CONFIDENTIAL

Report: Chilt/IF11026

# An ad hoc fire resistance test performed on 3No. horizontal ventilated rain screen cavity fire barrier seals

AD-hoc test conducted to the general principles of BS EN 1363-1: 1999, using the test method stated in EOTA TR31: 2008 (fire resistance tests for cavity barriers)

Test date: 5th May 2011



committed to excellence

Prepared for: Complete Fire Protection Ltd
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# Contents

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# 1 Introduction

Five ventilated rainscreen cavity barriers were supplied for test, only three of which are subject to this report.

The ventilated rainscreen cavity fire barrier sealing systems were installed into a simulated timber frame to non combustible blockwork wall cavity horizontal supporting construction and tested to evaluate their fire resistance.

# 2 Specimen verification

The specimens were delivered to Chiltern International Fire Ltd (CIFL) during May 2011. CIFL fabricated the supporting construction, and the client, with assistance as required from CIFL, installed the specimens into the supporting construction.

# 3 Description of supporting constructions

**Horizontal supporting construction**

The supporting construction comprised lightweight reinforced aerated autoclaved concrete floor lintels, 150mm thick x 1350mm wide x 250mm deep, and 47mm thick x 1350mm wide x 250mm high timber floor joists faced with OSB and vapour check paper, with 1000mm x 1000mm exposed to the furnace.

The exposed area of the supporting construction included 3No apertures, 1 No. 25mm wide x 1000mm long x 250mm high and 2 No. 50mm wide x 1000mm long x 250mm high, to accept the ventilated cavity fire barrier seals.

# 4 Description of specimen

Details of the specimens are shown in Appendix 1. All measurements are in millimetres and the descriptions are written viewing the specimens from the unexposed face unless stated otherwise.

## 4.1 Cavity fire barrier sealing systems

Each cavity barrier sealing system was installed into its corresponding aperture within the supporting construction.

**Cavity seal C**

The cavity barrier sealing system comprised a 50mm wide x 4.6mm thick foil wrapped intumescent, Reference CB50/30TF, fixed to the timber with 20mm long panel pins at 250mm centres, and double sided self adhesive tape. The system incorporated a butt joint 500mm from the front of the furnace.

The system was fitted centrally within the cavity.

The free air gap of the cavity was 50mm wide.

**Cavity seal D**

The cavity barrier sealing system comprised a 50mm wide x 4.6mm thick foil wrapped intumescent, Reference CB50/30TM, fixed to the timber with 20mm long panel pins at 250mm centres. The system incorporated a butt joint 500mm from the front of the furnace.

The system was fitted centrally within the cavity.

The free air gap of the cavity was 50mm wide.

**Cavity seal E**

The cavity barrier sealing system comprised a 30mm wide x 2.3mm thick foil wrapped intumescent, Reference CB25/30CFP, fixed to the timber with 20mm long panel pins at 250mm centres. The system incorporated a butt joint 500mm from the front of the furnace.

The system was fitted centrally within the cavity.

The free air gap of the cavity was 50mm wide.

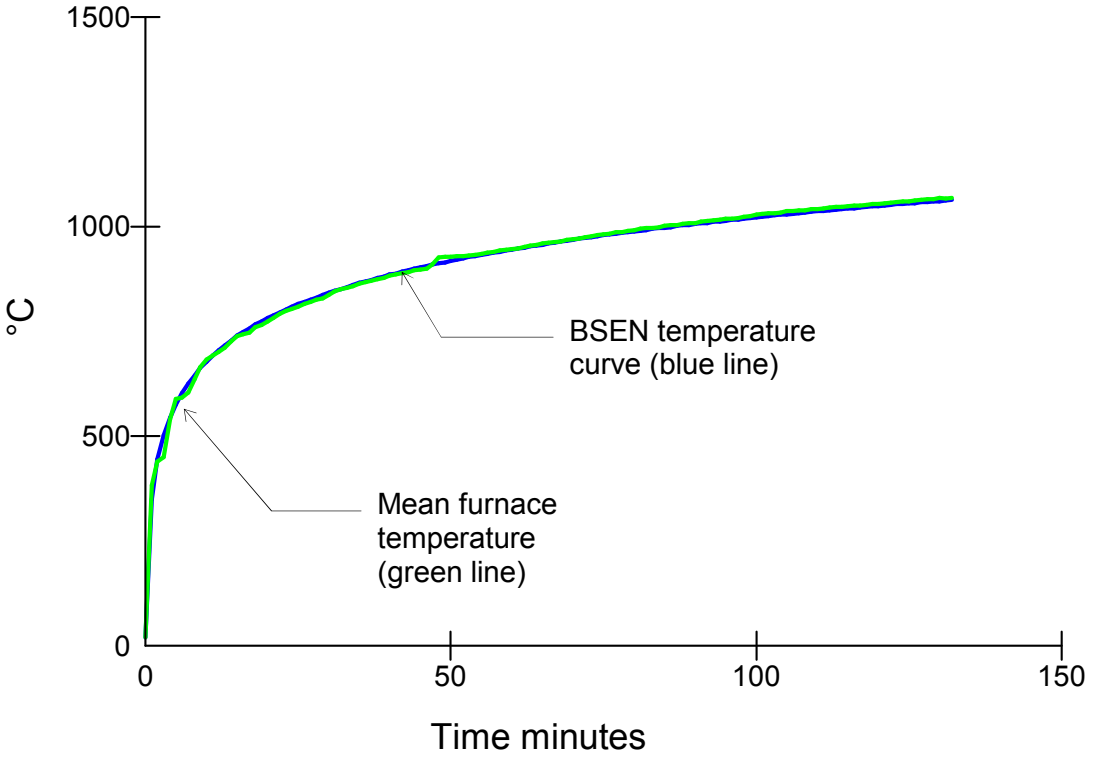
# 5 Test conditions

## 5.1 Ambient temperature

The ambient temperature of the test area at commencement of test was 16ºC. The ambient temperature for the duration of the test has been tabulated in Appendix 2.

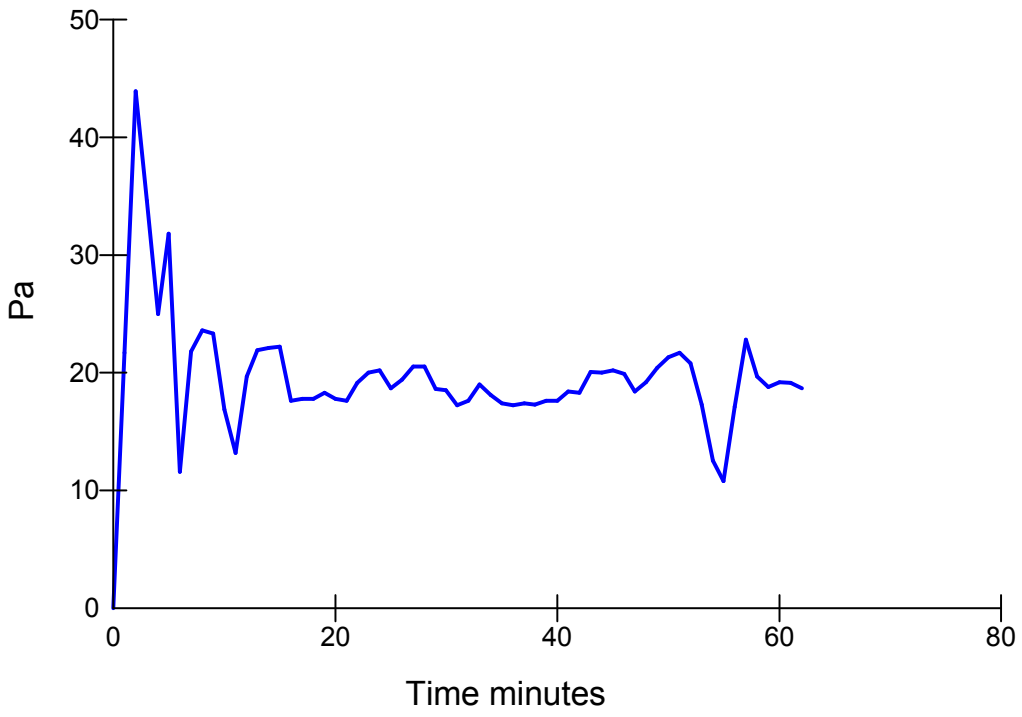
## 5.2 Furnace temperature

The furnace was controlled to follow the temperature/time relationship specified in BSEN 1363-1, 1999, as closely as possible, using the average of four plate thermocouples suitably distributed within the furnace. The furnace temperatures for the duration of the test have been tabulated in Appendix 2 and are shown graphically below:

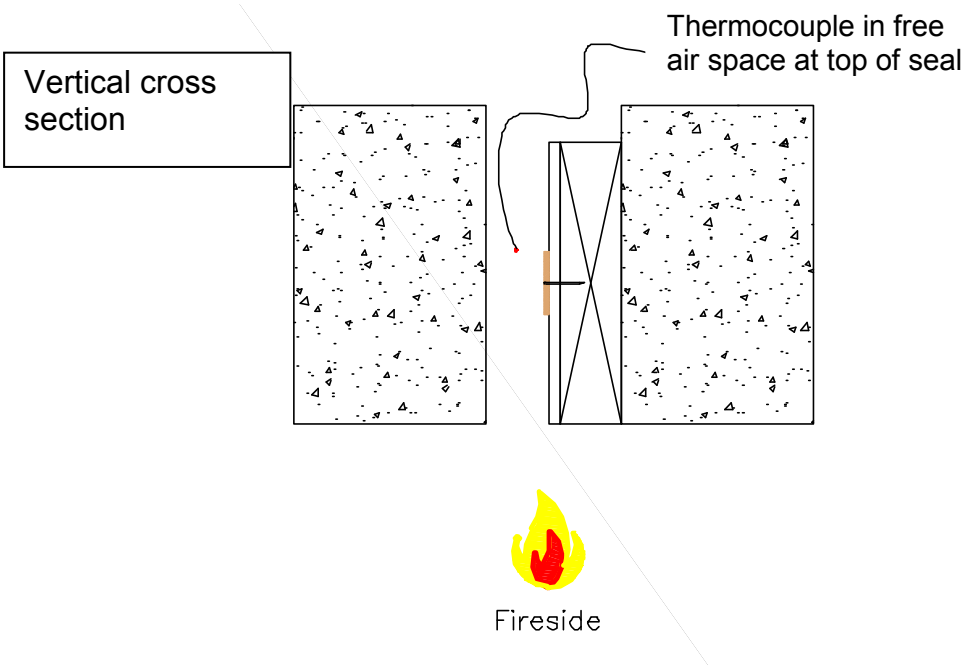


## 5.3 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 18 ± 5 Pa and after 10 minutes was maintained at 18 ± 3 Pa with respect to atmosphere, at a point approximately 0.3m from the underside of the specimens equating to 20pa at the underside of the seals. The pressure readings have been tabulated in Appendix 2 and are shown graphically below:



## 5.4 Thermocouple positions



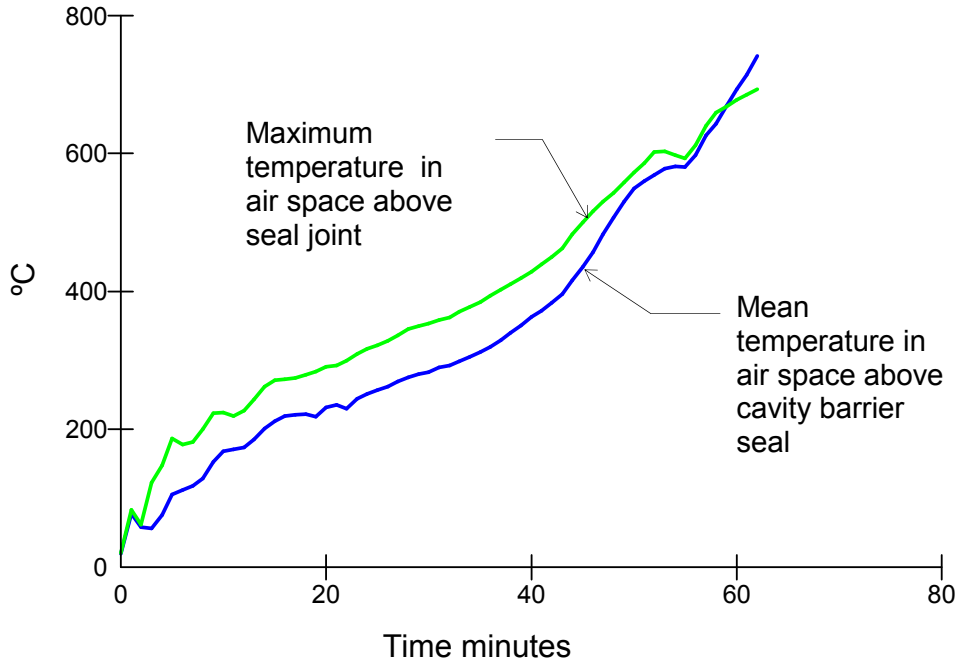

The temperature of the unexposed face was monitored by means of the following thermocouples attached to the specimens in the positions detailed below: (see Appendix 1 figure 3)

| Specimen Identification | Thermocouple number | Position |
|---|---|---|
| - | 1-4 | Furnace thermocouples |
| **C** | 18 | Central in the cavity free air space at the top of the seal 330mm from the front of the aperture |
| **C** | 19 | Central in the cavity free air space at the top of the seal joint 500mm from front of the aperture |
| **C** | 20 | Central in the cavity free air space at the top of the seal 660mm from the front of the aperture |
| **D** | 21 | Central in the cavity free air space at the top of the seal 330mm from the front of the aperture |
| **D** | 22 | Central in the cavity free air space at the top of the seal joint 500mm from front of the aperture |
| **D** | 23 | Central in the cavity free air space at the top of the seal 660mm from the front of the aperture |
| **E** | 24 | Central in the cavity free air space at the top of the seal 330mm from the front of the aperture |
| **E** | 25 | Central in the cavity free air space at the top of the seal joint 500mm from front of the aperture |
| **E** | 26 | Central in the cavity free air space at the top of the seal 660mm from the front of the aperture |
| **-** | 27 | Laboratory ambient |

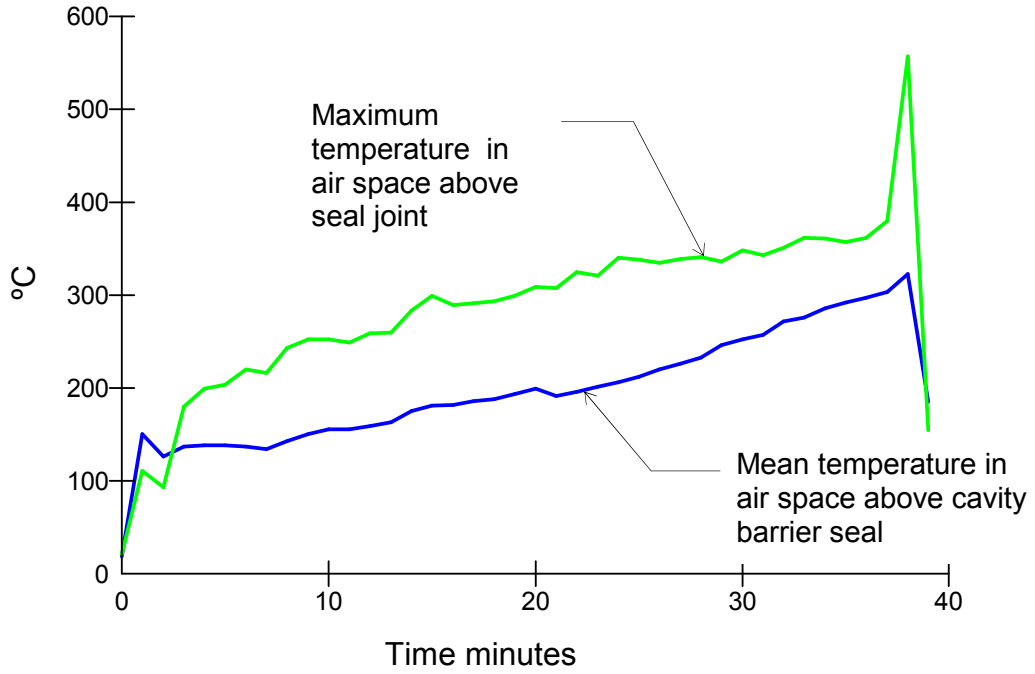
## 5.5 Unexposed face temperatures

Due to the nature of ventilated cavity barrier seals, typically, an initial spike in temperature is recorded by the thermocouples adjacent to each seal as it is open to the furnace. The temperature is rapidly reduced once the seals react and fill the whole cavity.

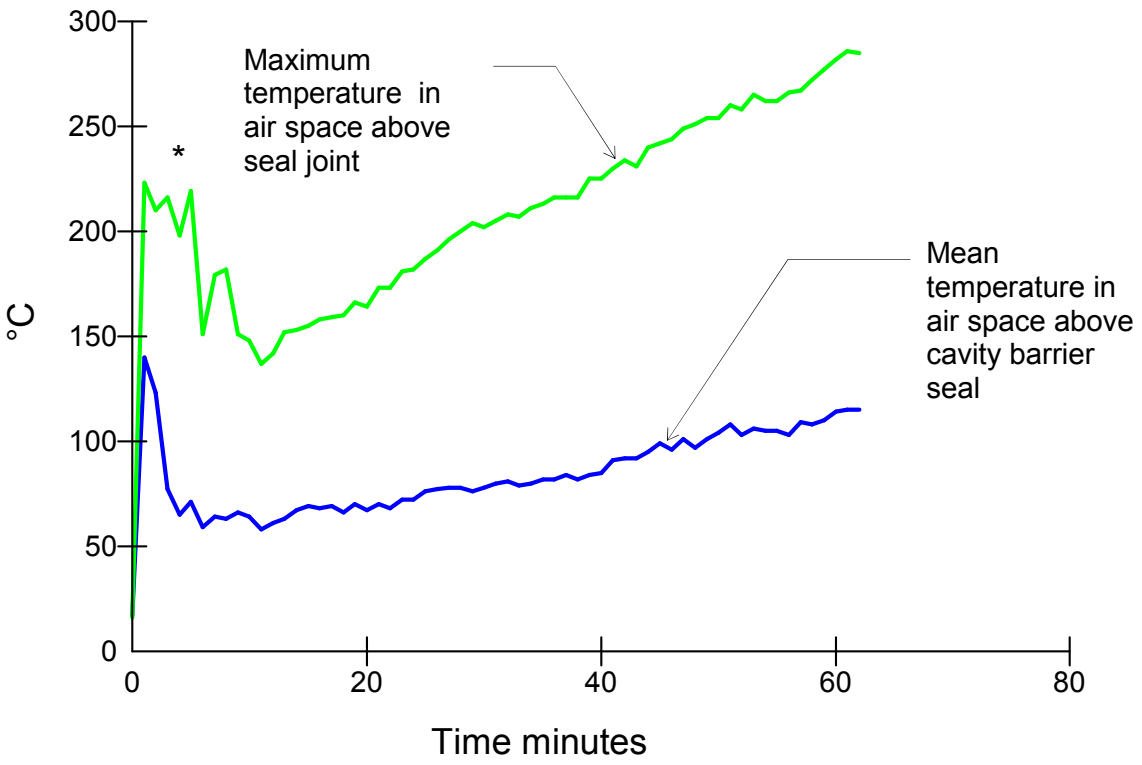
**Cavity fire barrier seal C**




**Cavity fire barrier seal D**



**Cavity fire barrier seal E**




* Point of initial spike in temperature before seal has reacted to seal the gap.

## 6 Observations

All observations relate to the unexposed face unless otherwise stated.

| Time (minutes) | Seal | Comments |
|---|---|---|
| 0.00 | | Test started |
| 0.30 | C/D/E | The seals are reacting. |
| 26.40 | D | There is a glow visible from the butt joint area. |
| 38.30 | D | There is continuous flaming from the butt joint of the seal thereby constituting **integrity failure.** |
| | C/E | There is a glow visible from the butt joint. |
| 53.30 | C | There is smoke issuing from behind the OSB |
| 56.53 | E | There is smoke issuing from behind the timber frame and OSB |
| 58.50 | C | There is a glow visible along the entire length of the cavity between the OSB and seal |
| 62.00 | | Test terminated. |

# 7 Expression of results

**Overall performance**

**Technical failure of integrity and insulation would deem to have occurred at the start of the test due to the open void required for such seal types. However, following the expansion of the intumescent layer, the gap typically becomes sealed and the product achieved the integrity and insulation stated below.**

| | **Integrity** | | | **Insulation** |
|---|---|---|---|---|
| | Cotton pad | Gap gauge | Continuous flaming | |
| Cavity barrier seal C | 62** (sixty two) minutes | Not applicable | 62** (sixty two) minutes | 7 (seven) minutes |
| Cavity barrier seal D | 38* (thirty eight) minutes | Not applicable | 38 (thirty eight) minutes | 3 (three) minutes |
| Cavity barrier seal E | 62** (sixty two) minutes | Not applicable | 62** (sixty two) minutes | #27 (twenty seven) minutes |

***** Failure criteria was not achieved prior to initial failure
****** No failure had occurred at termination of the test at 62 minutes
**# Failure after ventilated cavity had fully sealed after approximately 5 minutes.**

## 8 Limitations

The results only relate to the behaviour of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

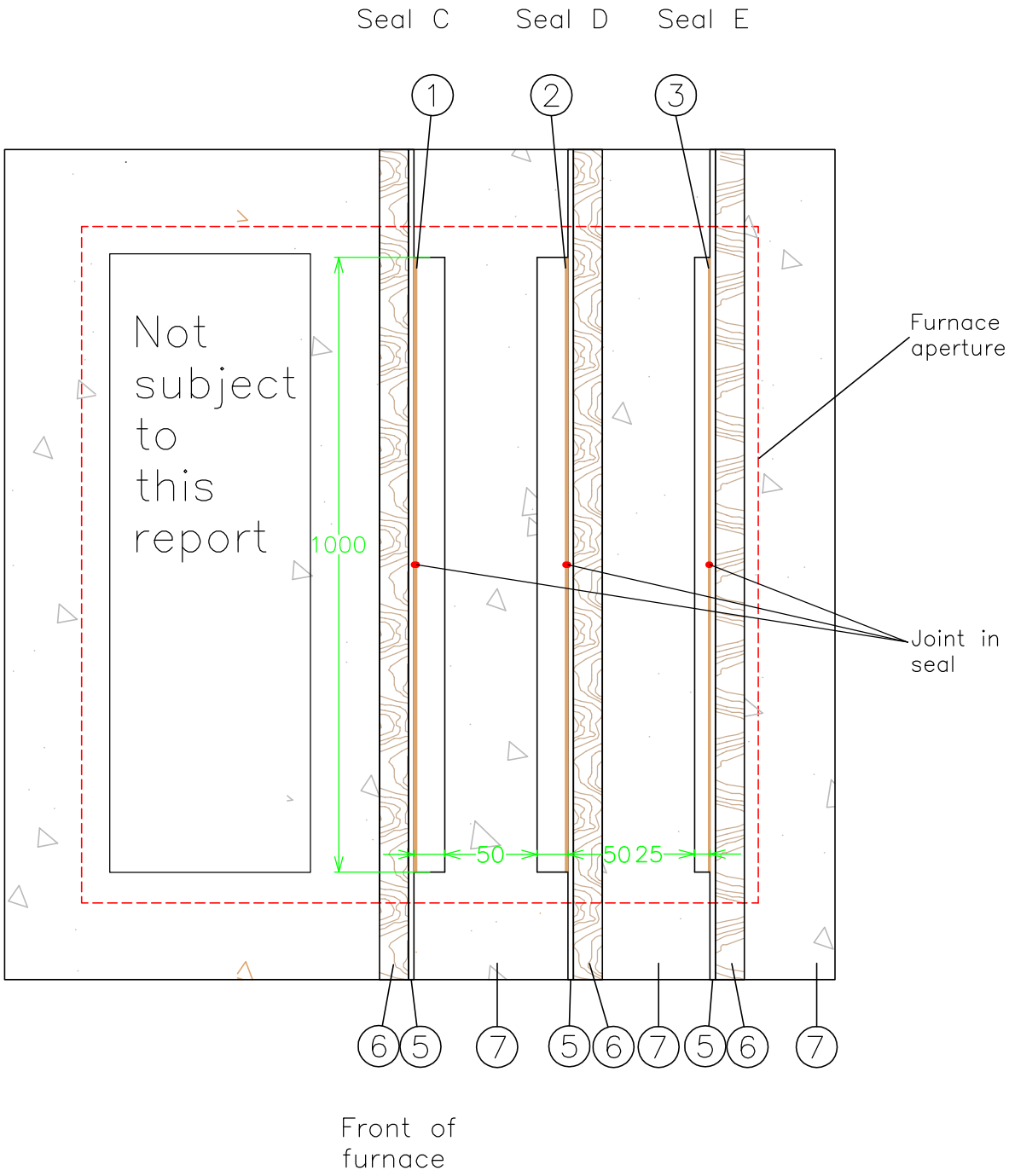
This report covers a test which was conducted to an Ad-hoc procedure which is not the subject of any British or European standard specification, but the test utilised the general principles of fire resistance testing given in BSEN1363-1: 1999, and used the test method stated in EOTA TR31: 2008 (fire resistance tests for cavity fire barriers). Since fire tests are the subject of continuing Standardisation process, and because existing standards are the subject of review and possible amendment and new interpretations, it is recommended that the report be referred back to the test laboratory to ensure that the methodology adopted and the results obtained remain valid in the light of the situation prevailing at that time.

| | | |
|---|---|---|
| **Signature:** | | |
| **Name:** | Ross Newman | Vincent Kerrigan |
| **Title:** | Principal Test Engineer | Technical Manager |
| **Date of issue:** | | 10-08-2011 |

## Appendix 1 – figures 1 – 3

Key to figures

1. 50mm wide x 4.6mm thick foil wrapped intumescent reference CB50/30TF
2. 50mm wide x 4.6mm thick foil wrapped intumescent reference CB50/30TM
3. 30mm wide x 2.3mm thick foil wrapped intumescent reference CB25/30CFP
4. Panel pins 20mm long
5. 9mm thick OSB
6. 250mm high x 47mm thick timber joist
7. 250mm high x 150mm thick lightweight aerated autoclaved reinforced concrete lintel




Viewed from unexposed face

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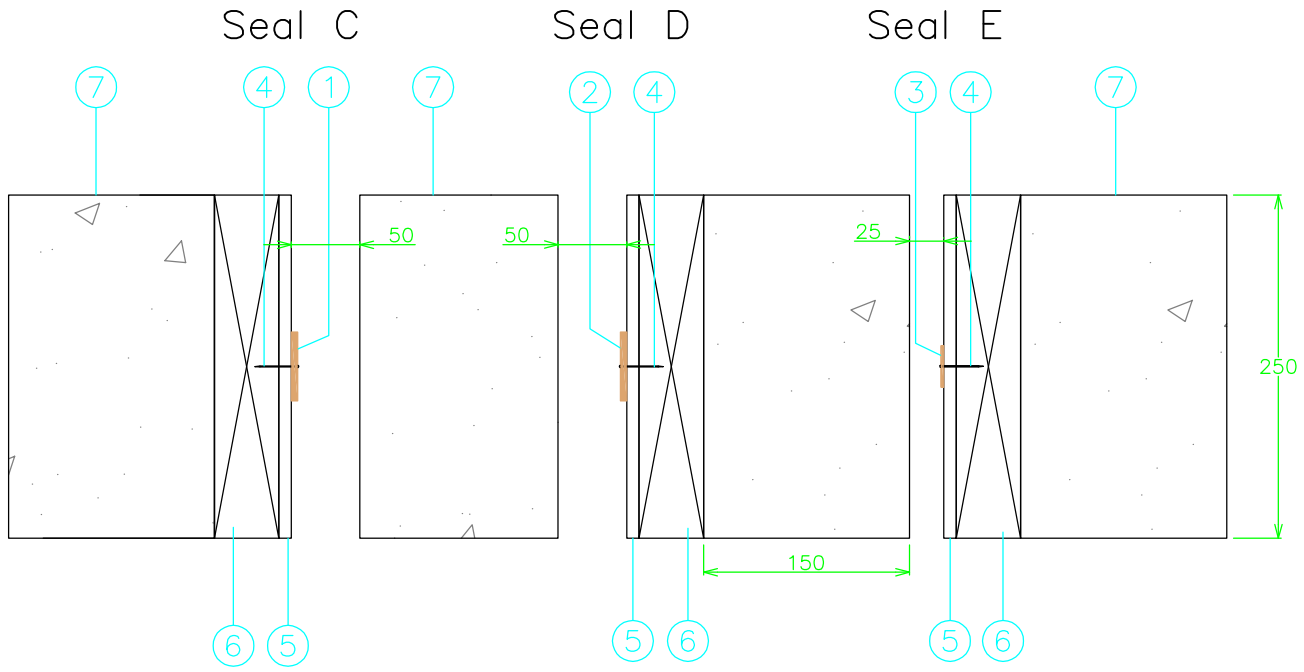
| Title | | |
|---|---|---|
| Unexposed face (All dimensions in mm) | | |
| Date Drawn 14/06/11 | Drawn By ARD | Scale NTS |
| Project No. Chilt/IF11026 | | Appendix 1 |




Fire side

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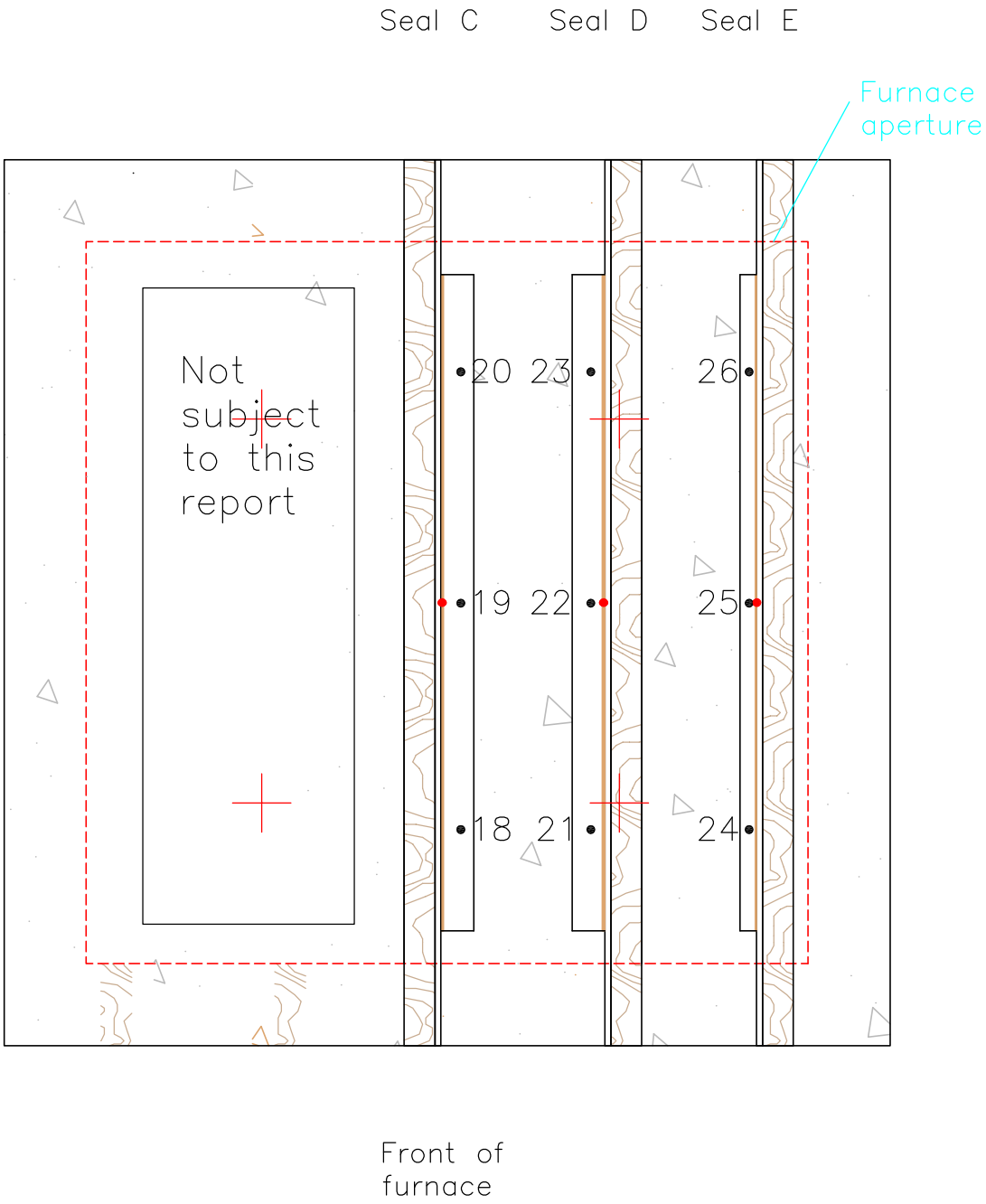
| Title | | |
|---|---|---|
| Cross sections of cavity barrier seals (All dimensions in mm) | | |
| Date Drawn 14/06/11 | Drawn By ARD | Scale NTS |
| Project No. Chilt/IF11026 | | Appendix 1 |

Complete Fire Protection Ltd




Furnace thermocouples

Unexposed face thermocouples

Joints in seal

Viewed from unexposed face

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| Title | Unexposed face elevations showing thermocouple positions (All dimensions in mm) | |
|---|---|---|
| Date Drawn 14/06/11 | Drawn By ARD | Scale NTS |
| Project No. Chilt/IF11026 | | Appendix 1 |

## Appendix 2 - raw test data (3 pages)

(see Figure 3 of Appendix 1 for channel locations) Insulation failure times and corresponding thermocouple reading

| Time | Chan 0 | Chan 1 | Chan 2 | Chan 3 | Chan 4 | Chan 18 | Chan 19 | Chan 20 | Chan 21 | Chan 22 | Chan 23 | Chan 24 | Chan 25 | Chan 26 | Chan 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | Pa | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C |
| 0 | 0 | 21 | 21 | 22 | 22 | 21 | 21 | 20 | 19 | 21 | 20 | 20 | 16 | 15 | 16 |
| 1 | 21.7 | 89 | 191 | 174 | 59 | 77 | 83 | 79 | 165 | 111 | 135 | 50 | 223 | 231 | 16 |
| 2 | 43.9 | 173 | 297 | 290 | 137 | 54 | 62 | 62 | 119 | 93 | 133 | 71 | 210 | 176 | 16 |
| 3 | 34.6 | 289 | 413 | 392 | 262 | 52 | 123 | 61 | 121 | 180 | 153 | 57 | 216 | 98 | 16 |
| 4 | 25 | 424 | 513 | 547 | 460 | 88 | 148 | 64 | 120 | 199 | 157 | 47 | 198 | 83 | 17 |
| 5 | 31.8 | 540 | 590 | 647 | 626 | 96 | 187 | 117 | 122 | 203 | 154 | 58 | 219 | 84 | 17 |
| 6 | 11.6 | 586 | 628 | 673 | 665 | 99 | 178 | 126 | 120 | 220 | 155 | 44 | 151 | 74 | 16 |
| 7 | 21.8 | 576 | 625 | 658 | 641 | 104 | 182 | 132 | 118 | 216 | 150 | 52 | 179 | 76 | 16 |
| 8 | 23.6 | 628 | 667 | 713 | 707 | 108 | 200 | 151 | 123 | 243 | 164 | 43 | 182 | 84 | 16 |
| 9 | 23.3 | 673 | 708 | 754 | 752 | 120 | 224 | 187 | 126 | 252 | 174 | 50 | 151 | 83 | 16 |
| 10 | 16.9 | 681 | 715 | 753 | 749 | 131 | 225 | 205 | 128 | 252 | 185 | 55 | 148 | 74 | 16 |
| 11 | 13.2 | 671 | 709 | 733 | 725 | 134 | 219 | 208 | 129 | 249 | 184 | 45 | 137 | 72 | 16 |
| 12 | 19.7 | 666 | 706 | 726 | 712 | 137 | 227 | 212 | 132 | 259 | 187 | 47 | 142 | 76 | 16 |
| 13 | 21.9 | 678 | 718 | 741 | 727 | 146 | 243 | 225 | 134 | 260 | 193 | 52 | 152 | 75 | 16 |
| 14 | 22.1 | 698 | 740 | 763 | 753 | 160 | 262 | 242 | 141 | 283 | 209 | 59 | 153 | 76 | 16 |
| 15 | 22.2 | 716 | 758 | 781 | 773 | 170 | 271 | 255 | 146 | 299 | 216 | 57 | 155 | 81 | 16 |
| 16 | 17.6 | 725 | 765 | 783 | 775 | 178 | 273 | 261 | 145 | 289 | 220 | 59 | 158 | 77 | 16 |
| 17 | 17.8 | 728 | 764 | 779 | 771 | 183 | 275 | 259 | 150 | 291 | 222 | 60 | 159 | 78 | 16 |
| 18 | 17.8 | 733 | 770 | 786 | 776 | 185 | 279 | 259 | 151 | 293 | 226 | 56 | 160 | 77 | 17 |

| Time | Chan 0 | Chan 1 | Chan 2 | Chan 3 | Chan 4 | Chan 18 | Chan 19 | Chan 20 | Chan 21 | Chan 22 | Chan 23 | Chan 24 | Chan 25 | Chan 26 | Chan 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | Pa | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C |
| 19 | 18.3 | 739 | 775 | 792 | 786 | 189 | 284 | 247 | 161 | 299 | 226 | 57 | 166 | 83 | 16 |
| 20 | 17.8 | 747 | 782 | 799 | 791 | 195 | 291 | 270 | 166 | 309 | 232 | 53 | 164 | 82 | 16 |
| 21 | 17.6 | 752 | 788 | 804 | 796 | 201 | 293 | 270 | 144 | 307 | 238 | 58 | 173 | 83 | 17 |
| 22 | 19.1 | 759 | 796 | 810 | 801 | 210 | 300 | 251 | 145 | 325 | 247 | 50 | 173 | 86 | 17 |
| 23 | 20 | 768 | 805 | 820 | 808 | 215 | 310 | 274 | 145 | 321 | 258 | 56 | 181 | 88 | 17 |
| 24 | 20.2 | 773 | 810 | 826 | 813 | 225 | 317 | 277 | 148 | 340 | 265 | 54 | 182 | 91 | 17 |
| 25 | 18.7 | 778 | 816 | 829 | 816 | 232 | 322 | 282 | 155 | 338 | 270 | 63 | 187 | 90 | 17 |
| 26 | 19.4 | 785 | 821 | 835 | 821 | 240 | 328 | 284 | 164 | 335 | 276 | 62 | 191 | 92 | 17 |
| 27 | 20.5 | 790 | 827 | 840 | 825 | 249 | 336 | 289 | 170 | 339 | 282 | 63 | 196 | 93 | 17 |
| 28 | 20.5 | 797 | 835 | 850 | 835 | 258 | 345 | 294 | 180 | 341 | 286 | 63 | 200 | 94 | 17 |
| 29 | 18.6 | 811 | 841 | 856 | 841 | 262 | 350 | 299 | 202 | 336 | 291 | 57 | 204 | 95 | 17 |
| 30 | 18.5 | 822 | 847 | 862 | 847 | 264 | 353 | 303 | 207 | 348 | 297 | 60 | 202 | 96 | 17 |
| 31 | 17.2 | 827 | 852 | 865 | 852 | 270 | 359 | 310 | 218 | 343 | 297 | 62 | 205 | 99 | 17 |
| 32 | 17.6 | 832 | 857 | 871 | 858 | 271 | 362 | 315 | 242 | 351 | 302 | 62 | 208 | 100 | 18 |
| 33 | 19 | 836 | 861 | 875 | 862 | 277 | 370 | 322 | 247 | 362 | 305 | 56 | 207 | 102 | 18 |
| 34 | 18.1 | 842 | 865 | 878 | 864 | 281 | 378 | 330 | 265 | 361 | 307 | 57 | 211 | 103 | 18 |
| 35 | 17.4 | 848 | 869 | 882 | 869 | 285 | 385 | 340 | 272 | 357 | 313 | 59 | 213 | 106 | 18 |
| 36 | 17.2 | 852 | 872 | 886 | 872 | 289 | 394 | 350 | 277 | 362 | 318 | 58 | 216 | 107 | 18 |
| 37 | 17.4 | 856 | 876 | 889 | 875 | 297 | 403 | 362 | 287 | 380 | 320 | 60 | 216 | 109 | 18 |
| 38 | 17.3 | 859 | 879 | 893 | 880 | 305 | 411 | 375 | 318 | 557 | 328 | 54 | 216 | 111 | 18 |
| 39 | 17.6 | 862 | 883 | 895 | 882 | 315 | 420 | 388 | 308 | 154 | 63 | 56 | 225 | 113 | 18 |
| 40 | 17.6 | 865 | 885 | 898 | 883 | 323 | 429 | 404 | 50 | 8 | 5 | 55 | 225 | 115 | 18 |
| 41 | 18.4 | 868 | 888 | 900 | 887 | 328 | 439 | 417 | 38 | 8 | 8 | 64 | 230 | 118 | 18 |

| Time | Chan 0 | Chan 1 | Chan 2 | Chan 3 | Chan 4 | Chan 18 | Chan 19 | Chan 20 | Chan 21 | Chan 22 | Chan 23 | Chan 24 | Chan 25 | Chan 26 | Chan 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | Pa | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C | °C |
| 42 | 18.3 | 870 | 890 | 904 | 892 | 339 | 450 | 429 | 38 | 8 | 6 | 65 | 234 | 119 | 19 |
| 43 | 20.1 | 873 | 893 | 907 | 892 | 348 | 463 | 444 | 37 | 8 | 6 | 62 | 231 | 122 | 19 |
| 44 | 20 | 877 | 896 | 909 | 895 | 373 | 483 | 460 | 38 | 8 | 6 | 66 | 240 | 125 | 19 |
| 45 | 20.2 | 881 | 898 | 912 | 899 | 399 | 500 | 474 | 39 | 8 | 11 | 70 | 242 | 128 | 19 |
| 46 | 19.9 | 883 | 901 | 914 | 900 | 427 | 516 | 488 | 39 | 8 | 5 | 63 | 244 | 130 | 19 |
| 47 | 18.4 | 885 | 904 | 917 | 903 | 466 | 531 | 501 | 37 | 8 | 5 | 71 | 249 | 132 | 19 |
| 48 | 19.2 | 887 | 905 | 919 | 905 | 498 | 543 | 517 | 40 | 8 | 7 | 60 | 251 | 135 | 19 |
| 49 | 20.4 | 892 | 911 | 926 | 912 | 528 | 558 | 535 | 42 | 8 | 7 | 64 | 254 | 138 | 19 |
| 50 | 21.3 | 896 | 916 | 930 | 916 | 553 | 573 | 545 | 45 | 8 | 5 | 68 | 254 | 140 | 19 |
| 51 | 21.7 | 900 | 919 | 934 | 918 | 570 | 586 | 550 | 41 | 7 | 5 | 74 | 260 | 143 | 19 |
| 52 | 20.8 | 903 | 923 | 936 | 923 | 574 | 602 | 564 | 39 | 8 | 5 | 59 | 258 | 147 | 20 |
| 53 | 17.3 | 928 | 956 | 980 | 973 | 581 | 603 | 576 | 40 | 9 | 12 | 66 | 265 | 147 | 20 |
| 54 | 12.5 | 932 | 955 | 977 | 969 | 588 | 598 | 577 | 40 | 7 | 6 | 67 | 262 | 144 | 20 |
| 55 | 10.8 | 913 | 935 | 952 | 942 | 590 | 593 | 573 | 39 | 8 | 7 | 70 | 262 | 141 | 20 |
| 56 | 17.1 | 904 | 923 | 938 | 927 | 610 | 612 | 587 | 37 | 8 | 7 | 64 | 266 | 143 | 20 |
| 57 | 22.8 | 908 | 929 | 950 | 940 | 630 | 641 | 622 | 41 | 7 | 5 | 68 | 267 | 150 | 20 |
| 58 | 19.7 | 918 | 939 | 961 | 954 | 646 | 659 | 640 | 42 | 8 | 6 | 64 | 272 | 152 | 20 |
| 59 | 18.8 | 923 | 944 | 966 | 958 | 676 | 668 | 663 | 41 | 8 | 6 | 67 | 277 | 154 | 20 |
| 60 | 19.2 | 927 | 948 | 968 | 963 | 705 | 678 | 682 | 43 | 9 | 7 | 73 | 282 | 156 | 20 |
| 61 | 19.1 | 929 | 949 | 972 | 963 | 726 | 685 | 702 | 46 | 9 | 10 | 74 | 286 | 157 | 21 |
| 62 | 18.7 | 932 | 953 | 974 | 967 | 738 | 693 | 747 | 44 | 8 | 5 | 72 | 285 | 158 | 21 |