SPECIFICATION AND GUIDELINES FOR THE SELECTION AND APPLICATION OF FASTENERS FOR THE MANUFACTURE OF PLASTICS WINDOWS AND DOORS

Ref: W363/1: February 2001
Foreword

These guidelines have been prepared by the Technical Committee of the British Plastics Federation Windows Group in conjunction with manufacturers and suppliers of fasteners. It is intended to help the fabricator to understand the importance of correct fastener selection in relation to the performance of the finished product. In addition these guidelines will help to assess the performance of the fastener.

Compliance with these guidelines does not of itself confer immunity from legal obligations.
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1. **Scope**

This document gives specifications and guidelines for the selection and application of threaded fasteners and blind rivets as applied to windows and doors manufactured from GRP or PVC-U profiles.

For any applications which are outside the scope of this document, reference should be made to the fastener manufacturer or supplier.

2. **Definitions**

For the purpose of this document the definitions given in BS 6100 generally apply together with the following:

- **profile**
  length of pultruded GRP or extruded PVC-U material of defined cross section.

- **reinforcement**
  additional member, usually metallic, added to profiles.

- **hardware**
  fittings attached to the window or door that are used to operate or secure it.

- **window screw**
  commonly used expression for a threaded fastener suitable for use in fabricating plastics windows and doors, of various design configurations to suit specific applications.

  - **self piercing/self tapping screw**
    purpose designed threaded fastener complete with an integral piercing point suitable for drilling into the profile only.

  - **self drilling/self tapping screw**
    purpose designed threaded fastener complete with an integral drill point suitable for drilling through the profile into steel and aluminium and producing the correct size tapping hole.

  - **repair screw**
    purpose designed threaded fastener for replacing a stripped smaller screw into either profile or reinforcement.

  - **pre-drilled screw**
    purpose designed threaded fastener, without a drilling or piercing point, typically used for insertion into a pre-drilled hole in the profile only.

  - **friction stay screw**
    purpose designed threaded fastener suitable for fastening variable geometry friction stay hinges to reinforced or un-reinforced profiles.
2.4.6 bi-metallic screw
purpose designed threaded fastener, usually of austenitic stainless steel, with a carbon steel drill point tip for drilling into metal reinforcement.

2.5 blind rivet
hollow rivet body pre-assembled with a headed pin or mandrel. The pin or mandrel is designed to fracture at a predetermined load during the setting operation when the materials to be fastened have been drawn closely together to give a tight joint.

2.6 bi-metallic corrosion
accelerated corrosion caused by reaction between dissimilar metals, especially in a humid environment.

2.7 corrosion
gradual degradation or decay of a component, usually indicated by red or white deposit.

2.7.1 white rust
white rust usually indicates corrosion of the protective coating.

2.7.2 red rust
red rust usually indicates corrosion of the base metal.

NOTE. It should be established that this is not contamination from other components.

3. Design

NOTE. A purpose designed fastener can fail in use if used in an application for which it is not designed. If in doubt, consult your supplier for advice.

3.1 Screws
Screw types with thread forms and head details designed to suit specific applications are shown in annexes 2 and 3, with typical dimensions.

When screws are used to attach variable geometry friction stay hinges, purpose designed screws shall be used.

3.2 Blind rivets
Blind rivets found in the window and door industry are generally of the following types:

A: Standard open end
B: Multi-grip open end
C: Peel type
   (i) 90° countersunk
   (ii) dome head
D: Standard sealed type

Rivet types are shown in annex 4.

NOTE. Certain rivets, after application, leave holes through their centres which could permit the ingress of water. Where such ingress would be into an un-drained chamber or onto steel reinforcement, then these holes should be sealed by, for instance, the use of proprietary plugs supplied by the manufacturer.
4. Material and finish

All fasteners will be subject to atmospheric attack of varying degree depending on application and geographical location.

To minimise corrosion arising from electrolytic reaction, metals which are in contact with each other shall only be used in combinations which have ratings 0 or 1 for atmospheric environments given in PD 6484 or are otherwise protected to prevent electrolytic reaction. Guidance on minimising bi-metallic corrosion can be obtained from PD 6484 or the fastener supplier.

All fasteners shall comply with the material requirements for hardware and fixings contained within:

- BS 7412 – “Specification for plastics windows made from PVC-U extruded hollow profiles.”, or

Details of common fastener materials that are available for the attachment of hardware are given in annex 1.

Fasteners used for the attachment of hardware shall have a corrosion resistance in excess of 240 h in neutral salt spray test to BS 7479.

Additional corrosion protection is required for fasteners used to attach stainless steel hardware. They shall be protected against corrosion to provide in excess of 500 h in neutral salt spray test to BS 7479.

The tests are to be conducted in the manner in which the fastener is to be used and undertaken by a laboratory accredited for this test by the United Kingdom Accreditation Service (UKAS).

NOTE. It should be noted that there is no direct correlation between salt-spray testing and real-time natural environment exposure.

5. Fastener selection

5.1 General
Fasteners must not be used in any application not recommended by the manufacturer and/or the supplier. Fasteners should be selected in accordance with table 4 for screws and table 5 for rivets.

For details of fastener types, refer to section 3, and annexes 2 and 3.

5.2 Screws (see table 5.1)
Where screws go into reinforcement, the length of the screw must be such that the screw projects through the reinforcement by at least two threads.

5.3 Rivets (see table 5.2)
The diameter of blind rivets shall be selected to suit the existing holes in the hardware for the window or door.

NOTE. In order to achieve the required tensile and shear strength, it is important that the correct material diameter and length is selected. The length of the blind rivet must have the grip capability of the combined thickness of hardware, profile and reinforcement where applicable.

5.4 Security
When windows and doors are designed to be of enhanced burglary resistance, it is vital that every component, down to the last screw and rivet, mirrors those that were used on the specimen tested for burglary resistance.

6. Quality Control
Guidance of quality control is given in annex 6.
ANNEX 1 – Common Fastener Materials

Carbon steel
- Needs protection for 500 h resistance to base metal corrosion (red rust).
- Can self-drill into aluminium and galvanised steel reinforcement.
- Not recommended for attachment of stainless steel fittings because of the risk of reduced corrosion resistance due to electrolytic reaction between dissimilar metals.
- Magnetic.

Martensitic
- Un-modified martensite needs protection for 500 h resistance to base metal corrosion (red rust).
- Can be modified to achieve in excess of 1000 h resistance to base metal corrosion (red rust).
- Can self-drill into aluminium and galvanised steel reinforcement.
- Suitable for the attachment of stainless steel fittings.
- Magnetic.

Austenitic
- Does not need any additional protection as it currently offers the highest corrosion resistance.
- Suitable for the attachment of stainless steel fittings.
- Non-magnetic.

Bi-metallic
- Austenitic stainless steel with Carbon steel tip to self-drill into steel reinforcement
- Only the austenitic portion of the fastener shall be in contact with the window system hardware and reinforcement. If the carbon steel portion is in contact with the reinforcement it requires additional protection for 500 h resistance to base metal corrosion (red rust).
- Suitable for the attachment of stainless steel fittings
- Non-magnetic
### ANNEX 2 - Screw types and Typical Dimensions

<table>
<thead>
<tr>
<th>Screw type</th>
<th>Design</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-drilled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td><img src="pre_drilled_A.png" alt="Image" /></td>
<td>Single thread with high thread flanks, fully threaded, approximately 3.5 - 4.5 mm diameter</td>
</tr>
<tr>
<td>B</td>
<td><img src="pre_drilled_B.png" alt="Image" /></td>
<td>Twin thread, one high one low, fully threaded, approximately 3.5 - 4.5 mm diameter</td>
</tr>
<tr>
<td>Self drilling/ self starting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td><img src="self_drilling_C.png" alt="Image" /></td>
<td>Machine thread with self drilling point approximately 4 mm diameter</td>
</tr>
<tr>
<td>D</td>
<td><img src="self_drilling_D.png" alt="Image" /></td>
<td>Self-tapping single or twin thread with self drilling point 3.5 - 4.2 mm diameter</td>
</tr>
<tr>
<td>E(i)</td>
<td><img src="self_drilling_E(i).png" alt="Image" /></td>
<td>Spaced thread form with self drilling point approximately 4.5 mm diameter</td>
</tr>
<tr>
<td>E(ii)</td>
<td><img src="self_drilling_E(ii).png" alt="Image" /></td>
<td>Twin thread, one high one low, with self drilling point 3.5 - 4.2 mm diameter</td>
</tr>
<tr>
<td>Self piercing/ self tapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td><img src="self_piercing_F.png" alt="Image" /></td>
<td>High thread, single or twin threaded with self piercing point 4.5 - 4.8 mm diameter</td>
</tr>
<tr>
<td>G(i)</td>
<td><img src="self_piercing_G(i).png" alt="Image" /></td>
<td>Single thread with high thread flanks, fully threaded, self piercing point approximately 4.3 mm diameter</td>
</tr>
<tr>
<td>G(ii)</td>
<td><img src="self_piercing_G(ii).png" alt="Image" /></td>
<td>Twin thread, one high one low, spoon or self piercing point 3.5 - 4.2 mm diameter</td>
</tr>
<tr>
<td>Repair screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H(i)</td>
<td><img src="repair_H(i).png" alt="Image" /></td>
<td>Twin thread, one high one low, spoon or self piercing point approximately 4.8 mm diameter</td>
</tr>
<tr>
<td>H(ii)</td>
<td><img src="repair_H(ii).png" alt="Image" /></td>
<td>Single thread with high thread flanks, fully threaded, self piercing point approximately 4.8 mm diameter</td>
</tr>
<tr>
<td>Mechanical joint screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td><img src="mechanical_joint_J.png" alt="Image" /></td>
<td>Type AB self-tapping thread and point 4.8 - 5.5 mm, spaced portion to facilitate clamping action</td>
</tr>
</tbody>
</table>

**NOTE.** This table is not intended to be exhaustive and cover every screw available
### ANNEX 3 - Screw head forms

<table>
<thead>
<tr>
<th>Head detail</th>
<th>Typical design</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countersunk</td>
<td></td>
<td>Designed for use in securing countersunk furniture and can be used for reinforcement retainment</td>
</tr>
<tr>
<td>Double (raised) countersunk</td>
<td></td>
<td>Designed for use in securing countersunk furniture to the profile</td>
</tr>
<tr>
<td>Pan head</td>
<td></td>
<td>Designed for use in securing non-countersunk furniture and for some reinforcement retainment applications</td>
</tr>
<tr>
<td>Special pan head</td>
<td></td>
<td>Special head form designed for use in securing friction stays</td>
</tr>
<tr>
<td>Self countersinking head</td>
<td></td>
<td>A specially designed countersunk head complete with underhead features such as ribs or facets to form a mating countersink into profile sections for reinforcement applications</td>
</tr>
<tr>
<td>Bugle head</td>
<td></td>
<td>Typically used in securing sub-sills to outer frames</td>
</tr>
</tbody>
</table>

**NOTE.** The drive detail or recess into the head of the screw is generally of Phillips, Pozi-drive or similar form.

**NOTE.** This table is not intended to be exhaustive and cover every type of screw head available.

### ANNEX 4 - Rivet types

<table>
<thead>
<tr>
<th>Rivet type</th>
<th>Unset</th>
<th>Set</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td>Standard open-end</td>
</tr>
<tr>
<td>B</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td>Multi-grip open-end</td>
</tr>
<tr>
<td>C(i)</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td>Peel type 90° countersunk</td>
</tr>
<tr>
<td>C(ii)</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td>Peel-type domed head</td>
</tr>
<tr>
<td>D</td>
<td><img src="image9.png" alt="Image" /></td>
<td><img src="image10.png" alt="Image" /></td>
<td>Standard sealed type</td>
</tr>
</tbody>
</table>
ANNEX 5 - Attachment

General
It is important to ensure that any fastener is applied at 90° to the material at all times.

Screws
It is important to use the correct torque setting and screwdriver bit for each application. If the screwdriver bit does not engage fully into the recess, or if the torque setting on the screwdriver is too high, damage to any corrosion protection layer may occur with the resulting increase in likelihood of corrosion.

Where holes have to be pre-drilled into the profile it is essential that the hole is of the correct diameter otherwise the fastener will not be effective.

Torque setting
The use of excessive torque may lead to stripping and failure of the fastener. The torque setting on the screwdriver should be the minimum required to effect a complete fastening. At initial set up this should be established through trial and error on scrap material gradually building up to the required torque level.

Screwdriver speed
Screws are generally applied using an air driven screwdriver. Where such tools are used, an optimum consistent drive speed under load of 1500 - 2000 rpm is recommended.

For applications into profile only, a lower speed of 500 rpm may be preferable.

Rivets
Blind rivets are installed using manually operated or pneumatic/hydraulic blind rivet setting tools.

It is important that the instructions and maintenance procedures supplied with the setting tool are strictly adhered to and the necessary precautions followed.

It is also important to utilise the correct nosepiece to suit the blind rivets being used.

Where holes have to be pre-drilled into the profile it is essential that the hole is of the correct diameter otherwise the fastener will not be effective.
### Table 5.1 Screws for typical fabrication applications

<table>
<thead>
<tr>
<th>Screw code</th>
<th>Into Profile only</th>
<th>Through profile into steel to 2mm or aluminium 2.5mm</th>
<th>Through profile into steel to 2 - 3mm or aluminium 2.5 - 3.5mm</th>
<th>Through profile into steel to 3 – 3.5mm or aluminium 3.5 to 4mm</th>
<th>Through profile into mechanical joint block</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes*</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>B</td>
<td>Yes*</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
<td>Yes**</td>
<td>Yes**</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>No</td>
<td>Yes**</td>
<td>Yes**</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>E(i),(ii)</td>
<td>PVC-U</td>
<td>Yes**</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>G(i),(ii)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>H(i),(ii)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes**</td>
</tr>
</tbody>
</table>

NOTE. * requires that the profile be pre-drilled.

NOTE. ** requires that the GRP profile be pre-drilled.

NOTE. For applications outside the scope of this table always consult your screw supplier.

NOTE. The thread on repair screws should be compatible with the thread already cut into the profile otherwise strip-out of the threadform will occur. Repair screws should be inserted by hand.

### Table 5.2 Blind rivets for typical fabrication applications

<table>
<thead>
<tr>
<th>Rivet type</th>
<th>Into profile only</th>
<th>Through profile into steel or aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PVC-U</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C(i), (ii)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>D</td>
<td>PVC-U</td>
<td>Yes</td>
</tr>
</tbody>
</table>
ANNEX 6 - Hints on Quality control

Screws

In all applications every screw fastener should be capable of withstanding an applied torque of 1.0 Nm without strip-out of the thread form occurring. This should be measured using a torque screwdriver and should form part of the standard quality control procedures.

If the screw head is damaged during application, then the screw should be removed, discarded and replaced.

In order to ensure that the thread formed during the original application is engaged, this replacement should be carried out by hand.

Blind rivets

Visual inspection of the set work will give evidence of a poor quality riveted joint. The following are typical examples of poor quality rivet applications:

(i) The broken-off part of the mandrel in the set rivet body protrudes beyond the flange of the rivet.

(ii) The assembly is loose indicating that the rivet has not given a sufficiently high clamping force, or the flange of the rivet does not sit flat in the hardware, indicating that the rivet was not applied in a plane normal to the hardware.

Where sealing of hollow rivets is necessary, check that the sealing operation has been carried out.

Good Working Practice

- In certain instances, one piece of hardware may need more than one type of screw, e.g. a friction stay hinge may require a screw into profile only on one hole and screws through the profile into reinforcement on others. Alternatively, the same piece of hardware may be used in both reinforced and unreinforced applications. In such cases it may be convenient to have two air screwdrivers set at the appropriate torques.

- For air driven tools, check that the correct air pressure is maintained.
• Check airlines, couplings and tools for leakage.

• Clearly mark or label separate driving tools that have been set at different torque settings to ensure that the correct torque is used in each application.

• Label bench mounted fastener containers with both fastener type and applications. Keep fastener containers well separated to avoid mis-matching.

• Check for wear of screwdriver bits and replace when worn or damaged.

• When vents are removed to assist in installation, the screws should be re-inserted by hand to ensure correct engagement of threads and to avoid overtightening. A careful note should be made of exactly where each screw was removed from as there may be different screws used in certain applications and it could be important that they are replaced in their original position.

• The fabricator may find it useful to have a series of diagrams available at various work stations to illustrate how the fasteners must be located into the reinforcement and hardware.

• Peel type rivets should not be used in applications where they may foul on the profile wall and so possibly reduce their effectiveness.