

TECHNICAL REPORT

**Fire hazard testing -
Part 2-16: Glowing/hot-wire based test methods - Summary of the round robin
tests related to the use of pyrometer for glow-wire temperature measurements
according to IEC 60695-2-10**

iTeh Standards
Document Preview

[IEC TR 60695-2-16:2025](https://standards.iteh.ai/catalog/standards/iec/f359b1c7-418b-4a32-9886-f4c47fb0b03d/iec-tr-60695-2-16-2025)

<https://standards.iteh.ai/catalog/standards/iec/f359b1c7-418b-4a32-9886-f4c47fb0b03d/iec-tr-60695-2-16-2025>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2025 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

[IEC TR 60695-2-16:2025](https://standards.iteh.ai/catalog/standards/iec/f359b1c7-418b-4a32-9886-f4c47fb0b03d/iec-tr-60695-2-16-2025)

<https://standards.iteh.ai/catalog/standards/iec/f359b1c7-418b-4a32-9886-f4c47fb0b03d/iec-tr-60695-2-16-2025>

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope.....	11
2 Normative references	11
3 Terms and definitions	11
4 Pre-round robin test.....	11
4.1 General.....	11
4.2 Pre-round robin test objectives	12
4.3 Pre-round robin test plan	12
4.4 Pre-round robin test participants.....	13
4.5 Pre-round robin test results	14
4.5.1 Glow-wire pocket hole dimensions variation.....	14
4.5.2 Thermal contact between thermocouple tip and pocket hole end	27
4.6 Pre-round robin test outcome	40
5 First round robin test	41
5.1 General.....	41
5.2 First round robin test objectives	41
5.3 First round robin test plan.....	42
5.4 First round robin test participants	44
5.5 First round robin test results	44
5.5.1 Verification of pyrometer measurements in comparison to thermocouple measurements	44
5.5.2 First round robin test X-Ray CT scan measurements results	87
5.6 First round robin test outcome	93
6 Second round robin test.....	94
6.1 General.....	94
6.2 Second round robin test objectives	94
6.3 Second round robin test plan	94
6.4 Second round robin test participants.....	99
6.5 Second round robin test results	99
6.5.1 General	99
6.5.2 Verification of heating currents	100
6.5.3 Characteristics, usage conditions of instruments.....	107
6.5.4 Pyrometer calibration	109
6.5.5 Test plans comparison of silver (Ag) melting temperature measurements	111
6.5.6 Comparison of temperatures measurements	114
6.5.7 Summary of second round robin test data quality	122
6.6 Second round robin test outcome	123
7 Conclusion	123
Bibliography	124
Figure 1 – Pre-round robin test plans	13
Figure 2 – Glow-wire and pocket hole measured areas	15
Figure 3 – Pocket hole depth measurement points.....	20

Figure 4 – Pocket hole diameter measurement points	22
Figure 5 – Graph of pocket hole diameter measurements.....	23
Figure 6 – Laboratories thermocouple airgap in glow-wire pocket hole	26
Figure 7 – Thermocouple silver foil melting temperatures by laboratory	28
Figure 8 – Pyrometer silver foil melting temperatures by laboratory.....	29
Figure 9 – Laboratory 1 measured heating currents at target temperatures plotting	30
Figure 10 – Laboratory 2 measured heating currents at target temperatures plotting	31
Figure 11 – Laboratory 3 measured heating currents at target temperatures plotting	32
Figure 12 – Laboratory 4 measured heating currents at target temperatures plotting	33
Figure 13 – Laboratory 5 measured heating currents at target temperatures plotting	34
Figure 14 – Laboratory 6 measured heating currents at target temperatures plotting	35
Figure 15 – Laboratory 7 measured heating currents at target temperatures plotting	36
Figure 16 – Laboratory 8 measured heating currents at target temperatures plotting	37
Figure 17 – Laboratory 9 measured heating currents at target temperatures plotting	38
Figure 18 – Laboratory 10 measured heating currents at target temperatures plotting	39
Figure 19 – First round robin test – Test plan 1.....	43
Figure 20 – First round robin test – Test plan 2.....	43
Figure 21 – First round robin test – Test plan 3.....	44
Figure 22 – First round robin test – Laboratory 1 heating currents and pyrometer measured temperatures plotting	48
Figure 23 – First round robin test – Laboratory 1 heating currents and thermocouple measured temperatures plotting	48
Figure 24 – First round robin test – Laboratory 3 heating currents and pyrometer measured temperatures plotting	49
Figure 25 – First round robin test – Laboratory 3 heating currents and thermocouple measured temperatures plotting	50
Figure 26 – First round robin test – Laboratory 4 heating currents and pyrometer measured temperatures plotting	51
Figure 27 – First round robin test – Laboratory 4 heating currents and thermocouple measured temperatures plotting	51
Figure 28 – First round robin test – Laboratory 5 heating currents and pyrometer measured temperatures plotting	53
Figure 29 – First round robin test – Laboratory 5 heating currents and thermocouple measured temperatures plotting	53
Figure 30 – First round robin test – Laboratory 6 heating currents and pyrometer measured temperatures plotting	54
Figure 31 – First round robin test – Laboratory 6 heating currents and thermocouple measured temperatures plotting	55
Figure 32 – First round robin test – Laboratory 7 heating currents and pyrometer measured temperatures plotting	56
Figure 33 – First round robin test – Laboratory 7 heating currents and thermocouple measured temperatures plotting	56
Figure 34 – First round robin test – Laboratory 8 heating currents and pyrometer measured temperatures plotting	58
Figure 35 – First round robin test – Laboratory 8 heating currents and thermocouple measured temperatures plotting	58

Figure 36 – First round robin test – Laboratory 9 heating currents and pyrometer measured temperatures plotting	59
Figure 37 – First round robin test – Laboratory 9 heating currents and thermocouple measured temperatures plotting	60
Figure 38 – First round robin test – Laboratory 10 heating currents and pyrometer measured temperatures plotting	61
Figure 39 – Figure 38 – First round robin test – Laboratory 10 heating currents and thermocouple measured temperatures plotting	61
Figure 40 – First round robin test – Laboratory 1 Measured silver (Ag) melting temperatures	64
Figure 41 – First round robin test – Laboratory 3 Measured silver (Ag) melting temperatures	65
Figure 42 – First round robin test – Laboratory 4 Measured silver (Ag) melting temperatures	66
Figure 43 – First round robin test – Laboratory 5 Measured silver (Ag) melting temperatures	68
Figure 44 – First round robin test – Laboratory 6 Measured silver (Ag) melting temperatures	69
Figure 45 – First round robin test – Laboratory 7 Measured silver (Ag) melting temperatures	70
Figure 46 – First round robin test – Laboratory 8 Measured silver (Ag) melting temperatures	72
Figure 47 – First round robin test – Laboratory 9 Measured silver (Ag) melting temperatures	73
Figure 48 – First round robin test – Laboratory 10 Measured silver (Ag) melting temperatures	74
Figure 49 – First round robin test – Laboratory 1 Measured potassium bromide (KBr) melting temperatures	76
Figure 50 – First round robin test – Laboratory 3 Measured potassium bromide (KBr) melting temperatures	78
Figure 51 – First round robin test – Laboratory 4 Measured potassium bromide (KBr) melting temperatures	79
Figure 52 – First round robin test – Laboratory 5 Measured potassium bromide (KBr) melting temperatures	80
Figure 53 – First round robin test – Laboratory 6 Measured potassium bromide (KBr) melting temperatures	81
Figure 54 – First round robin test – Laboratory 7 Measured potassium bromide (KBr) melting temperatures	83
Figure 55 – First round robin test – Laboratory 8 Measured potassium bromide (KBr) melting temperatures	84
Figure 56 – First round robin test – Laboratory 9 Measured potassium bromide (KBr) melting temperatures	85
Figure 57 – First round robin test – Laboratory 10 Measured potassium bromide (KBr) melting temperatures	86
Figure 58 – First round robin test – Glow-wire and pocket hole measured areas	88
Figure 59 – First round robin test plot of pocket hole diameter measurements	92
Figure 60 – First round robin test – Laboratories thermocouple airgap in glow-wire pocket hole	93
Figure 61 – Second round robin test – Test plan 1	95

Figure 62 – Second round robin test – Test plan 1 Example of pyrometer measurement area	96
Figure 63 – Second round robin test – Test plan 2	97
Figure 64 – Second round robin test – Test plan 2 Example of pyrometer measurement areas	97
Figure 65 – Second round robin test – Test plan 3	98
Figure 66 – Second round robin test – Test plan 3 Example of pyrometer measurement areas	99
Figure 67 – Second round robin test – Test plan 1 – Laboratory 1 heating currents at target temperatures plotting	100
Figure 68 – Second round robin test – Test plan 1 – Laboratory 7 heating currents at target temperatures plotting	101
Figure 69 – Second round robin test – Test plan 1 – Laboratory 9 heating currents at target temperatures plotting	102
Figure 70 – Second round robin test – Test plan 2 – Laboratory 1 heating currents at target temperatures plotting	103
Figure 71 – Second round robin test – Test plan 2 – Laboratory 5 heating currents at target temperatures plotting	104
Figure 72 – Second round robin test – Test plan 2 – Laboratory 7 heating currents at target temperatures plotting	105
Figure 73 – Second round robin test – Test plan 2 – Laboratory 9 heating currents at target temperatures plotting	106
Figure 74 – Second round robin test – Test plan 3 – Laboratory 1 heating currents at target temperatures plotting	107
Figure 75 – Second round robin test – Laboratories measured emissivity values	111
Figure 76 – Second round robin test – Test plan 1 Silver (Ag) foil measured melting temperatures by pyrometer and thermocouple	112
Figure 77 – Second round robin test – Test plan 2 Silver (Ag) foil measured melting temperatures by pyrometer and thermocouple	113
Figure 78 – Second round robin test – Test plan 3 Silver (Ag) foil measured melting temperatures by pyrometer and thermocouple	114
Figure 79 – Second round robin test – Laboratories' measurements for target temperature 950 °C	116
Figure 80 – Second round robin test – Laboratories' measurements for target temperature 850 °C	117
Figure 81 – Second round robin test – Laboratories' measurements for target temperature 750 °C	118
Figure 82 – Second round robin test – Laboratories' measurements for target temperature 650 °C	119
Figure 83 – Second round robin test – Laboratories' measurements for target temperature 550 °C	120
Figure 84 – Laboratories' variation per target temperature for pyrometer and thermocouple measurements	121
Figure 85 – Laboratories' standard deviation per target temperature for pyrometer and thermocouple measurements	122
Table 1 – Pre-round robin test objectives	12
Table 2 – Pre-round robin test participants and test conditions	14
Table 3 – Glow-wire and pocket hole measured areas descriptions	15

Table 4 – X-Ray CT scan images measurements results.....	16
Table 5 – Glow-wire and pocket hole alignment measurements (beginning of test plan).....	17
Table 6 – Glow-wire and pocket hole alignment results comparison	18
Table 7 – Glow-wire and pocket hole alignment analysis results (beginning of test plan)	19
Table 8 – Pocket hole depth measurements results (beginning test plan)	21
Table 9 – Pocket hole depth measurements results comparison.....	21
Table 10 – Pocket hole diameter measurements results (beginning test plan)	22
Table 11 – Pocket hole diameter measurements results comparison	23
Table 12 – Glow-wire tip diameter and thickness measurements results (beginning of test plan).....	24
Table 13 – Pocket hole depth measurements results comparison.....	24
Table 14 – Thermocouple airgap in glow-wire pocket hole measurements results (beginning of test plan)	25
Table 15 – Thermocouple airgap in glow-wire pocket hole results comparison.....	26
Table 16 – One-point temperature measurement verification results by thermocouple	27
Table 17 – One-point temperature measurement verification results by pyrometer.....	28
Table 18 – Silver foil melting temperature comparison thermocouple and pyrometer.....	29
Table 19 – Laboratory 1 measured heating currents at target temperatures results.....	30
Table 20 – Laboratory 2 measured heating currents at target temperatures results.....	30
Table 21 – Laboratory 3 measured heating currents at target temperatures results.....	31
Table 22 – Laboratory 4 measured heating currents at target temperatures results.....	32
Table 23 – Laboratory 5 measured heating currents at target temperatures results.....	33
Table 24 – Laboratory 6 measured heating currents at target temperatures results.....	34
Table 25 – Laboratory 7 measured heating currents at target temperatures results.....	35
Table 26 – Laboratory 8 measured heating currents at target temperatures results.....	36
Table 27 – Laboratory 9 measured heating currents at target temperatures results.....	37
Table 28 – Laboratory 10 measured heating currents at target temperatures results.....	38
Table 29 – Heating current variation at target temperatures and laboratories	39
Table 30 – Pyrometer temperature measurements at target temperatures	40
Table 31 – Pre-round robin test outcomes	40
Table 32 – First round robin test objectives	42
Table 33 – First round robin test participants and test conditions	44
Table 34 – First round robin test pyrometers characteristics.....	45
Table 35 – First round robin test pyrometers installation conditions.....	45
Table 36 – First round robin test pyrometers emissivity calibration results.....	46
Table 37 – Laboratory 1 heating currents and measured temperatures.....	47
Table 38 – Laboratory 3 Heating currents and measured temperatures	48
Table 39 – Laboratory 4 Heating currents and measured temperatures	50
Table 40 – Laboratory 5 Heating currents and measured temperatures	52
Table 41 – Laboratory 6 Heating currents and measured temperatures	53
Table 42 – Laboratory 7 Heating currents and measured temperatures	55
Table 43 – Laboratory 8 Heating currents and measured temperatures	57
Table 44 – Laboratory 9 Heating currents and measured temperatures	58