Pages: 4 **Encl.:** 0
Ref: LIA / JAG

Client information

Client: ENNOGIE ApS
Address: Orebygårdvej 16
7400 Herning
Denmark

The results relate only to the items tested. The report should only be reproduced in extenso - in extracts only with a written agreement with this institute.

1. Introduction

This classification report defines the classification assigned to the solar roof panel "Ennogie Solar Roof, ERS-0191" in accordance with the procedures given in EN 13501-5:2016.

2. Details of solar roof panel

2.1 Nature and end use application

The solar roof panel "Ennogie Solar Roof, ERS-0191" is defined as an active solar module for use as a roof panel.

Its classification is valid for the product that in the end use application is laid loose onto combustible and non-combustible end-use substrates, cf. 4.3.

2.2 Description

The solar roof panel "Ennogie Solar Roof, ERS-0191" is fully described in the test report in support of the classification listed in 3.1.

3. Reports and test results in support of this classification

3.1 Reports

Name of laboratory	Name of client	Report ref. No	Test method/field of application rules	Date
DBI	ENNOGIE ApS	PFA11943A	CEN/TS 1187 Test 2	2022-06-09

3.2 Test results

Test conditions: Loose laid

Test pitch: 30°

Substrate: Standard substrate of expanded polystyrene with a measured density of 16.3 kg/m³.

Parameter	Criteria		Test results ^a					Compliance Y/N
	Mean	Max	Spe.1	Spe.2	Spe.3	Mean	Max	
Damaged length at 2 m/s – roof covering	≤ 0,550 m	≤ 0,800 m	0.060	0.060	0.055	0.058	0.060	Y
Damaged length at 2 m/s – substrate	≤ 0,550 m	≤ 0,800 m	0.030	0.040	0.050	0.040	0.050	Y
Damaged length at 4 m/s – roof covering	≤ 0,550 m	≤ 0,800 m	0.050	0.060	0.065	0.058	0.065	Y
Damaged length at 4 m/s – substrate	≤ 0,550 m	≤ 0,800 m	0	0	0	0	0	Y

^a Not for extended application.

4. Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with EN 13501-5:2016.

4.2 Classification

The solar roof panel “Ennogie Solar Roof, ERS-0191” in relation to its external fire performance is classified: B_{ROOF}(t2).


4.3 Field of application

This classification is valid for the following conditions:

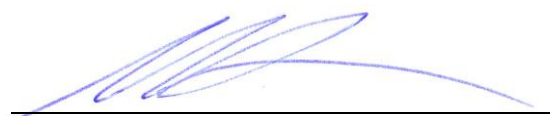
- any combustible and non-combustible substrate with density equal to or greater than 12.5 kg/m³.

5. Limitations

This report does not represent type approval or certification of the product.



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Test Report

Name of client: ENNOGIE ApS
Product name: Ennogie Solar Roof, ERS-0191
File no.: PFA11943A
Date: 2022-07-11 **Revision no.:** 0
Pages: 4 **Encl.:** 3
Ref: JAG / LIA

Client information

Client: ENNOGIE ApS

Address: Orebygårdvej 16

7400 Herning

Denmark

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1. Product

Solar roof module designated Ennogie Solar Roof, ERS-0191 on a standard expanded polystyrene (EPS).

Description (stated by the client)

See enclosure 1 and 2.

2. Manufacturer

Not stated.

3. Nature of test

With reference to Ennogie ApS sampling report dated 2022-06-17, the client desired product type determination (PTD) in accordance with CEN/TS 1187 test 2.

4. Sample

2022-06-01 DBI-Danish Institute of Fire and Security Technology received the following samples:

Eight Solar roof modules, from sample batch 01, with dimensions 900 x 600 x 7.5 mm.

The weight per unit area at 20°C (undried) was 18.3 kg/m² at the state of receipt as determined by weight and measures of the sample.

The samples was marked not marked.

5. Test specimens

Six test specimens were constructed as follows (seen from the top):

– Ennogie Solar Roof, ERS-0191

laid loose onto a substrate of 50 mm expanded polystyrene (EPS) with dimensions 400 x 1000 mm and a density of 16.3 kg/m³, c.f. CEN/TS 1187:2012 (5.4.2.2.).

The test specimens were supported by a 10 mm thick fibre reinforced calcium silicate board with dry density 640 ± 70 kg/m³.

6. Conditioning

On 2022-06-02 the specimens were stored in a conditioning room with an atmosphere of relative humidity of 50 ± 5% and a temperature of 23 ± 2°C. The specimens were kept in this room until the tests were performed.

7. Test methods

The test was performed in accordance with:

CEN/TS 1187:2012 Test methods for external fire exposure to roofs. Test 2: Method with burning brands and wind.

8. Test results

Date of test: 2022-06-09

The results are shown in the following table:

Test No.	1	2	3	4	5	6
Air velocity (m/s)	2	2	2	4	4	4
Time (minutes.seconds)						
End of flaming in crib	3:39	3:48	3:32	2:38	2:48	2:38
End of glowing	8:57	7:46	7:08	5:57	4:55	5:53
Length of damage, mm (as measured form the centre of the source of the fire) in the						
- roof covering	60	60	55	50	60	65
- substrate	30	40	50	0	0	0

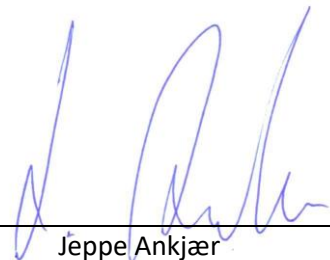
For Photos of the test specimens after test see enclosure 3.

9. Statement

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.



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Active module data sheet

ERS-0191 (130 W)



General specifications



Mechanical

Length	1.302 mm
Width	665 mm
Height	30-40 mm (sloping)
Weight per module	13,5 kg
Front cover	3,2 mm textured, tempered glass, no AR coating
Back cover	3,2 mm textured, tempered glass, no AR coating
Back rail	0,6 mm coated steel, CR5, RAL 9005 (black)
Appearance of solar panel	All black, including bus bars
Junction box protection class	IP67
Cable cross section	4 mm ²
Length of cables	2 x 1.200 mm + 2 x 150 mm
Connector	MC4 compatible

Installation

C-C distance, vertical	1.190 mm
C-C distance, horizontal	625 mm
Mounting system	Built into module - no exposed screws
Weight per m ²	18 kg
Coverage per module	0,744 m ²
Wind / Snow Load	2.400 Pa

Electrical

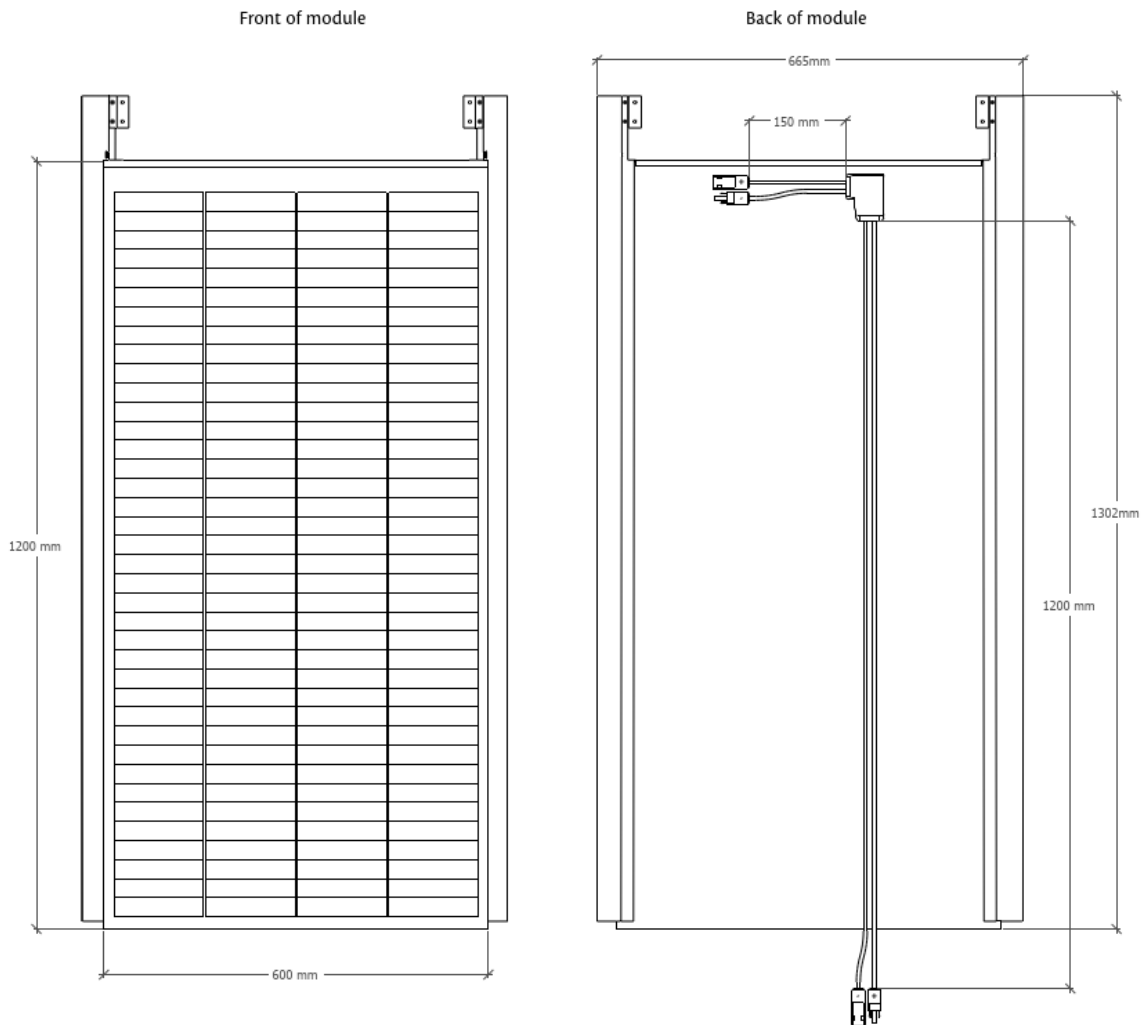
Cell type	Mono c-Si, shingled
Cell layout	Two parallel strings of 76 active cells
By-pass diode	Active, low loss, internal. In series with positive connector
Nominal power [-0/+3] (P _{MPP})	130 W
Nominal power per m ²	175 W
Current at max. power (I _{MPP})	3,10 A
Voltage at max. power (V _{MPP})	41,94 V
Short circuit current (I _{sc})	3,26 A
Open circuit voltage (V _{oc})	51,10 V

Active module data sheet



ERS-0191 (130 W)

Detailed drawing of module



Panel layers	
1	3,2 mm tempered glass
2	Transparent lamination foil
3	Shingled mono c-Si cells
4	Transparent lamination foil
5	Black lamination foil
6	3,2 mm tempered glass



External Exposure to Fire Classification Report

Name of client: ENNOGIE ApS
Product name: Ennogie Solar Roof, ERS-0204
File no.: PCA10814B
Date: 2022-07-12 **Revision no.:** 0
Pages: 4 **Encl.:** 0
Ref: LIA / JAG

Client information

Client: ENNOGIE ApS

Address: Orebygårdvej 16

7400 Herning

Denmark

The results relate only to the items tested. The report should only be reproduced in extenso - in extracts only with a written agreement with this institute.

1. Introduction

This classification report defines the classification assigned to the solar roof adapter panel "Ennogie Solar Roof, ERS-0204" in accordance with the procedures given in EN 13501-5:2016.

2. Details of adapter panel

2.1 Nature and end use application

Solar roof adapter panel "Ennogie Solar Roof, ERS-0204" is defined as an inactive solar module for use as a roof panel.

Its classification is valid for the product that in the end use application is laid loose onto combustible and non-combustible end-use substrates, cf. 4.3.

2.2 Description

Solar roof adapter panel "Ennogie Solar Roof, ERS-0204" is fully described in the test report in support of the classification listed in 3.1.

3. Reports and test results in support of this classification

3.1 Reports

Name of laboratory	Name of client	Report ref. No	Test method/field of application rules	Date
DBI	ENNOGIE ApS	PFA11943B	CEN/TS 1187 Test 2	2022-06-09

3.2 Test results

Test conditions: Loose laid.

Test pitch: 30°

Substrate: Standard substrate of expanded polystyrene with a measured density of 16.3 kg/m³.

Parameter	Criteria		Test results ^a					Compliance Y/N
	Mean	Max	Spe.1	Spe.2	Spe.3	Mean	Max	
Damaged length at 2 m/s – roof covering	≤ 0,550 m	≤ 0,800 m	0.100	0.100	0.095	0.098	0.100	Y
Damaged length at 2 m/s – substrate	≤ 0,550 m	≤ 0,800 m	0	0	0	0	0	Y
Damaged length at 4 m/s – roof covering	≤ 0,550 m	≤ 0,800 m	0.095	0.085	0.090	0.090	0.095	Y
Damaged length at 4 m/s – substrate	≤ 0,550 m	≤ 0,800 m	0	0	0	0	0	Y

^a Not for extended application.

4. Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with EN 13501-5:2016.

4.2 Classification

The solar roof adapter panel “Ennogie Solar Roof, ERS-0204” in relation to its external fire performance is classified: B_{ROOF}(t2).

4.3 Field of application

This classification is valid for the following conditions:


- any combustible and non-combustible substrate with density equal to or greater than 12.5 kg/m³

5. Limitations

This report does not represent type approval or certification of the product.



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Test Report

Name of client: ENNOGIE ApS
Product name: Ennogie Solar Roof, ERS-0204
File no.: PFA11943B
Date: 2022-07-11 **Revision no.:** 0
Pages: 4 **Encl.:** 3
Ref: JAG / LIA

Client information

Client: ENNOGIE ApS
Address: Orebygårdvej 16
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The results relate only to the items tested. The report should only be reproduced in extenso - in extracts only with a written agreement with this institute.

1. Product

Solar roof adapter module designated Ennogie Solar Roof, ERS-0204 on a standard substrate of expanded polystyrene (EPS).

Description (stated by the client)

The adapter modules consisting of Larson FR panels coated with JetBlack PVDF glued to a metal bar each side, for further see enclosure 1 and 2 .

2. Manufacturer

Alucoil, Spain.

3. Nature of test

With reference to Ennogie ApS sampling report dated 2022-06-17, the client desired product type determination (PTD) in accordance with CEN/TS 1187 test 2.

4. Sample

2022-06-01 DBI-Danish Institute of Fire and Security Technology received the following samples:

Eight Solar roof adapter modules, sample batch 01 FG202204-06-B, with dimensions 900 x 600 x 6.4 mm.

The weight per unit area at 20°C (undried) was 12.5 kg/m² at the state of receipt as determined by weight and measures of the sample.

The samples was marked not marked.

5. Test specimens

Six test specimens were constructed as follows (seen from the top):

- Ennogie Solar Roof, ERS-0204

laid loose onto a substrate of 50 mm expanded polystyrene (EPS) with dimensions 400 x 1000 mm and a density of 16.3 kg/m³, c.f. CEN/TS 1187:2012 (5.4.2.2.).

The test specimens were supported by a 10 mm thick fibre reinforced calcium silicate board with dry density 640 ± 70 kg/m³.

6. Conditioning

On 2022-06-02 the specimens were stored in a conditioning room with an atmosphere of relative humidity of 50 ± 5% and a temperature of 23 ± 2°C. The specimens were kept in this room until the tests were performed.

7. Test methods

The test was performed in accordance with:

CEN/TS 1187:2012 Test methods for external fire exposure to roofs. Test 2: Method with burning brands and wind.

8. Test results

Date of test: 2022-

The results are shown in the following table:

Test No.	1	2	3	4	5	6
Air velocity (m/s)	2	2	2	4	4	4
Time (minutes.seconds)						
End of flaming in crib	3:05	3:08	3:12	2:48	2:38	2:14
End of glowing	7:36	7:24	7:29	5:02	5:16	4:52
Length of damage, mm (as measured form the centre of the source of the fire) in the						
- roof covering	100	100	95	95	85	90
- substrate	0	0	0	0	0	0

For photos of the test specimens after test see enclosure 3.

9. Statement

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.



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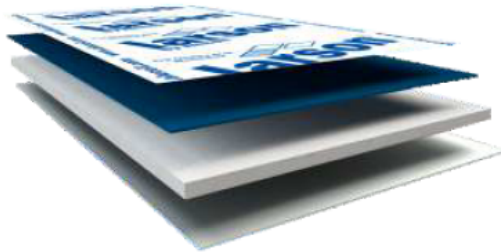


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larson® FR

Fire class architectural **B-s1, d0** according EN 13501-1



1. Protective film
2. **Coated aluminium**
3. Mineral FR Core
4. **Aluminium with protection primer**



larson® FR aluminium composite panel, is a high-tech product for architectural façade cladding. It is formed with two aluminium sheets, 5005 alloy, bonded by a mineral fire retardant (FR) core. **Alucoil®** has developed a core that delays panel combustion which allows this material to achieve **B-s1, d0 classification**, according to the EN 13501-1 standard.

Panel features

	larson® FR
Panel thickness	3 / 4 / 6 (mm)
Panel weight	6,14 / 7,78 / 11,06 (kg/m ²)
Aluminium thickness	0,5 (mm)
Moment of inertia (I)	1583 / 3070 / 8630 (mm ⁴ /m)
Rigidity (EI)	1108 / 2150 / 6041 (kNcm ² /m)
Standard width	1000 - 1250 - 1500 (mm)
Min. / max. length	2000 - 8000 (mm)
Core	MINERAL FIRE RETARDANT
Reaction to fire test	B-s1, d0⁽³⁾ EN 13501-1 BS 8414-1 ⁽³⁾ Full scale test NFPA 285 ⁽⁴⁾ Full scale test

Aluminium features

Modulus of elasticity (E)	70000 (N/mm ²)
Ultimate tensile strength (R _m)	125 < R _m < 185 (N/mm ²)
Elasticity limit (R _{p0.2})	> 80 (N/mm ²)
Elongation (A)	> 3 (%)
Standard aluminium alloy	5005 ⁽¹⁾ EN 573-3
Aluminium thermal expansion	2,3 mm/m Δ100°C
Coated surface	a) PVdF 2L Coastal 31μ b) NEW fluorlac® Feve LUMIFLON™ 30μ c) DG5 High Durable Polyester: DG5 2L Coastal 35μ & DG5 3L Coastal 55μ

⁽¹⁾Other alloy available. Alunatural finishes - alloy 3000. ⁽²⁾Alucoil®'s vertical riveted & 45mm cassette installation systems. ⁽³⁾Details of tested constructive system appear in Tecnalia's 070717-002A report. ⁽⁴⁾Details of tested constructive system appear in Intertek's 1029361145AT-004B report. Extended technical data sheet available upon request. Some of the information that appears in the catalogue could be estimated or extrapolated. Please request with Alucoil®'s technical department to confirm exact values to be used in specific calculations or projects.

Coating possibilities

PVDF (Polyvinylidene Fluoride). Coating based on PVDF resins (Kynar and Hylar as main brands) with extraordinary performance.

Nominal paint thickness:

- a) **PVDF 2L Coastal:** 31 μ approx.
- Gloss levels from 20 to 40 g.u.
 - Excellent colour stability, almost no chalking and very good chemical resistance.
 - Great protection against weathering, UV radiation and atmospheric contaminants.
 - Outstanding flexibility for profiling, bending and roll forming.
 - Recommended for demanding environments like industrial and coastal areas, airports, etc.

DG5 (High Durable Polyester). Coating based on HDP resins.

Nominal paint thickness:

- a) **DG5 2L Coastal:** 35 μ approx, (depending on the colour)
 b) **DG5 3L Coastal:** 55 μ approx, (depending on the colour)
 c) **DG5:** 25 μ approx.
- Gloss levels from 10 to 90 g.u.
 - Outstanding protection against weathering, UV radiation and atmospheric contaminants.
 - Excellent hardness and flexibility for profiling, bending and roll forming.

PUR/PA (Polyurethane/Polymaïnde). Coating based on polyurethane resins.

- Very flexible and good formability.
- Good chemical resistance.
- Outstanding scratch resistance and high abrasion resistance.
- Good substrate adhesion: also used in primer systems.

NEW fluorlac® Coating for larson® panels

FEVE LUMIFLON™ 2 LAYERS. LUMIFLON™ fluoropolymer resins based coating with a nominal thickness of 30 μ , (depending on the colour).

COLOURS:

- RAL & NCS colour charts with matt, satin and high gloss finishes.
- Matched colours.

QUANTITIES:

- **Orders from 75 sqm.**
- Panel dimensions:
 - a) **larson® FR** (orders from 75 m² till 300 m²):
 - 1575x5000 mm / 1575x4000 mm
 - 1500x5000 mm / 1500x4000 mm / 1500x3200 mm
 - 1250x5000 mm / 1250x4000 mm / 1250x3200 mm
 - b) **larson® A2** (orders from 75 m² till 500 m²):
 - 1500x5000 mm / 1500x4000 mm
 - 1250x5000 mm / 1250x4000 mm

SERVICES:

- Very short delivery times, **2-3 weeks.**
- One face coated with a protective film of 100 μ thick.

Other characteristics:

- Excellent weatherability and chemical resistance.
- High abrasion resistance.

PVDF 2L Coastal: 31 μ

fluorlac® FEVE LUMIFLON™ 2L: 30 μ

DG5 2L Coastal (HDP): 35 μ

PUR/PA: 16 μ (alunatural finishes)

