

## **Aluminium Windows**

### **Introduction**

Aluminium windows have become popular in new developments and as replacement of steel windows in existing buildings. Recent incidents of failure of aluminium windows, however, have aroused safety concern as falling of a dislodged casement from a height can be catastrophic in densely populated areas.

2. Building (Construction) Regulation 3 stipulates that materials used in any building works or street works shall be of a suitable nature and quality for the purposes for which they are used; adequately mixed or prepared; and applied, used or fixed so as to perform adequately the functions for which they are designed. Obviously such requirement is applicable to aluminium windows to be installed in any buildings. This practice note specifies requirements on the design and installation of aluminium windows and on the prevention of water seepage. Compliance with the design and installation requirements of aluminium windows described in para. 3 to 7 of this PNAP will be accepted by the Building Authority (BA) as meeting the provisions of Building (Construction) Regulation 3. Any deviations from these requirements have to be separately substantiated for acceptance.

### **Design and Installation Requirements**

3. For large windows falling within the criteria stipulated in Practice Note for Authorized Persons and Registered Structural Engineers (PNAP) 239, their structural design should be submitted to the BA for approval in accordance with the requirements laid down therein. For other windows, Authorized Persons (AP) and Registered Structural Engineers (RSE) should ensure that they are properly designed and installed to meet the performance requirements and the safety standards in the Building (Construction) Regulations whilst Registered Contractors should have experienced and skilled supervisors and workers as well as suitable quality assurance procedures in place to ensure the proper installation of the windows. Some relevant standards, specifications and codes of practice on materials, design and installation of aluminium windows are given in Appendix A for reference and information. AP and RSE could also make reference to other national or international standards.

4. Window members, transoms and mullions together with the glass panes should be of adequate size and strength taking into consideration the location, height and orientation of the windows. Window frames should be securely and rigidly fixed in place to window openings in walls. Where fixing lugs are adopted, they shall be of stainless steel or hot dip galvanized steel having a minimum material thickness of 1.5mm and be placed at 300mm centres maximum. Where a spacing greater than 300mm is proposed, the AP/RSE should satisfy that the performance of the windows including structural stability and waterproofing would not be compromised. Adequate site supervision should be provided to check that all the fixing lugs are properly fixed.

5. All structural members of a window section shall have a minimum aluminium thickness of 2mm and the depth of the mullion section shall not be less than 38mm. Particular attention shall be paid to the fixing details of the hinges. All hinges and fastening mechanisms adopted in the installation shall be able to withstand the positive and negative pressures due to the designed wind conditions when the window is closed and shall be of adequate size and strength commensurate with the size of the window.

6. To ensure the strength and rigidity of side hung casement windows as well as the safety of the occupants operating the casements, the maximum width of the sash should be 700mm.

7. Where 4-bar hinges are adopted, reference should be made to the Guidelines on Fixing of 4-bar Hinges at Appendix B.

### **Cleaning**

8. Corrosive agent should not be used for the cleaning of external walls and windows of buildings upon the completion of building works unless it is thoroughly washed with clean water immediately after application.

### **Window Stay**

9. Suitably designed window stay can minimize the effect of strong wind on the durability of hinges and casements.

### **Water Seepage**

10. Besides safety consideration, water leakage from windows poses undue nuisance to the occupants. AP and RSE are reminded to bear this in mind when detailing window design and contractors are reminded that poor workmanship is a major cause of the problem. Reference may be made to the *Guidelines on Prevention of Water Seepage in New Buildings* issued by the Buildings Department in March 2005.

11. In order to ensure the durability of windows, it is recommended that the top member of a window frame should have a built-in projecting fin with a drip nose to prevent water ingress into the window frame/casement so as to minimize the possibility of corrosion due to accumulation of water. A typical section of the projecting fin is at Appendix C.

### **Water Tightness Test**

12. It is advisable to perform field water test on the installed aluminium window to ensure water tightness and quality of the completed window unit. Some national standard testing methods are given in Appendix D for reference.

**General**

13. A similar practice note has been issued to Registered Contractors.



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Building Authority

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paras 6, 8, 9, 11 and Appendix C & D  
added

Index under : Aluminium Windows  
Windows  
Water Seepage

**Standards and Codes of Practice  
On Aluminium Window in Building Works**

The various standards and codes of practice on aluminium window in building works as listed below are intended to provide reference information for the purpose of specifying materials and design for aluminium windows and the lists are not exhaustive.

BS EN ISO 1461	: Hot dip galvanizing
BS 952: Part 1	: Glass for glazing
BS 1161	: Aluminium alloy sections for structural purposes
BS 1449: Part 2	: Stainless and heat resisting steel plate, sheet and strip
BS 1470	: Aluminium plate, sheet and strip
BS 1471	: Aluminium drawn tube
BS 1474	: Aluminium bars and extrusions
BS 1615	: Anodic oxidation coatings on aluminium and its alloys
BS 3111	: Stainless steel fasteners
BS 3987	: Anodic oxidation coatings on wrought aluminium
BS 4479	: Recommendations for the design of metal articles that are to be coated
BS 4873	: Aluminium alloy windows
BS 5889	: Sealants
BS 6105	: Corrosion-resistant stainless steel fasteners
BS 6262	: Code of Practice for glazing for buildings
BS 6375: Part 1 and Part 2	: Performance of windows
BS 8118	: Structural use of aluminium
CP 3012	: Cleaning and preparation of metal surfaces
PD 6484	: Commentary on corrosion at bimetallic contacts and its alleviation

2. AP and RSE may also make reference to other national or international standards and specifications.

### Guidelines on Fixing of 4-bar Hinges

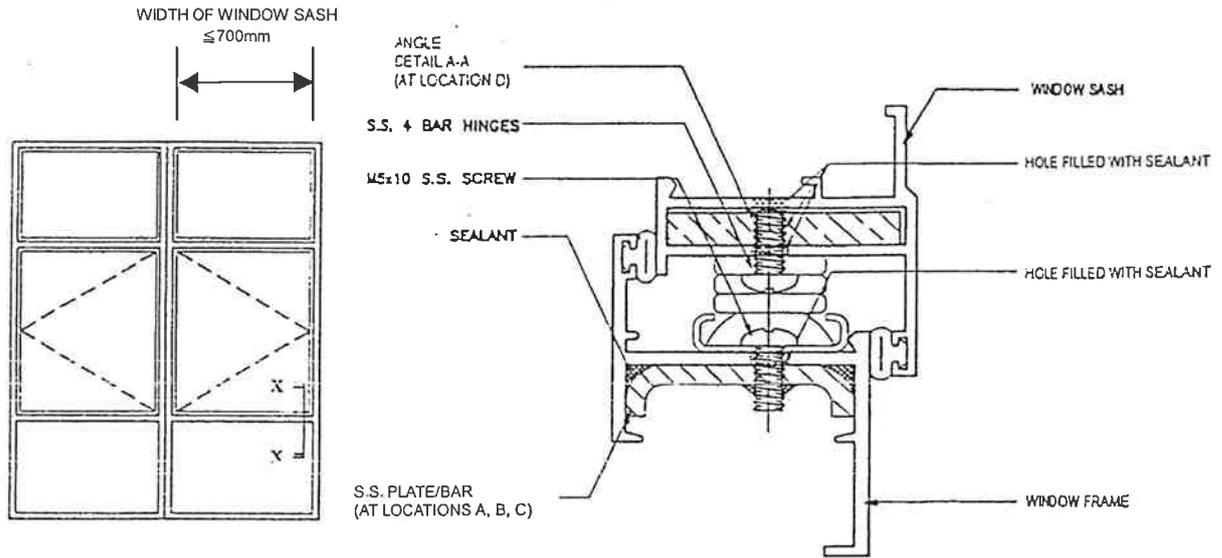
4-bar hinges shall be manufactured from stainless steel with adjustable friction shoe, and all stainless steel bars of the hinge shall have a minimum thickness of 2.5mm. For better corrosion resistance, stainless steel rivets/screws shall be used for the fixing of hinges and aluminium rivets shall not be used as they tend to corrode. At least 3 Nos. of 4.8mm diameter stainless steel rivets or 5mm diameter stainless steel screws shall be used to fix each bottom and top bars of the hinge to the window frame and the openable sash.

2. As stainless steel hinges and rivets/screws are used in aluminium window installation, due consideration and measures should be taken to prevent contact between dissimilar metals.

3. To provide sufficient anchorage for the stainless steel rivet or screw to fasten the hinge to the window frame and the openable sash, a positive mechanical fixing, for example by inserting a stainless steel or hot dip galvanized steel plate or bar/angle of not less than 3mm thick inside the section to provide sufficient threads for the screw(s) shall be adopted. A typical example of this arrangement is at Annex I. As an alternative, the window sections for fixing the hinge may be thickened locally to not less than 5mm. A typical example is at Annex II. When insertion of an extra piece of stainless steel or hot dip galvanized steel bar/angle inside the section or local thickening to 5mm is not adopted, the thickness of aluminium sections for fixing the 4-bar hinge shall be substantiated by calculations that it could provide sufficient anchorage for the stainless steel rivet or screw.

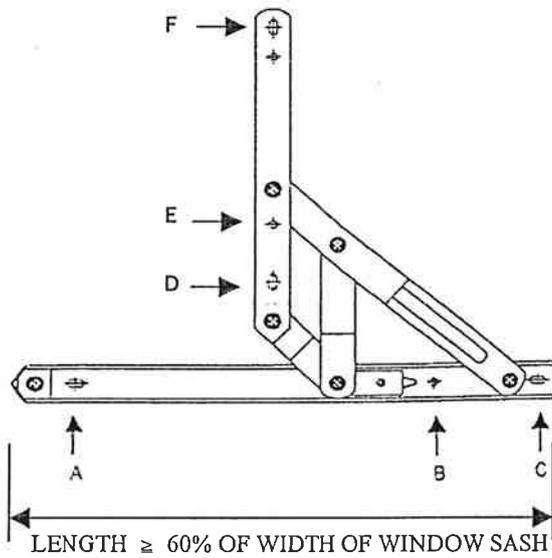
4. The length of the 4-bar hinge should be at least 60% of the width of the side hung casement window.

**Annex I to Appendix B**  
**(PNAP 248)**  
**(APP-116)**



**ELEVATION**

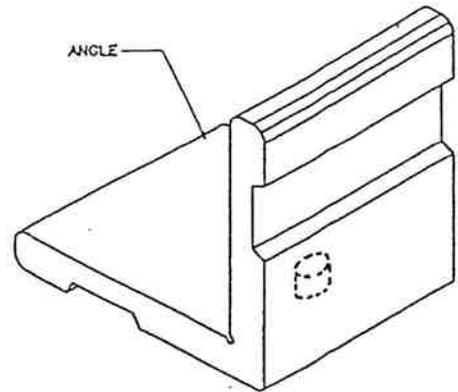
**SECTION X-X**  
**SIDE HUNG WINDOW WITH S.S. PLATE/BAR AND**  
**ALUMINIUM ANGLE INSERTED FOR FIXING SCREWS**



A, B, C, E, F – LOCATION FOR SCREW TO WINDOW FRAME/SASH  
 (LOCAL THICKENING BY S.S. PLATE/BAR)

D – LOCATION FOR SCREW TO WINDOW SASH  
 (LOCAL THICKENING BY ANGLE)

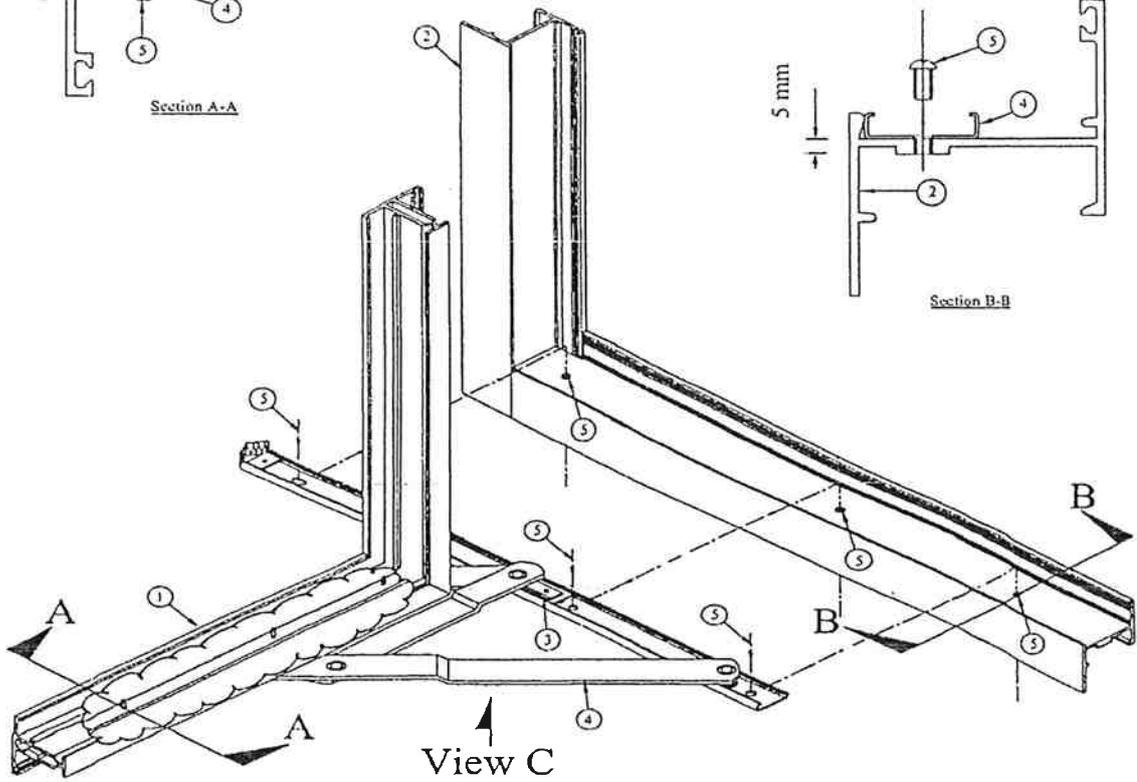
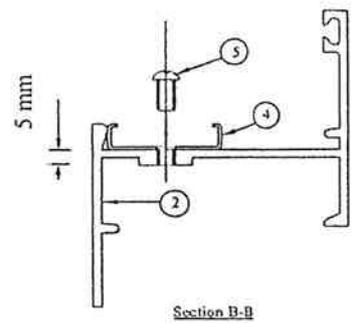
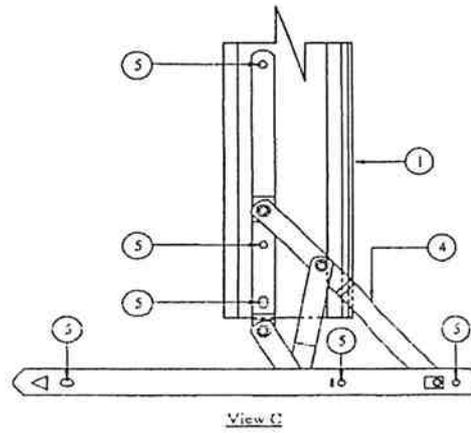
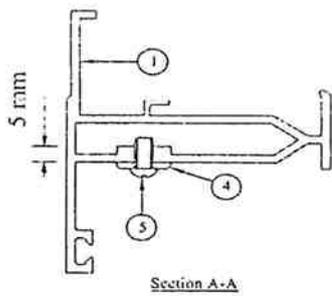
**S.S. 4-BAR HINGE**



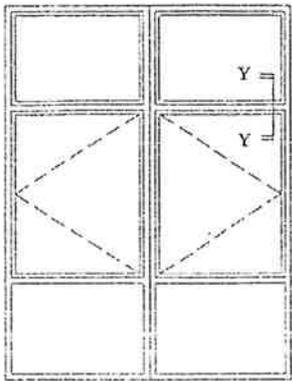
**DETAIL A-A**

**Annex II to Appendix B**  
**(PNAP 248)**  
**(APP-116)**

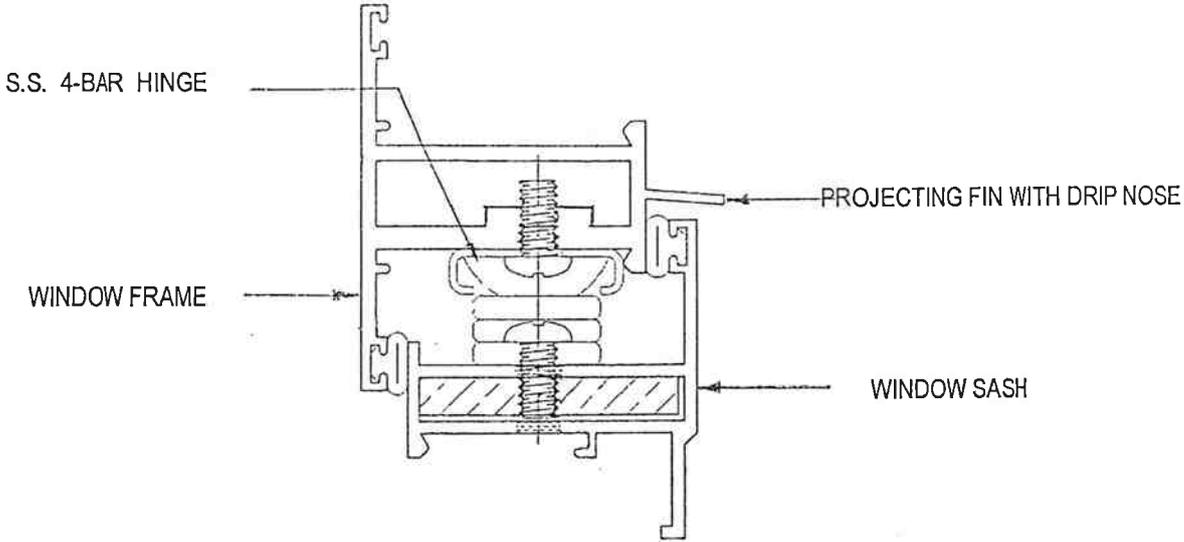
ITEM	DESCRIPTION	MATERIAL
1	WINDOW SASH	ALUMINIUM
2	WINDOW FRAME	ALUMINIUM
3	BRASS PLATE	BRASS
4	4-BAR HINGE	STAINLESS STEEL
5	M5 x 16mm PAN HEAD MACHINE SCREW, PITCH 0.8mm	STAINLESS STEEL



**WINDOW FIXING**



**ELEVATION**



**SECTION Y-Y  
TOP MEMBER OF WINDOW FRAME  
WITH BUILT-IN PROJECTING FIN**

**Appendix D**  
**(PNAP 248)**  
**(APP-116)**

<b>Standard</b>	<b>Description</b>
ASTM E330	Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
ASTM E331	Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
ASTM E547	Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential
AAMA 501.1	Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration using Dynamic Pressure
AAMA 501.2	Specification for Field Check of Metal Shop Fronts, Curtain Walls and Sloped Glazing Systems for Water Leakage
AAMA 501.3	Specifications for Field Check of Water and Air Leakage Through Installed Exterior Windows, Curtain Walls and Doors by Uniform Air Pressure Difference.