

A TECHNICAL ADVICE LEAFLET ABOUT

# Window Repairs

in Historic Buildings in  
South Gloucestershire

This leaflet is one of a series of non-statutory guidance notes produced by South Gloucestershire Council in support of its Local Plan policies relating to historic buildings.



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This leaflet gives general advice on the repair of windows in historic buildings. It is not intended as a comprehensive guide or specification. Each property requires individual consideration. Prior to carrying out any repairs to windows in an historic building contact South Gloucestershire Council's Conservation department for advice and seek independent professional advice.

**Introduction**

Windows make a significant contribution to the character of a building, and the retention and repair of historic windows is important to the maintenance of the fine traditional building stock of South Gloucestershire. Windows are often referred to as the 'eyes' of a historic building. A building with its original windows will have much more interest than one with modern joinery, even if an attempt has been made to match the historic detailing. Careful repair and maintenance will extend the life-span of original features and maintain the character of the area's historic buildings, and help to reinforce local distinctiveness.

Buildings in South Gloucestershire have a wide variety of original window patterns, but most are either side-hung casements or counter-balanced sashes. A mix of casements and sashes may be found on a historic building as it has evolved over time. The historical development of window design and detailing reflects the advances which were continuously being made in glass manufacturing, as well as changing architectural fashions. Subtle variations in pattern, design and detailing all contribute to a richness of character, and it is important to preserve the variety of window patterns, and avoid the urge to unify to one pattern.

*Siston Court – The building has a variety of window patterns, which reflect the various phases of development over the centuries. Seventeenth century transom and mullion windows remain on the first floor, whereas the ground floor windows have been replaced with decorative sash windows in the nineteenth century.*

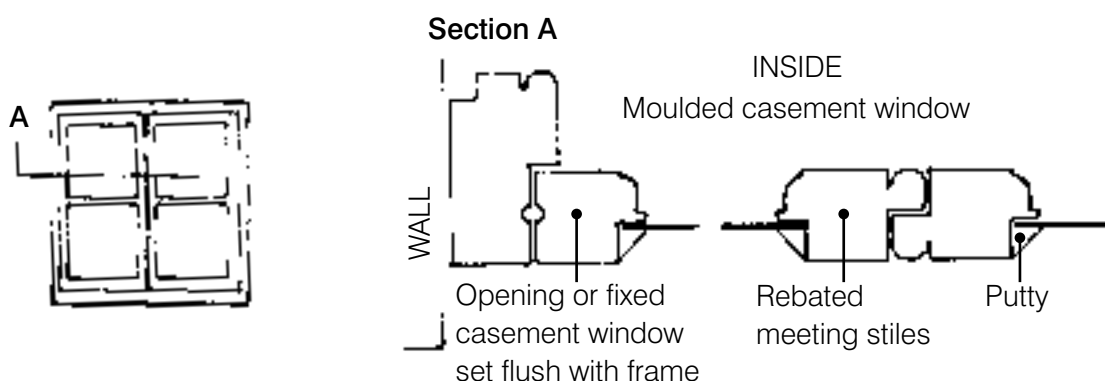


## Casement windows

Medieval houses generally did not have glazed windows. Windows were constructed from stone or timber frames, with dividing mullions. The unglazed openings were closed with either timber shutters or oiled cloth or paper. It was not until the Elizabethan period, when glass became less expensive that glazed windows were installed in ordinary houses. Window openings were divided by vertical posts of stone or timber called mullions, sometimes with additional horizontal dividers called transoms, and both were normally moulded. It was common in the earliest windows for the glass to be fixed directly in to the stone or timber surround. Where there were opening 'lights' these consisted of side hung wrought or cast iron, or timber, casements set into the stone frame. Early casements often had wrought iron, rather than timber, frames, and it was quite common in the earliest windows for only one, or part of one, of the 'lights' to be opening. Early casements survive in many of the historic buildings in the area.

Early windows were generally glazed using small diagonal shaped panes of glass known as 'quarries or quarrels'. These were held in place by lead H-section strips of lead called cames, which were soldered together to form one large glazed window. The fixed lights were installed direct to the masonry or wood and the lead secured with wire fastened to vertical iron bars called 'stanchions' or, if horizontal 'saddle bars'. The diamond shaped glass of the earliest windows continued in common use throughout the seventeenth century, as they were cheaper than square or rectangular glass panes, until changes in manufacturing techniques made these more common from the later seventeenth century. Opening casements demanded more craftsmanship, and consequently there were fewer opening lights than fixed in most early buildings. These were hung on iron pintles fixed to the frame, and have a variety of decorative fixtures and fittings, including handles and catches to hold them shut, and stays to keep them open.

Timber casements of the 18th and 19th centuries, unlike modern windows, were set flush within the frame and were painted not stained. The individual glass panes were divided with narrow moulded glazing bars. Many farm buildings around South Gloucestershire retain these window types.



## Sash windows

Sash windows became fashionable from the mid to late 17th century and predominate in towns like Marshfield, Thornbury and Chipping Sodbury. Sashes work on a system of balanced weights and pulleys to allow the window to be held open at any chosen level. Early sash windows often had only one opening sash, and were set flush with the wall surface, with the sash box (which contained the weight and cord system) exposed.

Following legislation to control spread of fires in the eighteenth century, sashes had to be recessed within the window reveal and the box concealed. Early sash windows have wider glazing bars and small square panes, but by the late 18th century fine glazing bars of about 14-18mm and larger panes of glass, were used, giving a very elegant appearance. Individual panes of glass became generally taller than they were wide, in accordance with the artistic theory of proportion of the 'golden section', however, there was never a standard Georgian window or pane size.



*Early sash window with small panes and wide glazing bars*



*Early nineteenth century plain arched sash window with Gothic style glazing bar decoration.*

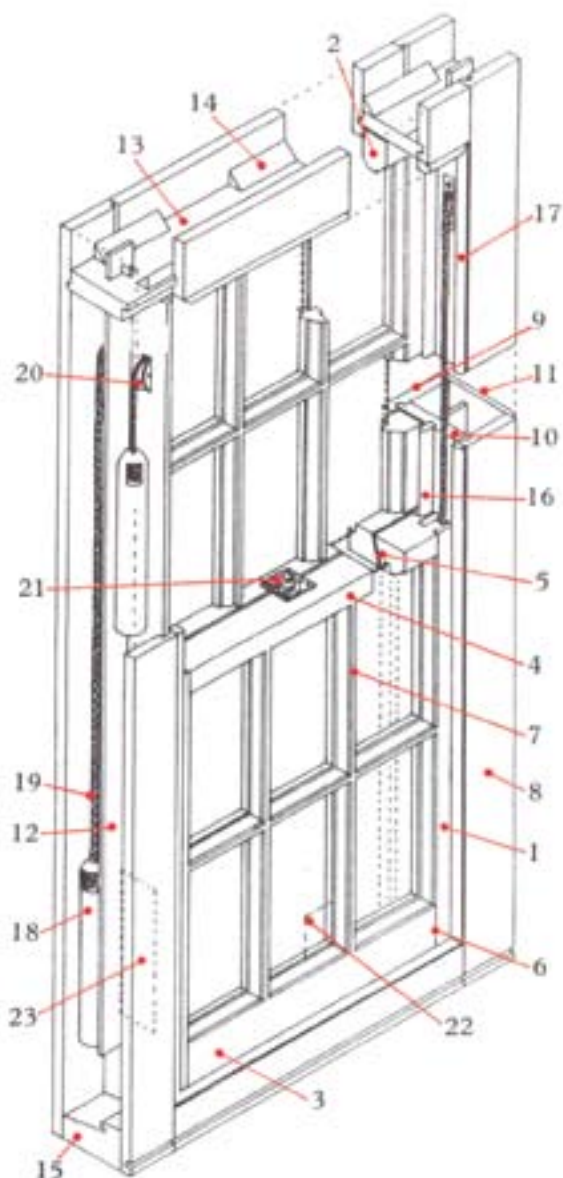


*Sash window with marginal glazing and moulded stone surround on corbels, and hoodmould on decorative brackets.*

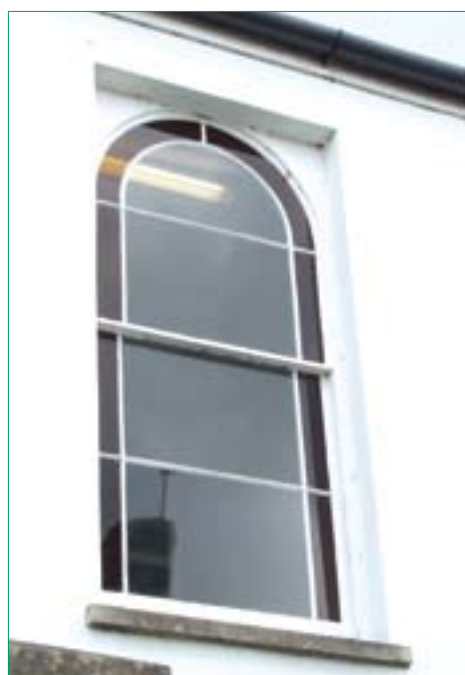


*Victorian sashes with large panes and horns.*

- 1 Vertical stile
- 2 Top rail
- 3 Bottom rail
- 4 Meeting rail
- 5 Bevelled face
- 6 Through mortice and tenon joint
- 7 Glazing bar
- 8 Inner lining
- 9 Outer lining
- 10 Pulley lining
- 11 Back lining
- 12 Parting slip
- 13 Soffit lining
- 14 Triangular fixing block
- 15 Cill
- 16 Parting bead
- 17 Stop bead
- 18 Counter weight
- 19 Sash cord
- 20 Pulley wheel
- 21 Sash fastener
- 22 Single sheet glazing held in place with sprigs and putty
- 23 Access pocket



© English Heritage. Detailed cross sectional diagram through a traditional timber vertical sliding sash window.



As glass manufacturing processes improved during the 19th century, sash windows became more varied and moved away from the small pane sashes to designs with fewer glazing bars and larger panes of glass. The introduction of heavier plate glass made it necessary to strengthen the sashes and as a result 'horns' started appearing on the lower joints of the top sashes.

Sash windows can be a variety of interesting and unusual designs and proportions, incorporating details such as curved glazing bars, marginal lights, and stained glass.

Early nineteenth century plain arched sash window with coloured marginal glazing, typical of this period of window.



*Traditional nineteenth century timber vertical sliding sash window with marginal glazing and slender glazing bars.*

## Repair or replace?

There is often an assumption that old windows will need to be replaced if they are in need of repair and because of this many original windows are lost - and money spent – unnecessarily. An historic building's character depends upon correct proportions, material and detailing as well as the retention of historic fabric. Careful repair ensures that these features can be retained.

A window often can appear to be in worse condition than it actually is, so make sure that the assessment is properly carried out, as detailed below. A specialist joiner, or blacksmith/metal window restorer for metal windows, will generally be able to advise on whether repair is possible, but bear in mind that some companies will prefer to make a new window than undertake time-consuming repairs.

### *Original windows should only be replaced as a last resort*

Historic joinery is usually made from naturally seasoned hard and softwoods, and if the timber is properly maintained, it is likely to outlast a modern replacement window. Historically timber was slow grown and naturally-seasoned, unlike the majority of modern timbers, and producers did not rely upon preservatives and stove-drying.

It is very uncommon for metal windows to be beyond repair. Although they may appear to have corroded, surface rust looks much worse than it is. Metal windows are often capable of restoration either in-situ or can be taken away to a workshop for more extensive repairs.

Modern windows tend to be poorly detailed and heavy in appearance with the 'storm-proofed' opening 'lights' set outside the main frame, protruding cills and no or crudely detailed mouldings. Double-glazing windows are easy to spot due to their external mirror-like reflection and spacer bars. Modern materials such as uPVC, stained hardwoods, 'stick-on' lead or glazing bars only add further to the loss of character of a period building. The difference between traditionally detailed timber casement and sash windows, and modern uPVC alternatives, can be seen in the images on this page.

Unlike traditional timber windows a modern uPVC window is not easily repaired and often has to be totally replaced when it fails. The repair of a timber window will use far less resources than the manufacture of a new window, and is, therefore, also far more sustainable.

The starting point for any repair or alteration work to an historic building is to seek professional advice. It is also very important to record and photograph original windows before they are altered or removed. Where windows with leaded lights are being removed for repair, it may be prudent to make a rubbing of the leaded lights in order to record their arrangement.

The installation of a new window in a listed building will require listed building consent.



*Modern top hung uPVC window with stick-on glazing bars and trickle vent, and 'storm proof' design.*

## Permissions required

Listed Building Consent is needed for alterations to listed buildings which affect their character as buildings of special architectural or historic interest and will be required for the replacement of a window, although not usually its repair. Remember that it takes at least 8 weeks to get Listed Building Consent, and it is a criminal offence to carry out unauthorised works to a listed building.

Most repairs to an existing window may be undertaken without Consent, but it is prudent to seek clarification from the Council's Conservation Officers that the works do not need consent before undertaking extensive repairs. Written details of the scope of the repairs may be required by the Conservation Officer in order for them to make this assessment.

**Planning Permission** may also be required for the replacement of windows in buildings which do not have permitted development rights, if the building is within a conservation area.

**Building Regulations** - for which a fee is payable - may be required if you are replacing windows.

*Always make sure that the necessary permissions are in place - and confirmed in writing - before starting work on site.*

## Repair of Metal Windows

### Window failure

Metal windows are nearly always capable of repair. Common problems include distortion, excessive layers of paint, failed hinges and fittings and rust.

Historic wrought iron and cast iron windows will not be galvanised, and therefore the risk of corrosion if exposed to water is common. Where corrosion occurs, the metal expands, and this can lead to cracked glass and split masonry at fixing points. However, if regularly maintained and protected against exposure to water through a suitable coating, metal windows can last for centuries.

If corrosion has occurred but the metal developed a stable protective surface, action will not be necessary. However, if corrosion continues it will be necessary to remove the rust, making sure that the underlying metal and glass is not damaged.

### Assessment of condition

Unless the repairs required are obviously very minor or limited to redecoration or restoration of the window furniture or surrounding window frames, the glazing and old putty will need to be removed from the metal frames, and then paint removed in order that a full inspection can be carried out. If the glass is historic it will need to be carefully salvaged for reinstatement. Putty softening is a specialist job, and should be carried out with great care (for further details see page 12) It should also be remembered however that entirely removing all coatings from the metal can destroy evidence of historic paint. Some paint layers should therefore be left behind where rust has not occurred.



## Repairs

Light rust can be removed by hand with wire brushes or hand held grinders, however, more severely corroded metal windows may need to be cleaned with acid pickling or air-borne abrasives. For acid pickling, phosphoric acid is preferable as it forms a protective phosphate layer on the surface. Wrought iron may also be cleaned by hot flame cleaning, however, cast iron cannot because of its brittle nature. These methods of cleaning should only ever be carried out by a skilled professional who is experienced in this work.

It should be remembered when rubbing down old paint to beware of hazardous dust. Red lead was often used historically as a metal window primer but is extremely toxic, and waste material should be disposed of appropriately.

Once the metal windows have been cleaned and all rust removed, an inspection will identify if any sections have corroded to the point that they are unable to provide adequate structural support. If this has occurred it is frequently the bottom rail which will have been exposed to greater amounts of water than other areas of the window. Defective areas of wrought iron can be cut out and new sections of the same profile welded on. Cast iron can rarely be repaired in this way and can instead be cold metal stitched. All new sections should match the original exactly.

Where distortion of a metal frame has occurred which has led to a window not closing, it can usually be eased back square, and draught proofing may also be fitted.

## Priming and re-decorating

As soon as the metal window has been cleaned it should be treated with a protective coating as surface rust will begin to appear immediately. One of the best alternatives to red lead (which is highly toxic) is a flame sprayed zinc primer to BS 5493. The windows should then be painted an historically appropriate colour. Alkyd resin paints can be suitable for metal windows, and Micaceous iron oxide paints offer greater durability but are limited in colour range so may need to be painted over.

## Refitting the window

Glass should be fitted in to their frames using either a traditional putty, or some modern mastics and butyls can be acceptable if painted over. Where metal windows or their timber sub frames are fitted direct to masonry they should be bedded in a lime putty mortar, and then pointed in lime putty mortar.

For advice on glass, draught protection, ventilation and secondary glazing refer to the sections under these headings on the following pages.



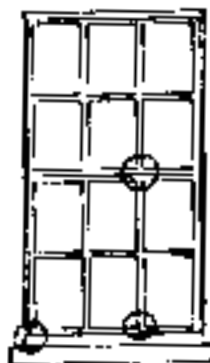


## Repair of Timber Windows

### Window failure

Timber windows tend to fail in particular places:

- (a) where the bottom rail meets the cill
- (b) in the joints of the bottom rail
- (c) in the joints of the bottom rail of a top sash
- (d) in the joints of the glazing bars with the bottom rail
- (e) the cill



The most common point of failure is at the junction between the cill and the frame at the bottom rail, where water tends to collect. If water can get through cracks in the paint, or a gap in the joint, it can be drawn up the timber by capillary action, and can cause quite extensive decay. For this reason, the upper sashes often survive better than the lower, although internal condensation can cause the same problems.

### Assessment of condition

The timber should be tested with a bradawl, key, or small knife, to see how far the rotten wood extends. In older windows with well-seasoned timber, the rot will often only affect the face of the cill, the bottom rail or the lower sections of the stiles. In this case the sound wood can be felt beneath the surface and the knife will not go deep into the timber.

If the bottom rail has dropped, do not assume that the whole window has failed. This is often caused by water rotting out the tenon holding the rail in place and can be remedied through careful repair. As a rule of thumb, if the rot is only in the bottom rail and lower sections of the stiles the window can normally be repaired rather than replaced. If substantial sections of the window stiles have failed then repair will be more difficult.

### Paint removal

Sometimes paint will have been used to cover over areas of timber decay and some paint removal may be necessary before repairs can start. Test areas should be attempted first. The lead content of some historic paints means that wet-abrasion is advisable and that breathing equipment should be used. But the original lead-based paints also provide a useful seasoning coat for the timber and it is better to leave these coats in place where possible.

### Localised repairs

Where small areas of repair are necessary, it is normally possible to make good using timber pieces and flexible filler. Traditional fillers are made using linseed oil and whiting although resin-based fillers are also now available.

The long-term performance of resins is untested, but they may be useful for small repairs by keeping intervention to a minimum. Hard fillers should not be used, as they can crack at the junction with the timber, allowing water into the area of repair.

## Major repairs

Window repairs require specialist joinery skills. Repairs are usually dependent upon splicing new sections of timber in to the old, keeping as close a match between timber types as possible to minimise differential movement. A leaflet produced by the Society for the Protection of Ancient Buildings (S.P.A.B.) gives a comprehensive guide to the most common splicing joints in use. Contact details are given at the end of this leaflet.



**Before Repairs**

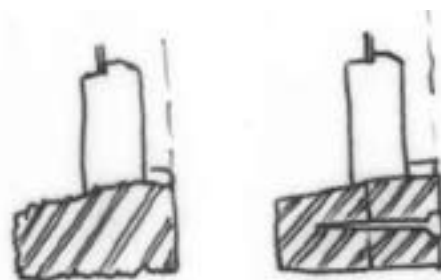


**After Repairs**

## Cills

Most window cills in the area are oak and it is unusual for the timber to decay beyond more than a surface area. The timber can usually be cut back from the surface to allow for a new section to be let in, although the form of the splicing piece will depend upon the location and extent of decay.

Where the water penetration has been more extensive and the ends of cills have failed, it is usually necessary to cut the whole cill out and replace it. This is a difficult operation. To avoid cutting out the external stone cill as well, substantial work may be required internally, which may have a harmful effect on the building.



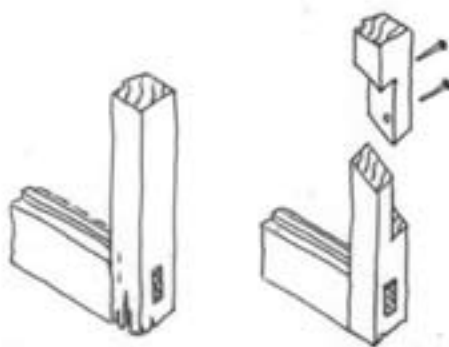
*Surface timber of cill cut away and new timber piece sliced on.*

## Mullions

Timber mullions will often perform a structural function in casement windows & the opening should be supported during repair works. Because the mullion needs to maintain the structural integrity of the window opening it may be necessary to replace the whole mullion rather than attempt to splice in a new section of timber.

## Lower stiles

Sashes can be removed from the box by releasing the staff bead and then the parting beads, ensuring that the weights do not drop to the bottom of the sash box. Each sash can then be removed for repairs. By drilling out the wedges and releasing the tenons of the sash, the stiles can be eased away to allow new sections of timber to be spliced in. This is difficult work and it is at this point that the glazing and glazing bars are most vulnerable.

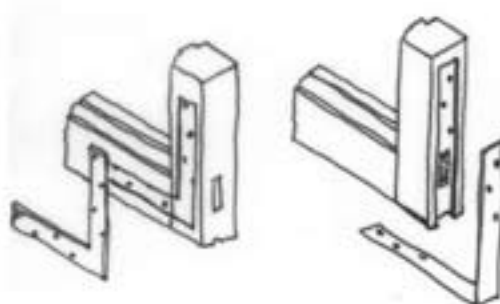


*A new section is spliced on and fixed with the joint face given minimal exposure*

Timber for new sections should match the original as closely as possible, with joints turned away from the surface. The internal faces of the joints should be painted. Flexible mastic may be used for the joint between old and new timber pieces if there is particular exposure to water.

## Bottom rail

If the bottom rail has dropped it may be possible to secure it by use of L-plates attached to the sash or casement surface. If the decay is extensive it may be necessary to replace the bottom rail and splice in new sections to the stiles. The new bottom rail should be profiled to match the original exactly. Remember to use rust-resistant fixings.



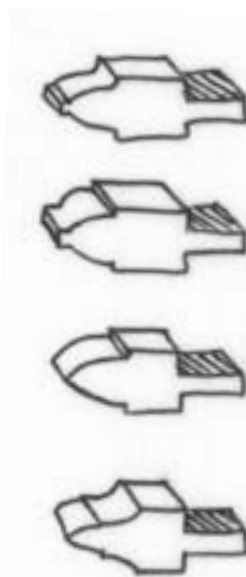
## Sash boxes

Failure will usually be limited to the lower section of the sash box unless there is a more serious problem with long-term saturation and dry or wet rot. Sections of new timber can be set in to the linings – again, illustrated details of this can be found in the S.P.A.B. leaflet – but remember to avoid disturbing the movement of the sash weights and cords. When repairing sashes it is also sensible to take the opportunity to renew the sash cords.

## Glazing bars

It is possible to replace sections of original glazing bars, by cutting and splicing, but this is difficult. If there is any breakage some specialist joiners can run new glazing bars to match the exact profiles of the original. Glazing bars are important to dating a building and vary enormously

Glazing bars vary in design through the area. They can be as fine as 14 or 16mm with profiles like lamb's tongue, ovolo or ogee. It is very important to the building's character and appearance to match the glazing bar details exactly, and not to accept a 25mm standard ogee bar to replace a much finer one, for example.



## Glass (history)

Historic glass is rare and vulnerable, and it is perhaps the most overlooked feature of a historic building. Historic glass has a quality that sparkles and refracts light, distorting the reflection unlike modern float glass, which gives a flat blank appearance. In domestic buildings the earliest surviving glass will most likely be 'crown' glass, very fine panes cut from a flat disc with its distinctive radiating ripples and spreading bubbles known as 'seeds'. Later 19th century 'cylinder', (also known as 'muff' or 'broad' glass) took over from crown glass. This was produced by forming a long cylinder which was reheated, cut and rolled out flat to achieve a sheet of glass. Like crown glass it still retained some imperfections but in general it did provide a flatter, more even pane.

Some buildings retain their original stained glass - particularly later 19th century or early 20th century porch or stair windows - with the glass held in place by lead cames.



By the 20th century drawn sheet glass was being produced and provided a thicker more even pane, but even this had some movement within the glass. Since the 1950's glass has been produced by floating molten glass over liquid tin. It is a truly flat, functional glass without any of the imperfections of previous glass types. It gives a dead and blank reflection, which is visually incongruous in historic settings. The consistent evenness, thickness and greater weight of the panes can impact upon historic window frames requiring additional weights for sashes and wider glazing bars. Historic glass which refracts light is preferable to modern float glass and should be retained.

## Glass (repair)

It is always difficult to salvage old glazing because old putty becomes so hard. Putty softening is a specialist job usually done using an infra-red lamp or a soldering iron but it is essential if old glass survives in a window.

The repair of historic stained glass should also only ever be carried out by specialist stained glass conservators. The Council's Conservation Officers may be able to provide lists of local specialist contractors.

Remember to protect all historic glazing when works are undertaken on-site in order to ensure that there are no needless breakages.

Modern detergents and commercial cleaning products should not be used to clean historic glass or leaded lights as this can lead to a discolouration. Glass can be cleaned with a mixture of distilled water and methylated spirits, applied with a soft cloth and, once dried, buffed off with a chamois leather. A neutral soap can be used to clean organic growth off leaded lights.

## Window furniture

Original window furniture is rare and it is important that it is maintained and conserved. Where original window furniture survives it should be set aside and reused. This is particularly important for casement windows where hinges and catches often survive.

### Window catches

The window catch was used to secure the window closed. There are three types of window catch used on early casement windows, the spring catch, the turnbuckle catch and the cockspur catch.

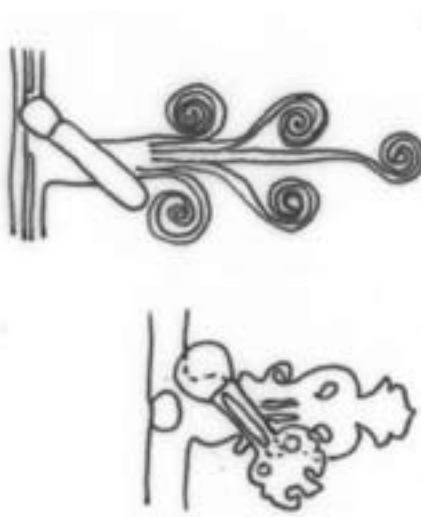
#### The spring catch

The spring catch usually had a decorative base plate which was fixed to the iron casement, on which was a horizontal bar with bent end which could pivot up and be received by a small iron bar which was set in to the window frame in order to secure the window. A variant on this design was a vertical spring catch known as the Woodman catch.



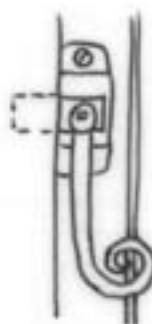
#### The Turnbuckle catch

The turnbuckle catch was used commonly on casement windows in Gloucestershire. A decorative baseplate is attached to the metal casement in the same way, and the attached turnbuckle can swivel and fasten either behind the fixed metal frame of the window if the surround is stone, or if the surround is timber the metal window frame is usually omitted and the catch clipped behind a projecting metal plate. The design of the baseplate can be highly decorative, and in South Gloucestershire the double scroll and open heart design are both common.



#### The Cockspur catch

This is the most simple of the window catches, and most similar in mechanism to many modern window catches, in essence being a small latch with a handle, which can be latched in to either a groove in the timber window surround or mullion.



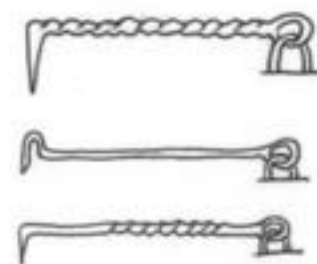
## Handles

Handles were usually attached to the lower rail of the opening casement in order that the window could be opened and shut without putting added pressure on the catch. The most common form of handles were the tulip leaf, the spiral, and the knob.



## Stays

Stays were horizontal bars with a hooked end which were used to keep the window in a fixed position when open. Stays were commonly attached to the outside cill and would either hook into a hole in the handle or an iron loop next to the handle. Another form of stay is the quadrant stay, which is a flat iron bar in a quarter circle, which has a wedged profile, and usually a decorative scroll at the end. This allows for the casement to be held open once it reaches the point of the bar where it can go no further.



This only allowed the window to be held fully open, however this was overcome by splitting the bar along the horizontal in order that it acted like a spring, holding the casement at varying positions.



## Draught protection

Various systems for enhancing the draught and noise resistance of single-glazed sash and casement windows are now available. Most use seals &/or brushes integrated into the frames or set between the sashes, and some can even provide hinges which release the sashes to allow for cleaning.

Freeing and re-using painted up shutters will provide increased protection from draughts, as will thick curtains.

In the case of metal casement windows, where draught is entering through the frame and the casement this may be due to distortion of the window. A specialist restorer will be able to ease the window back square. If the draught is still coming through, the gaps can be filled with putty or a non-corrosive silicone foam rubber sealant can be applied between the gap. It will be necessary to lacquer the adjoining casement edges which do not require sealant, to prevent the sealant joining the casement and the frame.

## Double & secondary glazing

It can be very difficult to achieve double glazing in historic buildings without compromising their character. This is often because the weight of the glass means that glazing bars, stiles and rails have to be very thick, and out of character with the building. Double glazing also 'deadens' reflections. Listed Building Consent is needed to change from single to double glazing in a window.

Secondary glazing may be acceptable, unless historic fabric such as shutters or architraves will be affected. Seek advice on this from the Council's Conservation Officers before making an application as Listed Building Consent may be needed for secondary glazing. If the building is not listed, secondary glazing can provide a useful alternative to double glazing providing both temperature and sound insulation.



## Ventilation

Traditional buildings rely on good ventilation and the ability for moisture to be transferred by evaporation through the wall surface and via working flues. It is advisable to provide lockable window stays to allow windows to be fixed ajar in order to provide background ventilation without harm to the character of the building. Trickle vents should never be incorporated into historic windows.



## Paint/Finishes

Maintenance is important to the long-term performance of metal and timber window units. Cracks in paint, for example, will allow water in which can lead to decay, so make sure that condensation is cleared off the windows and that the cill is throwing water away from the window.

Timber windows should be painted and not stained, unless the window is oak. In this case limewash may be used, but paint should not be applied.

## Replacement windows

If the existing historic windows are beyond repair and replacement windows are the only option, the replacement windows should be an exact replica of the original in material, design and detail. Replacement sash windows must be traditional weighted sliding sash, and not spiral or sprung balanced. Casement windows should be traditional flush casements, as shown in the technical drawing on page 3, as opposed to 'storm proof' units. uPVC and aluminium are not suitable alternatives to timber or iron windows.

## Further advice

1. The Council's Conservation Team can be contacted at [conservation@southglos.gov.uk](mailto:conservation@southglos.gov.uk)
2. The Society for the Protection of Ancient Buildings Technical Pamphlet no.13 'The Repair of Wood Windows' gives excellent, practical guidance on window repairs, including sample designs for spliced joints. Tel: 0207 377 1644 or online at [www.spab.org.uk](http://www.spab.org.uk)
3. Historic England publishes a number of free technical advisory sheets which can be downloaded from [www.historicengland.org.uk](http://www.historicengland.org.uk)
4. Linda Hall 'Early Casement Window Furniture'
5. The online Building Conservation Directory provides specifiers of works to historic buildings, which can be a useful starting point in the search for appropriate products and services, although there are likely to be other local companies which may be suitable. The directory can be accessed online at [www.buildingconservation.com](http://www.buildingconservation.com)



This information can be made available in other languages, in large print, Braille or on audio tape.

Please phone 01454 868004 if you need any of these or any other help to access Council services.

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