Thermal upgrading of existing windows.

IS IT:

- [ ] *Product*
- [X] *Technology*
- [ ] *Equipment*

APPLICABLE FOR:

- [ ] *Restoration*
- [X] *Rehabilitation*
- [ ] *New Construction*

APPLICABLE ON:

- [ ] *1. Foundations and underground structures*
- [ ] *2. Vertical structures*
- [ ] *3. Horizontal structures and vertical connections*
- [ ] *4. Roof and terraces*
- [ ] *5. Façade and building envelope*
- [X] *6. Finishes and completion elements*
- [ ] *7. Integrated services*
- [ ] *8. General strategies for building recovery*

Related companies: *No companies; university research; structural study.*

DESCRIPTION

Improvement of thermal performance of existing windows by upgrading them or replacing them with new ones.

In the case of original windows where the frame cannot be replaced, single glazed panels may be replaced by double glazed panels and simple measures may improve airtightness. In other cases, e.g., buildings of the modern movement, higher performance window frames and glazing may be used. The existing window-frames are replaced with new thermal-break aluminum window-frames with low-e glazing. Parts of the glazing may not be operable in order to reduce infiltration and thermal losses.

WHY TO USE

The thermal upgrade of windows is imperative for improving the thermal behavior of the building envelope. Excessive heat gain and heat loss through windows provoke the use of energy use for heating and cooling purposes. Where a window is clearly 'leaky' (with gaps around the frame and rails where sash windows meet) research has shown that repairing and draught proofing it can reduce air infiltration by over 80%.

Furthermore, improving the thermal resistance of the frame and replacing the original single glazed panels with double glazed ones is a significant measure towards energy efficiency.

HOW TO USE AND APPLY

In the case of upgrading windows retaining the existing frames, double glazed panels may be inserted replacing the single glazed ones. Whether the frame is metal or timber, the approach to re-glazing is much the same. The rebate must be cleaned, dusted and given a thin coat of primer, before new linseed-oil bedding putty is applied for wood windows and metal casement putty for metal frames. The glass pane can then be pressed into place and fastened with fixings that replicate the original system. Finally, more putty is used to seal the joint between the frame and the glass.

Insulated glass units (IGUs) rely on multiple layers of glass to reduce heat transfer, but the glass sheets are positioned much closer than in secondary glazing. In order to reduce heat transfer, the gap must be either evacuated or filled with an inert gas such as argon, krypton, or xenon to reduce the rate of heat transmission. Low-emissivity coatings are sometimes applied to the inner pane of glass to further reduce thermal transmission.

Simple measures may also have a dramatic effect on conductive transfer through the window: e.g., the installation of thermal roller blinds or shutters in the interior. Secondary glazing is especially effective if made from glass with a low-emissivity coating reducing heat loss. The best results are achieved by multiple systems – shutters or secondary glazing combined with curtains or blinds.

In multi-paned windows, secondary glazing will generally be more thermally efficient than replacing the existing glass with double glazing due to thermal bridging through the frame and glazing bars.

When existing single glazed windows can be replaced with new double-glazed ones, special care should be taken so that the new windows are similar to the original ones in terms of profiles and aesthetic appearance.

TECHNICAL CHARACTERISTICS

A thermal break is a non-metallic resin or plastic material installed in the metallic window frame that physically separates the interior part of the window from the exterior part. In this way the pathway for heat energy to be transferred or conducted through the window frame is "thermally broken".

The most common wiper seals are brush pile seals. These are capable of sealing a range of gap sizes and adapt to fill uneven gaps well. Some include a thin plastic fin or fins in the center to make a better seal. Other wiper seals are made of silicone or thermoplastic strips where a heavy-duty seal is needed. V-strip wiper seals are also available and can be used between the stiles and boxes of sliding sashes.

RECOMMENDATIONS AND OTHER INFORMATION

Repair, draught-proofing or secondary glazing is likely to be more cost-effective than replacement with double glazing. In multi-paned windows, double glazing will generally be less efficient than secondary glazing, due to the thermal bridging through the frame and glazing bars, particularly for metal frames.

Special care must be taken during the installation of new windows in order to ensure water and air tightness. In addition, special care should be taken for the aesthetic appearance of new windows that replace old ones in order to preserve the original character of the building.

In the case of inserting a double-glazed panel in an existing window frame special caution should be taken in preserving the original appearance of the window by avoiding any potential changes that would alter its architectural character.

EXAMPLES

In the case study of the Alexandros Demetriou Building, located in Nicosia (restoration architects: A. Michael, V. Ierides) [See database IO4], which forms part of the modern heritage of Cyprus, a continuous barrier (thermal break) between the inside and outside window frames was inserted to prevent conductive thermal energy loss. [See attached images at the end of this sheet].

REFERENCES / SOURCES AND LITERATURE

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WEBSITE OF THE COMPANY

N/A

IMAGES AND CAPTIONS

Fig.1-2: Replacement of window single glazed panels with double glazed ones in a traditional urban house.
©Architect: Antonia Theodosiou, photo: Antonia Theodosiou

Fig.2: Simulation of the tower of Alexandros Demetriou, after conservation and replacement of windows with new ones of advanced thermal properties. *©Architects: Ierides and Michael, photos: Ierides and Michaeil [See database IO4]*

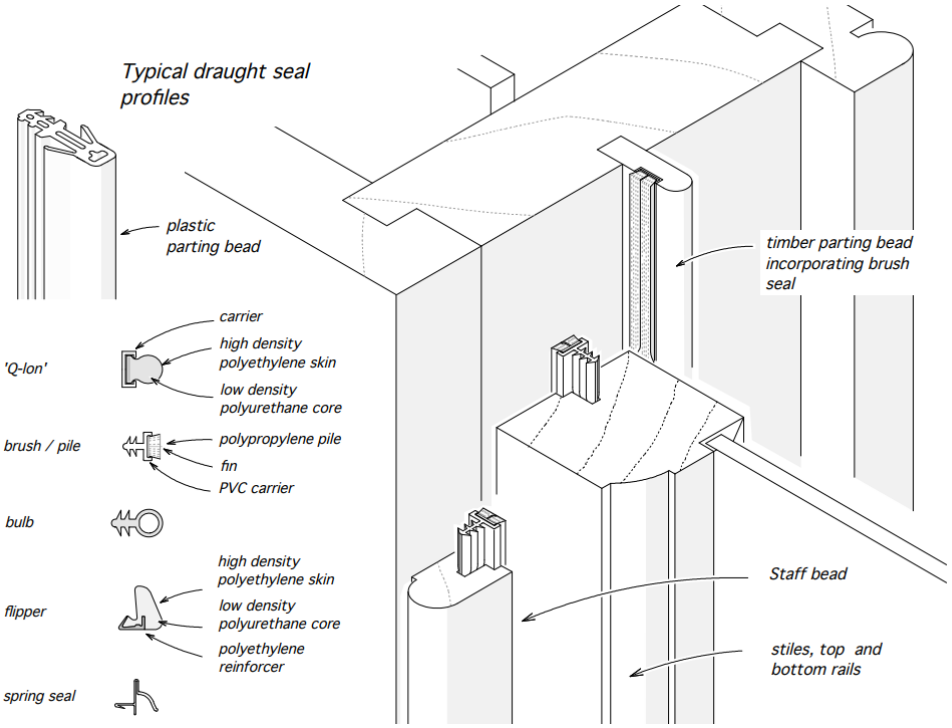

Fig.4: Example of draughtproofing for sash windows. *©Historic England, 2017, HEAG039*

Fig.5: Slim profile insulated glass units (IGU) that comprises a 3mm outer glazing, 3mm gas filled cavity and 4mm Low-E inner glazing giving a total thickness of 10mm. *© Historic England, 2017, HEAG039*

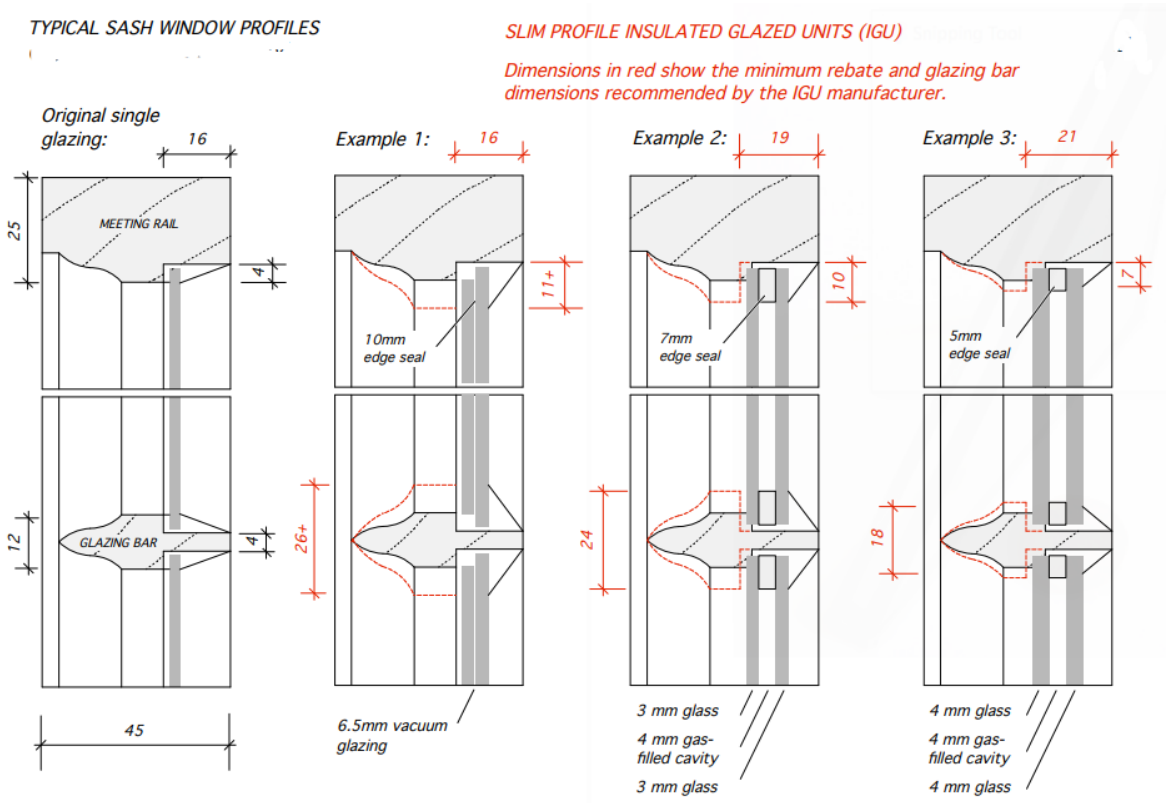

Fig.6: Different thicknesses of insulated glass units currently available when applied to a window with slim glazing bars (Dimensions shown are in millimeters). *©Historic England, 2017, HEAG039*