In focus

Cooking instructions **not as simple as you may think**

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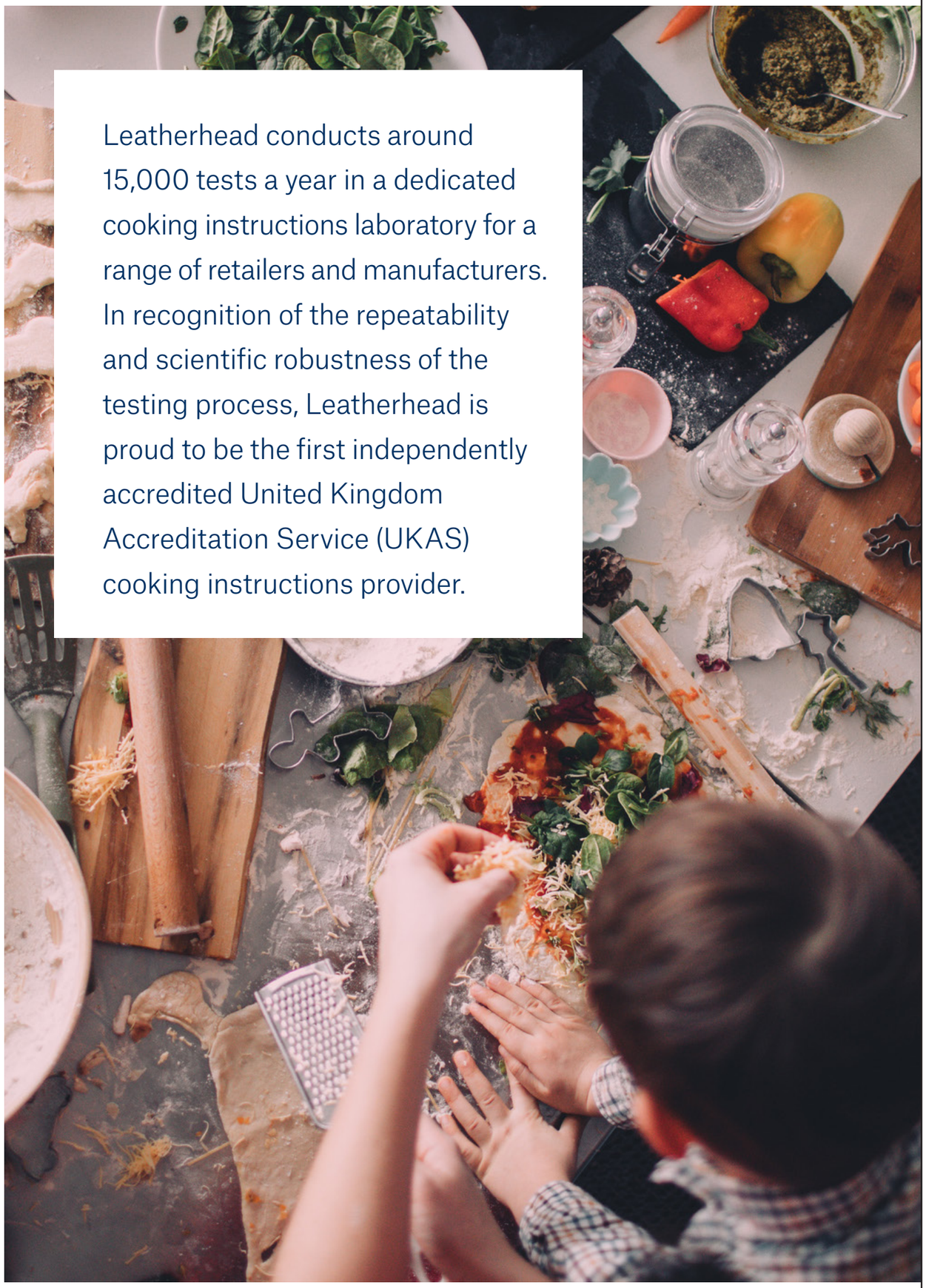
a **science group** company



Leatherhead conducts around 15,000 tests a year in a dedicated cooking instructions laboratory for a range of retailers and manufacturers. In recognition of the repeatability and scientific robustness of the testing process, Leatherhead is proud to be the first independently accredited United Kingdom Accreditation Service (UKAS) cooking instructions provider.

The British Retail Consortium (BRC) Global Standard states that where cooking instructions are provided to ensure product safety, they shall be fully validated to ensure that when the product is cooked according to the instructions, a safe, ready-to-eat product is consistently produced; this is also supported in both EU and UK guidelines and regulation. It is paramount therefore that food companies can demonstrate that their cooking instructions reliably produce a product that is safe to consume. These instructions must be developed with respect to the product's desired sensory characterises, in-home cooking equipment variability, consumer behaviour and compliance with the various retailer policies.

This paper highlights some of the factors that should be considered in this important, but often under-valued aspect of the product development process, to ensure compliance and the delivery of a great product to market.

1.0 Different cooking techniques

Each year, Leatherhead's cooking instruction team conducts around 15,000 cooking trials covering all types of techniques including oven, microwave, hob and grill. Products are cooked to reduce micro-organisms to safe levels and produce optimal sensory qualities for eating such as appearance, flavour and texture. The choice of cooking method will be determined by the product's size, whether it is solid or liquid, if it contains raw protein, what will be the easiest and quickest approach for consumers and what will deliver the best sensory outcome. Cooking techniques should be discounted if they don't deliver on ease or sensory quality.

The most common cooking methods are thermal oven and microwave oven. Thermal ovens are most suitable for cooking raw protein, and for baking and roasting sensory characteristics (e.g. crispy coating). Microwave ovens for heating food have been designed with convenience and speed in mind. Microwave ovens use approximately a third of the energy of thermal ovens and an increase in their use is expected as consumers seek to reduce household energy[1].

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[1] Switch Energy Supplier. (n.d.). How Much Electricity Do Your Appliances and Gadgets Use?. [online] Available at: http://www.switchenergysupplier.co.uk/how-much-electricity-do-your-appliances-and-gadgets-use/ [Accessed 25 Jun. 2019].

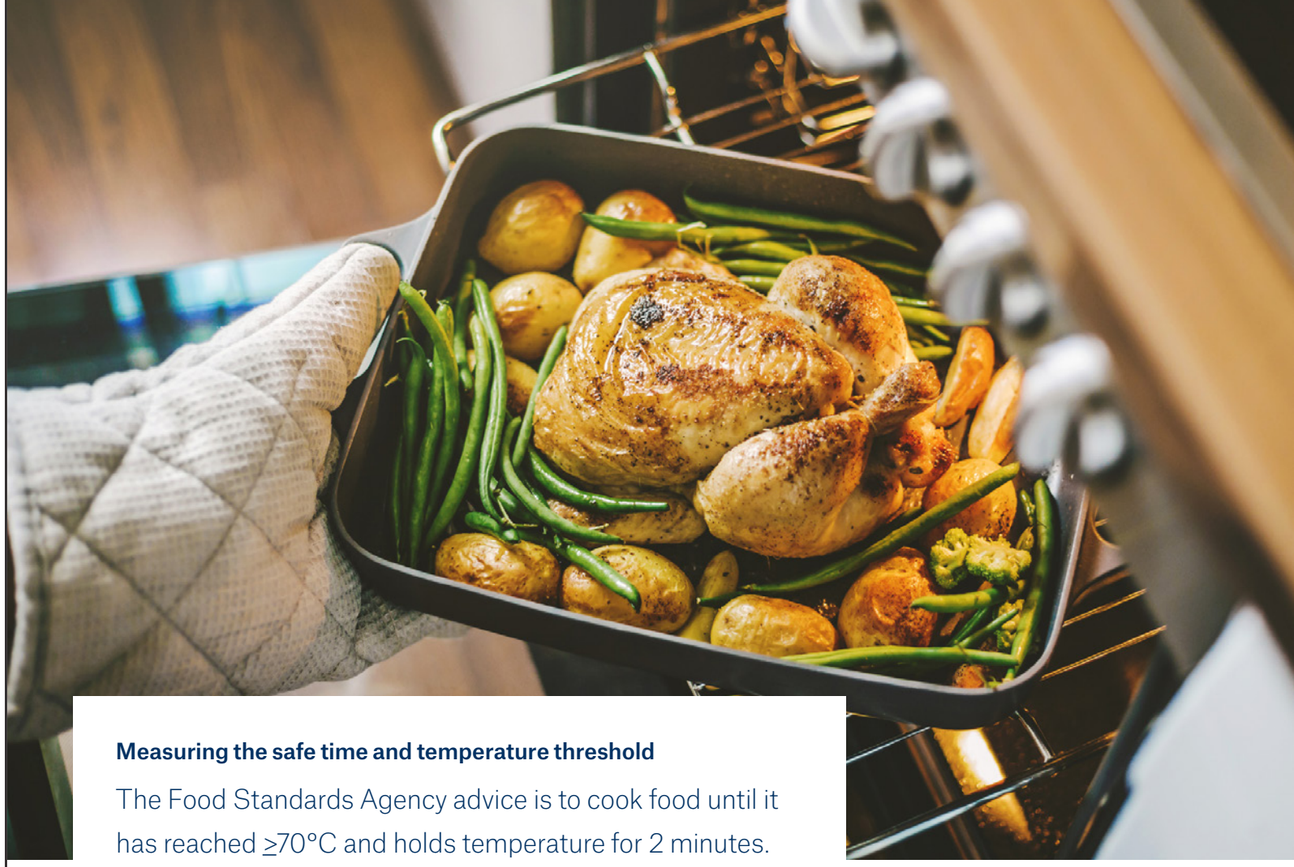
2.0 Consumers and cooking instructions

Consumer research by Leatherhead[2] showed that over 80% of respondents followed back-of-pack instructions, so there is a clear reliance and need for this on-pack information to help provide optimal cooking. Around a third said it was not easy to read the font on pack because it was too small, with some mentioning they would reach for their reading glasses, magnifying glasses, or the magnifier on their phone to read. With competing requirements for back-of-pack space, it is not surprising that instruction font size can be too small, but are some consumers being left to compromise on safety or quality because of not being able to read instructions?

3.0 The science behind developing cooking instructions

Instructions for new products are generated through a series of cooking trials where the cooking steps for a technique are refined until core temperatures are met and quality becomes optimal. All measuring equipment (balances, thermocouples) must be calibrated, kitchen appliances performance checked, and staff trained to ensure results are true and repeatable. Test samples must represent final production in terms of weight, ingredient composition and packaging. Once an instruction is successfully generated, it is verified by following the final instruction steps and conducting the same technical measures to confirm safety and quality. Testing must be repeated to show that results did not happen by chance.

80% of consumers never temperature probe food and so this supports the need for food producers to verify that their instructions achieve this important criterion, since consumers are unlikely to check themselves.



Measuring the safe time and temperature threshold

The Food Standards Agency advice is to cook food until it has reached ≥70°C and holds temperature for 2 minutes. Leatherhead's consumer survey[2] highlighted that over 80% of consumers never temperature probe food and so this supports the need for food producers to verify that their instructions achieve this important criterion, since consumers are unlikely to check themselves.

Core temperatures (i.e. the centre of the product and other areas likely to be the slowest to heat and those representing the range of components of the product e.g. meat, carbohydrate, sauce) are measured with thermocouples immediately post-cook. All core temperatures must hold for >70°C for 2 minutes to be microbiologically safe. Other equivalent time and temperature combinations may be used e.g. 75°C for 30 seconds[3].

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[2] Leatherhead Food Research (Dec 2017 – Jan 2018). Do consumers really follow cooking instructions?. [online] Available at https://www.leatherheadfood.com/news-detail/do-consumers-really-follow-cooking-instructions/ [Accessed 25 Jun. 2019].

[3] Food Standards Agency., (2018), Cooking your food. How to cook your food to prevent food poisoning. [online]. Available at: https://www.food.gov.uk/safety-hygiene/cooking-your-food [Accessed 25 Jun. 2019].

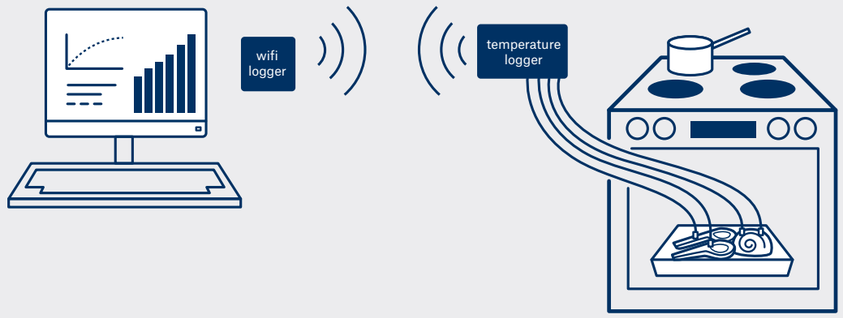
In-cook testing

This method measures core temperatures of the food throughout cooking (rather than post-cook) and allows the exact determination of when the safe temperature and time combination is achieved. It can help identify minimum cook times and equivalent temperature and time combinations, e.g. a lower oven temperature but for a longer time. This approach may be useful for products that are sensitive to over-cooking such as fish, or for minimising oven energy use.

Eating quality

As well as a safe cook, it is important that cooking or heating produces optimal sensory characteristics. For example, some vegetables may achieve 70°C for 2 minutes although they may still be too crunchy and need longer cooking. All samples should be critically assessed against a written sensory specification post-cook. Technicians conducting these assessments should be screened for sensory acuity and trained in sensory terminology.

Illustration of in-cook testing



Additional considerations on quality and safety

For starchy foods, instructions should seek to achieve lighter colour when frying, baking, toasting or roasting, to help reduce the possible formation of acrylamides[4]. Instructions should also avoid products getting too hot which may result in scalding from handling for example lifting a tub of overly hot soup from a microwave.

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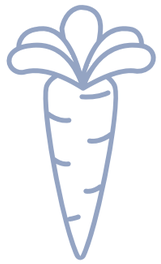

[4] Food Standards Agency. (2018). Acrylamide. Information on the risks of acrylamide and how you can reduce the chances of being harmed by it. [online]. Available at: https://www.food.gov.uk/safety-hygiene/acrylamide#how-to-reduce-acrylamide-at-home. [Accessed 25 Jun. 2019].

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Oven performance

To ensure accuracy of test results, equipment must be working accurately and reliably, and the following gives some examples of controls, checks and calibrations for microwave and thermal ovens to ensure they give reliable results.

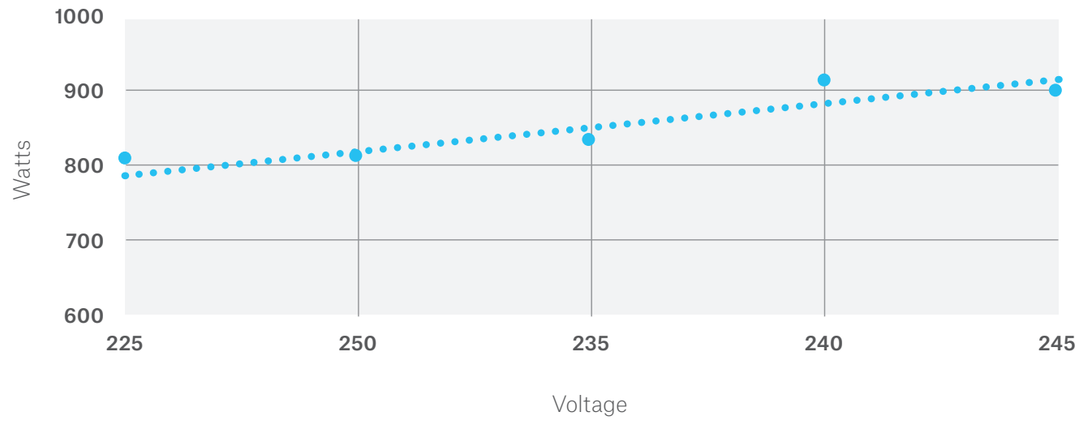
Microwave ovens

Microwave oven instructions specify power output in watts and may also give an A-E category rating. Power output is checked by heating 1,000g of water from 10°C to ambient under controlled conditions[5]. This check procedure is very sensitive and an error of just 0.5°C across start and end temperatures will lead to a discrepancy of over 40W. The A-E category rating check follows a near identical procedure but uses 350g of water which better represents the mass of food likely to be heated by the consumer[6].

Microwave power output can vary due to variation in supply voltage (Figure 1) and the temperature of the internal components of the microwave oven. A regulated supply voltage will help reduce variation due to voltage fluctuation. Loss of power from heating of internal components should be managed by controlling successive use and implementing strategies for forced cooling.

Figure 1 - Microwave power output in watts vs supply voltage

The graph shows how a change in voltage will change the power output of a microwave.



[5] The British Standards Institution. BS EN 60705:2015+A2:2018, Household microwave ovens - Methods for measuring performance. BSI Standards Limited. 2018

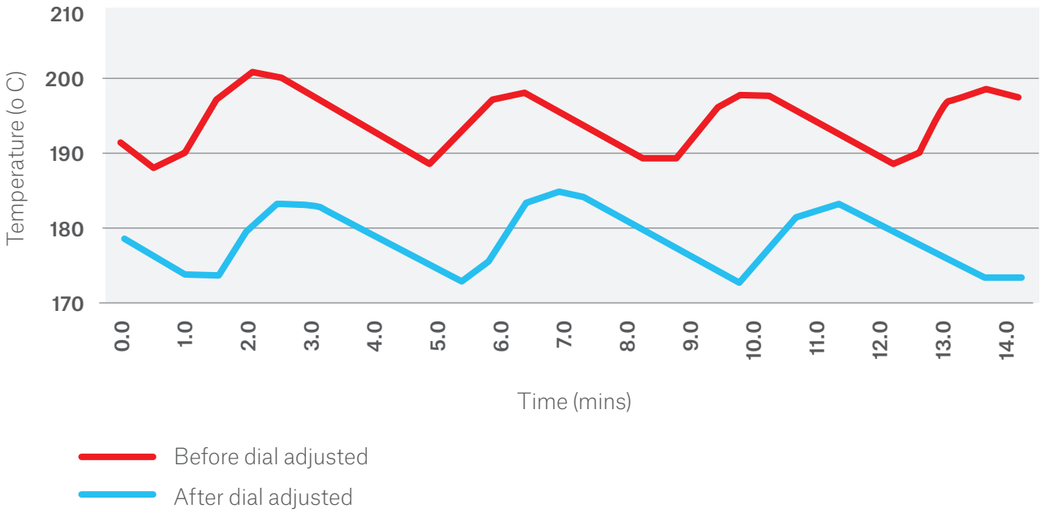
[6] Richardson, P. and Gordon, K. (1997). Guidelines on the verification of reheating instructions for microwaveable foods. Chipping Campden: Campden & Chorleywood Food Research Association

Thermal ovens

Thermal ovens must be tested to ensure that the dial setting (+/- appropriate limits) results in a true internal oven temperature. This will involve setting the dial temperature to the desired reading and then measuring the inside of the oven with a calibrated thermometer. If the temperature of the inside of the oven is different to the dial settings, then the settings are adjusted to match.

Figure 2 - Fan oven set at 180ºC

Example of thermal oven that was operating 14°C too high on average when set at 180°C. Post-adjustment shows much better agreement with the 180°C target.



4.0 What are the regulations and what are retailers looking for

There are both regulations and guidance from the UK and EU that indicate the use of instructions[7,8,9], and the latest BRC Global Standard states, that where cooking instructions are provided to ensure product safety, they shall be fully validated to ensure that when the product is cooked according to the instructions, a safe, ready-to-eat product is consistently produced[10]. Food companies therefore must have scientific data to show that the cooking instructions displayed on their products, reliably produce a product that is safe to consume. Individual UK retailers have policies that detail requirements for their suppliers and include specifics on how to create instructions using laboratory experimentation.

5.0 Clear and easy instructions

After determining the final steps that give a safe product with appropriate quality, the instructions need to be written in a way that is simple, concise and unambiguous.

In keeping with the simple approach, some retailers may require products within a range (e.g. party range) to have the same instructions (times and settings) where possible, so that it is easy for the consumer to prepare them all at once without undue complexity. Retailers may also have in-house styles for how the instructions are worded.

[7] GOV.UK., (n.d.). Food Labelling and Packaging. Food labelling - what you must show. [online]. Available at: https://www.gov.uk/food-labelling-and-packaging/food-labelling-what-you-must-show. [Accessed 25 Jun. 2019].

[8] EU Regulation 1169/2011 of the European Parliament and of the Council, on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004. [online]. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1507628799129&uri=CELEX:02011R1169-20140219. [Accessed 25 June. 2019].

[9] EC Regulation 178/2002 of the European Parliament and of the Council. Laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. [online]. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1507628832678&uri=CELEX:02002R0178-20140630. [Accessed 25 Jun. 2019].

[10] BRC Global Standards. Food Safety, Issue 8, Clause 5.2.5. London. BRC Global Standards. (2018).

6.0 Conclusion

UK and EU regulations together with the BRC provide a regulatory basis for cooking instructions and for good reason: consumers rely heavily upon the cooking instructions provided in order to deliver safe food at optimal quality. As a consequence, the generation of cooking instructions should be a thorough and scientifically accurate process that accounts for the range of potential variability when instructions are followed by consumers at home.

Despite there being individual policies at retailer level with specific protocols, good science is critical, and all measuring equipment, such as the performance of ovens, must be checked and calibrated to ensure true values are given and result in valid instructions.

How Leatherhead can help

Leatherhead offers independent, UKAS accredited cooking instructions testing (Laboratory testing no. 9365). With over 15 years' experience testing all food types for key retailers and food manufactures, we offer unparalleled customer service, including options for either a 24 and 48 hour turnaround and discounted pricing for members of Leatherhead.

About Leatherhead Food Research

Leatherhead Food Research provides expertise and support to the global food and drink sector with practical solutions that cover all stages of a product's life cycle from consumer insight, ingredient innovation and sensory testing to food safety consultancy and global regulatory advice. Leatherhead operates a membership program which represents a who's who of the global food and drinks industry. Supporting all members and clients, large or small, Leatherhead provides consultancy and advice, as well as training, market news, published reports and bespoke projects. Alongside the member support and project work, our world-renowned experts deliver cutting-edge research in areas that drive long term commercial benefit for the food and drink industry. Leatherhead Food Research is a trading name of Leatherhead Research Ltd, a Science Group Company.

help@leatherheadfood.com

T. +44 1372 376761

www.leatherheadfood.com

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Founded in 1986, Science Group was one of the founding companies to form the globally recognised Cambridge (UK) high technology and engineering cluster. Today the Group has 12 European and North American offices.

info@sciencegroup.com

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