INFORM

INFORMATION FOR HISTORIC BUILDING OWNERS

Maintaining traditional plain glass and glazing

HISTORIC SCOTLAND

Traditional glazing creates a 'shimmering' effect

Introduction

Traditional glass used to glaze windows is an often-overlooked element of traditional buildings yet contributes much to their character and appearance. The imperfections in glass produced before the 1950's create a characteristic and appealing 'shimmering' effect on the exterior by reflecting light at many angles in a way that modern glass does not. Equally, a slight distortion of the view out of a window is one of the charms of traditional glass. This INFORM is intended to outline the types of traditional plain glass and glazing systems most commonly encountered by building owners, and to give general guidance on their maintenance and repair.

The glazing system

Traditionally, glass was usually held in place either by strips of lead, known as 'kames', or by a series of small nails called 'sprigs' and linseed oil putty.

Traditional glass

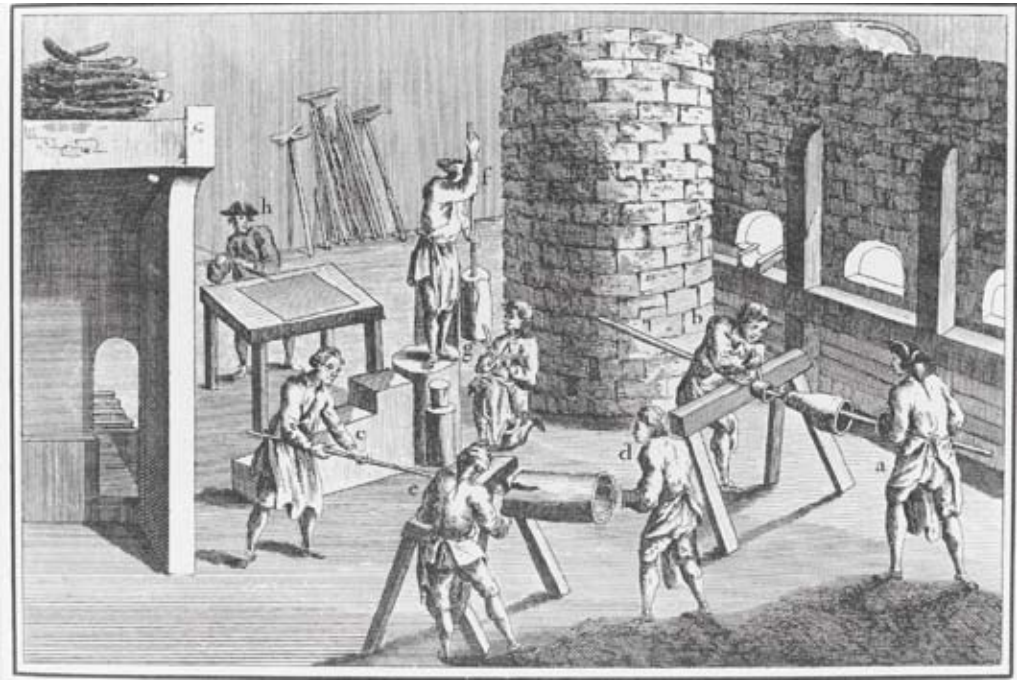
Glass is composed predominantly of silica (commonly obtained from sand, though other materials, such as flint, were also used). Traditional manufacturing techniques could not produce perfectly flat or transparent glass. Glass often contained air bubbles and was tinged with colour caused by impurities such as metal oxides in the sand used to make it.

By the 1680's-90's sash and case windows were becoming popular throughout Britain which led to a significant increase in the demand for window glass which has varied in type over time according to fashion, technology and other factors.

Common types of traditional glass

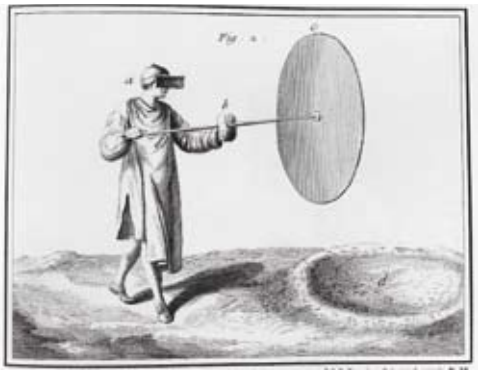
- **Cylinder glass** (also known as 'broad, 'sheet', or 'muff' glass) was made by blowing a cylinder of molten glass. This cylinder was cut along its side and flattened out in a furnace, giving the glass a slightly rippled surface. It can also be recognised by the pattern of the 'seed' which consists of elongated air bubbles that lie in straight parallel lines within the glass. Popular until the first half of the 18th Century.

Early traditional glass, probably cylinder glass



Making cylinder glass

- **Crown glass** was made by blowing and then spinning molten glass into a large thin disc known as a 'table' which was then cut into smaller panes. The glass is slightly curved and distinctive semi-circular lines called the 'ream' can often be seen in the glass. Crown glass is thinner than cylinder glass, but is also brighter and shinier as it never came in contact with a hard surface while molten. The seed lies in concentric circles, and panes often have a 'bellied' appearance when used in windows. Crown glass became increasingly popular from the middle of the 18th Century.



The distinctive semi-circular lines of crown glass

A "bull's eye" pane. This was the centre of the round table of crown glass and was the cheapest pane to be cut from the table. Image courtesy of R Curtis.

Plate glass in late Victorian windows

- **Plate glass** was made in a variety of ways. Early plate glass was made using either cylinder glass or glass which was cast by pouring molten glass onto a casting table. The cast or cylinder glass was then ground and polished until it was smooth. This was a labour intensive process and plate glass was therefore very expensive. It was consequently used predominantly for mirrors and for glazing high status buildings from the 17th Century onwards.

- **Patent Plate glass:** the process for producing Patent Plate glass was invented in 1839 by James Chance. Earlier types of plate glass required the initial sheet of glass to be very thick to allow for a portion of its surface to be ground away to make it flat. However, the Patent process enabled thinner sheets of glass to be ground and polished which meant that manufacturers could make more finished glass from the same amount of raw materials.

- **Drawn flat sheet:** a series of developments took place in the early 20th Century which enabled increased mechanisation of glass production. Various methods were invented which allowed a continuous sheet of glass to be 'drawn' out of a furnace of molten glass which was then passed through a series of rollers and cooled. These sheets were then mechanically ground and polished.

- **Modern float glass** was first developed in 1959 and is the standard type of glass used for glazing today. It is made by floating molten glass on a bed of molten tin, to produce perfectly flat glass.

Plate glass became popular with shop-owners during the 19th Century

Common risks to glazing

Due to its thinness, traditional glass is particularly vulnerable to breakage. It is therefore important to minimise any potential for damage at all times.

- **Use of scaffolding:** where scaffolding is necessary for building repair, care must be taken to ensure that no element of the scaffold is likely to damage the glazing and adequate temporary protection should be put in place to stop debris falling and hitting the glass. Window panes should not be broken to allow access for a scaffold tube into the building interior. If this is required a sash should be slid open to allow access.

Scaffolding can be hazardous to old glazing

- **Window repairs and replacements:** Glass is vulnerable to damage during window repairs, particularly if the frame needs to be dismantled to carry out comprehensive repairs. Where a window must be replaced, it is normally preferable to retain glass from the original and re-use if possible.

- **Alteration to existing windows:** Occasionally, building owners wish to reinstate an earlier glazing pattern, (for example where sashes glazed with a single pane of glass were once divided into six panes by glazing bars). Consideration should be given to the value of any existing plate glass however, as this is now an irreplaceable material.

- **Ultra violet filters:** Over time, modern applied UV filters may degrade and require removal. However, the adhesive used to attach UV filters to glass can sometimes be difficult to remove. A UV blind may be a more appropriate alternative to applying a filter directly to historic glass.

- **Inappropriate replacement glass:** The use of modern float glass to replace broken or missing panes of traditional glass can create a patchwork effect in windows, disrupting the view out and the appearance of the building façade as a whole. Replacement glass should match the original as closely as possible and this may call for the reuse of salvaged material.

- **Stone-cleaning products:** Care should be taken when cleaning masonry surrounding windows as run-off from stone-cleaning products can etch glass.

Maintenance

The maintenance of traditional glass and glazing systems is generally limited to cleaning, and the replacement of missing or dried glazing putty where necessary. Glass is best cleaned using a soft cloth and water. Abrasive cleaning agents should be avoided as these may damage the surface.

Regular painting of the windows and putty (ensuring that the paint overlaps slightly from the putty onto the glass) is important to keep the surrounding timber and glazing system in good condition.

Chemical and caustic paint stripping of window frames can cause irreversible damage to old glass. More suitable, and less aggressive, chemical paint removers are readily available from trade and DIY retailers.

Repairing glazing systems

The distinctive patterns of lead kames were designed to evenly distribute the weight of the glass. It is important to bear in mind that the design of these kames, and the sequence of their assembly is an important consideration for any repairs, or in designing replacement windows.

Where window putty needs to be replaced, linseed oil putty is usually the most suitable type. Traditional putty has not changed in character or composition over time, is still widely available, and is easy to apply. Rebates (the grooves into which the glass sits) should be painted prior to inserting new putty and new putty should be left to harden completely (about 28 days) before painting.

Inscriptions found on traditional glass can add to historical interest

Repairing traditional glass

As most types of traditional glass are no longer available apart from salvaged sources, it is preferable to retain original glazing wherever possible. Maintenance and repair work should therefore take every precaution to guard against breakages or loss.

Glass repairs should not be assessed without also considering the surrounding materials such as the timber frame, iron sprigs used to hold the glass in place or stone walls. The condition of these elements may contribute to, or directly cause, problems.

If windows must be dismantled for more comprehensive repairs, it will be necessary to remove glass panes from their frame. An alkali-based paint stripper, or an infrared lamp, specially designed for the purpose, can be used to soften putty and ease its removal. This reduces the risk of damage to glazing during the process. All sprigs and any other fixings should be removed with care before removing the pane from its frame. In some cases the bedding putty, which lies between the glass and the rebate of the window frame, can be more difficult to extract, making it undesirable to remove glass panes unless absolutely necessary.

Small cracks in the corners of panes can be left in-situ unless they pose a danger by admitting air or water. Larger cracks in very valuable glass can be repaired by a specialist using epoxy techniques.

An infrared lamp in use

Replacing traditional glass

Most types of traditional glass are irreplaceable. Reproduction cylinder glass is currently the only readily available form of traditional glass in the UK. Crown and plate glass are no longer produced in the UK. Curved glass can be particularly difficult and costly to replace as it must be made in special moulds, so every effort should be taken to protect it whenever it is liable to be at risk from associated works.

Curved glass can be difficult and expensive to replace

Where traditional panes must be replaced, as close a match as possible should be sourced. Salvaged glass, or cylinder glass may be suitable. Modern reproduction 'antique' glass is also available, and this may provide a closer match to original glazing than float glass. However, reproduction glass will not be able to replicate the appearance of older hand-made glass.

Useful Contacts / Further Reading

Looking after your sash and case windows – A short guide for homeowners ISBN 1-903570-94-8 (Available free from the Historic Scotland Conservation Bureau, address below)

The Historical and Technical Development of the Sash and Case Window in Scotland Research Report ISBN 1-900168-86-3 (Available from the Historic Scotland Conservation Bureau, address below)

The Conservation of Timber Sash and Case Windows - Practitioner Guide 3 ISBN 1-900-168-87-1 (Available from the Historic Scotland Conservation Bureau, address below)

Scotland's Listed Buildings: A Guide to Owners and Occupiers
Visit http://www.historic-scotland.gov.uk/index/publications/ownerspublications.htm

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