GRENFELL TOWER PUBLIC INQUIRY

Closing Submissions on behalf of Whirlpool Corporation ("Whirlpool")

1. FOREWORD

1.1. Before turning to its Closing Submissions, Whirlpool would like to publicly acknowledge the courage and bravery of all those who have given evidence to the Public Inquiry in recent months, and in particular the BSR witnesses and personnel from the emergency services who have all given their evidence in the most trying of circumstances.

1.2. Whirlpool also wishes to acknowledge the importance of this Public Inquiry into what occurred during those hours in which this tragedy unfolded. It is against that backdrop that Whirlpool makes these submissions to help provide the fullest context possible for the benefit of this Public Inquiry and all those associated with it.

2. INTRODUCTION

2.1. These submissions set out Whirlpool's position in respect of the evidence presented to the Public Inquiry on origin and cause of the Grenfell Tower fire. Whirlpool's submissions will focus on the issue at paragraph 11(c) of the List of Issues dated 4 June 2018 published by the Public Inquiry:

"*What was the cause and seat of the fire?*"

2.2. The Inquiry has now heard all of the expert evidence on this matter. Whirlpool considers the relevant expert evidence for the purposes of ascertaining the origin and cause of the fire to be:

(a) Provisional Phase 1 Report of Professor Nic Daeid dated 28 March 2018;

(b) Final Phase 1 Report of Professor Nic Daeid dated 1 November 2018;

(c) Phase 1 Report of Dr Glover dated 15 October 2018;

(d) Addendum to the Phase 1 Report of Dr Glover dated 16 November 2018;

(e) Oral evidence of Professor Nic Daeid to the Public Inquiry dated 28 November 2018; and

(f) Oral evidence of Dr Glover to the Public Inquiry dated 27 November 2018.

2.3. It has been determined by the Public Inquiry experts that the fire started in the kitchen of Flat 16 of Grenfell Tower.[1] Whirlpool does not challenge this finding.

2.4. On the question of the area of origin of the fire, Professor Nic Daeid, the primary expert instructed by the Public Inquiry to investigate these issues, concluded in her Final Report dated 1 November 2018 at paragraph 8.9.2:

"*it is more likely than not that the area of origin of the fire was located at the south east corner of the kitchen in the tall fridge freezer located along the south facing wall.*"

2.5. Whilst Whirlpool agrees that the area of origin of the fire is likely to have been located in the south east corner of the kitchen, Whirlpool submits that Professor Nic Daeid's conclusion that the origin of the fire was <u>in</u> the tall fridge freezer should not be accepted by the Public Inquiry. Whirlpool submits that this further refinement on the area of origin is not supported, on a balance of probabilities, through a consideration of all of

[1] Within the kitchen, there were a number of appliances, including a tall fridge freezer, a medium sized freezer, and a small fridge (placed on top of the medium freezer). Reference to those appliances in these submissions will use those descriptions.

the evidence that has been adduced to the Public Inquiry and, in particular, the evidence put forward by Dr Glover, the expert appointed by the Public Inquiry to conduct an electrical investigation.

2.6. In relation to cause, Professor Nic Daeid concluded in her Final Report at paragraph 5.5:

"*On the basis of the available evidence, it is not possible to determine the cause of the initial fire within flat 16, Grenfell Tower on the 14th June 2017. As a consequence, the cause of the fire remains undetermined.*"

2.7. Whirlpool submits that the correct conclusion, based on the evidence presented, is that it is not possible to determine the cause of the fire.

2.8. In oral evidence, Professor Nic Daeid went further than the conclusion in her Final Report. On 28 November 2018 before the Public Inquiry, Professor Nic Daeid stated that it was her conclusion that the "*cause of fire was electrical in nature, but that the exact nature of that cause…remains undetermined.*"[2] Professor Nic Daeid did not put forward this conclusion in her Final Report, and she did not explain why she had departed from the position set out in her Final Report in her oral evidence. It is to be assumed that she has been (at least to some degree) influenced by the Report, Addendum, and possibly the oral evidence of Dr Glover.

2.9. Dr Glover submitted his Report on 15 October 2018 and an Addendum to that Report on 16 November 2018. On the issue of origin of the fire, Dr Glover states at paragraph 16.2(1) of his Report that:

"*(1) the most probable fire origin is within BPS/1, the fridge freezer…*"

2.10. Dr Glover's Report does not go further than this and does not make any explicit finding as to cause. Dr Glover's Addendum, submitted one month later, revises some of his earlier findings, however, and for the first time posits a "*fire initiation scenario*",

[2] Page 75, lines 11 – 13 and page 76, line 2 of PI hearing transcript, 28/11/18

essentially setting out what Dr Glover believes to be the cause of the Grenfell Tower fire. This finding needs to be set against the instruction he was given prior to commencing his investigation, to assume that the cause of the fire was an "*abnormal electrical event*".

3. SUMMARY OF WHIRLPOOL'S SUBMISSIONS

3.1. It is Whirlpool's submission that the Public Inquiry should adopt the findings set out in Professor Nic Daeid's Provisional Report, namely that:

(a) The area of origin of the fire was in the south east corner of the kitchen;

(b) The area of origin was in or around the area of the tall fridge freezer located along the south wall of the kitchen;

(c) The cause of the fire remains undetermined although, it is more likely than not to be an accidental cause rather than a deliberate act.

3.2. Whirlpool makes the following submissions on the key issues:

The investigations of Professor Nic Daeid and Dr Glover were limited in scope

3.3. Both Professor Nic Daeid and Dr Glover acknowledge that their investigations were limited in scope.

3.4. Professor Nic Daeid explained that she necessarily had to carry out a paper-based fire investigation, which was, in her own words, "*not ideal*".[3]

3.5. Dr Glover was asked to carry out an investigation and assume that the cause of the fire was "*an abnormal electrical event*".[4] All of his findings and conclusions, and interpretation of the available evidence should therefore be read against that background. He did not examine the possibility of any non-electrical causes. This has led to the circular result of Dr Glover being asked to assume that the cause of the fire

[3] NNDR0000001, paragraph 3.8
[4] JDGR0000001, paragraph 1.1

was electrical in nature in his investigation (and asked to focussed only on electrical evidence) and then having the results of his investigation being used to support the proposition that the fire was electrical in nature. His approach was to determine the electrical cause of the fire through a process of elimination.[5]

The investigations of Professor Nic Daeid and Dr Glover were constrained by the limited evidence and information made available to them

3.6. The evidence that is available in the investigations into origin and cause has, out of necessity, been somewhat limited. That applies both to witness evidence as well as physical evidence.

3.7. For quite understandable reasons, it has not been possible for the Public Inquiry to hear live evidence from any of the occupants of Flat 16 or other Grenfell Tower occupants whose witness statements provided evidence on issues potentially relevant to the issue of cause. Whirlpool does not make any criticism of this, but the clear consequence is that it has not been possible to question those witnesses and explore the evidence, as would ordinarily be the case in a legal or technical investigation of this nature.

3.8. In addition, a number of the "*unknown materials*" in the south east corner of Flat 16 remain unidentified. Professor Nic Daeid in her Provisional Report quite rightly stressed the importance of these "*unknown materials*", their potential role in the cause of the fire, and the need for further analysis and investigation of those materials before a determination on cause can be reached. It would appear from the evidence that it has not been possible to carry out this further investigation and analysis.

The Public Inquiry should find that the fire originated in the south east corner of the kitchen in Flat 16

3.9. As these submissions will demonstrate, there is no evidential basis to narrow the area of origin to the tall fridge freezer and there is no evidence that uniquely points to the

[5] As set out in paragraphs 7.8 and 7.9 below

tall fridge freezer. Taking each of the points expressly relied upon by Professor Nic Daeid in turn:

(a) The witness evidence has not been fully tested;

(b) The thermal imaging camera footage does not support narrowing the area of origin to the tall fridge freezer;

(c) The fire patterns in the south east corner of the kitchen are inconclusive and equally supportive of the tall fridge freezer being attacked by fire;

(d) Dr Glover's investigation was fundamentally flawed and the "*fire initiation scenario*" put forward by him is not possible.

(e) The conclusions by the experts pointing to an electrical cause of the fire derives from circular reasoning between the experts not supported by the evidence itself.

The Public Inquiry should find that the cause of the fire is undetermined

3.10. At present, it is Professor Nic Daeid's view that the cause of the fire was likely to be "*electrical in nature*". This appears to be based upon the evidence of Dr Glover, who carried out the electrical investigation. As set out more fully below, Dr Glover's evidence contains fundamental errors and so should not be relied upon in determining cause:

(a) Dr Glover acknowledges that he based his conclusions on a process of elimination and assumptions as to the cause of the fire as set out in his instructions. He narrowed his theory to one wire, MJS/1, that evidenced arcing. Based on that, he assumed MJS/1: (i) must have been involved in the fire on 14 June 2017, and (ii) must have come from the tall fridge freezer, however, there is no evidence that uniquely supports these assumptions and such assumptions are not appropriate in circumstances where relevant evidence may have been lost or is unexamined;

(b) Dr Glover did not examine the same compressor relay compartment configuration that was in the Flat 16 tall fridge freezer. Dr Glover made a finding that the cause was due to a poor electrical crimp within the relay compartment, and based this conclusion on an observation of evidence of arcing in MJS/1. This finding was heavily dependent on where the wires were situated within that compartment. The actual compressor relay in the Flat 16 tall fridge freezer was different, with a different wiring configuration. The "*fire initiation scenario*" put forward by Dr Glover would not be possible in the actual compressor relay compartment;

(c) Dr Glover set out a theory on the cause of the fire (when Professor Nic Daeid has not even done so in her Final Report), despite acknowledging that he is *"not a cause and origin expert"*.

(d) There is no basis for Dr Glover to conclude that the crimp connector in his "*fire initiation scenario*" was poor;

(e) There is, as a matter of fact, insufficient electrical current for the crimp connector to overheat in the way posited by Dr Glover in his "*fire initiation scenario*";

(f) The explanation of how the RCCB in the consumer unit tripped in Dr Glover's "*fire initiation scenario*" is unsupported by the evidence and not plausible.

4. THE INVESTIGATIONS OF PROFESSOR NIC DAEID AND DR GLOVER WERE LIMITED IN SCOPE

4.1. Professor Nic Daeid and Dr Glover both acknowledge that their investigations were necessarily limited in scope, in different ways. As a consequence, it is Whirlpool's submission that neither was able to complete a scientific assessment of origin and cause in accordance with the Code of Practice for Investigators of Fires and Explosions for the Criminal Justice Systems in the UK dated April 2017 ("**Code of Practice**"). Further, Whirlpool submits that the consideration of the analysis and conclusions of Professor

Nic Daeid and Dr Glover should be undertaken against the backdrop of these limitations.

Professor Nic Daeid

4.2. The nature of the investigation carried out by Professor Nic Daeid and the understandable inherent limitations consequent upon that are clearly set out in her Report:[6]

(a) She did not carry out a first-hand investigation of the origin and cause of the fire;

(b) She reviewed work undertaken by the initial fire investigation teams; and

(c) She undertook a largely paper-based exercise and acknowledges in her Report that such an exercise is not ideal as she did not see the first-hand three-dimensional space within which the fire had occurred when the evidence was still in situ.

4.3. The consequence of these limitations is that Professor Nic Daeid was necessarily reliant on the investigations of others (and the presentation of those investigations), rather than being able to carry out her own investigation whilst the evidence was in situ and apply her own expertise directly to examination of all of the physical evidence.

Dr Glover

4.4. Similarly, in his Report, Dr Glover acknowledges that his assessment was limited in scope and premised on the assumption that the cause of the fire was electrical:

"*The purpose of this Report is to assess the fire origin within an area that has already been established by other investigators, based on a fire that was caused by an abnormal electrical event. Non-electrical fire origins (for example, origins of fires caused by a lit*

[6] NNDS000001, paragraphs 4.4, 4.6 and 4.9

candle, a smouldering cigarette or an incendiary fire), which are outside my area of expertise, are not assessed." [7] (emphasis added)

4.5. Dr Glover reiterated these limitations in his oral evidence before the Public Inquiry on 27 November 2018:

(a) *"I am not an expert in non-electrical fires, only electrical fires."*[8]

(b) *"Now, I am assuming that this is an electrical fire. As I mentioned, I'm not a cause and origin expert. I have no opinion on whether this was a non-electrical fire caused by a lit candle or a smouldering cigarette. I'm assuming we have an electrical fire here, and I'll leave it to the fire investigators to tell the inquiry whether this was a non-electrical fire."*[9]

4.6. In summary:

(a) Dr Glover was asked to assess the fire origin in an area already identified by others;

(b) He was asked to assume that the fire was caused by an "*abnormal electrical event*";

(c) He did not assess the potential for any non-electrical fire origins.

5. THE INVESTIGATIONS OF PROFESSOR NIC DAEID AND DR GLOVER WERE CONSTRAINED BY THE LIMITED EVIDENCE

5.1. The physical evidence and indeed the factual witness evidence that is available to the expert fire investigators is of critical importance. Due to entirely understandable

[7] JDGR0000001, paragraph 1.1
[8] Page 4, line 21 of PI hearing transcript, 27/11/18
[9] Page 107, line 25 and page 108 lines 1-5 of PI hearing transcript, 27/11/18

reasons, it has not been possible for all of the evidence from and relating to Flat 16 to be available for the experts.

5.2. It is Whirlpool's submission that the Public Inquiry cannot on the available evidence and in light of the, perhaps inevitably, limited nature of some of that evidence, come to a determination on the balance of probabilities that the point of origin was in the tall fridge freezer and that the cause was as posited by Dr Glover.

5.3. Those limitations are set out below.

A proper fire scene investigation could not be executed in the circumstances

5.4. At paragraphs 7.1 and 7.2 of her Final Report, Professor Nic Daeid sets out the objectives of a fire scene investigation and best practice for fire scene investigators. She endorses the standards for fire scene investigations set out in the Code of Practice. The Code of Practice was also endorsed by the Chief Officer's Association, the Institute of Fire Engineers and the United Kingdom Association of Fire Investigators. As Professor Nic Daeid notes at paragraph 7.2.2 of her Report:

"*the code of practice for investigators of fires and explosions for the criminal justice systems in the UK provides details of the processes and practices which should be followed during a competent fire scene investigation. While there will always be circumstances where strategic decisions need to be made which may require a deviation from the code of practice, such deviations should be justified and documented.*"

5.5. On this issue, Whirlpool further refers to paragraphs 8.8.1 – 8.8.3 of Professor Nic Daeid's Final Report.

5.6. Whirlpool submits that the original fire scene investigation, and associated evidence gathering process, did not meet the standards set out in the Code of Practice.

5.7. Whirlpool commends the bravery of the fire investigators who were on the scene in the very early stages after the fire, and acknowledges the extremely difficult circumstances in which they were operating at the time. Because of those circumstances, however, it has been acknowledged, both by Professor Nic Daeid[10] and through the evidence of Watch Manager Matthew Leaver, that in some areas the recording of the fire scene and the evidence gathering process did fall short of the standards set out in the Code of Practice.

5.8. During his evidence to the Public Inquiry on a particular aspect of the fire scene investigation and evidence retrieval, WM Leaver said:

"*I do appreciate it was not following the scientific method as best to the letter of the law as it possibly could be. All we did at the time was as best we could given the circumstances we were working under.*"[11]

5.9. Furthermore, WM Leaver acknowledged in his oral evidence that potentially significant evidence may have been shovelled from the kitchen into the hallway and down the lift shaft:

"Q: Was the shovelled water checked for potentially significant debris before it shoved down the lift shaft?

A: No, in all honesty.

Q: Should it have been done, I suppose is my question?

A: In the cold light of day, if we could've taken that flat and put it in a field somewhere, then yes, we would've filtered everything." [12]

[10] NNDS0000001, paragraphs 8.7.12, 8.7.16, 8.7.17, 8.7.26, 8.7.29, 8.7.30 and 8.8.19
[11] Page 114, lines 16 – 20 of PI hearing transcript, 11/09/18
[12] Page 114, lines 6 – 20 of PI hearing transcript, 11/09/18 and NNDS0000001, paragraph 8.7.12.

5.10. Both Professor Nic Daeid and WM Leaver acknowledge that it is quite possible that some important evidence was removed or lost from Flat 16 in the early stages of the investigation as a consequence.

5.11. It is also noted that because of the way in which the evidence had to be gathered, some of that evidence has never been subjected to detailed analysis. In particular, the evidence collected from Flat 16 was predominantly electrical evidence. Consequently, any evidence from the kitchen that may point to a non-electrical cause may not have been collected, examined, or considered.

Unknown materials in the south east corner of the kitchen in Flat 16 were not identified

5.12. There are a number of materials within the relevant area of origin that remain unidentified and unexamined.

5.13. The investigations into the origin of the fire have, Whirlpool would submit quite correctly, focussed on the relatively small area between the cooker and the window in the south east corner of Flat 16. This is supported by the available evidence. It is in this area that Mr Kebede said that he first saw smoke when he entered the kitchen of Flat 16 on the night of the fire. This is most graphically shown in the plan that was drawn during his interview and exhibited to his witness statement dated 16 June 2017, in which he marked the area in which he saw the smoke, placing the smoke under the window, towards the south east corner of the kitchen.[13]

5.14. In her Provisional Report Professor Nic Daeid makes a number of references to the need for further investigation of the materials that were in the south east corner of the kitchen of Flat 16 on the night of the fire.[14]

5.15. By way of illustration, Whirlpool notes the following:

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[13] Page 5 of the first MPS witness statement of Mr Kebede (MET00006339) and exhibit BEK/2 (MET00005190). Note that the plan subsequently prepared for the Public Inquiry and attributed to Mr Kebede's statement (IWS00000490 and Exhibit BK/2) is different on this issue.
[14] NNDR0000001, paragraphs 7.6.25 and 7.6.46

(a) Paragraph 4.4 of Professor Nic Daeid's Provisional Report: "*at this time the area between the tall fridge freezer and the window, which contained currently unknown items, is also included within this area of origin.*"

(b) Paragraph 7.3.4 of Professor Nic Daeid's Provisional Report: "*the identity and positioning of items within the south-east corner of the kitchen in between the tall fridge freezer and the window remain unknown.*"

(c) Paragraph 7.3.5 of Professor Nic Daeid's Provisional Report: "*there may have been other items within the kitchen, particularly between the tall fridge freezer and the window and the current identity of these items is unknown.*"

5.16. In her Final Report, however, the recommendations to carry out further investigation and analysis of the materials in the south east corner of the kitchen of Flat 16 have been removed. It may be that all the "*unknown materials*" have been identified, however, there is no indication in Professor Nic Daeid's Final Report that this is the case. If that is correct, there are a number of items that remain unknown. That is most stark in respect of items that are clearly visible in the post-fire photos, but there will also clearly have been combustible materials that have burned in the fire and are no longer in any recognisable form.

5.17. From reviewing the photographs and witness evidence alone, it is clear that much of the debris as well as a number of items in the south east corner of the kitchen have not been identified or accounted for. By way of example:

(a) There is a grill that is partially behind the tall fridge freezer[15];

(b) There are a number of metal poles, which also appear to be in the early videos of the fire in the corner and over the front of the window[16];

[15] MET00008347
[16] MET00008347 and MET00000848

(c) There is a dented metal panel under the window[17];

(d) A step stool can be seen under the window[18];

(e) There appears to be some coiled material under the step stool under the window[19];

(f) Mr Kebede stated in an interview on 14 June 2018 that there was a rubbish bin under the window[20];

(g) Ms Afeworki stated in a statement on 17 April 2018 that there was a radiator under the window[21];

(h) Ms Kinfu refers to a "*cleaning brush*" in her statement of 24 May 2018[22] – it is not clear if this is the same as the mop described by Ms Afeworki.

5.18. The only witness who gave oral evidence to the Public Inquiry who was involved in the initial fire scene investigation and retrieval of evidence was WM Leaver. Counsel to the Public Inquiry put a number of photographs to WM Leaver that showed some of the debris and materials set out above.[23] WM Leaver was unable to shed any light on what those items were or confirm that all of that debris and specific items had been retrieved and exhibited during the fire scene investigation, and subjected to any further analysis.[24]

5.19. Whirlpool submits that it is clear that based on the debris in these photographs, there were, on the night of the fire, a number of items in the corner between the tall fridge freezer and the window which remain unidentified and in relation to which no further investigation has been carried out. This would also include combustible materials that

[17] MET000005968
[18] Ibid.
[19] Ibid.
[20] MET00080582, page 7
[21] MET00013021, page 1
[22] IWS0000547, paragraph 7
[23] Pages 121 – 126 of PI hearing transcript, 11/09/18.
[24] Ibid.

were damaged or consumed early on in the fire, or even removed or lost in the early stages of the investigation. These materials may well have been some of the first items that ignited in the south east corner and, therefore, could relate to potential causes outside the tall fridge freezer.

5.20. In addition, it has not been possible to further consider the evidence of the occupants about the other items around the window. Instead, reliance has been placed on the witness statements of Mr Kebede and Ms Afeworki who have both stated that there was a mop and bucket in the corner by the window, even though this appears to be contradicted by the physical evidence.[25]

5.21. Whirlpool does not consider that the evidence seen and heard by the Public Inquiry is adequate or has been sufficiently interrogated (as had been anticipated by Professor Nic Daeid in her Provisional Report) to justify a finding that there were no potentially significant materials in the corner other than a mop and bucket.

Key witnesses were not available to give oral evidence

5.22. In her Report, Professor Nic Daeid quite rightly stresses the importance of witness evidence in determining the origin and cause of the fire. In the context of the Grenfell Tower fire, important evidence on that issue has been received from the three occupants of Flat 16. For completely understandable reasons, it has not been possible for any of the three previous occupants of Flat 16 to be able to attend the Public Inquiry to give oral evidence.

5.23. This has meant that the Public Inquiry has not had the benefit of being able to hear from those witnesses and the Inquiry team has not been able to put any questions to them to help clarify the areas of their evidence where there is some ambiguity, in particular, between what may have been said in different interviews and statements.

[25] NNDS0000001, paragraph 8.8.4

5.24. Some of the other residents of Grenfell Tower when describing the general conditions in their flat on the night of the fire have also given evidence that may be relevant to cause and may point to a non-electrical cause of the fire. Again, the Public Inquiry has not had the benefit of being able to seek clarification on those issues, as they have not given evidence in person to the Inquiry.

5.25. In particular, reference is made to the following statements:

(a) Zakariya Chebiouni,: "*We always sleep with the windows in the kitchen and living room closed because people throw things out of their windows sometimes, like burning cigarettes that could catch a curtain and start a fire. Once rice was thrown into our flat.*"[26] (emphasis added)

(b) Robert Schwillens: "*For example, if people from flats used to flick cigarette butts out of their windows above our flat. You could often find cigarette butts in a small gap where the edge of the window (ie the bottom of the window frame) met the cladding on the outside of the window.*"[27] (emphasis added)

(c) Salah Eddine Chebiouni: "*We generally kept the windows closed because people smoke and we worry about them throwing a lit cigarette down, and flame catching a curtain.*"[28] (emphasis added)

5.26. Given that Mr Kebede has confirmed that his kitchen window was open by some ten inches on the night of the fire, it is clear that there is the potential for an alternative source of ignition to have entered the kitchen through the window by the tall fridge freezer and ignited unknown combustible materials in the corner. This does not appear to have been considered.

[26] IWS00001076, paragraph 16
[27] IWS00000854, paragraph 8
[28] IWS00009045, paragraph 24

6. THE PUBLIC INQUIRY SHOULD FIND THAT THE FIRE ORIGINATED IN THE SOUTH EAST CORNER OF FLAT 16'S KITCHEN

6.1. In a scientific fire investigation, one of the first steps is to identify and evaluate the area where the fire originated (referred to as the area of origin).

6.2. This is set out in some detail by Professor Nic Daeid at paragraphs 8.8.1 – 8.8.3 of her Final Report. In these paragraphs she sets out what it required to undertake a proper fire scene investigation and thus establish the area of origin of the fire. Whirlpool specifically refers to paragraph 8.8.3:

"*8.8.3 The determination of the origin of a fire must be based upon the evaluation of a series of 'hypotheses' or 'propositions' which can be tested and evaluated based on the available information and physical evidence.*"

6.3. In her Provisional Report, Professor Nic Daeid put forward three hypotheses to establish the origin of the fire.[29] They were:

(a) Hypothesis 1 – the fire in Grenfell Tower started in the kitchen of Flat 16 as opposed to any other flat in Grenfell Tower;

(b) Hypothesis 2 – the fire started in the south east end of the kitchen of Flat 16, Grenfell Tower, as opposed to elsewhere within the kitchen; and

(c) Hypothesis 3 – the fire started in the south east corner in or around the area of the tall fridge freezer as opposed to any other appliance or item in the south east corner of the kitchen of Flat 16.

6.4. However, in her Final Report, hypothesis 3 has been changed to the following:

"*…that it is more likely than not that the fire started in the south-east corner in the tall fridge freezer…*"[30]

[29] NNDR0000001, paragraph 4.2
[30] NNDS0000001, paragraph 5.2

6.5. The evidence upon which Professor Nic Daeid relies in support of her conclusion as to the origin of the fire is contained at paragraph 8.8.54 of her Final Report. In summary, she states that a combination of the following pieces of evidence have led her to conclude that it is more likely than not that the area of origin of the fire was located at the south east corner of the kitchen in the tall fridge freezer:

(a) Witness statements;

(b) TIC footage;

(c) Fire patterns on the tall fridge freezer and laminate flooring underneath the tall fridge freezer; and

(d) The conclusions of Dr Glover in relation to his electrical examinations.

6.6. For the reasons set out below, Whirlpool submits that this evidence should not result in the narrower drawing of hypothesis 3 as set out in Professor Nic Daeid's Final Report as opposed to the wording contained in her Provisional Report. Whirlpool deals with each of these items in turn below.

The witness evidence was untested

6.7. As has been noted above (see paragraphs 5.22 to 5.26) none of the relevant factual witnesses gave evidence to the Public Inquiry and accordingly it was not possible to seek any greater clarity in relation to the evidence provided in the interview transcripts and witness statements provided.

6.8. There were clear inconsistencies in some of the factual witness accounts.

6.9. In addition, and as noted above at paragraphs 5.24 and 5.25, there is additional witness evidence that may have had some bearing on cause that it has not been possible to investigate further.

The TIC footage does not support the narrowing of the area of origin to the tall fridge freezer

6.10. The TIC footage of the firefighters who first entered Flat 16 is submitted to be of evidential value in determining the answers to hypothesis 1 and hypothesis 2 in Professor Nic Daeid's Report.

6.11. The TIC footage from inside the kitchen was taken, however, at least 25 minutes after the origination of the fire, and after the point at which the fire had spread to the external cladding. The flaming observed on the TIC footage is likely to be associated with the external cladding.[31] Furthermore, the TIC footage taken after the firefighters enter the kitchen is footage that is recorded after most of the fire within the kitchen has been extinguished by Firefighters Brown and Batterbee and potentially from outside by a covering jet.[32]

6.12. Consequently, Whirlpool submits that the TIC can only help in identifying the area between the cooker and the window as potentially the area of origin of the fire. It certainly cannot assist with narrowing the area of origin further to within the tall fridge freezer.

The fire patterns are inconclusive and equally supportive of the tall fridge freezer being subjected to a fire attack

6.13. Professor Nic Daeid deals with the issue of burn and fire patterns insofar as it is relevant to the hypothesis three. This is set out in her Report at paragraph 8.8.53 of her Final Report which notes:

"*8.8.53 Figure 72 illustrates the southeast corner of flat 16 on the 9th October 2017. This photograph was taken after most of the contents of flat 16 had been removed. The fire patterns within this photograph illustrate physical evidence that suggest the area*

[31] As interpreted by Professor Luke Bisby in his final report (LBYS0000001) at paragraph 643
[32] Page 19 of LFB Operational Response Report Version 2.0 (LFB00004828) which records that at 01:11:11 FF Archer is "*operating the covering jet at the East elevation spraying window above the window of flat 16.*"

of origin of the fire to be within the southeast part of the kitchen. These fire patterns include;

(1) Burn pattern on the laminate floor corresponding to the position of the tall fridge freezer

(2) Position of melting on the socket and conduit on the wall next to the tall fridge freezer

(3) Lowest area of burning of the skirting board in the southeast part of the kitchen corresponding to the position of the tall fridge freezer." (emphasis added)

6.14. It is important to note that Professor Nic Daeid only uses the burn and fire patterns and her analysis of those burn and fire patterns to suggest that the area of origin of the fire is within the south east part of the kitchen. Importantly, it does not provide any evidence to refine further that area of origin: i.e. it is not supportive of a conclusion that the fire originated in the tall fridge freezer.

6.15. It is notable that it is the view of Whirlpool's experts, Exponent, that the damage to the south east part of the kitchen and to the tall fridge freezer would be the same if the tall fridge freezer was attacked by fire, rather than the area of origin of the fire. As explained in the Exponent Report of 22 January 2018:

"A fire originating external to the fridge freezer will create the same or very similar damage patterns to those observed on the flooring under the fridge freezer if the combustible components of the fridge freezer become involved in the fire. The fire damage to the flooring does not uniquely support the fridge freezer as the point of origin or cause of the fire."[33]

[33] WPL00003234, paragraph 5

6.16. Put simply, the burn and fire patterns would be the same if the tall fridge freezer had been attacked by a fire originating from outside the appliance or from within. They do not narrow the area of origin of the fire to the tall fridge freezer.

Dr Duncan Glover's investigation was fundamentally flawed and his "fire initiation scenario" is not possible

6.17. Dr Glover has produced a Report for the Public Inquiry, followed by an Addendum to that Report a month later. In his Report, he did not make a determination on cause. However, in his Addendum he set out a "*fire initiation scenario*" concluding that the cause of the fire was an overheated crimp connector in the tall fridge freezer's compressor relay compartment.

6.18. As set out more fully below (see paragraphs 7.5 to 7.72), Whirlpool submits that there are fundamental flaws in the analysis conducted and the conclusions reached by Dr Glover. Many of these flaws may be understandable given that much of Dr Glover's analysis was conducted following a review of an exemplar fridge freezer that in material aspects was not the same as the tall fridge freezer within Flat 16; however, they are still manifestly incorrect.

7. THE PUBLIC INQUIRY SHOULD FIND THAT THE CAUSE OF THE FIRE IS UNDETERMINED

Professor Nic Daeid

7.1. Whirlpool notes above that Professor Nic Daeid, the expert instructed to investigate the cause has currently advised that the cause should be undetermined and Whirlpool submits that that is correct. However, because of some ancillary issues raised in the report of Professor Nic Daeid and also in the evidence of Dr Glover, Whirlpool makes the following submissions.

7.2. In her Provisional Report, Professor Nic Daeid held that the cause of the fire remained undetermined, but identified detailed investigations that needed to be carried out to

properly be able to establish the cause of the fire. In particular at paragraph 7.7 she stated:

(a) *7.7 "The determination of the cause of a fire requires to be substantiated and underpinned by physical evidence that explains all the stages required for a fire to occur. This requires an understanding of the physical and combustion properties of the materials within the area of origin as well as the specific conditions needed to pyrolyse (thermally decompose) and ignite these materials and sustain combustion.*

(b) *7.7.1 No in-depth analysis of the electrical system or combustibility analysis of the tall fridge/freezer and related artefacts has been undertaken by any fire investigator. Only visual non-destructive examinations have been undertaken and reported so far [A11].*

(c) *7.7.2 Such in-depth analysis would have to include for example, tests of the combustibility of materials which are present within the area of origin such that the sequence required for viable heating, generation of pyrolysis products and ignition of these products scenarios can be demonstrated conclusively.*

(d) *7.7.3 Such in-depth analysis would have to include additional destructive examination of electrical wiring, kitchen appliances and equipment. Tests of the combustibility of materials which are known to be present within the area of origin would also need to be undertaken. This is required in order that the sequence required for viable heating, generation of pyrolysis products and ignition of these products scenarios can be demonstrated conclusively. "*

7.3. With the exception of the further investigation undertaken by Dr Glover into a limited number of exhibits, these investigations and analysis do not appear to have been carried out. It was perhaps unsurprising, therefore, and correct in Whirlpool's submission, that Professor Nic Daeid's Final Report maintained that the cause of the fire was "*undetermined*".

7.4. Contrary to her Final Report however, in oral evidence on 28 November 2018, Professor Nic Daeid stated that she considered that the cause of the fire was "*electrical in nature*".[34] Professor Nic Daeid expressed concerns with Dr Glover's Report and Addendum: when giving evidence she stated that she was "*not in full agreement*"[35] with his conclusions, but did not clarify further. It is clear that she relied at least in part upon his investigations.

Dr Glover

7.5. For the first time, in his Addendum, Dr Glover introduced his theory as to the cause of the Grenfell Tower fire. For the reasons set out below, Whirlpool submits that Dr Glover's findings on the issue of cause should be disregarded. Dr Glover's evidence has particular significance due to the apparent reliance placed on it by Professor Nic Daeid.

7.6. Dr Glover's conclusions extended to setting out his view on cause, even though he acknowledged that he was not an expert on cause and origin. It is Whirlpool's submission that Dr Glover's evidence should not form the basis of a determination on cause, nor indeed be the basis for a narrowing of the area of origin.

7.7. As a preliminary point, and as stated above, all of the investigations carried out by Dr Glover were against the backdrop that he had been asked to assume that the fire had been caused by an "*abnormal electrical event*". The importance of this assumption, when considering his analysis and conclusions, cannot be understated particularly when consideration is being given to any reliance placed on conclusions arising out of the assumption.

7.8. As a consequence, and as Dr Glover acknowledged, the approach he took was essentially a process of elimination, reviewing each piece of evidence that was available to him to establish if it could have been the cause of the fire. This type of elimination

[34] Page 76, lines 2 – 4 of PI hearing transcript, 28/11/18
[35] Page 71, lines 13 – 15 of PI hearing transcript, 28/11/18

process cannot be appropriate in circumstances where it is not known what evidence may have been lost in the sweeping out of water from the flat, or indeed other evidence that was collected into bags but not examined.

7.9. Dr Glover was eventually left with one wire, MJS/1:

"So if we have an electrical fire, we're left with MJS/1, the only arc-damaged exhibit that in my opinion could have tripped circuit 7 for the kitchen"[36]

7.10. He therefore constructed a "*fire initiation scenario*" around MJS/1. This "*fire initiation scenario*" was essentially that:

(a) Overheating occurred in a crimp in a wire connector within the compressor relay compartment of the tall fridge freezer;

(b) This led to heat and/or fire which melted and/or ignited the plastic on other wires within the compressor relay compartment;

(c) That resulted in an arc fault on the energised capacitor wire within the compressor relay compartment (MJS/1) from a line to neutral short that tripped the 32 A MCB;

(d) The fire ensued; and

(e) Smoke from the kitchen fire caused a short in a flat socket, which was on circuit 8 (which socket was located in the separate hallway), which subsequently caused the RCCB in the consumer unit to trip. All this is alleged to have happened prior to Mr Kebede turning off the main electricity supply switch.

7.11. The events in this scenario are not supported by the evidence. As will be explained more fully below, this theory is not only improbable, it is not possible in the circumstances.

[36] Page 108, lines 6 – 8 of PI hearing transcript, 27/11/18

Dr Glover's analysis about the provenance of wires MJS/1 and JDG/1 was flawed and does not indicate on the balance of probabilities that MJS/1 came from the tall fridge freezer

7.12. Given the centrality of MJS/1 to Dr Glover's theory, it is clearly necessary to consider (i) the type of damage evidenced on the wire; and (ii) where that wire was retrieved from, when determining whether or not it could have played a role in the fire.

7.13. Dr Glover posits that MJS/1 exhibits arc damage and that the arcing must have occurred either during a prior electrical event or at the time of the fire on the night of 14 June 2017. Because he concluded that MJS/1 is the only wire a short to which could have tripped the MCB in the consumer unit, he inevitably finds that MJS/1 has come from the tall fridge freezer. It is Whirlpool's submission that an examination of MJS/1 alone does not support this conclusion on the balance of probabilities.

Determining arc damage is a subjective analysis

7.14. Dr Glover concludes in his Report that "*the damage in the fused area of MJS/1 is arc damage*".[37]

7.15. Determining arc damage is a subjective analysis and there is often disagreement between fire investigators on whether a wire displays evidence of arc damage (i.e. fire attack whilst energised), or simply damage from involvement in a fire (i.e. fire attack whilst not energised).

7.16. Whirlpool notes that MJS/1 was previously analysed by both Key Forensics and Bureau Veritas, who both concluded that arc damage was not present:

(a) Bureau Veritas Report dated 7 November 2017: *"The damages was observed to be slight but consistent along its surface with evidence of small drips, fusing and erosion. This damage was not consistent with arcing damage"*[38]*;*and

[37] JDGR0000001, page 18
[38] MET00007996_30, paragraph 10.23.8

(b) Key Forensics Report dated 11 August 2017: *"heat from fire caused localised melting of copper, rather than…electrical arcing"*[39].

7.17. Even assuming that Dr Glover is correct that MJS/1 exhibits evidence of arc damage, this does not lead to the irresistible conclusion that it must have come from the tall fridge freezer. Whirlpool submits that this is simply not supported by the evidence, in particular, the location where MJS/1 was found.

Location of where MJS/1 was found does not support conclusion that it came from the tall fridge freezer

7.18. Initially, Dr Glover held that there were <u>two wires</u> (MJS/1 and JDG/1) that showed arc damage and that on the balance of probabilities both had come from the tall fridge freezer.

> *"It is concluded that arc-damaged Exhibits MJS/1 and JDG/1 are consistent with a wire from either the run capacitor or an internal jumper wire within the relay compartment of BPS/4* [i.e. the tall fridge freezer]."[40]

7.19. Dr Glover's determination was based on a wire count of both wires. MJS/1 and JDG/1 are short sections of 24 strand copper conductors: MJS/1 has two 24 strand electrical conductors and JDG/1 has three 24 strand electrical conductors. Among the electrical items in the kitchen that were examined for wire strand count, the medium freezer (MJD/38) and the tall fridge freezer (BPS/1) both contain 24 strand electrical conductors. Critically, no accounting was conducted for the wire strand counts of other electrical items in Flat 16.

7.20. On the basis that he determined there were only two appliances where the wires could have come from (a proposition that Whirlpool submits he was not in a position to make, having not examined all of the evidence), and as the medium freezer was not plugged in on the night of the fire, Dr Glover concluded that the arced wires must either have

[39] MET00005197_0006

arced at a time prior to the fire (presumably in any appliance with a 24 strand count), or on the night of the fire (only in the tall fridge freezer). Indeed, at page 19 of his Report, Dr Glover acknowledged that:

> "*If the arc damage to MJS/1 or JDG/1 prior to and unrelated to the fire, then the pre-existing arc damage provides no information about the origin or cause of the fire.*"

7.21. In his Addendum, Dr Glover revised his opinion that JDG/1 had come from the tall fridge freezer. As a consequence, and by default, Dr Glover was left with MJS/1 that became central to his "*fire initiation scenario*".

7.22. Whirlpool submits that the evidence of where MJS/1 was retrieved from suggests that it may not have come from the tall fridge freezer.

7.23. MJS/1 was not collected from within the tall fridge freezer itself and was not even found in close proximity to the tall fridge freezer:

(a) MJS/1 was collected from the evidence bag exhibited as MJD/32 described as "*wiring and miscellaneous*".[41]

(b) Evidence bag MJD/32 was collected from debris in the middle bedroom on 11 July 2017, some 27 days after the fire.[42]

(c) This is some distance from the location of the tall fridge freezer, but was in relatively close proximity to where the medium sized freezer was moved to after the fire when it was placed in the middle bedroom.[43]

7.24. Dr Glover originally suggested in his Report that the reason why both JDG/1 and MJS/1 were in closer proximity to the medium freezer rather than to the tall fridge freezer was due to the amount of water that was in the flat and the post-fire firefighting and evidence

[41] JDGR0000001, paragraph 4.2
[42] JDGR0000001, paragraph 4.2
[43] MET000012419

recovery activities which relocated these wires from within the tall fridge freezer to the location where they were found.[44]

7.25. Whirlpool submits that this is not persuasive. Specifically:

(a) Were MJS/1 to have been a wire originally from the tall fridge freezer it would be the only item of electrical evidence recovered in relation to the tall fridge freezer that was not recovered in the immediate vicinity of the tall fridge freezer. This was confirmed by Dr Glover in his evidence.[45]

(b) Dr Glover has not satisfactorily explained why, if he now accepts that JDG/1 came from the medium freezer, the same cannot be said for MJS/1. Conversely, he has not explained why he now does not consider it likely that JDG/1 was relocated, but that MJS/1 was.

7.26. In fact, nothing inherent in MJS/1 permits an irresistible conclusion that it came from the tall fridge freezer and/or was significant as to the cause of the fire: the damage on MJS/1 may not be arcing, but instead it may simply be exhibiting fire damage; alternatively, it may be arcing but may relate to an earlier event involving a different appliance for example, the medium freezer. Mr Kebede has described in some detail what appears to be a significant electrical fault in the medium freezer, which he was unable to fix.[46] Without questioning Mr Kebede, it is not possible to find out further details, however, it must remain a possibility that MJS/1 related to this earlier incident (as, indeed, Dr Glover has found in relation to JDG/1, and which also may be the result of fire damage and not arcing)[47] or to an as yet other unexamined electrical items or appliances in the flat.

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[44] JDGR0000001, paragraph 15.2
[45] Page 106, lines 12 – 16 of PI hearing transcript, 27/11/18.
[46] IWS00000490, paragraph 42
[47] JDGR0000001, page 69

The configuration of the compressor relay compartment examined by Dr Glover was different to that in the Flat 16 tall fridge freezer

7.27. Much of Dr Glover's work is based on his examination of an exemplar fridge freezer.[48] Although the model type, FF175BP, is the same as the tall fridge freezer in Flat 16, in a number of important respects the construction of the exemplar differs from that of the tall fridge freezer in Flat 16. Although the operation of the appliances may be similar, some parts and components that are critical to Dr Glover's analysis are different.

7.28. In particular, the exemplar fridge freezer investigated by Dr Glover has a different compressor relay compartment (which sits alongside the compressor unit) than that in the tall fridge freezer within Flat 16. The tall fridge freezer from Flat 16 used an EMY66CLP model compressor and associated relay compartment whereas the exemplar fridge freezer RJT/16 was made with a TWB1370MJS model compressor and relay compartment. Importantly, the layout of the wiring within those systems and in particular the compressor relay compartment are quite different, one example being that the tall fridge freezer does not use "*jumper wires*" as referred to by Dr Glover in his Report.[49]

7.29. Dr Glover acknowledged that there were differences between the two compressor systems in the exemplar and the tall fridge freezer, but was unable to articulate precisely what those were and did not appreciate the impact they might have on his "*fire initiation scenario*", set out below.[50]

7.30. In his Addendum and oral evidence, Dr Glover has not articulated his argument by reference to the actual wiring configuration located within the compressor relay compartment of the tall fridge freezer in order to account for the wiring geometry visible in photographs taken prior to disassembly of the evidence[51]. Instead, he placed

[48] This exemplar was provided by a third party to whom Whirlpool had previously supplied the appliance for fuel load tests, not for electrical wiring analysis.
[49] JDGR00000001, page 51
[50] Page 60, lines 18 – 23 and page 62, lines 18 - 25 of PI hearing transcript, 27/11/18
[51] Page 113, lines 8 – 13 of PI hearing transcript 27/11/18

considerable reliance on Figure 7 of his Addendum, which is a circuit diagram of the fridge freezer with annotations. Critically, such a diagram is not, and is not intended to be, an actual representation of the wiring geometry.

The location of the wires in the actual compressor relay compartment in the tall fridge freezer does not support the fire initiation scenario

7.31. Dr Glover's finding that the cause was due to a fire initiation in the wires of the compressor relay compartment was heavily dependent on where the wires would have been situated within the compartment.

7.32. It is a critical part of Dr Glover's "*fire initiation scenario*" that the short circuit occurred within the compressor relay compartment. Specifically, for the scenario to be possible, the section of MJS/1 exhibiting the alleged arc damage must itself have been within the compressor relay compartment. For the reasons set out below, Whirlpool submits that this was simply not possible. This is because it would need to be close to the crimp connector that Dr Glover says overheats. If it was outside the compressor relay compartment, it is most likely that the insulation on other wires within the compressor relay compartment would have heated and melted first, causing an arc on a non-capacitor wire.

7.33. At paragraph 2.1(2) of his Addendum dated 16 November 2018 Dr Glover states:

"*(2) Fire and heat from the fire melts and burns off the insulations on the internal wire as well as adjacent wires, resulting in a short circuit (arc fault) from the energised wire across the run capacitor wires in the compressor relay compartment: Exhibit MJS/1.*"

7.34. Furthermore, in oral evidence, Dr Glover said of MJS/1:

"The fused section is within the relay compartment, and that's my opinion, that's my conclusion, and the line to neutral short circuit that gives you the arc damage to MJS/1 is all within the relay compartment."[52] (emphasis added)

7.35. Insofar as it is helpful for the Public Inquiry, Whirlpool has marked up image MET00009047_0001 showing the position of JDG/6B, JDG/6C, and JDG/6A.

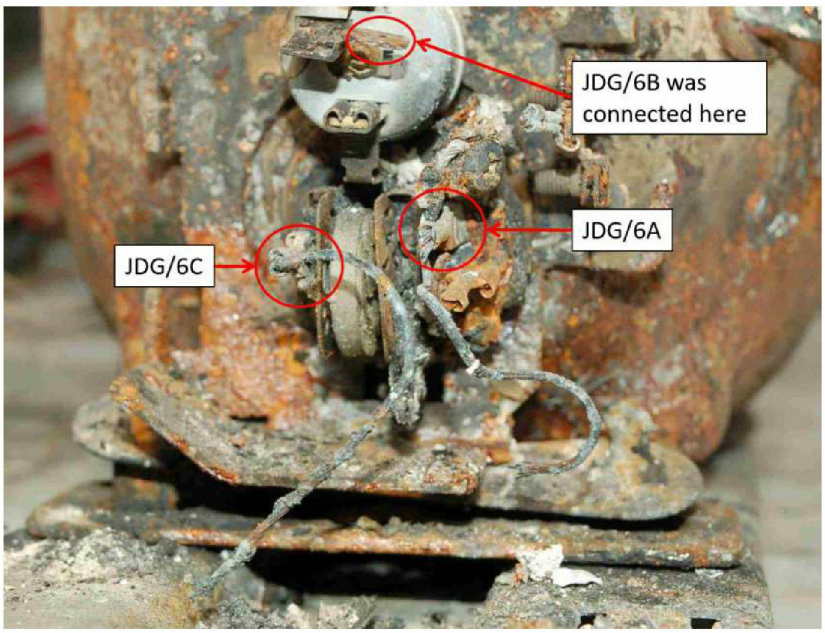

Fig.1 showing the compressor relay compartment with location of JDG/6B, JDG/6C and JDG/6A marked.

7.36. This image shows where JDG/6B (the crimp connector) was located (it was removed during examination) and JDG/6C and JDG/6A, two wires within the compressor relay compartment. Dr Glover confirmed in oral evidence that he considered that the arc-damaged part of MJS/1 would be located at the end of JDG/6C, which can be seen curving from where JDG/6C is marked towards the bottom of the image at Fig. 2.

[52] Page 129, lines 1 – 4 of PI hearing transcript, 27/11/18

7.37. It is worth setting out the relevant parts of Dr Glover's *"fire initiation scenario"* with reference to Fig. 1 above. Dr Glover concludes that:

(a) The crimp connector at JDG/6B (marked) overheats;

(b) This overheating causes melting of the insulation wires within the compressor relay compartment;

(c) The wire insulation on the wires in MJS/1 heats and melts, causing the wires to arc;

(d) MJS/1 (unmarked) would be after the end of the intact JDG/6C wire that can be seen in Fig.1.

7.38. Dr Glover stated that JDG/6C was approximately 7cm in length and therefore, on his theory the end of JDG/6C would have been connected to the end of MJS/1. The shortest part of the wire to the fused area on MJS/1 is around 1.5cm from the end of MJS/1. Therefore, according to Dr Glover, the wire would have been attacked by fire at around 8.5cm along its length. He confirmed that it was his view that:

"So what you end up with is about 7 centimetres here, another 1.5 centimetres here, 8.5 centimetres, that's about 3.2 inches. 3 inches of wire in my opinion would fit quite comfortably within the compressor relay compartment." [53]

7.39. Not only is Dr Glover clear that on his hypothesis, MJS/1 would be within the compressor relay compartment, but it would also have to be for his theory to be possible. For an arc to take place outside the compartment according to Dr Glover's overheated crimp ignition source theory, the plastic housing of the compressor relay compartment that covers the wires and the external wires would need to be compromised without any of the wires inside the compartment arcing.

[53] Page 117, lines 24 – 25 and page 118, lines 1 – 3 of PI hearing transcript, 27/11/18

7.40. It is Whirlpool's submission that Dr Glover's "*fire initiation scenario*" is impossible in the actual compressor relay compartment in the Flat 16 tall fridge freezer. Dr Glover's analysis was based on the physical wiring layout of the exemplar TWB137MJS compressor relay compartment, which is materially different to that located within the tall fridge freezer in Flat 16. In the exemplar TWB137MJS compartment, the two capacitor conductors are immediately adjacent to the comparable energized conductor with crimp connector JDG/6B. That wiring layout is substantially different from the layout for the EMY66CLP compressor relay compartment in the subject tall fridge freezer.

7.41. As noted by Dr Glover and referenced above, the length of still intact JDG/6C was 7 centimetres. In the wire configuration in the actual EMY66CLP compressor relay compartment, if MJS/1 was attached to the end of JDG/6C, it would in fact be <u>outside</u> of the compressor relay compartment. Whirlpool can confirm:

(a) In the EMY66CLP compressor relay compartment (which was in the Flat 16 appliance), the length of the capacitor wire in the compressor relay compartment is **7 centimetres;**

(b) In the exemplar TWB137MJS compressor relay compartment the length of the capacitor wire in the compressor relay compartment is **17 centimetres.**

7.42. Despite the importance of the wire measurements to Dr Glover's fire initiation scenario, it should be noted that no actual measurements of the length of wires inside exemplar compressor relay compartments were taken by him.

7.43. In summary, Dr Glover claims that the arc on MSJ/1 occurred within the compressor relay compartment. As noted above, in fact, MJS/1 could not have been located within the compressor relay compartment, and therefore no short circuit could have occurred leading to the alleged arc damage on MJS/1.

There is no basis for Dr Glover to conclude the crimp connection was poor

7.44. A critical part of Dr Glover's "*fire initiation scenario*" is that the crimp connection in the electrical connector JDG/6B was sufficiently poor so as to allow the connector to overheat and subsequently ignite the wiring insulation. For the reasons set out below, Whirlpool submits that this is incorrect.

7.45. Dr Glover has claimed that by examining the CT scan cross sections of the open barrel wire crimp in the electrical connector JDG/6B, he could establish that the crimp was of poor quality and therefore had high electrical resistance, which allowed the connector to overheat sufficiently to ignite wiring insulation. Dr Glover did not rely upon any objective, or electrical engineering arguments for establishing that the crimp connection was poor. Such objective criteria would include assessing the electrical resistance in the connection, measuring the crimp height in comparison to the specification for the part, considering the effects of fire exposure on the crimp itself, and identifying unique damage patterns at the alleged overheated connection that are indicative of localised electrical resistance overheating.

7.46. In his assessment, Dr Glover does not appear to have accounted for the crimp design at all. Indeed, he admitted that in his Addendum he had selected only five cross-sections for each of JDG/6A and JDG/6B out of a possible 80+ cross section images, but did not take account of where the rib in the crimp was: *"So even though I'm showing it like that, I did not specifically say: yes, this came from that rib".*[54]

7.47. Furthermore, Dr Glover's evidence was contradictory as to what might resemble a "*good crimp*". In his Addendum, he stated that JDG/6A was a "*good crimp*" describing it as "*Good Crimp with No Space in Wire Barrel & Very Few Voids*", further stating:

> *"As shown in Figure 3, there is no space between the curved sections of the wire barrel, and there are very few void spaces in the cross-sectional slices."*[55]

[54] Page 127, lines 9 – 15 of PI hearing transcript 27/11/18
[55] JDGR0000019, page 6

7.48. When it was pointed out to him during his oral evidence that even a "*good crimp*" such as JDG/6A might exhibit voids, he then revised his opinion, stating that JDG/6A was a "*better crimp*", but not a "*good crimp*".[56]

7.49. There are multiple factors to consider when evaluating whether a crimp connection has overheated prior to a fire. In addition to understanding the current flow through such a connector (see below), post-fire investigation should also include a review of several aspects related to the physical properties of the crimp. This type of post-fire analysis can be challenging. Thermal expansion alone due to fire exposure can cause a crimp connection to loosen causing voids, and oxidation of fire-exposed conductors can also cause physical changes to the crimp.

7.50. It is Whirlpool's submission that Dr Glover has not conducted a sufficiently detailed examination of the crimp connector to enable him to draw conclusions about its condition prior to the fire, taking into account its design and any damage due to involvement in the fire.

There is insufficient current in the connector for it to overheat

7.51. A critical part of Dr Glover's "*fire initiation scenario*" is that there was sufficient current passing through the alleged poor crimp connector to melt and ignite insulation on an energised internal wire within the compressor relay compartment. For the reasons set out below, Whirlpool submits that in fact there was insufficient current in the connector for the overheating to have taken place.

7.52. At paragraph 2.1(1) of Dr Glover's Addendum he suggests:

> "*(1) Insulation on an energized internal wire within the compressor relay compartment ignites due to an overheated, poor crimp connection: Exhibit JPG/6B.*"

[56] Page 82, line 22 of PI hearing transcript, 27/11/18

7.53. In order to raise the temperature of a connection to a point where it can melt and ignite insulation, power must be delivered to the connection in sufficient quantity.

7.54. Dr Glover deals with this issue only briefly at page 7 of his Addendum.

7.55. As explained by Dr Glover in his oral evidence, the amount of heat generated is a function of the square of the current.[57] A simple example demonstrates the significance that changes in the current cause to the power that can be dissipated as heat. A current of 1 amp passing through a resistor of 1 ohm results in 1 watt of power (or heat output). Increasing the current tenfold to 10 amps, however, increases the power to 100 watts.

7.56. In his oral evidence, Dr Glover was asked what testing he had carried out to ascertain the actual current that would have flowed through JDG/6B. He stated:

"When the compressor is on, I would estimate that - and it's my estimate – in that range of 5 to 10 amperes for the compressor load current, under normal conditions."[58]

7.57. It is clear that he had undertaken no testing. Instead, he gave an estimate of that current (of 5-10 amps), which is the value it is to be inferred he adopted for the purpose of the fire initiation scenario in his Addendum.

7.58. Critically, however, Dr Glover's analysis fails to account for the true current flowing through the connector, and, as his oral evidence and the physical evidence demonstrate, his estimate of current for the compressor is markedly wrong.

7.59. Considerable evidence was available for Dr Glover's review which demonstrates that the current through JDG/6B is significantly less than the 5-10 amps of current that Dr Glover estimates. Since, as acknowledged by Dr Glover, the power is proportional to the square of the current, this error is significant. There are several pieces of evidence that enable the typical operating current to be estimated:

[57] Page 85, lines 12-16 of PI hearing transcript 27/11/18
[58] Page 122, lines 22-25 of PI hearing transcript 27/11/18

(a) Dr Glover's own photograph in Figure A10-6 in his Report of the data plate on the exemplar TWB137 MJS compressor shows that the fridge freezer is designed to use 120 watts, which corresponds to approximately 0.5 amps given a 230 volt input.[59]

(b) The data plate on a fridge freezer with the EMY66CLP compressor expressly states that the operating current is 0.5 amps.

(c) This operating wattage is also consistent with information found in Operating Instructions for the model FF175B. For example, page two of the manual states, "*The socket can withstand the maximum power of the appliance, which is indicated on the data plate located on the bottom left side of the fridge* (e.g. 150 W)."[60] The reference to 150 watts again places a bound on the current at 0.65 amps.

7.60. When questioned during oral evidence on this point, Dr Glover stated that he did not accept that the full path of the current going through the connector during normal operation would be around 0.4 amps.[61] When asked to give a reason, he simply stated:

"Well, we need to know what the compressor load is, and I have not calculated that, but I am assuming that it's more than that."[62]

7.61. This assumption was incorrect.

7.62. With a current closer to 0.3 to 0.4 amps, and assuming a 1 ohm crimp resistance, the wattage at the connector is 0.09 to 0.16 watts, not the 25 to 100 watts from 5 amps and 10 amps respectively) of heating that Dr Glover's estimate of current would imply. It is Whirlpool's submission therefore that the crimp connector simply could not have had sufficient current to overheat.

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[59] When relating power to current with a known voltage, power (P) is given by the product of current (I) and voltage (V). That is, P = I*V.
[60] WPL00003246_0002
[61] Page 130, lines 4 – 8 of PI hearing transcript, 27/11/18
[62] Page 130, lines 10 – 12 of PI hearing transcript, 27/11/18

Dr Glover's conclusion on the consumer unit is unsupported by the evidence and not plausible

7.63. A further critical element to Dr Glover's "*fire initiation scenario*" is that the residual current circuit breaker was tripped as a result of sufficient smoke entering a plug socket in the hallway of Flat 16. For the reasons set out below, Whirlpool submits that this is unsupported by the evidence.

7.64. The evidence from the consumer unit is critical as it provides some indication of where the fire started, as acknowledged by both Professor Nic Daeid and Dr Glover. The facts in relation to the consumer unit are as follows:

(a) Mr Kebede called 999 at approximately 00:54 after he had seen smoke in the kitchen;

(b) According to his witness statement, Mr Kebede turned off the main circuit breaker within 4 minutes of the alarm going off;

(c) The main breaker was off, as were the Main Circuit Breaker ('MCB') for the kitchen sockets and the Residual Current Circuit Breaker ('RCCB') for the kitchen circuits and the apartment plug sockets;

(d) The MCB will trip if it detects a short circuit or overcurrent; the RCCB will trip if there is a fault to ground;

(e) If the RCCB had tripped before the MCB, it would have de-energised the kitchen circuit meaning that the MCB could no longer trip.[63]

7.65. Consequently, there must have been a specific set of circumstances that caused both to trip simultaneously or two separate incidents that caused them to trip sequentially (with the MCB tripping first). Dr Glover's hypothesis is that:

[63] JDGR0000001, page 11

(a) The MCB in the circuit breaker had already tripped due to the line to neutral fault on MJS/1;

(b) Smoke and smoke particles in the hallway of Flat 16 attacked an energised socket (prior to Mr Kebede switching off the circuit breaker);

(c) This resulted in a current flow to the grounding socket received in excess of 30 milliAmperes (30mA) which tripped the RCCB.

7.66. Dr Glover has not sufficiently explored whether this scenario is feasible. In order for a ground fault to occur, enough particulates from the smoke must be deposited inside the socket on circuit 8 to form a conductive path between the line and the ground inputs within the socket. A significant amount of smoke particulates must be deposited in order for this to occur, which requires dense smoke and a significant period of exposure time. This means that the smoke layer must be intense and reach to the floor level sockets in the flat. According to his witness statement, however, Mr. Kebede turned off the main breaker within approximately four minutes of the fire alarm. The kitchen doors were closed, and therefore no smoke should have reached the sockets on circuit 8 at all. Whirlpool submits that if smoke was descending from the ceiling to floor level in the flat in the volume and with the intensity necessary for Dr Glover's theory, this would have been referenced by both Mr Kebede and Ms Kinfu in their statements. In fact, their statements reference very little, if any, smoke being present in the hallway.

7.67. Dr Glover has not addressed these points, nor has he provided any cogent evidence supporting his theory:

(a) During his oral evidence, when questioned about the level of smoke required to cause the RCCB to trip, he could not give any indication[64];

[64] Page 97, lines 11 – 21 of PI hearing transcript, 27/11/18

(b) During his oral evidence, when asked how long it would take for a sufficient level of smoke to reach and permeate a plug, he was unable to give any indication[65];

(c) Dr Glover has not considered how the smoke would have left the kitchen if the door was shut (stating that in respect of the question of whether the door was open or closed, *"I don't have an answer"*[66]);

(d) Dr Glover has not considered which plug socket might have been attacked. He refers to evidence that there was smoke in the hallway, but has not placed the attack at a plug socket in the hallway (if indeed there even is one); and

(e) Dr Glover admitted that he relied heavily on the evidence of Ms Afeworki in relation to her recollection of seeing smoke, preferring it to that of Mr Kebede and Ms Kinfu, both of whom contradict Ms Afeworki on this point. He does acknowledge the differing evidence given by Mr Kebede and Ms Afeworki in footnote four to his Addendum; however, he does not expand on their evidence any further in oral evidence.[67]

7.68. It is Whirlpool's submission that Dr Glover's hypothesis and his oral evidence on this matter are implausible.

7.69. Furthermore, as previously noted, none of the occupants of Flat 16 have been able to attend at the Public Inquiry to give evidence. For Dr Glover's hypothesis to be accepted, the Inquiry would be required to prefer the evidence of Ms Afeworki over that of Mr Kebede and Ms Kinfu. In circumstances where, for entirely proper reasons, none of their evidence has been tested or clarified, Whirlpool submits that such a finding would be inappropriate, particularly on a matter of such importance as the cause of the fire.

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[65] Page 101, lines 6 – 16 of PI hearing transcript, 27/11/18
[66] Page 101, line 5 of PI hearing transcript, 27/11/18
[67] Page 98, line 14 to page 101, line 5 of PI hearing transcript 27/11/18

7.70. As regards whether or not Mr Kebede closed the door after him when he exited the kitchen, the evidence is that he did. The best evidence of this is the images from the Thermal Imaging Camera of the first firefighters going in to Flat 16 to fight the fire, where it is clear from those images that the door was closed.

7.71. In all the circumstances, Whirlpool submits that it is extremely unlikely that prior to Mr Kebede turning off the mains electricity supply there would ever have been sufficient smoke in the hallway to be able to cause the tripping of the RCCB.

7.72. Dr Glover's theory on smoke in the hallway is a critical element of his fire initiation scenario. If his theory on the RCCB tripping as a result of smoke cannot be accepted on a balance of probabilities, his entire hypothesis as to how the fire began is fatally undermined. If the RCCB did not trip as a result of smoke subsequent to Dr Glover's postulated live neutral short circuit then it must have tripped simultaneously with the tripping of the circuit 7 circuit breaker, which could only have occurred with a short circuit involving 'ground', which would not occur in the fire initiation scenario as postulated by Dr Glover.

8. CONCLUSION

8.1. In conclusion, Whirlpool makes the following submissions:

(a) The Public Inquiry and its experts have not had full access to all of the physical and witness evidence;

(b) Both Professor Nic Daeid and Dr Glover were working within a more narrowly defined scope than would be ideal in a full fire investigation into origin and cause in accordance with the Code of Practice;

(c) On the evidence available, there is nothing that uniquely points to the tall fridge freezer as the area of origin of the fire or any of its component parts as being the cause of the fire;

(d) Professor Nic Daeid appears to have based the narrowing of her conclusion on area of origin and cause to a large extent on Dr Glover's electrical investigation;

(e) There are significant and fundamental flaws in Dr Glover's electrical investigation, which investigation was itself based on the process of elimination, assuming that the cause of the fire was an "*abnormal electrical event*";

(f) The "*fire initiation scenario*" postulated by Dr Glover is not possible in the tall fridge freezer;

(g) The tripping of the RCCB through smoke in the hallway within four minutes of Mr Kebede calling 999 is not supported by any evidence and is not plausible.

8.2. Critically, Dr Glover's hypotheses are conjunctive, rather than alternatives. If the Public Inquiry finds any of the various limbs are not proven to the requisite standard (as Whirlpool submits it should), Dr Glover's "*fire initiation scenario*" cannot be accepted.

8.3. It is Whirlpool's respectful submission that, for the reasons set out in these submissions, the Public Inquiry cannot, on the balance of probabilities properly reach any other conclusion than that put forward by Professor Nic Daeid in her Provisional Report, namely that:

(a) The area of origin of the fire was in the south east corner of the kitchen;

(b) The area of origin was in or around the area of the tall fridge freezer located along the south wall of the kitchen;

(c) The cause of the fire remains undetermined although, it is more likely than not to be an accidental cause rather than a deliberate act.

Cooley (UK) LLP
6 December 2018