

British Beer and Pub Association

Technical Circular

No. 470

**Guidance on the design and testing of toughened
glassware for trade use**

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Guidance on the design and testing of toughened glassware for trade use

This technical circular is not intended to provide a specification or to provide any guarantee of the fitness for purpose of toughened glassware used in trade.

As there are no formal technical standards for toughened glassware within the UK, the following guidance has been developed by the BBPA to help assist members to develop a test programme to understand the suitability of toughened glassware intended for use in trade.

The information contained with this guidance document may also be used to assist the process of design for new glassware. In particular, to understand the impact of the design process and different design elements on the extent and success of the toughening process.

1. Introduction

The BBPA has estimated that in excess of 95% of the glassware used by beer brand owners to represent their products is toughened. In addition, whilst there are no formal British Standards for toughened drinking glassware, some brand owners have developed informal specifications, to help confirm the extent of toughening and ensure the suitability and safety of such containers for use in trade.

Whilst not a formal specification, the following guidance is intended to provide BBPA members with a suggested suite of tests which may be used to develop an understanding of the suitability of toughened glassware for use in trade. The areas that these tests cover may also be used as part of the design process when considering the development of new glassware and in particular how various design elements may impact on the toughening process.

The following test will not provide a guarantee of fitness for trade, but will allow brand owners to determine whether the toughening process used to treat the glassware has been successful and how this will be impacted by general handling and use in retail outlets.

2. Scope

The following tests have been identified following consultation with the BBPA members and, whilst not exhaustive, provides a series of tests that may be used to determine the basic quality and appropriateness of the finished glassware under test, the extent and degree of toughening and the robustness of the finished glassware.

The test suite may also be used by brewers to help in the process of designing toughened drinking glassware and to determine how design features such as embossing, changes in container shape or application of decorative artwork may impact on the extent and degree of toughening.

3. Toughened Glassware

Toughening involves heating glassware to a temperature in excess of 500° C and then controlling airflow to uniformly cool the surface to induce consistent stress across the glass. This is done in such a way as to ensure that if the glass should fail, it would do so in a uniform manner producing small, regular pieces on fracture.

4. Impact of Design on Toughened Glassware

Various design elements can impact on the extent of toughening and most importantly the requirement for branding on glassware. Branding is most commonly included in the manufacturing process either via embossing or printing using glass based inks. Use of glass based inks at this point of production is unlikely to impact on toughening, whereas the application of embossed branding can make the toughening process harder to achieve.

Changes or variations in glass thickness across the glassware introduces variation in the thermal conductivity of the container and therefore impacts on the ability to produce a consistent stress pattern throughout the glass. Successful toughening of embossed glassware, or indeed any design element which causes variations in glass thickness, will depend on producing features with as uniform a thickness as possible to ensure that the cooling process can be controlled.

Once produced, reheating glass will generally reverse the toughening process. For this reason, glassware purchased from secondary glass 'decorators' that use glass based inks to brand glassware will usually result in glassware becoming non-toughened since the glassware needs to be reheated to similar temperatures found during moulding to ensure that the inks will set.

There are alternatives to the use of glass based inks which do not disrupt the toughening process. Organic inks are not glass based and therefore do not require the same degree of heat to ensure that they will set. UV technology is able to provide sufficient 'heat' without reversing the toughening process. However, whilst these offer an alternative to the dual branding and manufacturing process, the finish may not be as resilient as glass based inks.

5. Glassware Testing

The following tests are suggested for inclusion in the assessment of the extent and success of the toughening process as well as the evaluation of suitability and robustness of the glassware for use in trade.

BBPA members may wish to use the following tests as the basis of a quality specification for toughened glassware and which would then be defined further based on specific requirements and in partnership with their glass manufacturer:

Tests	Rationale
Visual Assessment	Visual observations to identify design features, visible defects or imperfections within/on the glass and mechanical damage that might affect performance during use.
Glass Thickness	Assessment of glass distribution throughout the container. Thicker glass, ideally not less than 2mm, is easier to toughen.
Toughening Performance	Identification and visualisation of toughening patterns to indicate the extent of glass which has undergone thermal heat strengthening / toughening.
Scratch Testing	To check for the presence of surface tensile stress.
Impact Testing and Fragmentation Assessment	To test strength of glass and most importantly the fragmentation pattern across the glass (this test is key to ensure the glass can't be used as an improvised weapon).
Thermal Shock Endurance Calculation	To test the ability of the glassware to withstand varying changes in temperature such as during dishwasher cycles or movement from hot washing conditions to colder storage temperatures. Assessing the impact of repeated dishwasher cycles (i.e 500 cycles) can also be used to test the resilience of glassware decoration.

6. Glass Testing Laboratories

Independent confirmation of the success of the toughening process may be obtained through laboratory service which specialise in the assessment of glass packages and glassware:

*Glass Technology Services Ltd (GTS)
9 Churchill Way, Sheffield, South Yorkshire S35 2PY.*

Brewers may also wish to discuss the availability of any relevant analysis capabilities with their own glass suppliers, who may also offer similar analytical services of this nature.