SPECIFICATION

ZRH CH FACTORY HEATER CALIBRATION

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1 Purpose

This document defines / describes a procedure applied during the manufacturing of ZRH FPD 4.1 cigarette holders and future versions of this design to calibrate the heater resistance/temperature curve. The need for calibration comes from the fact that the electrical resistance of the heater track is a function of the temperature of the heater. Taking advantage from this property, the cigarette holder actually regulates heater resistance while it is configured with a temperature profile expressed in °C; hence it needs to be able to convert from temperature to corresponding resistance values. Figure 1 illustrates the overall temperature regulation process.

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Figure 1: Temperature regulation process

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2 Scope and applicability

This document applies to the following:

- Discipline(s): Product Development
- Project(s): ZRH CPD Realization
- Function(s): T&PD

More specifically, this specification applies to the phase of the manufacturing process which calibrates ZRH FPD 4.1 (and followers) cigarette holder heaters. The document provides a step-by-step description of the calibration method as well as the algorithms to implement in manufacturing tools.

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3 Background

3.1 Relation between resistance and temperature of the heating element

In the literature, the relation between resistance and temperature for metals such as gold, platinum and silver is commonly approximated using the Callendar (Callendar, 1887) equation:

$$R = R_0(1 + AT + BT^2) \quad (1)$$

where R is the resistance at temperature T, R_0 is the resistance at 0°C, A and B are metal specific constants. For platinum, the above equation is an accurate representation of the resistance/temperature curve for $T \geq 0$ only.

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3.3 Observations

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4.2 Calibration procedure

This section describes the heater calibration procedure performed during the manufacturing of the cigarette holders. The description provides an overview of the cal bration system as well as a detailed list of the steps to perform.

4.2.1 Overview

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5 Accuracy considerations

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7 Reference documents

Callendar, H. L. (1887). On the Practical Measurement of Temperature: Experiments Made at the Cavendish Laboratory, Cambridge. *Philosophical Transactions of the Royal Society of London. A. Volume 178*, 161-230.

Mathews, J. H. (n.d.). *The Newton Polynomial*. (California State University, Fullerton) Retrieved June 11, 2012, from http://math.fullerton.edu/mathews/n2003/NewtonPolyMod.html

8 Related documents

[1] ZRH_CPD_SPC_F42 Manufacturing Test Specification.doc
[2] ZRH_CPD_TLS_heater_cal bration_numerical_aspects.xlsx

9 Revision history

Version N°	Author	Description of change (including reason for change)	Type of change
1.0	Farine, Robin	Original issue.	1

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

For proof of date and status, refer to the DISCO attr butes tab in the document properties.

10 Review and approval

Select the reviewers and approvers based on document needs. Please refer to, PMI_RD_WKI_000085 Quality Management Document review & approval for more details.

This document has been approved by:

Name	Function	Justification
Schaerer, Caroline	Quality Management Executive	Signed as Quality Reviewer
Bernauer, Dominique	Associate Staff Engineer	Signed as Subject Matter Expert Reviewer
Kuczaj, Arkadiusz	Associate Staff Scientist	Signed as Peer-Reviewer
Farine, Robin	Associate Staff Engineer	Signed as Approver/Author
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For proof of review and approval (Dates and electronic sign-off), refer to the DISCO history tab in the document properties.

Roles and respons bilities of signatories are defined in the documented work instruction

11 Abbreviations

Abbreviations	:	
FPD	:	Functional Product Design
PFM	:	Pulse Frequency Modulation
SME	:	Subject Matter Expert
ZRH	:	Zurich Program

For complete definition, refer to PMI OPS Glossary