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PM500
VERIFICATION OF CONFORMITY
TO EN 45545-2

Rev.nr	Datum	Ändring	Sign
1	2015-04-27	Added 5P02184, 5P02184-1	AÅ
2			
3			
4			
5			
Dokumentplats			Sign.

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Verification of Oxygen Index according to EN ISO 4589-2.

(2 appendices)

Introduction

SP has been commissioned by Polyamp AB to fire test PCB according to EN ISO 4589-2. The purpose of the test is to form a basis for technical fire classification according to EN 45545-2.

Products

According to the sponsor:

- PCB called "Huvudkort P2600F", consisting of Shengyi S1000-2, with article number 210690. Nominal thickness 1.9 mm \pm 10%. Manufacturer PCB Connect.
- PCB called "Trafokort P3876F", consisting of FR4 IPC-4101B/129, with article number 210665. Nominal thickness < 3.5 mm. Manufacturer Multi-Teknik Mönsterkort AB.

According to EN 45545-2, table 2, the product is defined as a "Listed Product" to which the following parameters apply:

Product No: EL9
Location: Electrotechnical Equipment
Description: Printed circuit boards
Requirement Set: R24

Sampling

The samples were delivered by the client. It is not known to SP Fire Research if the products received are representative of the mean production characteristics.

The samples were received August 14, 2014 at SP Fire Research.

Test results

The test was conducted according to paragraph 10 "Procedure C" – Comparison with a specified minimum value of the oxygen index (short procedure), specimen form used was "III" and dimensions were 80 – 150 mm \times 10 \pm 0.5 mm \times \leq 10.5 mm. Results are given in appendix 1 - 2.

The test results relate only to the behaviour of the test specimens under the conditions of this test method. These results must not be used to infer the fire hazards of the material in other forms or under other fire conditions.

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Criteria

Test specimen form	Ignition procedure	Period of burning after ignition	Extent of burning
I, II, III, IV and VI	A Top surface ignition	< 180	< 50 mm below the top of the specimen
	B Propagating ignition	< 180	< 50 mm below the top of the specimen
V	B Propagating ignition	< 180	< 80 mm below the top of the specimen

When testing according to “Procedure C” – Comparison with a specified minimum value of the oxygen index (short procedure), passing two out of three tests is needed for an approval.

Classification criteria

According to EN 45545-2 table 5, requirement set No. R24, classification criteria regarding test results from test according to EN ISO 4589-2 are tabulated below.

Test method, Parameter (Unit)	Requirement Definition	HL1	HL2	HL3
EN ISO 4589-2: Oxygen Content (%)	Minimum	28	28	32

Note

The accreditation referred to is valid for EN ISO 4589-2.

Assessment

Oxygen Index was verified according to EN ISO 4589-2, “Procedure C - Comparison with a specified minimum value of the oxygen index (short procedure). Specified minimum OI was 32.0. The test result fulfills the classification criteria listed by EN 45545-2, table 5, requirement set No. R24, Hazard Level HL1, HL2 and HL3.

**SP Technical Research Institute of Sweden
Fire Research - Fire Dynamics**

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Appendices

- 1 Test results – PCB P2600F
- 2 Test results – PCB P3876F

Appendix 1

Test results - verification of Oxygen Index according to EN ISO 4589-2:1999+A1:2006**Product**

According to the sponsor:

- PCB called "Huvudkort P2600F", consisting of Shengyi S1000-2, with article number 210690. Nominal thickness 1.9 mm \pm 10%. Manufacturer PCB Connect.

Test preparation

The product was cut in pieces 125 mm x 10 mm x 1.8 mm.

Test procedure

A - Top ignition

C - Comparison with a specified minimum value of the oxygen index (short procedure)

Test results

Test no	Oxygen concentration (%)	Burning period (s)	Length burnt (mm)	Response
1	32.0	11	2	O
2	32.0	10	2	O
3	32.0	9	2	O

Measured data

Thickness 1.7 – 1.8 mm.

Area weight 3.7 kg/m².

Conditioning

Temperature 23 \pm 2 °C.

Relative humidity (50 \pm 5) %.

Date of test

September 16, 2014.

Appendix 2

Test results - verification of Oxygen Index according to EN ISO 4589-2:1999+A1:2006**Product**

According to the sponsor:

- PCB called "Trafokort P3876F", consisting of FR4 IPC-4101B/129, with article number 210665. Nominal thickness < 3.5 mm. Manufacturer Multi-Teknik Mönsterkort AB.

Test preparation

The product was cut in pieces 60 mm x 10 mm x 2.9 mm.

Test procedure

A - Top ignition

C - Comparison with a specified minimum value of the oxygen index (short procedure)

Test results

Test no	Oxygen concentration (%)	Burning period (s)	Length burnt (mm)	Response
1	32.0	8	3	O
2	32.0	10	3	O
3	32.0	6	2	O

Measured data

Thickness 2.9 mm approximately.

Area weight 7.8 kg/m².

Conditioning

Temperature 23 ± 2 °C.

Relative humidity (50 ± 5) %.

Date of test

September 16, 2014.

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Investigation regarding classification according to EN 45545-2

(3 appendices)

Introduction

SP has been commissioned by Polyamp AB to investigate a possible classification of a DC/DC converter according to EN 45545-2 "Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components".

The references in brackets, like (4.7), relate to paragraphs in the document EN 45545-2.

Product

According to the client:

"Polyamp DC/DC-converter, PM500 family". See photographs of the investigated product in appendix 2 and 3.

Manufacturer

Polyamp AB, Åtvidaberg, Sweden.

Sampling

The sample was delivered by the manufacturer. It is not known to SP Fire Research if the product received is representative of the mean production characteristics.

The sample was received on March 2, 2015 at SP Fire Research.

Requirements regarding electronic equipment not contained within a technical cabinet

According to EN 45545-2, electronic equipment not contained within a technical cabinet must be classified. Products which comply with the highest level of reaction to fire performance according to commission decision 96/603/EC or have an A1 classification according to EN 13501-1 need no further testing (4.2 a). If it can be shown that the specified requirements according to EN 45545-2 are not technically achievable with functionally suitable products, then existing commercially available products can be used until and unless a suitable product is developed. The essential requirements in 4.1 shall however not be compromised and need verification. Examples of these kinds of products are electronic devices on printed circuit boards (4.7). According to the grouping rules (4.3) a maximum of 500 g of non-listed classified products, according to R24, and a maximum of 100 g of unclassified products per group are allowed.

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A “group” is dependent on the horizontal (< 20 mm) and vertical (< 200 mm) distance between products and also on the area of the products, which should not exceed 0.2 m². No requirements apply to products with a combustible mass < 10 g not in touching contact with another unclassified product with a combustible mass < 10 g (4.3).

Product geometry and composition

The product called “Polyamp DC/DC-converter, PM500 family” has the dimensions (width × height × depth) 215 × 70 × 220 mm.

The products total mass is 2515 g and is divided into the following groups:

Non-combustible material, 1802 g

Electronic devices on printed circuit boards, 544 g. See note below.

Combustible material components weighing less than 10 g not in contact with another component weighing less than 10 g, unclassified, 28 g.

Listed products, Table 2 in EN 45545-2, R24 (HL1 and HL2 / HL3), 143 g.

Note

The majority of combustible components attached to the PCB are estimated to weigh < 10 g and not to be in touching contact with another unclassified combustible material weighing < 10 g. The components are not weighed individually due to them being attached to the PCB.

Evaluation

The product called “Polyamp DC/DC-converter, PM500 family” is considered to comply with the criteria according to EN 45545-2 provided that the listed products of 143 g above are compliant to the criteria in R24.

Product versions of the investigated product are also deemed to comply with the criteria according to EN 45545-2, provided that the mass of grouped combustible, unclassified, products do not exceed 100 g and the mass of non-listed combustible products, classified according to R24, do not exceed 500 g.

Comment

Requirement Set R24 means testing according to EN ISO 4589-2 (Oxygen Index). For classification according to HL1 and HL2, the criterion is $OI \geq 28$ and for HL3 the criterion is $OI \geq 32$.

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Appendices

1. Specification
2. Photos, parts of the product
3. Photos, complete product

Appendix 1

Specification**Specification of combustible and non-combustible components, the components masses and criteria for classification**

Photos, see appendix 2 and 3.

Table 1

Pos. no.	Description of parts	Mass (g)	Photo no.	Requirement set
Non-combustible:				
1	Chassis, top	734.6	1	- ¹⁾
2	Chassis, bottom	737.7	2	- ¹⁾
3	Panel. Alarm	88.5	3	- ¹⁾
4	Panel, in- & output	87.7	4	- ¹⁾
5	Metal parts from Phoenix Contact PC4/4-ST-7	10.9	6	- ¹⁾
6	Steel screws and spacers	39.3	10	- ¹⁾
7	Semiconductor heat sink assemblies	60.0	11	- ¹⁾
8	Transformer heat sink	31.2	13	- ¹⁾
9	Aluminium oxide	12.0	14	- ¹⁾
Total mass non-combustible:		1801.9		

¹⁾ For products classified as A1 according to EN 13501-1 or described in commission decision 96/603/EC, no further testing is required (4.2.a).

Appendix 1

Pos. no.	Description of parts	Mass (g)	Photo no.	Requirement set
Combustible:				
10	Phoenix Contact PC4/4-ST-7	5.6	5	- ²⁾
11	Phoenix Contact PC4/2-ST-7	8.4	7	- ²⁾
12	Phoenix Contact PC4/2-ST-7	3.0	8	- ²⁾
13	Phoenix Contact SMSTB 2,5/3-G-5,08	6.6	9	- ²⁾
14	Thermal gap pad	4.8	12	- ²⁾
15	PCB with electronic device	686.6	15	See 16,17
16	PCB, empty	142.5	16	R24
17	Electronic devices on PCB*	544.1	15	- ^{1,2,3,4)}
Total mass combustible:		170.9		

* The devices were not weighed individually since they were unable to be removed from the PCB. Some non-combustible components are also attached to the PCB.

- ¹⁾ For products classified as A1 according to EN 13501-1 or described in commission decision 96/603/EC, no further testing is required (4.2.a).
- ²⁾ The component is not in contact with any other components weighing less than 10 g. according to figure 1 in EN 45545-2 this product does not need to be tested.
- ³⁾ Electronic devices on printed circuit boards are allowed without further testing (4.7).
- ⁴⁾ Up to 100 g of unclassified products are allowed per group (4.3.2).

Appendix 2

Photos, parts of product



Photo 1: Chassis top, 734.6 g.



Photo 2: Chassis bottom, 734.7 g.



Photo 3: Panel, alarm, 88.5 g.



Photo 4: Panel, in- & output, 87.7 g.



**Photo 5: Phoenix Contact
PC4/4-ST-7, 5.6 g**



**Photo 6: Metal parts from Phoenix
Contact PC4/4-ST, 10.9 g.**

Appendix 2



Photo 7: Phoenix Contact PC4/2-ST-7, 8.4 g.



Photo 8: Phoenix Contact PC4/2-ST-7 3.0 g.



Photo 9: Phoenix Contact SMSTB 2,5/3- ST-5,08 and Phoenix Contact MSTBA2,5/3-G-5,08, 6.6 g.



Photo 10: Steel screws, 39.3 g.



Photo 11: Semiconductor heat sink assemblies, 60.0 g.



Photo 12: Thermal gap pad, 4.8 g.

Appendix 2



Photo 13: Transformer heat sink, 31.2 g.



Photo 14: Aluminium oxide, 12.0 g.



Photo 15: PCB with electronic device, 686.6 g.



Photo 16: PCB, empty, 142.5 g.

Appendix 3

Photos, complete product



Photo 17: Complete product, 2515. 2 g.

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Reaction to fire classification report according to EN 45545-2

1 Introduction

This classification report defines the classification assigned to a product family of Polyamp DC/DC-converter, called "PM500 family", in accordance with the procedure given in EN 45545-2:2013.

2 Details of classified product

2.1 General

The product family "PM500 family" is defined as "DC/DC-converter".

2.2 Product description

The product family, "PM500 family", is fully described in the reports provided in support of classification and listed in Clause 3.1.

3 Test reports & test results in support of classification

3.1 Test reports

This classification is based on reports listed below:

Name of laboratory	Name of sponsor	Test report ref no	Test method/ Reference
SP	Polyamp AB	5P02184	EN 45545-2
SP	Polyamp AB	4P05366	EN ISO 4589-2

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3.2 Test results

Test method	Parameter	Number of tests	Results	
			Mean value	Compliance with parameters
<i>EN ISO 4589-2</i>		6		
Oxygen Index	%		> 32	Compliant

4 Classification and field of application

4.1 Reference

This classification has been carried out in accordance with EN 45545-2 “Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components”.

According to 4.3 Interior “Grouping rules”, it is permitted to have up to 100 g of products with no requirements for each group and up to 500 g of products that are compliant at least to the requirement R24 in Table 5 for each group.

To meet the set of material requirements according to table 5, requirement set R24, components have to meet the following requirements when tested according to EN ISO 4589-2:

HL1

- Oxygen Index (%), minimum 28.

HL2

- Oxygen Index (%), minimum 28.

HL3

- Oxygen Index (%), minimum 32.

According to 4.7 “Products to be approved on functional necessity”, electronics devices on printed board are mentioned as commercially available products that can be used until and unless a suitable product is developed, when requirements specified in the EN 45545-2 are not technically achievable with functionally suitable products.

4.2 Classification

Products within the product family called "PM500 family" in relation to its reaction to fire behaviour are classified according to 4.5 "Non-listed products", 4.3 "Grouping rules" and 4.7 "Products to be approved on functional necessity". Certain materials contained within the products are listed in table 2 in the standard EN 45545-2 and have therefore been evaluated according to respective requirement sets.

Reaction to fire classification: HL1, HL2 and HL3

4.3 Field of application

This classification is valid for the following end use conditions:

- Interior
- Mounting of additional products, non-compliant to table 2 in the standard EN 45545-2, within a horizontal distance of 20 mm and/or a vertical distance of 200 mm, must be preceded of assessment according to EN 45545-2.

This classification is valid for the following product parameters:

- Each product of the product family may contain no more than 100 g of products with no requirements.
- Each product of the product family may contain no more than 500 g of products that are compliant at least to the requirement set R24.

5 Limitations

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

The sample was delivered by the client. SP Fire Research was not involved in the sampling procedure.

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