



uPVC Window

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

Name and Address of Certificate Holder:

**M/s Sintex Industries Ltd.
Kalol (N. Gujarat) – 382721
Gandhinagar, India**

Performance Appraisal
Certificate No.

PAC No **1004-C/2011**
Issue No. **01**
Date of Issue: **29.06.2011**



Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
Government of India
Core 5A, First Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Tel: +91-11-2463 8096, 2463 8097; Fax: +91-11-2464 2849
E-mail: bmtpc@del2.vsnl.net.in Web Site: <http://www.bmtpc.org>

PERFORMANCE APPRAISAL CERTIFICATE

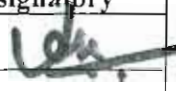
FOR

uPVC WINDOW

ISSUED TO

M/s SINTEX INDUSTRIES LTD

STATUS OF PAC 1004-C/2011

S.No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1.	01	29-06-11	29-06-13	--	--	28-06-13		

PAC No.1004-C/2011

Issue No. 01

Date of issue 29-06-2011

CONTENTS

PART1 CERTIFICATION.....	3
1.1 Certificate Holder	3
1.2 Description of Product	3
1.3 Assessment	3
1.4 Use of the Product and its Limitations	4
1.5 Conditions of Certification	5
1.6 Certification	5
PART II CERTIFICATE HOLDER'S TECHNICAL SPECIFICATION	6
II.1 General	6
II.2 Specifications for the product	6
II.3 Selection and Installation	8
II.4 Critical details	9
II.5 Maintenance requirements	10
II.6 Skills/ training needed for installation	10
II.7 Warranties provided by the PAC holder	10
II.8 Service provided by the PAC holder	10
PART III BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE	10
III.1 Basis of Assessment	10
III.2 Manufacturing Process	11
III.3 Factory Inspection	11
III.4 Laboratory tests done for assessment	11
III.5 Inspection of the product	13
PART IV STANDARD CONDITIONS	15
PART V LIST OF STANDARDS AND CODES USED IN ASSESSMENT.....	17
CERTIFICATION	18
PART VI ABBREVIATIONS	19
PERFORMANCE APPRAISAL CERTIFICATION SCHEME – A BRIEF.....	20
ANNEXURE	21

PART I CERTIFICATION

I.1 CERTIFICATE HOLDER: M/s Sintex Industries Ltd.
Kalol (N. Gujarat) – 382721
Gandhinagar, India
Phone No. 02764-253500
Fax No. 02764-253800

I.2 DESCRIPTION OF PRODUCT

I.2.1 Name of Product – uPVC Window

I.2.2 Brief Description – uPVC Windows are made out from different types of uPVC extruded hollow multi chamber profile sections. These are designed to provide the fabricator with total manufacturing flexibility for complete choice of window style & sizes. The window system consists of three basic profiles i.e. Outer frame, Shutter frame & beading profiles. Corners are heat welded in the conventional manner.

I.3 ASSESSMENT

I.3.1 Scope of Assessment – Suitability of uPVC Windows for internal & external applications in residential, commercial, schools, hospitals and factory buildings etc.

Types: These windows may be of following types:

- i) Suprima Series Openable Single Glazing Windows
- ii) Suprima Series Sliding Single Glazing Windows
- iii) Suprima Series Openable Double Glazing Windows
- iv) Suprima Series Sliding Double Glazing Windows
- v) Ultima Series Openable Windows
- vi) Ultima Series Sliding Windows
- vii) Energy Saving Windows with Elastomeric Gaskets

Sizes: These windows are available in sizes of 0.91m x 1.82m (3.0ft to 6.0 ft) X 0.61m x 1.82/2.31m (2.0 ft to 6.0/7.0 ft)

I.3.2 Scope of Inspection – Scope of inspection included verification of production, performance and testing facilities at the factory & competence of technical personnel, status of quality assurance and testing in the factory.

I.3.3 Assessment Summary

I.3.3.1 The assessment was done through inspection, laboratory testing & equipment at the factory, conducting the tests in the laboratory and field observations of the windows.

I.3.3.2 Manufacturing & test facilities – Manufacturing and test facilities available in the factory were found to be suitable & adequate to produce windows as per the desired specifications. The PAC holder maintains testing laboratory with necessary equipment for quality assurance.

I.3.3.3 Competence of Technical Personnel – Persons involved in testing were found to be well conversant with testing procedures required for the quality control of the product.

I.3.3.4 Inspection in Actual use – Twelve windows installed at the factory and at Satyamev Jayate School in Ahmedabad during the year 2009 were inspected. They showed no distress & were found to be functioning satisfactorily.

I.3.3.5 Quality Assurance Procedure – The firm follows a defined Quality Assurance System for production of uPVC Windows (See Quality Assurance Plan attached as Annexure).

I.4 TESTS OF THE WINDOWS & THEIR LIMITATIONS

I.4.1 Design Data – The data & information provided in Part II of this Certificate shall be used for selection of the type & size etc. of these windows.

I.4.2 Storage & handling at the user end before installation

I.4.2.1 Storage – At the user's end the windows shall be stacked along the wall or hard surface so that they may not fall & break when taken out for installation. They shall be stacked flat on bearer strips properly covered to exclude moisture inside a shed / building.

I.4.2.2 Handling – uPVC Windows shall be handled carefully during storage or installation in order to prevent occurrence of damages to the faces & edges. The windows shall not be dragged along a stack or any surface but shall be lifted clear of a stack or any surface on which they are stored.

I.4.3 Tests of the windows

I.4.3.1 The samples of the windows tested as per the relevant Standards listed in Part V of this Certificate have met the requirements namely Visual inspection & Overall dimensions, Corner strength, Softening point, Heat reversion, Heat ageing, Resistance to impact, Modulus of elasticity, Impact strength, Air permeability, Water tightness, Safety, Wind resistance, Sound insulation etc. in accordance with the test reports of CIPET, Ahmedabad and NPL, New Delhi which led to the conclusion that they can be used as windows in residential buildings, offices, malls, schools, hospitals and factories etc. provided they are installed with appropriate frame and hardware in accordance with manufacturer's instructions & guidelines.

I.5 CONDITIONS OF CERTIFICATION

I.5.1 Technical conditions –Raw materials and the finished uPVC windows shall conform to the requirement given in Clause II--2.2.

I.5.2 Quality Assurance – The Certificate Holder shall implement & maintain a quality assurance system in accordance with Scheme of Quality Assurance (SQA) given in the Annexure attached with this Certificate.

I.5.3 Handling of User Complaints

I.5.3.1 The Certificate holder shall provide quick redressal to consumer/user complaints proved reasonable & genuine and within the conditions of warranty provided by him to customer/purchaser.

I.5.3.2 The Certificate holder shall implement the procedure included in the SQA. As part of PACS Certification he shall maintain data on such complaints with a view to assess the complaint satisfaction and suitable preventive measures taken.

I.6 CERTIFICATION

I.6.1 On the basis of assessment given in Part III of this Certificate & subject to the conditions of Certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part I & II of this Certificate, uPVC Windows covered by this Certificate conforms to the requirement of the specifications.

PART II CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

II.1 GENERAL

II.1.1 The PAC holder shall manufacture the windows in accordance with requirements specified in the relevant Standards and Clause II-2.3.

II.2 SPECIFICATIONS FOR THE PRODUCT

II.2.1 Specifications – The specifications for raw materials and the windows shall be as per performance criteria when tested in accordance with various Standards listed Part V of this Certificate.

II.2.2 Technical Specifications

II.2.2.1 Raw Materials /Components

1. uPVC Raw Material – Shall conform to IS 10151 and of grade PVC 67GER01

(i)	Inherent Viscosity	0.91 to 0.95
(ii)	Heat Loss	0.30 % (w/w) max.
(iii)	Porosity (DOP)	0.21 to 0.29 ml/gm
(iv)	App. Bulk density	0.51 to 0.59 gm/cc
(v)	Residual VCM	2 PPM max.

2. Glass – Shall conform to BS 952 (Part1):1978 and of thickness 4mm & 5mm

3. Rubber Gasket (EPDM)

(i)	Polymer	EPDM
(ii)	Tensile Strength	60 Kg/cm ² min.
(iii)	Elongation at break	200% min.
(iv)	Hardness	70 Shores "A" min.

II.2.2.2 Construction & workmanship – uPVC windows are made out of extruded uPVC multi-chamber hollow profiles with isolated drainage and reinforced with galvanized steel. The corners & joints shall be mitre cut and fusion welded. The outer frame of these windows shall be made out of extruded uPVC sections having overall dimensions of 60x60mm and maximum wall thickness of 2.3mm + 0.3mm with usual process variation and provided with special galvanized steel reinforcement for optimum structural strength having wall thickness of 1mm +0.1mm. The fixed mullion shall be made out of extruded uPVC section having overall dimensions of 60x76mm and maximum wall thickness of 2.3mm + 0.3mm with usual process variation. These

are also reinforced with special galvanized steel reinforcement. The shutter frame shall be made out of 60x78mm having wall thickness of 2.3mm + 0.3mm with usual process variation and provided with special G.I. Steel reinforcement. The clip on beading shall be used for provision of single & double glazing. Mitre cut glazing beads shall be provided for better aesthetics. EPDM weather & glazing gasket shall be provided for frame & shutter.

All the hardware is made of material resistant to atmospheric corrosion. Windows are provided with various security devices like single/multi point locking system, friction stays or butt hinges with stays, powder coated cock spur handles/multi-purpose lock handles as per the requirement. The window surfaces shall be covered with self adhesive protective tape to avoid dirt & scratches on them. Windows shall be installed by using plumb both vertically from inner & outer sides and horizontally by spirit level and are fitted by using special fasteners.

II.2.2.3 Design – These windows shall be designed as per requirement of the manufacture.

II.2.3 Performance characteristics of uPVC Windows – These windows shall meet the following performance criteria when tested in accordance with the relevant Indian and company Standards:

S.No	Performance Characteristics	Test Method	Acceptable Criteria
1.	Heat Reversion Test	Appendix A	Shall not be greater than 2%
2.	Heat Ageing at 150°C	Appendix B	No bubble or crack shall appear
3.	Resistance to Impact by falling mass	Appendix C	Shall not puncture or damage
4.	Colour Fastness	Appendix D	Shall be min. 4 on grey scale
5.	Impact Strength after exposure to artificial ageing	Appendix E	Shall be 70% of original value
6.	Corner Strength Test	Appendix F	Welded joint shall not fracture
7.	Air Permeability	Appendix G	Shall be within the Air flow when Set pressures are applied
8.	Water Tightness Test	Appendix H	There shall not be any water penetration from any location
9.	Wind Resistance		Shall be within deflections when

	(i) Deformation Test (ii) Repeated pressure Test (iii) Safety Test	Appendix I	set pressures are applied There shall not be any functional defect Shall not observe any permanent deflection & functional defect
10.	Mechanical strength Tests (i) Fastening and unfastening Test (ii) Warping Test (iii) Racking Test (iv) Torsion Test (v) Diagonal Deformation Test (vi) Test for locking, opening or restricted opening devices	ISO 8248:1985 Clause No. 7.1.1 Clause 7.2.1 Clause 7.2.2 Clause 7.2.3 Clause 7.2.4 Clause 7.3	Shall be possible to operate the windows effectively with ease and with minimum force Windows shall not exhibit any damage on its structure/frame or result in loosening on its hinges Opening/restricted opening devices as fitted shall effectively and efficiently function on the windows
11.	Charpy Impact Strength	IS 13360 (Part 5, Sec 5):1996	Shall be min. 6 KJ/mm ²
12.	Sound Insulation Test	IS 9901 (Part 3):1981	Adequate diffusion shall exist

II.2.4 Marking – Besides the identification mark of the PAC holder as manufacturer and any other marking he may use, the type & batch number shall be marked suitably on each window.

II.2.4.1 The location of locking system shall also be marked.

II.2.5 Packing details of finished windows for delivery -- Windows shall be packed by using 2 Ply corrugated roll of size 30'' & 40'' as well as self adhesive tape roll to ensure safe & defect free delivery to customers. Suitable labels shall be pasted on the windows before packing.

II.3 SELECTION & INSTALLATION

II.3.1 The user/installer shall be responsible for proper selection at site as per manufacturer's instructions. In this regard PAC holder shall provide proper guidance in writing.

- II.3.2 Choosing type** – The type of window shall be chosen depending upon the requirement of the user. They shall be installed with appropriated frame and hardware in accordance with good engineering practice.
- II.3.3 Choosing size** – Appropriate size of the window shall be chosen to suit the wall opening or conversely the window opening shall be sized to the shutter size as per the requirement of the user.
- II.3.4 Handling** – Windows shall be carefully handled during storage or installation in order to prevent occurrences of damage to the faces & edges. The window shall not be dragged along a stack or any surface, but shall be lifted clear of a stock or any surface on which they are stored.
- II.3.5 Installation of Window & glass**
- II.3.5.1** Put the window in the cavity of the wall. Check plumb level of window from both sides (vertically & horizontally) so that there is no gap between the wall and the sides
- II.3.5.2** After marking the position of screws, take out the window
- II.3.5.3** Drill the holes in the wall according to size of the screws and insert the roll plugs of required size
- II.3.5.4** Again put the window in the cavity of wall and adjust the packing & check plumb level again and fit the screws of required size.
- II.3.5.5** Fill the gaps with cement or silicon sealant and clean the window by blower
- II.3.5.6** Cut the U type gasket at 45° and paste the end section of gasket with adhesive
- II.3.5.7** Place the glass & gasket in the frame of shutter and fit the beading in the shutter frame of window.
- II.3.6 Good practices for installation & maintenance** - Good practice as per details provided by the manufacturer shall be followed for installing the windows.
- II.3.7 Hinges** – It is recommended that the hinges & hardware chosen shall satisfy the requirements of relevant Indian Standards.
- II.3.8 Other Hardware** –Windows shall take hardware like hinges, lock, friction stays, handles etc.
- II.3.9 Anodizing ability** -- Surface of the windows shall be smooth & self designed.

- II.3.10** **Colour system** -- uPVC Windows are finished on installation by self colour system and regularly maintained when colour deterioration is noticed.
- II.4** **CRITICAL DETAILS**
- II.4.1** Check sliding movement of window shutter, interlocking of shutters, number of screws fixed and leveling of window etc.
- II.5** **MAINTENANCE REQUIREMENTS**– Maintenance is required in the hardware to be fixed to the windows. However, these windows shall be installed strictly as per the instructions provided by the PAC holder.
- II.6** **SKILLS /TRAINING NEEDED FOR INSTALLATION**
No special skills other than the normal skills of a good carpenter are needed for installing the window shutters.
- II.7** **GUARENTEES/WARRANTIES PROVIDED BY THE PAC HOLDER** - These windows shall be warranted for a period of at least one year for colour resistance and warping under normal conditions from the date of actual completion of the project. Hardware shall also be warranted for a period of at least one year for any manufacturing defect from the date of actual completion of the project.
- II.8** **SERVICES PROVIDED BY THE PAC HOLDER**
- II.8.1** PVC Profile Sections used are maintenance free but after sales service is given only on the hardware by the manufacturer if these are not working properly or damaged.
- II.8.2** However, the users / customers shall ascertain from the PAC holder the type of service, the PAC holder is prepared to provide.

PART III BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

- III.1** **BASIS OF ASSESSMENT**
- III.1.1** The technical basis for assessment is as per the standards listed in Part V.
- III.1.2** The assessment is based on the results & reports of
 (i) Inspection of the factory

- (ii) Inspection of the test equipment used, test procedures followed and testing personnel in the laboratory of the factory
- (iii) Assessment of quality assurance procedures implemented in the factory
- (iv) Tests done in the factory in the presence of third party namely RITES on random samples of the windows taken by IO during inspection as per the performance characteristics of the manufacturer
- (v) Tests got done in independent laboratories namely CIPET & NPL by the manufacturer
- (vi) Inspection of uPVC windows in service

III.2 MANUFACTURING PROCESS

III.2.1

- (i) Cutting of outer & shutter frames
- (ii) Reinforcement insertion & Screwing
- (iii) 'V' Notch cutting
- (iv) Drainage hole, Water slot & Air vent hole milling
- (v) Corner welding
- (vi) Finishing
- (vii) Gasket & Beading fitting
- (viii) Shutter assembly
- (ix) Hardware fitting
- (x) Inspection
- (xi) Packing

III.2.2 Inspections and testing is done at appropriate stages of manufacturing process. The inspected windows are stored and packed to ensure that no damage occurs during transportation. As part of quality assurance, regular in-process inspections are carried out by the trained personnel of the PAC holder.

III.3 FACTORY INSPECTIONS

III.3.1

The factory was inspected by technical representatives of the Council. During inspection the entire manufacturing process along with the equipment and machinery were inspected. The manufacturing process was found to confirm to the process description given by the manufacturer. The in-process inspection and the inspection of the finished windows were in accordance with the SQA approved as a part of the requirements for grant of this PAC. It is the responsibility of the PAC holder to maintain and calibrate equipment for manufacturing and testing periodically to manufacture these windows in accordance with the specified parameters.

III.4 LABORATORY TESTS DONE FOR ASSESSMENT

III.4.1 Testing of samples

III.4.1.1 In the factory – The tests listed in the report i.e. Visual inspection, Overall dimensions, Corner strength, Air permeability, Water tightness, Wind resistance, Heat reversion, Heat ageing, Resistance to impact, Softening point, Apparent modulus of elasticity, Impact strength and Mechanical strength were done in the presence of third party namely RITES in the factory on random samples of windows taken by the IO for checking the product as well as the related test equipment. The tests were conducted using test methods covered by the relevant Indian Standards listed in Part V of this Certificate. The samples passed in all the tests conducted.

III.4.1.2 In independent laboratory – The performance tests for these windows specified in the relevant Standards and listed below have been got done on the samples in independent laboratories namely CIPET, Ahmedabad and NPL, N. Delhi by the manufacturer. The samples conform to the tests as per performance requirements and specifications given by the manufacturer.

Tests done in an independent laboratory

S.No.	Parameters	Test Method /Requirement	Results Obtained
--------------	-------------------	-------------------------------------	-------------------------

I.	uPVC Profile used 1.Tensile strength at Break 2.Elongation at Break 3.Vicat softening Temperature 4.Hardness (Shored) 5.Density 6.Heat Reversion 7. Heat Ageing at 150° C 8.Resistance to Impact by falling mass 9.Impact Strength 10. Colour Fastness 11.Impact Strength after exposure to artificial ageing	IS 13360(Part 5, Sec 2):1996/ 6N/mm² min. ---Do--/200% min. IS13360 (Part 6, Sec1): 1999/345.15° K min. IS13360 (Part 5, Sec11):1992/ 70 min. IS 13360(Part 3,Sec1): 1995/0.51-0.59 gm/cc Appendix A/Shall not be >2 Appendix B/ No bubble or crack shall appear Appendix C/Shall not puncture or damage IS13360 (Part 5, Sec 5): 1996/Shall be 6 KJ/mm² Appendix D/Shall be min. 4 on grey scale Appendix E/Shall be min. 70% of original value	47 N/mm ² 221% 355.15° K (82° C) 78 1.45 gm/cc 0.30% No crack, damage observed No puncture or damage observed 19.2 KJ/mm ² Better than grey scale No. 4 16.8 KJ/mm ²
II. uPVC Window			
1.	Corner Strength (3.5 N load)	Appendix F/ Welded joint shall not fracture	Found Satisfactory
2.	Air Permeability	Appendix G/ Shall be within the air flow when set air pressures are applied	Air flow passing through the window – 1.23 to 8.33 against Set pressure of 100 to 600N
3.	Water Tightness Test under dynamic pressure Cyclonic Pressure @ Median Value P- 1000 Pa	Appendix H/ There shall not be any water penetration from any location	Water penetration from any location at the window not observed

4.	Wind Resistance (Positive pressure) (i) Deformation Test (ii) Repeated pressure @ 800Pa (iii) Safety Test @ 1000 Pa	Appendix I Shall be within deflections when air pressures are applied There shall not be any functional defect Shall not observe any permanent deflection	Frontal deflection varies from 0.00 to 5.50 mm against Set pressures of 100 to 750 Any functional defect not observed Permanent deflection & any functional defect not observed
5.	Mechanical Strength Tests (i) Warping Test (ii) Racking Test (iii) Torsion Test (iv) Diagonal Deformation (v) Locking, opening or restricted opening devices	ISO 8248:1985	Found Satisfactory Found Satisfactory Found Satisfactory Found Satisfactory Found Satisfactory
10.	Airborne Sound Insulation Test	IS 9901(Part3):1981 Adequate diffusion shall exist	Airborne sound index is found to be 34 dB

III.5 INSPECTION & SUPPLY OF WINDOWS: - Twelve uPVC Windows installed in the factory and at Satyamev Jayate School in Ahmedabad during the year 2009 were inspected. None of them showed any distress and were functional. Details of the windows supplied by the manufacturer during the period 2006-2009 are given below:

S.No.	Supplied to	Location of Building	When Supplied
1.	Reliance Industries Ltd.	Jamnagar, Gujarat	2006 - 2007
2.	Mantri Developers (P) Ltd	Bangalore	2008 - 2009
3.	Pacifica Group of Companies	Ahmedabad	2008 - 2009
4.	IVRCL Infrastructure & Projects Ltd.	Hyderabad	2009
5.	Satyamev Jayate School	Bopal, Ahmedabad	October, 2009

PART IV STANDARD CONDITIONS

This certificate holder shall satisfy the following conditions:

- IV-1 The certificate holder shall continue to have the product reviewed by BMBA.
- IV-2 The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.
- IV-3 The quality of the product shall be maintained by the certificate holder.
- IV-4 The product user should install, use and maintain the product in accordance with the provisions in this Certificate.
- IV-5 This certificate does not cover uses of the product outside the scope of this appraisal.
- IV-6 The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.
- IV-7 Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)
- IV-8 The certificate holder agrees to inform BMBA of their distributors / licensees whenever appointed by him and agrees to provide to BMBA a six monthly updated list thereof.
- IV-9 The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.
- IV-10 If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

IV-11 In granting this Certificate, BMBA takes no position as to:

- (a) The presence or absence of patent or similar rights relating to the product;
- (b) The legal right of the Certificate holder to market, install or maintain the product;
- (c) The nature of individual installations of the product, including methods of workmanship.

IV-12 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

IV-13 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

IV-14 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

IV-15 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

IV-16 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

IV-17 The PAC holder shall not use this certificate for legal defense in cases against him or for legal claims he may make from others.



Place: New Delhi

Date of issue _____

Chairman TAC & for and on behalf of
Member Secretary, BMBA

Dr. Shailesh Kr. Agarwal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5/A, 1st Floor, India Habitat Centre, Lodhi Road,
New Delhi-110 003

PART V LIST OF STANDARDS & CODES USED IN ASSESSMENT

Part V.1 Standards -- These Standards are referred for carrying out particular tests only and do not specify the requirement for the whole product as such.

Part V.1.1 IS 9901 (Part-III): 1981 – Laboratory Measurement of Airborne Sound Insulation of Building Elements

Part V.1.2 IS 10151:1982 – Specifications for Polyvinyl chloride (PVC) for its use in contact with Foodstuffs, pharmaceuticals & drinking water

Part V.1.3 IS 13360 – Plastics – Method of Testing

Part V.1.3.1 Part 3, Sec 1:1995 – Determination of Density of Non-cellular Plastics

Part V.1.3.2 Part 5, Sec 2:1996 – Determination of Tensile Properties

Part V.1.3.3 Part 5, Sec 5:1996 – Determination of Charpy Impact Strength

Part V.1.3.4 Part 5, Sec 6:1999 – Determination of Impact Resistance by Free-falling Dart Method

Part V.1.3.5 Part 5, Sec 7:1996 – Determination of Flexural Properties

Part V.1.3.6 Part 5, Sec 11:1992 – Determination of Indentation Hardness by means of Durometer (Shore Hardness)

Part V.1.3.7 Part 6, Sec 1:1999 – Determination of Vicat Softening Temperature

Part V.1.3.8 ISO 8248:1985 – Windows and door height windows – Mechanical Tests

Part V.2 Company Standards of the PAC holder – The branded design and specifications of the raw materials and finished products are as specified by the manufacturer. The PAC holder has to make available the company standards to the consumers according to which testing have been done.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA) **uPVC Windows** bearing the mark Manufactured by M/s Sintex Industries is satisfactory if used as set out above in the text of the Certificate. This PAC No. **1004-C/2011** is awarded to **M/s Sintex Industries Ltd.**

The period of validity of this Certificate is as shown on Page 1 of this PAC. This Certificate consists of pages 1 to 38.



Embossin
g
Seal
of
BMBA

On behalf of BMTPC Board of Agreement

New Delhi, India
Place
Date

Chairman, Technical Assessment Committee (TAC) of
BMBA & Member Secretary, BMTPC Board of
Agreement (BMBA) Under Ministry of Housing and
Urban Poverty Alleviation, Government of India

Dr. Shailesh Kr. Agarwal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5A, 1st Floor, Indira Habitat Centre, Lodhi Road,
New Delhi-110 003

PART VI ABBREVIATIONS

Abbreviations

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

Performance Appraisal Certification Scheme - A Brief

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing & Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing & Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (T AC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No. 49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org

BUILDING MATERIALS & TECHNOLOGY PROMOTION COUNCIL**QUALITY ASSURANCE PLAN FOR uPVC WINDOWS**

S.No	PARAMETER TO BE INSPECTED	REQUIREMENT SPECIFIED	TEST METHOD	SAMPL E SIZE
I. ROUTINE TEST				
I.1.	Visual Inspection	Shall be free from any defect like improper finishing, all type of surface defects, fabrication defects etc.	Visual	5% in every lot
I.2.	Overall Dimensions	Shall be (+1) mm / (-) 0%	Measuring Tape or Vernier caliper as appropriate	-do-
II. TYPE TEST ON PROFILE SECTIONS USED				
II.1.	Heat Reversion Test	Not greater than 2%	Appendix A	-do-
II.2.	Heat Ageing Test	No bubble or crack shall appear	Appendix B	-do-
II.3.	Resistance to Impact at low temperature	No cracking through entire wall	Appendix C	-do-
II.4.	Colour Fastness	Min. 4 on grey scale	Appendix D	-do-
II.5.	Impact Strength after exposure to artificial ageing	70 % of Original value	Appendix E	--do--
III. PERFORMANCE TEST				
III.1	Corner Weld Strength Test	Welded joint shall not fracture when deformed to a max. of 5 mm by application of cantilever load at 350mm from the joint	Appendix F	3 Nos.
III.2	Air permeability Test at specified	Air permeability as tested at a specified pressure	Appendix G	-do-

	pressure 'P – 600Pa'			
III.3	Water Tightness Test under dynamic pressure – cyclonic aspects at specified pressure 'P – 1000 Pa'	No water penetration to be observed on the internal face of the window after applying Static pressure of 1.5 P for 1 minute and Dynamic pressure from 0.5p to 1.5P for 10 minutes where P is the specified pressure	Appendix H	-do-
III.4	Wind Resistance Test at specified pressure P1- 1000 Pa, P2 – 500 Pa & P3 – 1500 Pa	No functional defects and permanent or residual deformation to be observed after Deformation test at specified pressure P1, Repeated pressure test for '3' impulses at specified pressure P2 and Safety test at specified pressure P3	Appendix I	-do-
III.5	Mechanical Strength Test	Windows to be subjected to various tests against possible misuses and locking, opening & restricted opening devices	As per ISO 8248:1985	--do--
IV. TYPE TEST ON COMPOUND MATERIALS USED				
IV.1	Softening Point	345.15° K (72°C) min.	IS 13360 (Part 6, Sec 1):1999	-do--
IV.2	Apparent Modulus of Elasticity	2250 MPa min.	IS 13360 (Part 5, Sec 7):1996	--do--
IV.3	Charpy Impact Strength	6 KJ/mm ² min.	IS 13360 (Part 5, Sec 5):1996	--do--
V. TYPE TEST ON FINISHED WINDOWS (DOUBLE GLAZED ONLY)				
V.1	Sound Insulation Test	Air-borne sound insulation index as evaluated using filtered noise in one-third octave band frequency to be in the range of 34 ± dB	IS 9901 (Part3): 1981	1 No.

uPVC WINDOWS – METHOD OF TESTS

1. SCOPE

This document covers the various test methods which shall be followed to subject the uPVC window to evaluate their quality.

2. RAW MATERIALS

Raw material used for the manufacture for uPVC /profile sections shall meet the following specifications:-

S. No.	Performance Characteristics	Test Method	Requirement
1.	Vicat Softening Point	IS 13360 (Part 6,Sec1): 1999	72 ⁰ C min.
2.	Apparent Modulus of Elasticity	IS 13360 (Part5, Sec7): 1996	2250 MPA min.
3.	Charpy Impact strength	IS 13360 (Part 5,Sec5): 1996	12KJ/M ² min.
4.	Retention of Charpy Impact Strength after artificial ageing	--do---	70% of original value

3. PROFILE PROPERTIES:

3.1 Dimensions and Weights:

- i) The cross section of the profile must conform to the shape and dimensions of the manufacturer's drawing and the tolerance on outer surface shall not deviate more than ± 0.5 mm and glazing and seal grooves shall not deviate by more than ± 0.3 mm
- ii) The straightness of the profile as measured on the surface shall not deviate by more than 1.0 mm/ meter.
- iii) The weight of the profile section per meter shall not be less than 5 % of its normal value.

3.2 Heat Reversion Test:

When tested according to Appendix A, the mean maximum reversion on the profile shall not be greater than 2% and the variation between the individual face side of the profile shall not be more than 0.4%

3.3 Heat Ageing Test:

When tested according to Appendix B the profile shall not show any bubbles, cracks or delamination.

3.4 Resistance to Impact at Low Temperature:

When the main frame is tested according to Appendix C the profile shall not show any cracking through the entire wall thickness of the profile.

3.5 Colour Fastness Test:

When tested according to Appendix D, the maximum colour change allowed shall be No. 4 on the grey scale.

3.6 Impact Strength After Ageing Test:

When tested according to Appendix E, the average impact strength of exposed specimen shall not be less than 70 % of the impact strength of un-exposed specimens.

4. Performance Test:

The uPVC window shall meet the following performance requirements adequately:

4.1 Corner Weld Strength Test:

The welded joint of Window profile section when tested according to Appendix F, the welded joint shall not show any fracture when the horizontal member deforms up to 5mm by application of cantilever load at 350 mm distance from the joint.

4.2 Air Permeability Test:

Windows shall be tested as per Appendix G. The air permeability as tested at a specified pressure 'P' shall not exceed the specified requirement.

4.3 Water Tightness Test:

Not water penetration shall be observed on the internal face of the window after applying static pressure of 1.5 P for 1 minute and Dynamic pressure from 0.5 P to 1.5 P for 10 minutes where P is the specified pressure when tested Appendix H.

4.4 Wind Load Resistance Test:

No functional defects and permanent or residual deformation shall be observed after Deformation Test at specified P1, Repeated Pressure Test for 'n' impulses at specified P2 and Safety Test at Specified P3 when tested as per Appendix I.

4.5 Mechanical Tests:

Mechanical Tests namely Forces required to operate the window, Warping test, Racking test, Torsion test, Diagonal deformation test, and Tests for locking opening or restricted opening devices are tested as per Appendix-J.

APPENDIX A
(Based on ISO 6612: 1980)

HEAT REVERSION TEST

A.1 SCOPE:

Profile sections to be tested for its Heat Reversion Strength

A.2 APPARATUS:

Hot Air Circulating Oven

A.3 TEST PROCEDURE:

1. Prepare three test specimens of 200 ± 5 mm long and draw a line across the face at a distance of 10 mm from either ends. Measure the initial length between the two lines drawn at either end.
2. Test specimens shall be conditioned at 20°C for 30 minutes prior to testing.
3. The samples are then placed over a talc dusted stainless steel plate kept inside the Hot Air Circulating Oven at $100 \pm 20^{\circ}\text{C}$ or a period of one hour. The sample shall be placed in such a manner so that its minimum contact area is in contact with the talc dusted stainless steel plate.
4. The sample are then removed from the oven and allowed to cool at $20 \pm 5^{\circ}\text{C}$.
5. Measure the length between the pair of lines.

A.4 CALCULATE the % Reversion by using following equation

$$\% \text{ Reversion} = \frac{\text{Initial length measured} - \text{Length observed after test} \times 100}{\text{Initial length measured}}$$

HEAT AGEING TEST

B.1 SCOPE:

Profile sections to be tested for its Heat Reversion Strength

B.2 APPARATUS:

Hot Air Circulating Oven

B.3 TEST PROCEDURE:

1. Prepare three test specimens of 200 ± 5 mm
2. Test specimens shall be conditioned at 20°C for 30 minutes prior to testing.
3. The samples are then placed over a talc dusted stainless steel plate kept inside the Hot Air Circulating Oven at $150 \pm 2^{\circ}\text{C}$ for a period of one hour. The sample shall be placed in such a manner so that its minimum contact area is in contact with the talc dusted stainless steel plate.
4. The sample are then removed from the oven and allowed to cool at $20 \pm 5^{\circ}\text{C}$.
5. Observed the samples for any crack on them.

APPENDIX C
(Based on ISO 6612: 1980)

RESISTANCE TO IMPACT AT LOW TEMPERAYURE

C.1 SCOPE:

Profile sections to be tested for its Resistance to Impact at low temperature

C.2 APPARATUS:

Deep Freezer, Impact Tester

C.3 TEST PROCEDURE:

1. Prepare three test specimens of 300 ± 5 mm long
2. Test samples are than conditioned for at least 1 hour at a temperature of (-) 10°C .
3. Remove the samples one by one and place each specimen on a test stand of 200 mm span and strike it within 10 seconds with 1 kg hemispherical ended impactor with a tip radius of 25 mm at mid span position form a height of 1 metre. Repeat the test on the remaining 2 specimens like wise.
4. Observe the samples after the test for any cracks on them.

APPENDIX D
(Based on ISO 4892: 2000)

COLOUR FASTNESS TEST

D.1 SCOPE:

Profile sections to be tested for its Colour Fastness on exposure to adverse weather conditions.

D.2 APPARATUS:

Xenon arc lamp Weatherometer.

D.3 TEST PROCEDURE

1. Profile sample shall be exposed in Xenon arc lamp weatherometer.
2. The samples shall be mounted in a such way that outer face of the profile is directed towards the lamps.
3. The following conditions to be maintained during the testing in the Xenon arc weatherometer.

Radiant exposure H	:	7,20,000 Joules/m ²
Irradiance E	:	640 nm
Operation Mode	:	Continuous
Spectral Distribution	:	Out door
Temperature BST	:	65 ⁰ C
Relative Humidity	:	50%
Chamber Temperature	:	40 ⁰ C
Exposure Stage	:	a)Exposureto Light-102minutes(One cycle) b) Exposure to Light & Water Spray -18 minutes

4. The Colour change of the exposed face shall be rated by using the grey scale by instrumental method

APPENDIX E
(Based on ASTM D 5942: 1996)

ARTIFICIAL AGEING TEST

E.1 SCOPE:

Profile sections to be tested for its Impact Strength after artificial Ageing

E.2 APPARATUS:

Charpy Impact Tester, 'V' Notch Cutter

E.3 TEST PROCEDURE:

1. Prepare ten 'V' notched test specimens
2. Five Test specimens to be tested for Colour fastness as per Appendix IV
3. Determine the impact strength of the un-exposed specimens and calculate the average impact strength.
4. Determine the impact strength of the exposed/colour-fastness tested specimens and calculated the average impact strength.
5. The average impact strength of exposed specimen should not be less than 70% of the impact strength of un-exposed specimens.

CORNER WELD STRENGTH TEST

F.1 SCOPE:

Profile sections to be tested for its Welding Strength on corner joint

F.2 APPARATUS:

Clamping unit, load, Dial gauge

F.3 TEST PROCEDURE:

1. Three pair of sample of profile shall be cut at 45° and welded together to form 90° corner and it should be without reinforcement.
2. The samples to be mounted for $20 \pm 5^\circ \text{C}$
3. The sample to be mounted in the apparatus as shown in fig. 1 with region 'A' sample fully supported.
4. The dial gauge shall be set up in line with the top edge of the horizontal member and shall be positioned 100 ± 1 mm below the bottom edge of the support.
5. A Cantilever load shall be applied gradually without shock horizontal member until deformation of at least 5 mm is recorded on the dial gauge and shall be monitored for one minute
6. The load shall than be smoothly increased until breakage of the corner occur.

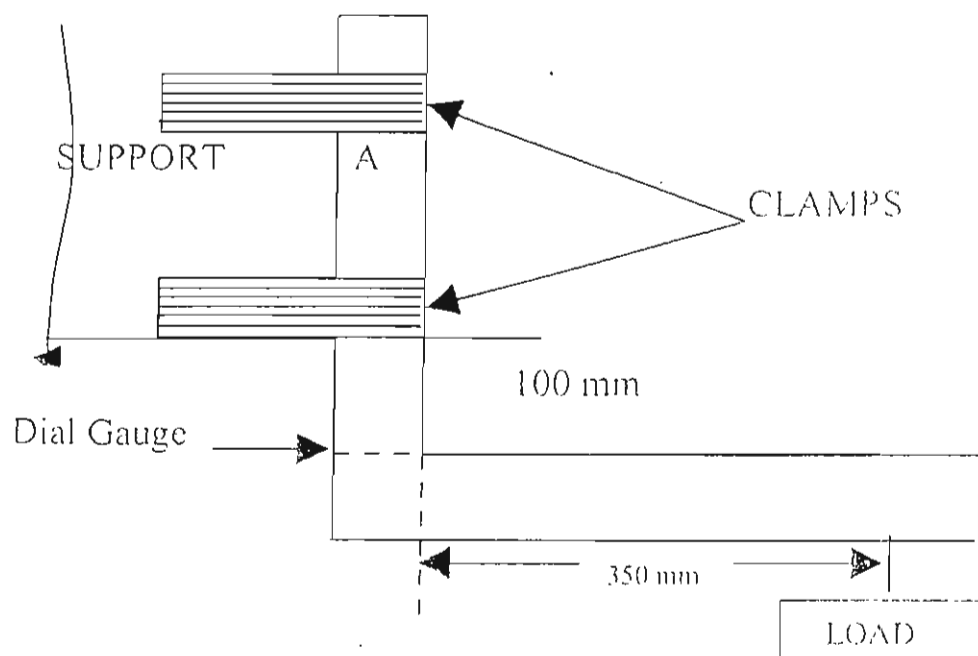


Fig. 1 Corner Weld Strength Test

AIR PERMEABILITY TEST

G.1 SCOPE:

Air permeability testing of Closed Windows to let air pass when it is subjected to a differential pressure.

G.2 APPARATUS:

Closed Chamber, Air Pressure Gauge [Range: 0-3500 Pascal, L.C. 0.1 or 1 Pascal], air flow measuring [$\text{m}^3 / \text{hr.}$]. Timer [L.C. 1/10 sec.] blower

Specimen: The area calculated from overall dimensions of the windows

Standard condition: Temp 20°C , Pressure 101.3 KPa, air density 1.202 gm/ m^3

G.3 TEST PROCEDURE:

1. The windows shall be subjected to positive pressure increasing in stages of 50, 100, 200, 300, 400, 500, 600 Pa and can be increased in steps of 100 Pa if the maximum pressure required is more than 600 Pa. The pressure at each stage is retained for a minimum period of 10 seconds.
2. The air flow at each pressure shall be measured and recorded.
3. If it is required to test a window for air permeability in the reverse direction, i.e. under negative pressure, the same method as above shall be used in the reverse direction.
4. Volume of air flow passing through the windows shall be adjusted to air flow in standard conditions by using the formula.
$$V_{293} = 293 \times pV / 101.3 \times T$$

P= Applied air pressure in KPa, V=
Volume of air flow measured in m^3/hr , T=Temperature of air flow
5. The air permeability is calculated for each pressure and tabulated as under

Sl. No.	Applied Pressure Pascal	Temp. Kelvins	V= Higher reading of air flow in Cum per hour as noted at each pressure	V ₂₉₃ = Air flow as adjusted to standard condition	Air permeability V ₂₉₃ /Sqm of total surface area of window
1	100				
2	200				
3	600 or above				

WATER TIGHTNESS TEST

H.1 SCOPE

Test method for determining the water tightness under dynamic pressure

H.2 APPARATUS:

Closed Chamber, Air Pressure Gauge [Range: 0-3500 Pascal, L.C. 0.1 or 1 Pascal] bowler, Water spraying assembly, Timer [L.C.1/10 sec]

H.3 TEST PROCEDURE:

1. Test Specimen/Window shall be fixed to the test rig mounted inside the pressure chamber and there shall be no leakage between test rig and the window frame.
2. Prior to testing open and close the opening parts if any of the window at the upper limit value of the test.
3. Apply static air pressure for 1 min. to the internal face of the test window at the upper limit value of the test.
4. Spray water across the test specimen. The amount of water shall not be less than 3 to 4 Lm²/min. and should be sprayed continuously and evenly over the whole area of the window under testing. (m² is the surface of area of Window under testing).
5. After 30 sec. apply dynamic pressure for 10 min to the weather exposed face of the window as per table 1.

Sl. No.	Pressurization median value Pa	Dynamic Pressure			
		Median Value Pa	Upper limit Pa	Lower limit Pa	Cycle durations
1.	< 1500 Pa	P	$P \times 1.5$	$P \times 0.5$	2 to 4
2.	> 1500 Pa	P	$P + 750$	$P - 750$	

Note: the pressure to be accelerated in increment of 20 Pa/Sec. up to the higher limit for each of the median Pressure Value of 100 Pa, 150 Pa, 250 Pa, 350 Pa, 500 Pa , 750 Pa and thereafter in steps of 250 Pa.

H.4 OBSERVATION: Observe visually the internal face of the Window after each phase and note any location where water penetration has occurred, if any. The moment water penetration is observed the test is terminated.

APPENDIX I
(Based on ISO 6612: 1980)

WIND LOAD RESISTANCE TEST

I.1 SCOPE:

Windows to be tested for the structural performance under +ve and -ve Air Pressure.

I.2 APPARATUS:

Chamber, Blower, dial gauge [25mm] (8 nos.)

Air pressure gauge [Range: 0-3500 Pascal, L.C. 0.1 or 1 Pascal] Timer [L.C.1/10 sec]

I.3 TEST PROCEDURE:

I.3.1 Deformation Test to be carried out at specified maximum pressure P1

1. Apply test pressure for not less than 10 seconds in stages of 100,200,300,400,500 Pa and thereafter in stages of 250 Pa up to the maximum pressure prescribed.
2. Measure the deflection if any at each stage along the longitudinal axial frame of the Window.
3. When the pressure is reduced to zero at each stage, note the residual permanent deflection along the longitudinal axial frame of the window.

I.3.2 Repeated Pressure Test to be carried out for specified 'n' impulses at specified pressure P2.

1. The window shall than be subjected to n-pressure impulses between 0- to P2.
2. In each impulse the pressure shall be increased from 0 to P2 in 1 sec. and held at P2 for 3 seconds and then brought to 0.

3. After completion of 'n' impulses, open and close moving parts of the Window 5 times.
4. Observe for any damage or functioning defects.

I.3.3 Safety Test at specified pressure P3

1. Apply max specified pressure (P3) and hold for 3 sec.
2. After completion of test open/close moving parts and observe any functional defects or any permanent/residual deformation.