

Assurance Services

Summary of Testing Results – FF175B

Report: 103250895LHD-002

Prepared for: Regulatory Delivery
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Summary of Testing Results – FF175B

Report

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Report Summary

NOTE: The summary should be read in conjunction with the full report & Standards/Legislation identified

This report summarises the findings documented in Intertek test report 103250895MKS-001 which must be read in conjunction with this report.

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Intertek was commissioned to perform a safety evaluation on the Hotpoint FF175B Refrigerator Freezer utilising the European Standards that were appropriate and in place at the date of manufacture of the original units. Testing was performed on a range of used models selected from the market by BEIS/Regulatory Delivery.

Several CB Test Reports prepared by IMQ relating to the original product testing and covering the period of manufacture and the standards applicable at the time were also reviewed and found to be satisfactory.

These test reports formed part of the manufacturers Technical File to support Declaration of Conformity under the Low Voltage Directive.

IMQ is the Italian test laboratory appointed by the manufacturer of the FF175B. The test report 103250895MKS-001 shows several 'failures' which warrant further explanation within the context of the evaluation performed and the used nature of the samples. In summary the items deemed as failures are as follows:

- Marking for mains supply connection not to be placed on removeable parts
- Required warnings in instruction manual
- Instructions for disposal in Spanish
- Rated current deviation

Each of these *minor* departures are described in the following sections of this report.

The Intertek test report 103250895MKS-001 uses the standard IECIEE Test Report Format (TRF) and as such provides the standardised text included in the template, comments on findings and P(ass), F(ail) or N/A results. The results are strictly in accordance with the requirements of the standards listed on the test report.

This narrative report provides additional commentary concerning the failures listed and explains the consequence and context of these departures.

The evaluation of *used* samples is a very different situation to the evaluation of a factory fresh model. The operational life of the model is unknown and detailed documentation which would normally be provided as part of the manufacturers product submission was not always available. Consequently, the test report notes cases where components may have been subjected to further detailed evaluation in the case of a new product and any assumptions made during testing of these samples are clearly stated. It is highly probable that when the product was originally tested, the laboratory would have been presented with a full set of product documentation and data and that this would have formed the basis for the test plan. For materials that could be shown to be independently tested to the required material standards, would not have required separate evaluation within the appliance.

Based upon limited market data, it is Intertek's opinion that the failure rate of refrigeration appliances is low. Intertek's judgement to include additional testing of the foam insulation was based on knowledge of the risk that the run capacitor IS now considered a potential ignition source. This is supported by evidence provided by the London Fire Brigade. Given the construction of the FF175B includes several large holes in the surface above the compressor and the run capacitor, Intertek conducted additional materials testing as agreed with BEIS, and this is documented in an Attachment to the Test Report 103250895MKS-001. The results of testing the insulation foam in isolation (as per the interpretation of Clause 30.2.1) for exposed material together with tests on the composite structure (of foam and plastic) are presented. Despite the findings noted it **remains Intertek's view that the Hotpoint FF175B represents no greater risk than other, similar refrigeration appliances placed on the market over the same period.**

In 2006, when this model was first placed on the market, there was insufficient historical data that would indicate that run or start capacitors represented a potential ignition source and therefore any exposed foam within the compressor cavity would very likely NOT have been assessed by test laboratories, including Intertek.

It is Intertek's view that the product complies with the standards that were in place and appropriate at the date of manufacture. Standards undergo regular update and those applicable to the FF175B have been amended over the years considering safety improvements including those related to run/start capacitors.

Harmonized standards such as BS EN 60335-1 and BS EN 60335-2-24 may be used as the basis of a presumption of conformity with the essential requirements of the EU Low Voltage Directive and its transposition into UK law as the Electrical Product Safety Regulations 1994.

Intertek has been involved throughout the complete investigation; from the initial discovery phase and inspection of both exemplar and the original appliance, through definition and interpretation of BEIS requirements, discussion and proposal of an 'abnormal' test program to simulate the effect of a capacitor fire, review of documentation provided by the manufacturer, installed base and market data and the regression analysis conducted to establish potential failure trends, culminating in a construction and testing program on representative appliances

Representative photographs of the products construction are included in the Annex of this report.

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1.0 Disclaimer

Due to the nature of Standards & Legislation, the statements made in this document do not & cannot provide definitive interpretations of the subject in question. The information provided in this document must therefore be regarded as guidance, based upon the present understanding of the standards & legislation, & the product at the time of issue.

2.0 Introduction

Intertek has been commissioned by the Department of Business, Energy and Industrial Strategy (BEIS) to act as an independent engineer to support the investigation into the source of a refrigerator fire. The subject of the investigation is a Hotpoint Model FF175B Refrigerator-Freezer unit manufactured in 2008.

Various representative models have been procured and cover the period 2006, 2007 and 2008. The primary focus of Intertek's evaluation of the FF175B has been to verify that the product met the relevant product safety standards that were in place *at the time of manufacture and original placement on the market*.

Representative models are all used units, in good general condition but the history and usage of the units is unknown.

This brief report aims to summarize the findings relating to **Failures** against the standard recorded in the Intertek Test report 103250895MKS-001 to 'weight' these within the context of the incident. This report is therefore a narrative report and should be read in conjunction with the full test report.

The following standards have been used as the basis for the evaluation. These standards were active at the date of original manufacture.

Standard	Standard ID	Title
1	BS EN 60335-1:2002+A2:2006	Household and similar electrical appliances — Safety —Part 1: General requirements
2	BS EN 60335-2-24:2003 + A2:2007	Household and similar electrical appliances — Safety — Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers

Part 1 defines the general requirements applicable to *all* appliances. The Part 2 covers details that are specific to refrigeration type products and this standard includes additional requirements and/or modified requirements of the Part 1 in accordance with the appliance type.

In common with all standards, numerous other standards are referenced from within these standards and cover the construction and requirements of major sub-assemblies (e.g. compressors and controls) or test methods.

The following sections of this report provide commentary and explanation of the findings detailed in Intertek Report 103250895MKS-001

3.0 Clause 7 Marking and Instructions

The FF175B is fitted with a Class Y mains attachment. **Clause 7.8** requires that except for type Z attachment, terminals for connection to the supply mains shall be correctly indicated and that *marking shall not be placed on removeable parts*.

For the FF175B, this requirement is recorded as a failure as the marking is on the removable cover plate of the compressor. See Figure 1



Figure 1: Mains cable attachment marking is on the removeable cover of the compressor

Whilst this is a departure from the requirements of the standard, the safety instructions provided with the appliance do clearly state:

'! The cable must be checked regularly and replaced by authorised technicians only (see Assistance)'

The safety instructions supplied further add:

'! The manufacturer declines any liability should these safety measures not be observed'

Intertek maintains that this minor departure has no bearing on the subject incident and does not impact the practical safety of the product.

Clause 7.12 covers Instructions for Safe Use.

Part 2 of the standard modifies the clauses of Part 1 and includes the following requirements for compression types appliances that use flammable refrigerants:

WARNING – Do not damage the refrigerant circuit (IEC 60335-2-24:2002)

WARNING – Do not use electrical appliances inside the food storage compartments of the appliance, unless they are of the type recommended by the manufacturer (IEC 60335-2-24:2002)

The instructions provided do not include these warnings and therefore depart from the requirements of the standard.

Intertek maintains that this minor departure has no bearing on the subject incident and does not impact the practical safety of the product within the context of THIS evaluation.

Clause 7.13 covers Instructions and other texts in an official language

The test report 103520895MKS-001 notes this as a failure because the disposal instructions were only supplied in Spanish.

Intertek maintains that this minor departure has no bearing on the subject incident and does not impact the practical safety of the product.

4.0 Clause 10 Power Input and Current

Clause 10.2 covers rated current variation for an appliance marked with rated current

It requires that at normal operating temperature, rated voltage and normal operation that the rated current does not vary by more than the maximum deviation in Table 2 of the standard. For motor-operated appliances with rated current between 0.2 and 1.5A the maximum deviation is 20%

10.2	TABLE: Current deviation					F
Current deviation of/at:	I rated (A)	I measured (A)	dI	Required dI	Remark	
220V	0.5	0.650	+30%	+20%	>+20%	
230V	0.5	0.640	+28%	+20%	>+20%	
240V	0.5	0.635	+27%	+20%	>+20%	

Intertek maintains that this minor departure has no bearing on the subject incident and does not impact the practical safety of the product within the context of THIS evaluation. It is possible that this variation in current occurs due to in service effects and ageing.

5.0 Clause 30 Fire Resistance Testing – Additional testing

The following tests are documented within the Attachment to the Test Report.

Within Part 1 of the standard, Fire Resistance testing is addressed under Clause 30 'Resistance to Heat and Fire'.

The clause appears on Page 101 of the edition referenced in section 3.0.

The first sub-clause 30.1 covers non-metallic materials that support or are in contact with live parts and is not considered within this summary report.

Clause 30.2 requires that 'parts of non-metallic material shall be resistant to ignition and spread of fire'. Parts made of soft or foamy materials are required to meet the flammability requirements of ISO 9772. However, the flammability tests *are not conducted on parts unlikely to be ignited or to propagate flames that originate inside the appliance.*



Photo 1 Foam fill point above Run capacitor

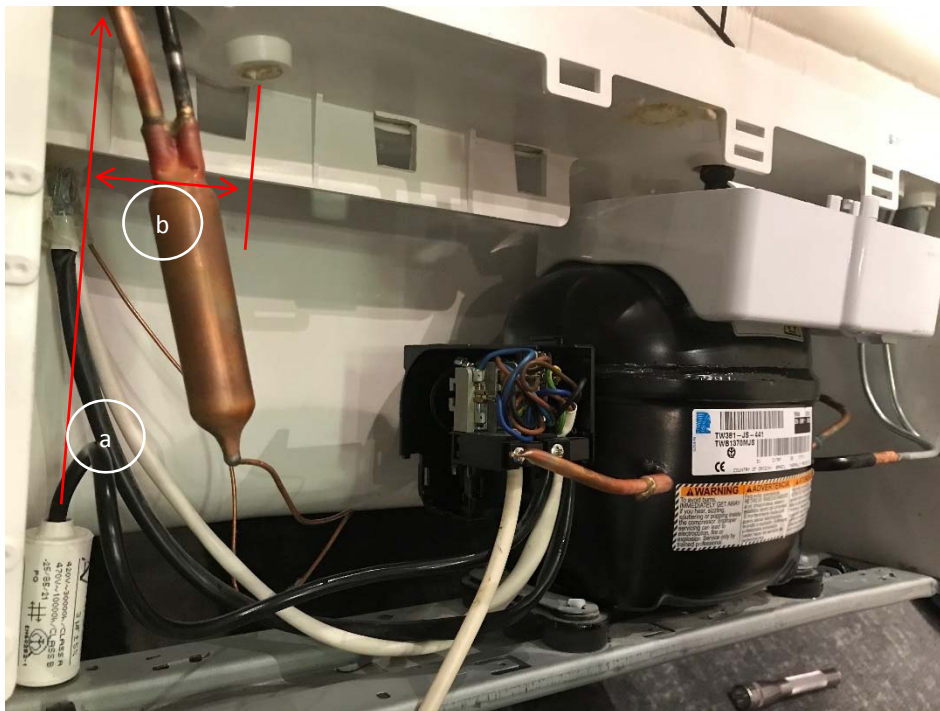


Photo 2 General view of underside of compressor compartment showing exposed foam

Photo 1 shows that there is a foam fill point in the area above the Run capacitor. The fill point is approximately 165mm above (dimension a) and 70mm to the right (dimension b) of the centre line of the Run capacitor. Photo 2 shows additional exposed foam in the panel above the compressor. Photo 5 shows additional exposed foam behind the plastic web at the back of the compartment.

Given the sample construction and that **bare foam insulation material was exposed within the rear compressor cavity, Intertek, in consultation with BEIS, elected to test the exposed foam.**

Please see Annex A for the text from the standard. The key points are as follows:

- a) Note 1 – references ‘remove the part under examination in its entirety and test it separately’
- b) Sub-clause 30.2.1 covers the glow wire test to IEC 60695-2-11 at 550°C with conditions that the test does not need to be performed on material classified at least HB40.
- c) Finally, acknowledgement that it is not possible to perform glow-wire testing on soft or foamy materials and that these ‘shall meet the requirements specified in ISO9772 for material classified as HBF’

The evaluation of used samples is a very different situation to the evaluation of a factory fresh model. The operational life of the model is unknown and detailed documentation which would normally be provided as part of the manufacturer's product submission was not always available. Consequently, the test report notes cases where components may have been subjected to further detailed evaluation in the case of a new product and any assumptions made during testing of these samples are clearly stated. It is highly probable that when the product was originally tested, the laboratory would have been presented with a full set of product documentation and data and that this would have formed the basis for the test plan. For materials that could be shown to be independently tested to the required material standards, would not have required separate evaluation within the appliance.

Based upon limited market data, it is Intertek's opinion that the failure rate of refrigeration appliances is low. Intertek's judgement to include additional testing of the foam insulation was based on knowledge of the risk that the run capacitor is now considered a potential ignition source. This is supported by evidence provided by the London Fire Brigade. Given the construction of the FF175B includes several large holes in the surface above the compressor and the run capacitor, Intertek conducted additional materials testing and this is documented in an Annex of the Test Report 103250895MKS-001. The results of testing the insulation foam in isolation (as per the interpretation of Clause 30.2.1) for exposed material together with tests on the composite structure (of foam and plastic) are presented. Despite the findings noted it **remains Intertek's view that the Hotpoint FF175B represents no greater risk than other, similar refrigeration appliances placed on the market over the same period.**

In 2006, when this model was first placed on the market, there was insufficient historical data that would indicate that run or start capacitors represented a potential ignition source and therefore any exposed foam within the compressor cavity would very likely NOT have been assessed by test laboratories, including Intertek.

The requirements of Clause 30.2 are further defined under Clause 30.2.1. ‘Parts for which the glow-wire test cannot be carried out meet the requirements in ISO9772 for category HBF material (IEC 60335-1:01 + A1:2004)’

Flammability tests were conducted on the soft foamy materials used in the appliance construction. These are used for the bulk of the thermal insulation material at the back, top and sides of the appliance together with the polystyrene material behind the rear panel within the fridge compartment. All tests were conducted to the requirements of ISO 9772.

These tests showed that the materials do not meet the HBF requirement **and Intertek has deemed this as a potential failure against the requirements of the standard when applying an interpretation of the intent of this clause.** In all tests and for all samples (of both materials) the flame burnt until the samples were totally consumed. The flame front travelled until the end of the sample and then extinguished, leaving a partially burnt sample.

Independent test data for the plastic material was not available at the time of our evaluation, although the manufacturer's data sheet claimed compliance with HB40. Intertek conducted a glow wire test (at 550°C) to confirm the material meets the HB40 requirement. Sample photographs from this test are included in the Annex of this report (see Photo 9). The result of the glow wire test shows that the material meets the HB40

requirements and that the composite structure whilst burning, does not propagate a flame. This characteristic is very different to exposed foam, tested in isolation.

The use of Hydrocarbon blowing agents within refrigeration insulation is well established, documented and has been the subject of review under the processing of electrical waste under the Waste Electrical and Electronic Equipment (WEEE) regulations. A report produced in 2012 provides similar findings and states that

'As a result of this, we believe that all fridge insulation foam produced using a hydrocarbon blowing agent should be considered highly flammable, unless tested and demonstrated otherwise'

The report may be accessed here:

http://www.weeeconsulting.co.uk/LIT_7627_0492fa%20-%20HC%20flamability%20tests.pdf

It is the author's view that much of the consideration for the material used for refrigeration insulation has been in 'isolation'; the report cited above for instance considers the implications of flammability *only from a waste* perspective in terms of classification, storage and handling.

Similarly, the drive to improve energy efficiency to meet EU Energy Labelling and EcoDesign requirements and the resultant increase in insulation may not have been fully aligned with Safety Standards development committees such as CPL/61 – 'Safety of household and similar electrical appliances'.

This, together with the scope for interpretation of the clause 30.2 requirements '*flammability tests are not conducted on parts unlikely to be ignited or to propagate flames that originate inside the appliance*', means that insulation materials may often *not be tested* by laboratories performing the safety evaluation.

Intertek's interpretation and position on testing the foam materials was determined by:

- The nature of the incident and the propagation of fire from the identified source throughout the appliance
- The fact that exposed foam areas appear in several places within the compressor compartment and that '...flames that originate inside the appliance' includes this area of the appliance.
- Information provided on other refrigerator incidents by the London Fire Brigade (LFB) showing that the fire load is substantial
- Noted changes in construction by several manufacturers on more recent refrigerator models to minimize or ensure that exposed foam is completely covered in the compressor area.



Photo 3 Foam insulation sample burning during tests (Courtesy: ITRI Innovation)

Annex A: Clause 30.2

Reference: BS EN 60335-1:2002+A2:2006 'Household and similar electrical appliances — Safety — Part 1: General requirements

For reference, the text from Clause 30.2 is included here. Please refer to the requirements under 30.2.1

A2) 30.2 Parts of non-metallic material shall be resistant to ignition and spread of fire.

This requirement does not apply to decorative trims, knobs and other parts unlikely to be ignited or to propagate flames that originate inside the appliance.

Compliance is checked by the test of 30.2.1. In addition,

- *for attended appliances, 30.2.2 is applicable;*
- *for unattended appliances, 30.2.3 is applicable.*

Appliances for remote operation are considered to be appliances that are operated while unattended and consequently they are subjected to the test of 30.2.3.

For the base material of printed circuit boards, compliance is checked by the test of 30.2.4.

The tests are carried out on parts of non-metallic material that have been removed from the appliance. When the glow-wire test is carried out, the parts are placed in the same orientation as they would be in normal use.

NOTE 1 For parts that have been removed, it is the intention that IEC 60695-2-11 Clause 4 item c) applies, which states "remove the part under examination in its entirety and test it separately".

These tests are not carried out on the insulation of wires.

NOTE 2 The selection and sequence of tests for resistance to fire are shown in Figure O.2.

30.2.1 *Parts of non-metallic material are subjected to the glow-wire test of IEC 60695-2-11, which is carried out at 550 °C.*

The glow-wire test is not carried out on parts of material classified at least HB40 according to IEC 60695-11-10 provided that the test sample use for the classification was no thicker than the relevant part of the appliance. A2)

Sub-clause 30.2.1 goes on further to cover parts such as foam:

A2) *Parts for which the glow-wire test cannot be carried out, such as those made of soft or foamy material, shall meet the requirements specified in ISO 9772 for material classified HBF, the test sample used for the classification being no thicker than the relevant part of the appliance.*

Annex B: Photographs of representative product



Photo 4 Compressor cavity, exposed foam at fill and vent point and behind cut-outs in web



Photo 5 Compressor cavity, exposed foam fill point, cable and a capillary entry point.



Photo 6 Untested foam around cable and capillary entry point



Photo 7 Controller – cable entry via sandwich panel

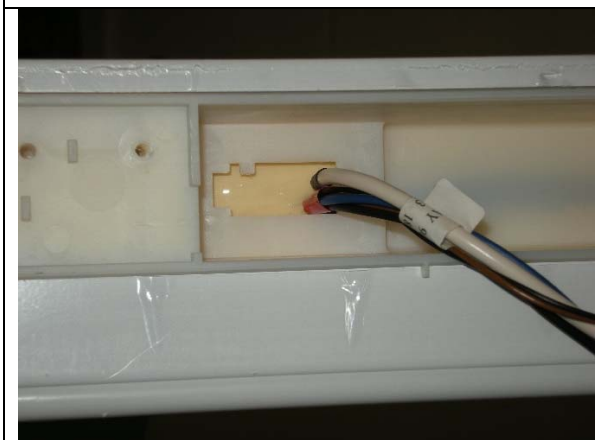


Photo 8 Controller – cable entry via sandwich panel (detail)

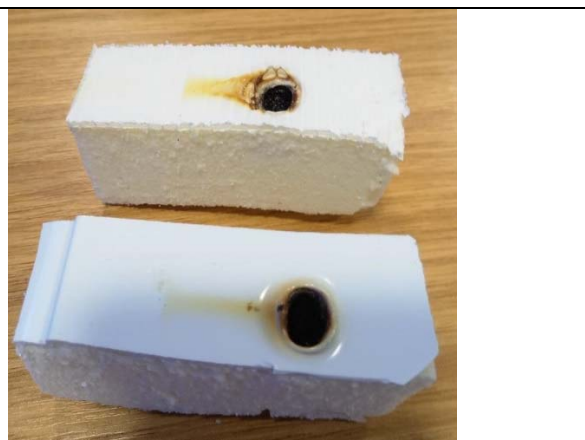


Photo 9 – Glow wire test on HB40 material and sandwich construction