
APPENDIX A3.2.3-10

HEATING BLADE SPECIFICATION (HEA.000051)

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PRODUCT SPECIFICATION

P1 HEATER

HEA.000051

(b) (4)

- 5MM WIDTH

(b) (4)



PRODUCT SPECIFICATION

P1 HEATER – HEA.000051 - 5MM WIDTH

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1 Purpose

This document sets the product specification of the heater 5mm width produced by (b) (4), to be integrated into a tobacco heating system (i.e. Holder).

This document defines the parameters of the heater to be fulfilled, such as thermal, electrical, mechanical, dimensional, material and other aspects.

This product specification refers to the product code HEA.000051 – Heater 5mm with (b) (4)

2 Scope and Applicability

This document applies to the following:

- Process(es): PMI R&D Processes - All
- Program: Product Development
- Project(s): P1 Product Development
- Function(s): PMI R&D

(b) (4)

3 Introduction

In order to heat a tobacco plug to a defined temperature, a component (heater) was developed based on a PT100 temperature sensor principle. This component is one part of a complete system including overmoulding bushing, electronic & mechanical parts and in the application phase a tobacco stick. The component brings the advantages to cope with the small dimension requirements of the system, while raising the temperature up to more than 400°C in an efficient way with minimal electrical power. In general, the component consists of one active structure which acts as a heater and a temperature sensor simultaneously

A calibration with the relationship between the temperature and the resistance of the heater needs to be stored in the electronics. The temperature of the heater will therefore be regulated by the embedded electronic in the system (Holder). The resistance of the heater needs to be carefully controlled to reach the desired temperature.

The temperature distribution along the active heating area of the heater should be as homogeneous as possible.

To attach the heater into the Holder, the heater will be overmoulded with a plastic piece (heater bushing) that will act on one hand as a mechanical support and on the other hand as the separation of the electronics from the heating zone.

(b) (4) is solely responsible for the component (heater). Overmoulding and the electronics is not in (b) (4) responsibility. Therefore requirements 5.2 and 5.5 dealing with the whole system are only indicative for (b) (4)

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4 Description of the Product

The heater consists of a platinum based resistive track (heating track) deposited on a ceramic substrate. The passive conductors conduct the electrical energy into the heating track. The bonding pads allow the heater to be connected to a PCB in the Holder.

The heater can be subdivided into four distinct areas:

- Active heating area - heat generation area
- Insertion area - tobacco plug insertion area
- Holding area – overmoulded area of the heater with bushing
- Connecting area - electrical contact area

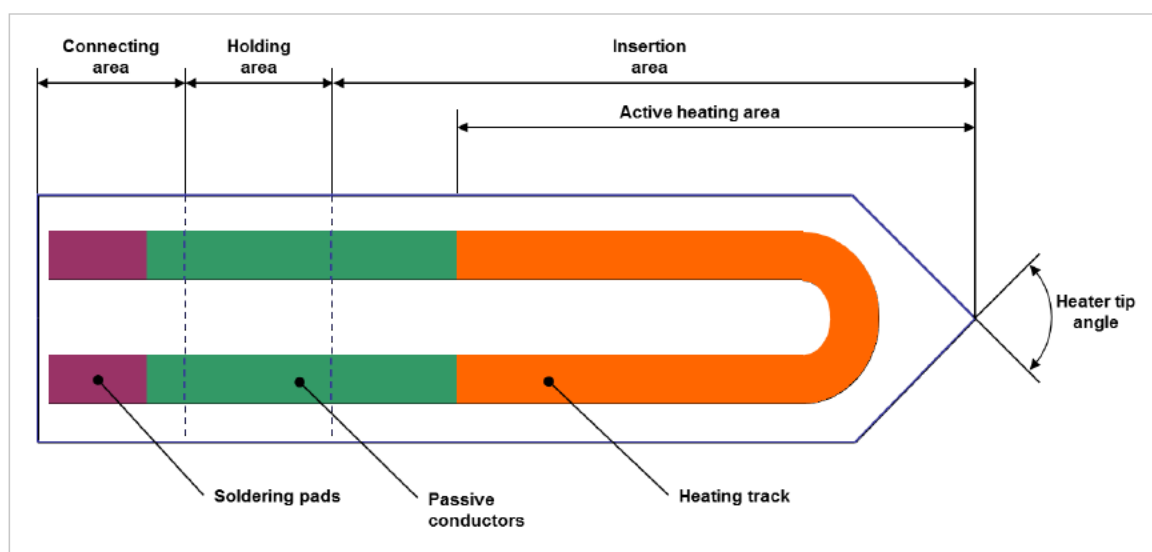


Fig. 1 - Scheme of the distinct areas of the heater

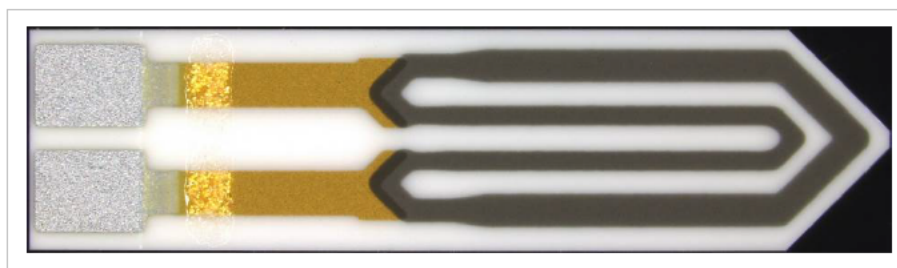


Fig. 2 - Picture of the 5mm heater (printed side)

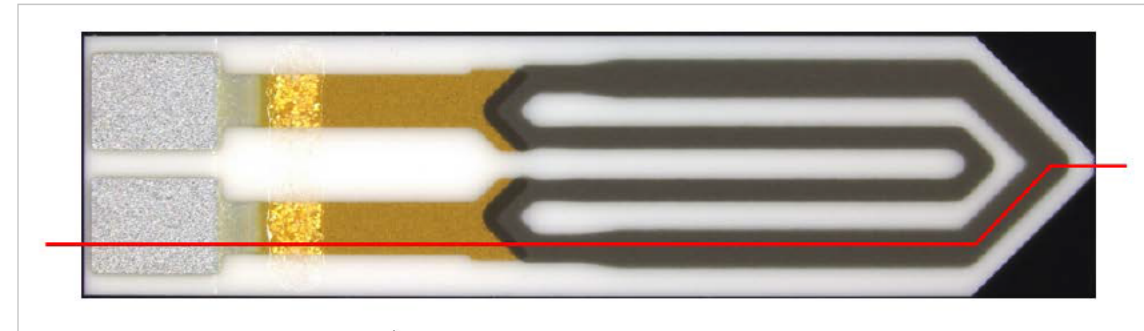
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Fig. 3 – Scheme of the heater (b) (4) layers as cut by the red line on the picture

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5 Technical Specifications

5.1 Dimensional requirements

Dimension of the heater is specified in the technical drawing 064_0061 "Heater". Refer to valid version logged and approved in PDIMS system.

5.2 Heating cycles and time requirements

The heating temperature profile (temperature and time) for the heater is dictated by the expected smoke deliveries generated along the smoking experience. The red curve represents the heater temperature. The graph below is not representative of a real temperature profile but only for illustration purposes. It serves to show that the operating heating temperature over the smoking experience duration might vary.

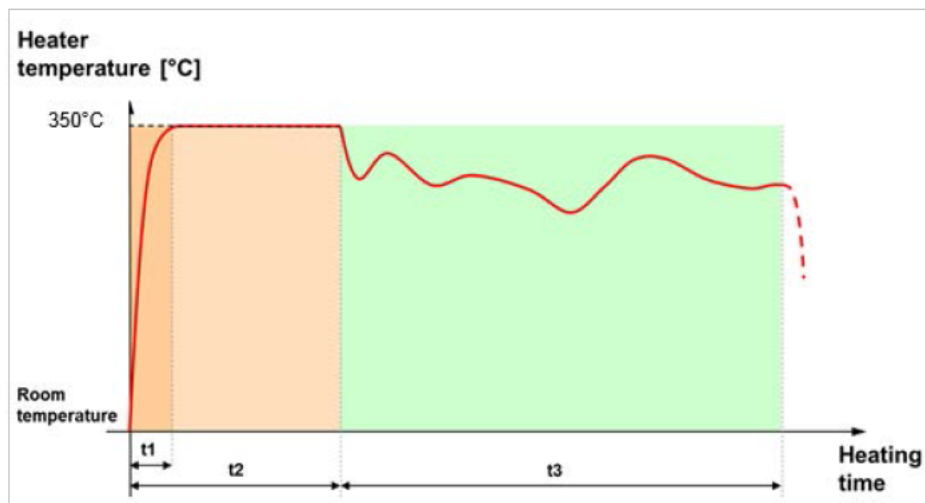


Fig. 4 – Heating temperature profile

Heating times requirements for the heater

Reference	Description	Target	Comments
5.2.1	t1 - time to reach operating temperature	4 seconds	Measured without overmolded bushing; Voltage applied on heater 3.2V DC. From 20°C to 350°C
5.2.2	t2 - time for pre-heating tobacco plug	~ 30 seconds	Indicative value
5.2.3	t3 - time for the consumption of the product	~ 6 min	Indicative value
5.2.4	Cleaning time	30 seconds	See reference 5.3.3



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5.3 Thermal requirements

The temperature of the heater is measured with an Infrared camera. The temperature is always measured over a defined surface. The size of the surface and its positioning is fixed as any variation of them will influence significantly the measured temperatures.

The measuring equipment allows to have an averaged value of the temperature over a defined surface and to measure the maximal temperature value on that defined surface.

In the table below, the "Mean operating temperature" represents an average temperature over a defined surface (i.e. measuring window) while the "Max operating temperature" represents the maximal temperature value (discrete point) on a defined surface (i.e. measuring window).

Thermal characterization is only done on engineering samples. 100% testing at operating temperature is done during the assembly process of the device in production.

The test setup for thermal requirements is:

- Ambient conditions: 25°C±2°C, 40-60%RH, no air flow
- Heater position: horizontal with metallic tracks on upper side, self-supporting with the electrical connections
- Electrical connections: Ø0.4mm golden plated copper wire soldered or welded on the silver pad
- Power supply: constant voltage adjustable to reach the required temperature

(b) (4)

Reference	Description	Tolerance	Comments
5.3.1	Mean operating temperature range		Measuring window AR04 (active heating area – IR camera)
5.3.2	Operating temperature gradient Delta between Max operating temperature (AR01) and Mean operating temperature (AR04)		Measuring windows AR04 and AR01 (active heating area – IR camera) Once temperature of the heater is stabilized
5.3.3	Heater cleaning temperature		Measuring window AR04 (active heating area – IR camera)
5.3.4	Max temperature in holding area		Located at the overmoulded bushing, during the entire smoking experience time or during cleaning process.

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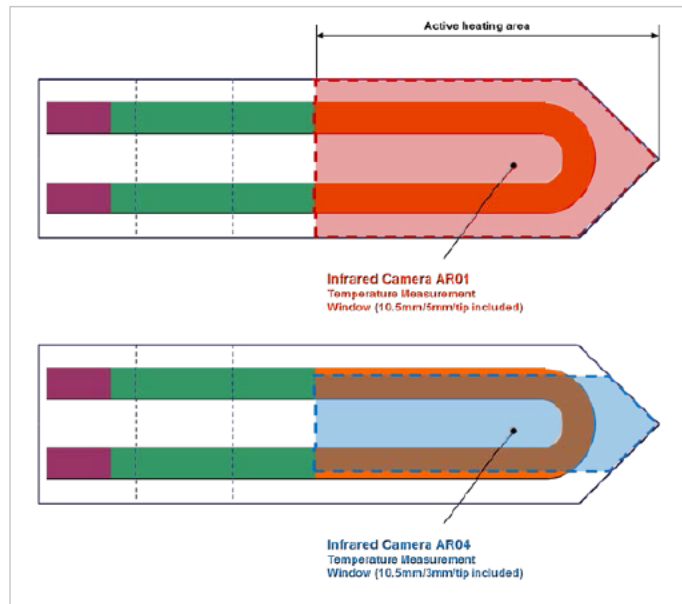


Fig. 5 – Scheme of the measuring windows of the InfraRed camera

5.4 Electrical requirements

Reference	Description	Target	Tolerance	Comments
(b) (4)				



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5.5 Mechanical requirements

During insertion of the heater into the heat stick, a compression effort occurs, due to the nature of the tobacco plug. As the heat stick is guided longitudinally when the heater is introduced, no radial effort is expected.

Reference	Description	Target	Comments
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(b) (4)

5.6 Material and assembly requirements

Reference	Description	Target	Comments
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(b) (4)

5.6.2	Heater surface state in holding area	Dimensions according to technical drawing	Structured surface with specific grain size and distribution
5.6.3	Material compliance to Directive 2011/65/EU	Compliant	ROHS compliance

5.7 Heater connection requirements

Reference	Description	Target	Comments
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5.7.2	Connecting pads material	Allow soldering of wires	
5.7.3	Shape and dimensions of connecting pads	According to technical drawing	



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5.8 Lifetime requirements

The test setup for lifecycle requirements is:

- Ambient conditions: 25°C±2°C, 40-60%RH, no air flow
- Heater position: horizontal with metallic tracks on upper side, self-supporting with the electrical connections
- Electrical connections: Ø0.4mm golden plated copper wire soldered or welded on the silver pad
- Pulsed power supply: 3.0V during 5 seconds, then 55 seconds rest time

Reference	Description	Target	Comments
(b) (4)			
5.8.3	Peeling test	See Remark	

Remark:

Reference 5.8.1 to 5.8.2: currently not assessed (b) and no validated data are available to confirm the targets.

Reference 5.8.3: currently not applicable at (b) test method to be validated and target to be confirmed

Reference 5.8.1 to 5.8.3: currently not applicable. Remark will be removed once test methods and target values are confirmed.

5.9 Operating conditions

Reference	Description	Target	Comments
5.9.1	External temperature	+0°C to +50°C	
5.9.2	External humidity	5% to 95% RH	Non-condensing



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6 Cosmetic Specifications

Remark : The pictures used to illustrate the cosmetic specification sections may not represent the latest heater design. However the cosmetic specification criteria applies for the latest heater design approved.

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7 Related documents

- Product Code HEA.000051 - Refer to latest valid version logged and approved in PDIMS system.
- Technical drawing 064_0061 "Heater" – Refer to latest valid version logged and approved in PDIMS system.

Note:

(b) does not have access to PDIMS. Release of valid specification and technical drawing is done through Engineering Change Notification Process from PMI.



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8 Revision history

Version N°	Author	Description of change (including reason for change)	Type of change
1.0	Degoumois, Yvan	Original issue	1
2.0	Robert, Jacques	Modification of layout fig 3 . (b) (4)	1
3.0	Robert, Jacques	(b) (4)	1

(1. Major change/new version; 2. Minor change; 3 Review without change)

For proof of date and status, refer to the EDMS attributes tab in the document properties.

9 Review and approval

This document has been approved by:

Name	Function	Justification
Plojoux, Julien	Manager Design Verification	Signed as Subject Matter Expert Reviewer
Hiscott, Sebastian	Manager QA Devices	Signed as Subject Matter Expert Reviewer
Degoumois, Yvan	Manager Engineering Industrialization	Signed as Subject Matter Expert Reviewer
Robert, Jacques	Manager Technology Program	Signed as Author
Tabasso, Alain	Director Electronic Devices RRP	Signed as Approver/Owner

For proof of review and approval (Dates and electronic sign-off), refer to the EDMS history tab in the document properties.

10 Abbreviations

Abbreviations	:	Description
EDMS	:	Electronic Data Management System
PDIMS	:	Product Development Information Management System
ROHS	:	Restriction of Hazardous Substances
SME	:	Subject Matter Expert



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