Test Report

Nr. 14-000559-PR02

(PB-E03-020310-de-01)

ROSENHEIM

Date 07.10.2014

Producer fischerwerke GmbH & Co. KG

Weinhalde 14-18

72178 Waldachtal

Object Component test with frame screws for fastening a plastic frame of a window in the structure

Product Window frame screw FFS bzw. or window frame screw FFSZ Ø 7.5 mm, dowel-less frame screw, Plastic windows made of PVC multi-chamber profiles with Steel reinforcement, vertically perforated brick masonry of the type ISO - Plan plus 0.11

Translation of the original document in German Language by fischer Competent Team Engineering

In the case of differences in the translation, the original document in German always applies

Content

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ift Rosenheim GmbH
Geschäftsführer:
Dr. Jochen Peichl
Prof. Ulrich Sieberath

Theodor-Gietl-Str. 7 - 9
D-83026 Rosenheim
Tel.: +49 (0)8031/261-0
Fax: +49 (0)8031/261-290
www.ift-rosenheim.de

Sitz: 83026 Rosenheim
AG Traunstein, HRB 14763
Sparkasse Rosenheim
IBAN: DE90711500000000003822
SWIFT-BIC: BYLADEM1ROS

Anerkannte Stelle
Notified Body 0757
PÜZ-Stelle: BAY 18

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DAkkS Deutsche Akkreditierungsstelle
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1 Description of the problem

In a component test, frame screws from fischerwerke GmbH & Co. KG are to be examined for fastening a plastic window with diagonal blocks on the side. The component test consists of a defined sequence of climatic and mechanical loads, whereby the plastic window and the fastening elements are subjected to tensile, compressive and shear loads and the resulting superimpositions. The rapid test in the laboratory is intended to detect changes in the fastening area due to creep and aging.

2 Product

For the test, a plastic window - system S8000 IQ 90 - was inserted into a model structure and fastened with the dowel-less frame screws to be examined. The plastic window is designed as a 1-sash tilt and turn window with profiles made of PVC / white, 6-chamber design with a construction depth of 74 mm. The glazing is a multi-pane insulating glass in the structure 4/16/4. The window is designed with steel reinforcement in both the sash and the frame area. The sash weight is 36.1 kg. The selection of the samples (frame screws) was made by the client. The following frame screws were chosen:

- **Window frame screw FFS 7.5 x 202, Ø 7.5 mm, length 202 mm, head 11.5 mm** (Fig. 1), screw connection on the right side

- **Window frame screw FFS 7.5 x 122, Ø 7.5 mm, length 122 mm, Head Ø 11.5 mm** (Fig. 2), upper screw connection on the right side

- **Window frame screw FFSZ 7.5 x 202, Ø 7.5 mm, length 202 mm, head 8.5 mm** (Fig. 3), screw connection on the left side

- **Window frame screw FFSZ 7.5 x 122, Ø 7.5 mm, length 122 mm, head 8.5 mm** (Fig. 4), upper screw connection on the left side

Fig.1 Window frame screw FFS 7,5 x 202

Fig.2 Window frame screw FFS 7,5 x 122

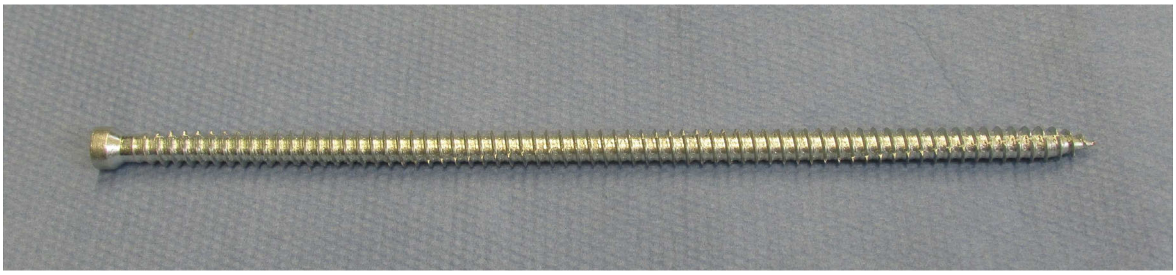


Fig. 3 Window frame screw FFSZ 7,5 x 202

Fig. 4 Window frame screw FFSZ 7,5 x 122

The frame screws are made of galvanized steel and are equipped with a continuous, self-tapping thread for dowel-free stand-off installation. The vertical load transfer at the window level (dead weight) is carried out by supporting blocks on which the window is placed. The transfer of loads horizontally at the window level takes place via diagonal blocks. The load is transferred via the frame screws at right angles to the window level. The test specimen structure is shown schematically in Figure 5. The building is made of perforated brick masonry of the ISO - Plan plus 0.11 type with a wall thickness of 240 mm Brick association. With a wall opening of approx. 1275 mm × 1510 mm and a window size of 1230 mm × 1480 mm, the result is a lateral joint of approx. 23 mm and a lower or upper joint of approx. 10 mm. In order to be able to apply the pressure necessary for the wind loads, the connection joint was masked with a window connection film. The execution is done in such a way that no influences from the installation situation on the fastening, e.g. a covering of the window frame with plaster exist.

Ansicht= View Schnitt =Section

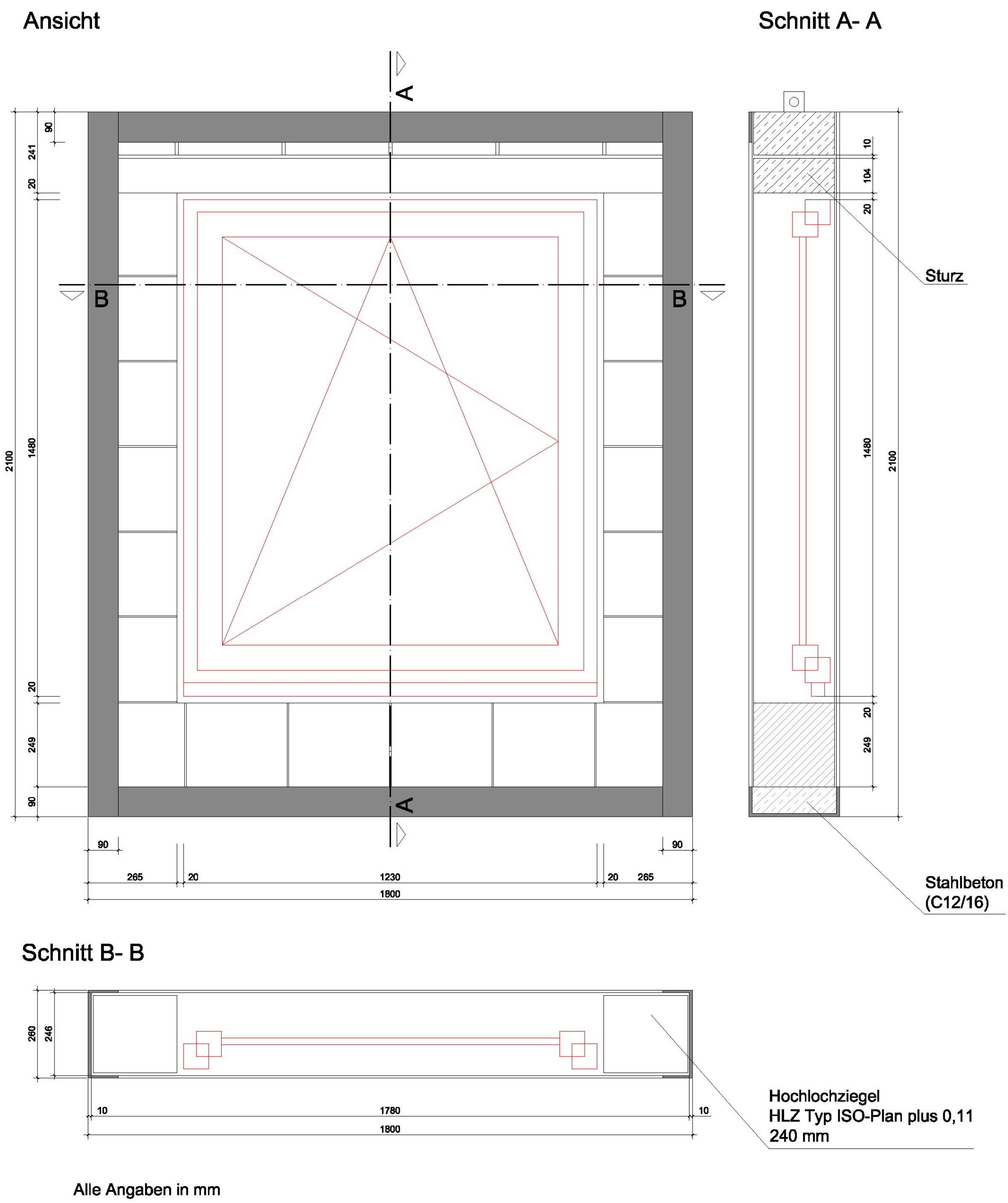


Fig. 5 Test object

3 Test

3.1 Installation of the window

The installation of the window was carried out on June 25, 2014 by the client in the ift laboratory.

The frame was pre-drilled with a Ø 6.0 mm drill and then placed in the opening, on wooden support blocks below, aligned with inflatable air cushions for assembly and temporarily fixed. The masonry was pre-drilled through the frame with a Ø 6.0 mm drill. The frame screws were inserted through the frame into the subsurface. The window was fixed with three frame screws on the side and two frame screws on top. The attachment in the lower area was not part of the test. Figure 6 shows the position of the fastening points in the view.

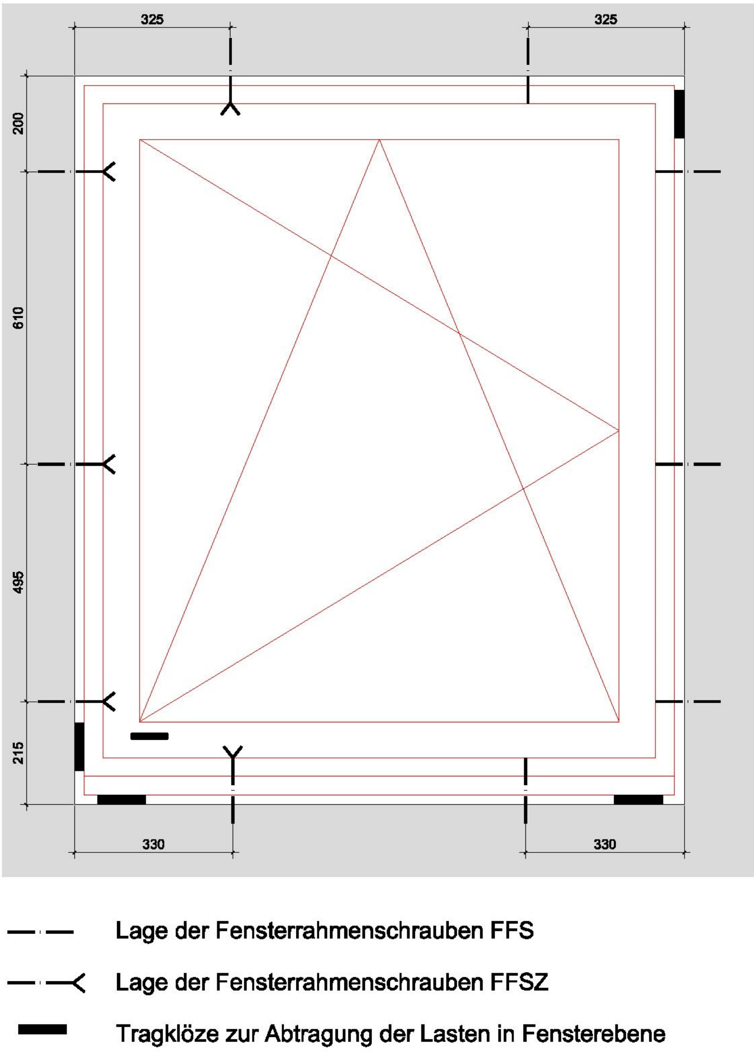


Fig. 6 Schematic representation of the fastening points and position of the blocking, size in mm

Figure 7 shows the position of the frame screws in the profile and wall cross-section. The fastening in the frame profile is done by 2 profile walls and 1 steel wall of the reinforcement. The screw length selected results in a screw-in depth of approx. 135 mm on the side and a screw-in depth of approx. 50 mm at the top.

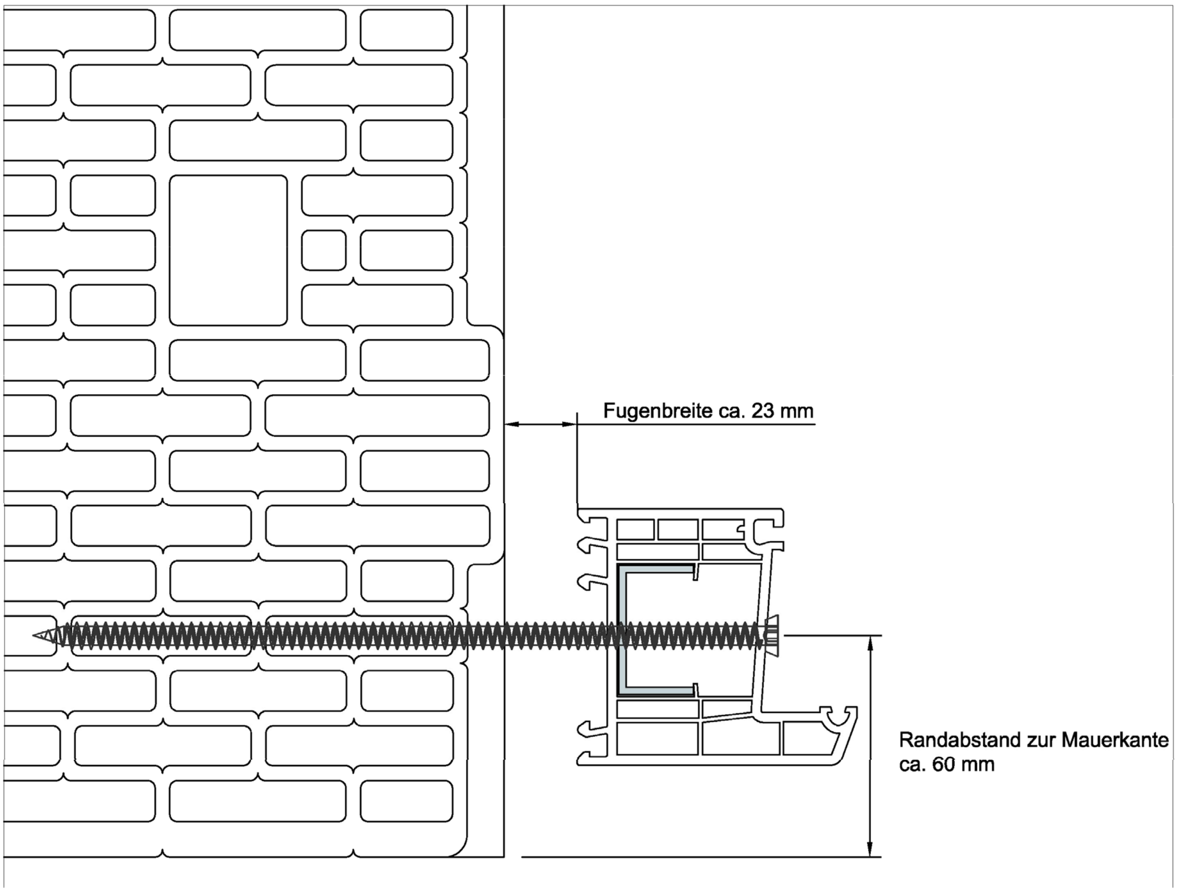


Fig. 7 Position of the window frame screws in the profile and wall cross-section

3.2 Test Elementes

Elements	Number of divices
Linear potentiometer for recording changes in position at right angles to the window level during the load tests (14 pieces). The arrangement of the measuring points can be seen in Figures 8 and 9.	20094
Torque wrench	20127
Window test bench	22200
Climatic chamber	23030
Fog test bench	22203
Impact body for pendulum impact	21702

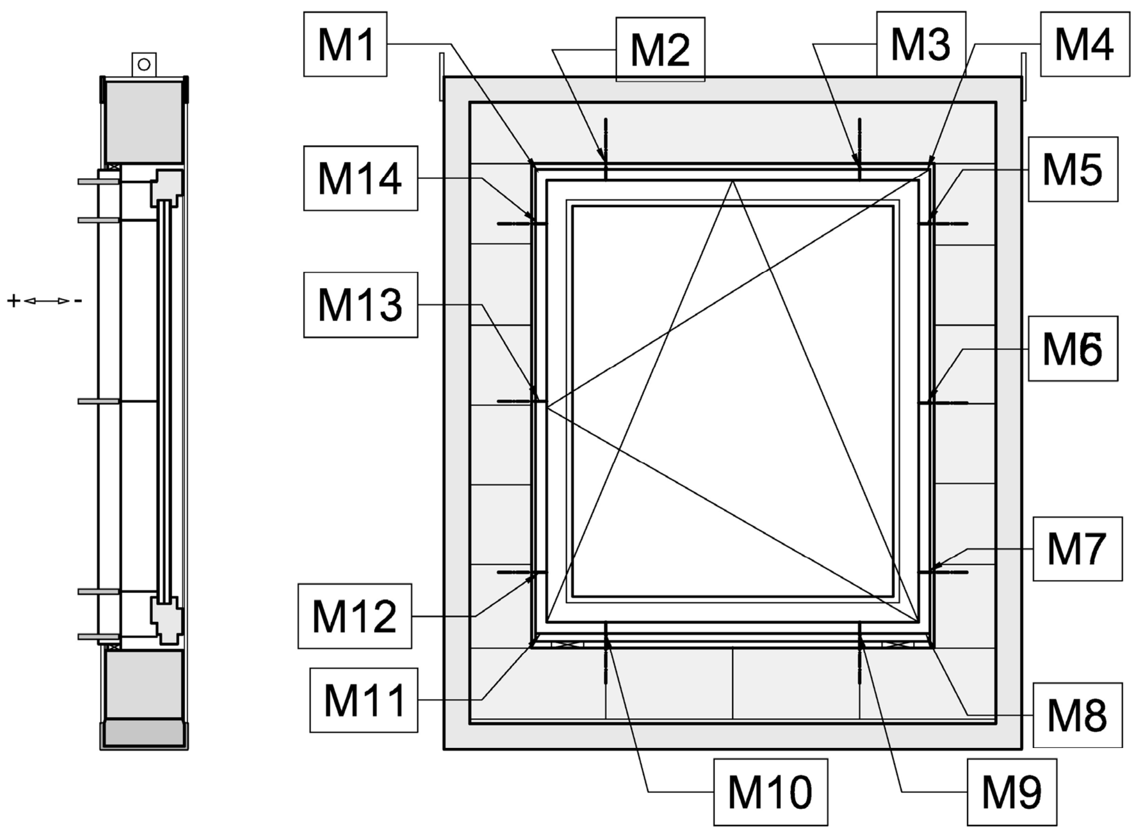


Fig.8 Schematic representation of the position of the linear potentiometer

Fig. 9 View of test specimen with attached measuring points

3.3 Test execution

Date/ Time: 26. 06. 2014 till 22. 07. 2014
Risponsable: Thomas Stefan, Dipl.-Ing. (FH)

3.4 Test Sequence

3.4.1 Incoming Test

1. Visual assessment of the position and arrangement of the fasteners in the window and in the structure.
2. Testing of the operating forces according to DIN EN 13115; The tension-free installation of the window is checked.
3. Loading of the 90 ° opened sash with a load on the sash corner; Test based on DIN EN 14608 with up to 800 N, corresponding to class 4 according to DIN EN 13115.
4. Load under static pressure based on DIN EN 12211, pressure level p1 with ± 1600 Pa, corresponding to class 4 according to DIN EN 12210.

3.4.2 Stress Test

5. Alternating pressure-suction load with 200 cycles based on DIN EN 12211, as shown in Figure 10; Pressure level p2 with ± 800 Pa, corresponding to class 4 according to DIN EN 12210.

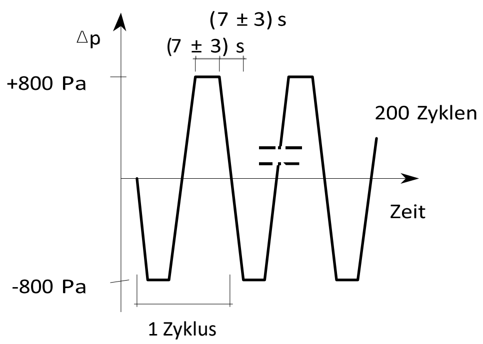


Fig. 10 Representation of the alternating pressure-suction load

6. Thermal cycling from the outside with 10 cycles, as shown schematically in Figure 11. The indoor climate prevails on the inside of the window during exposure.

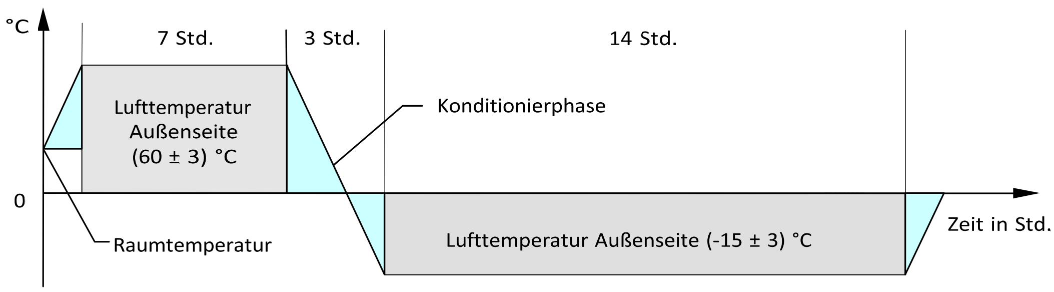


Fig. 11 Thermal cycling for one cycle

7. Simulated use by activating 10,000 fittings based on DIN EN 1191. The sash is tilted, closed, opened and closed 10,000 times.
8. Repetition of the alternating pressure-suction load with 200 cycles, as under 5. described.

3.4.3 Final test

9. Repeat the load under static pressure as described under 4
10. Repetition of the test of the operating forces according to DIN EN 13115.
11. Load under static pressure - safety test based on DIN EN 12211, pressure level p3 with ± 2400 Pa, corresponding to class 4 according to DIN EN 12210.
12. Simulate an unplanned use - pendulum impact test based on DIN EN 13049, height of fall 700 mm according to class 4.
13. Removal of the window, including visual assessment of the condition of the fasteners and the holes in the window and in the structure.

In the tests according to points 3 - 6 as well as 8 and 9, the change in position of the window frame to the building structure at right angles to the window level, during and after the load, in the area of the fastening points (M02, M03, M05, M06, M07, M09, M10, M12, M13, M14) and the frame corners (M01, M04, M08, M11) as shown in Figure 8. Furthermore, the test specimen is checked for visible changes to the fastenings during and after the loading. All tests are carried out in a normal climate, unless otherwise noted.

4 Results

4.1 Incoming Test

4.1.1 Visual assessment of the position and arrangement of the fasteners in the window and in the building

The frame screws were screwed into the frame in the area of the stiffening and embedded flush into the profile or screwed up to the head. The edge distance to the brickwork edge was approx. 60 mm. The fastening was carried out in accordance with the specifications in the "Installation Guide". The frame screws were firmly seated in the frame and in the masonry at all fastening points. The transfer of its own weight takes place at the bottom using wooden support blocks. In the side area was padded diagonally.

4.1.2 Testing of the operating forces according to DIN EN 13115

After fixing it in the structure and fine-tuning the fittings, operating the window on the handle was easy and the window could be opened and closed properly.

At approx. 3.3 Nm (mean value from three measurements), the operating forces were below the 10 Nm permitted according to the quality and test regulations of the RAL quality associations for windows and house doors, and below the 5 Nm permitted in DIN EN 13115 class 2.

4.1.3 Load as a result of a load on the sash corner based on DIN EN 14608

The sash with a dead weight of 36.1 kg was additionally loaded one after the other with additional loads of 200 N, 400 N, 600 N and 800 N (according to class 4 according to DIN EN 13115) on the closing side when it was opened approx. 90 °. After a loading time of 5 minutes in each case, the additional load was removed. A waiting time of 2 minutes was observed between the load levels. After the loading was completed, the window was checked for movement. The occurred maximum of displacement is described in Fig. 12.

There were no permanent deformations or visible changes at the fastening points (change in position at the measuring points after loading ≤ 0.5 mm). The window could be operated without any problems after the load. The window was adequately anchored in the structure.

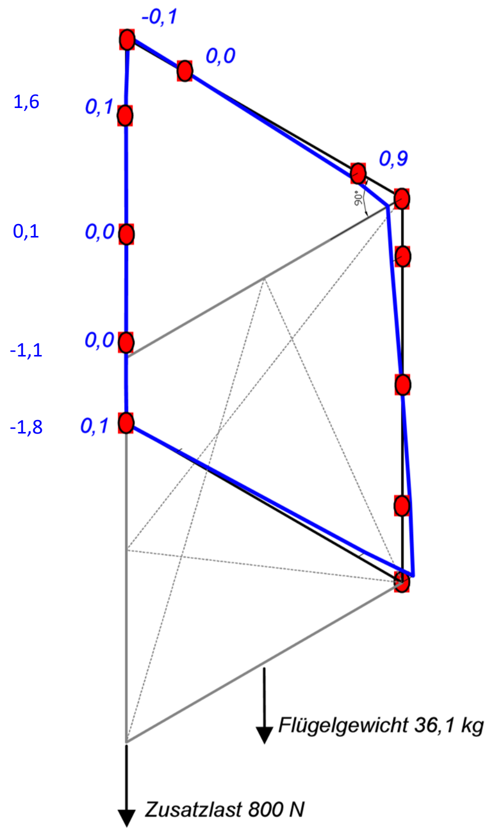


Fig. 12 Displacements [mm] of Frame with the sash open (dead weight 36.1 kg) and an additional load of 800 N.

4.1.4 Load under static pressure based on DIN EN 12211

A wind suction and wind pressure load of 1600 Pa each (corresponding to class 4 according to DIN EN 12210) was applied to the window from the outside.

The movements that occurred were reversible (change in position at the measuring points after loading ≤ 0.5 mm). There was no permanent deformation.

4.2 Stress test

4.2.1 Alternating pressure-suction loads based on DIN EN 12211

The test specimen was subjected to an alternating pressure-suction load of ± 800 Pa (corresponding to class 4 according to DIN EN 12210) and 200 cycles from the outside.

The deformations of the window under wind load were reversible (change in position at the measuring points after loading <0.2 mm). There were no permanent deformations or visible changes.

4.2.2 Thermal cycling from the outside

On the outside of the test specimen, a temperature change between (+ 60 ± 3) ° C and (-15 ± 3) ° C outside air temperature was generated by means of a climatic chamber and passed through 10 times. The maximum deformations that have occurred are shown in Figure 13. The deformations of the window under thermal load were reversible (change of position at the measuring points after loading ≤ 0.2 mm. Due to the influences of the lower fastenings in combination with the support block for load transfer below, a change in position of ≥ 0 occurred at fastening point 7, see Figure 8 , 5 mm after the load. However, this change in position did not affect the functionality of the window or the fastening). No permanent deformations or visible changes occurred during the fastening to be assessed

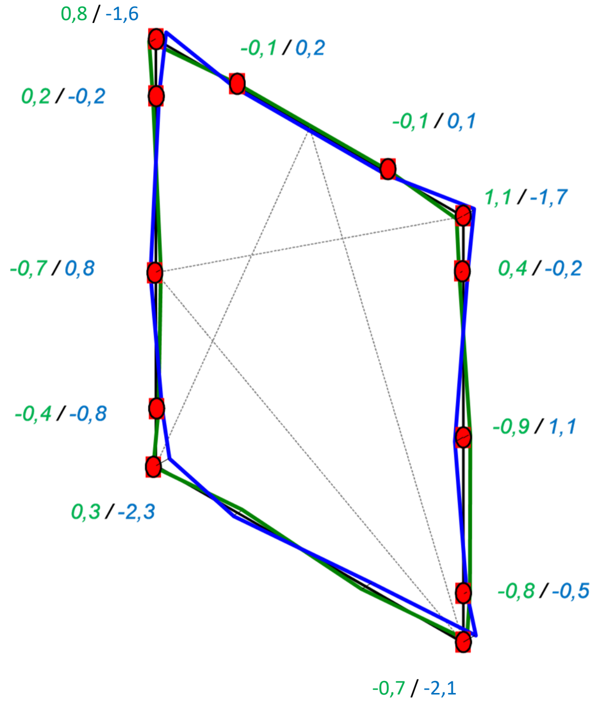


Fig. 13 Maximum deformation [mm] under thermal cycling between + 60 ° C (green) and - 15 ° C (blue).

4.2.3 Simulated use - permanent function test based on DIN EN 1191

After the simulated operation with 10,000 (ten thousand) cycles, no permanent deformation occurred. There were no visible changes. The window could be operated without any problems after the load.

4.2.4 Repetition of the alternating pressure-suction load according to 4.2.1

The maximum deformations that have occurred are shown in Figure 14.

The movements and deformations of the window were reversible (change in position at the measuring points after loading ≤ 0.2 mm). There were no permanent deformations or visible changes.

Compared to the first alternating pressure-suction load, no significant changes were found at the attachment points with regard to the maximum deformations that had occurred.

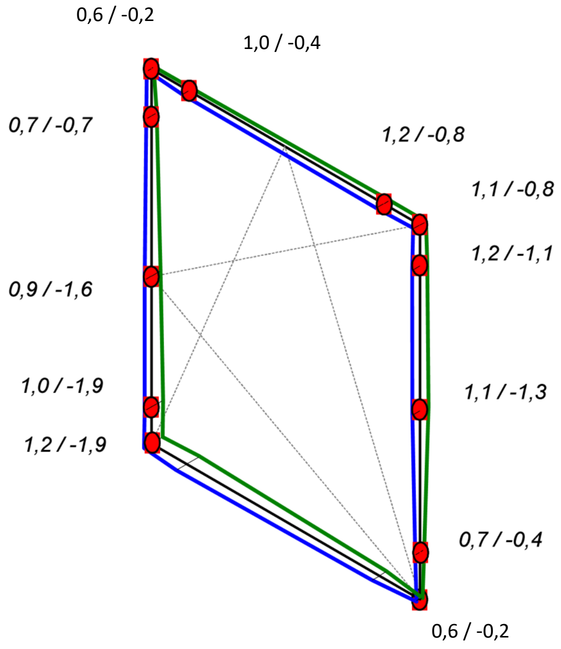


Fig. 14 Deformation [mm] of the window frame with alternating pressure-suction loads of + 800 Pa (blue) and - 800 Pa (green).

4.3 Final test

4.3.1 Repetition of the loading under static pressure according to 4.1.4

The maximum deformations that have occurred are shown in Figure 15.

The movements that occurred were reversible (change in position at the measuring points after loading ≤ 0.2 mm). There were no permanent deformations or visible changes.

Compared to the first static pressure load, there were no changes to the maximum deformations at the attachment points.

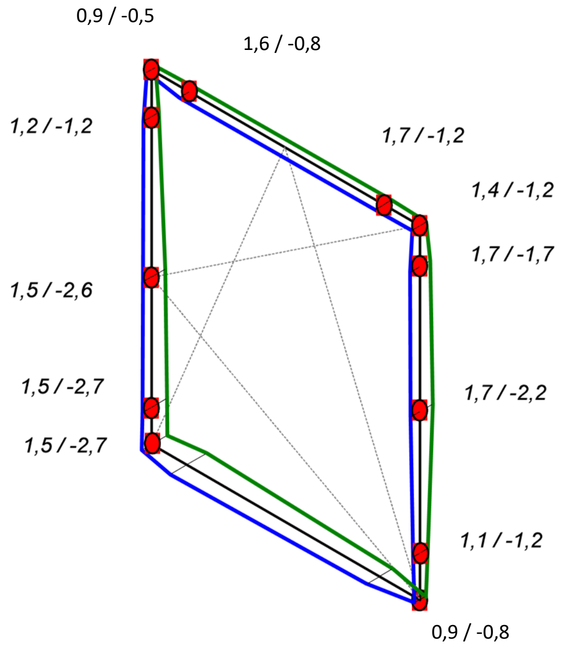


Fig. 15 Deformation [mm] of the window frame with static pressure load of + 1600 Pa (blue) and - 1600 Pa (green).

4.3.2 Repetition of the test of the operators

The window could be opened, closed and tilted.

At approx. 2.9 Nm (mean value from three measurements), the operating forces were below the 10 Nm permitted according to the quality and test provisions of the RAL quality associations for windows and house doors, and below the 5 Nm permitted in DIN EN 13115 class 2.

4.3.3 Load under static pressure - safety test based on DIN EN 12211

The safety test was carried out with a pressure of ± 2400 Pa (corresponding to class 4 according to DIN EN 12210).

The window remained firmly anchored in the structure. No function-impairing changes to the window were observed after exposure.

4.3.4 Simulation of an unplanned use - pendulum impact test based on DIN EN 13049

A shock load was simulated by a pendulum impact test with a shock body according to DIN EN 12600 (double tire pendulum with a weight of 50 kg). A height of fall of 700 mm, corresponding to class 4 according to DIN EN 13049, and an impact point on the window in the center of the glazing were chosen (Fig. 16).

The window remained adequately anchored in the structure after the impact. The frame screws were partially permanently deformed by the impact load. No loosening in the masonry was found.

Fig. 16 Test setup pendulum impact

4.3.5 Removal of the window and visual assessment of the condition of the fasteners and the holes in the window and in the structure

After completing the tests, the window was dismantled. The frame screws and the drill holes in the frame and in the masonry were examined visually.

All frame screws had a firm fit in the masonry. The drill holes in the masonry and in the frame profile showed no changes (widening or breakouts) (for example, Figures 17 and 18). Figures 19 to 22 show the condition of the frame bolts with some slight deformations due to the impact loads.

Fig. 17 and 18 Condition of the holes in the masonry and frame profile after dismantling the frame screws.

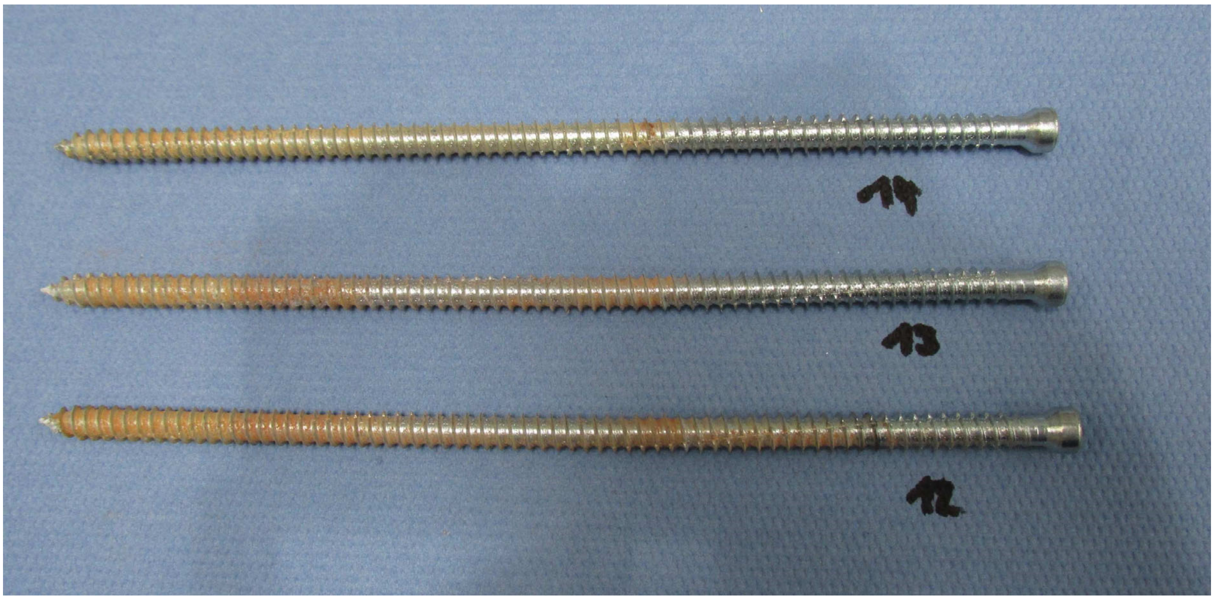


Fig.19 Condition of the window frame screws FFSZ 7.5 x 202 with some slight marks deformations dismantling

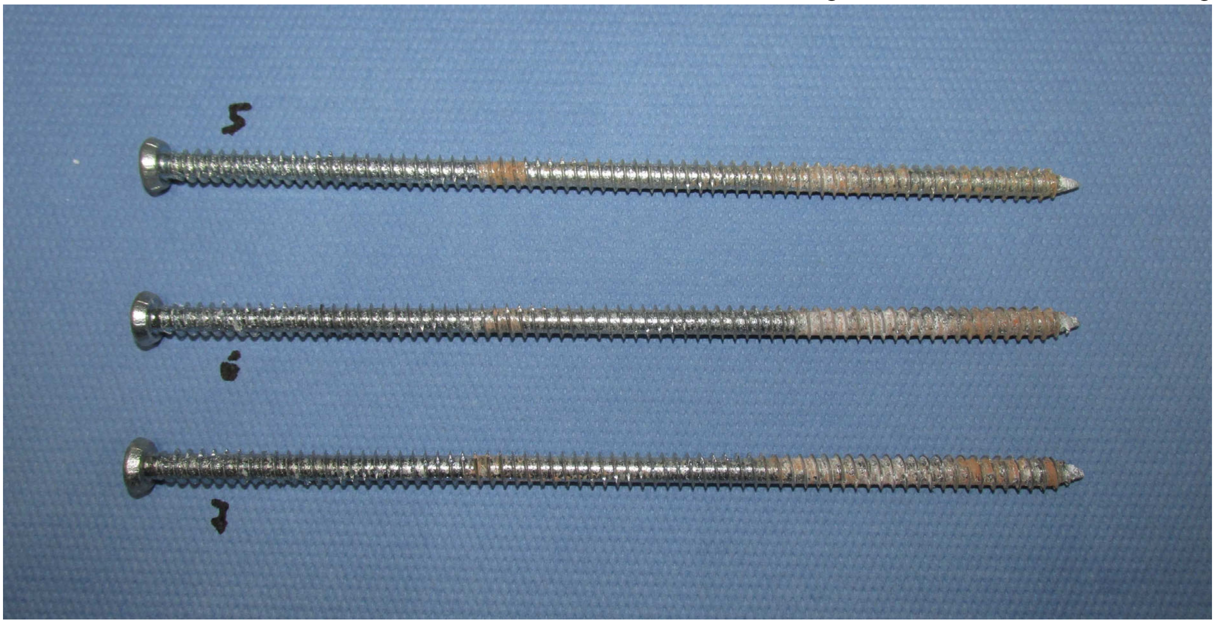
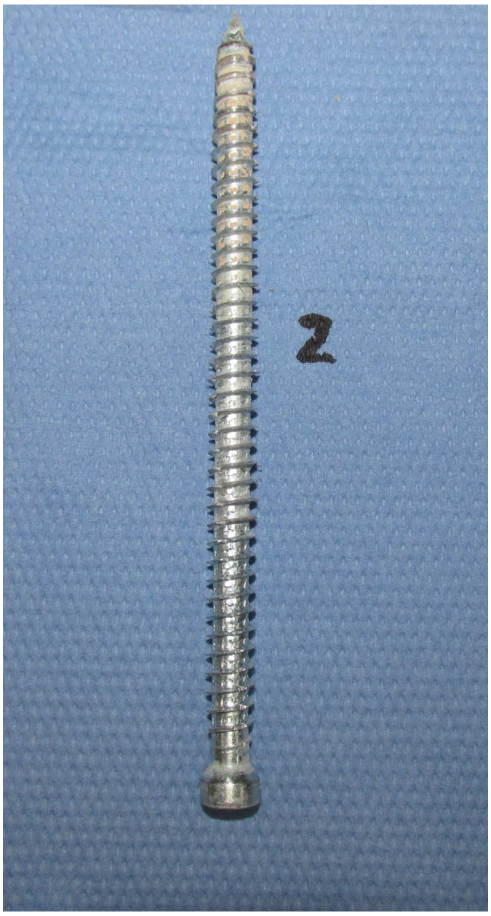


Fig. 20 Condition of the window frame screws FFS 7.5 x 202 with some slight deformations after dismantling



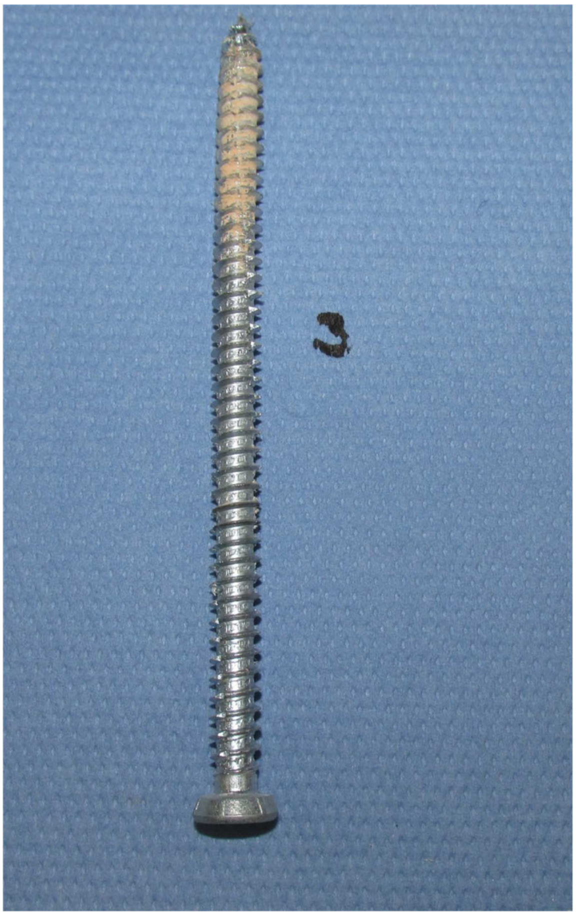


Fig. 21 and 22 Condition of the window frame screw FFSZ 7.5 x 122 and
Window frame screw FFS 7.5 x 122 with partially light deformations after dismantling

5 Evaluation and statement

In a component test, the fastening of a plastic window to the building was made with dowel-less frame screws of the type

- Window frame screw FFS 7.5 x L, Ø 7.5 mm, head Ø 11.5 mm

- Window frame screw FFSZ 7.5 x L, Ø 7.5 mm, head Ø 8.5 mm

from fischerwerke GmbH & Co. KG examined. For the component test, the fastening was carried out all around with an edge distance to the wall edge of approx. 60 mm. The load transfer of the window's own weight was carried out at the bottom using support blocks into the subsoil. The transfer of loads horizontally in the window level was carried out using diagonal blocks.

The component test consisted of climatic and mechanical loads that result in a practical load on the built-in plastic window including the fasteners. The following loads were carried out on the basis of applicable standards:

- Behavior with an additional load of up to 800 N on the open sash based on DIN EN 14608,
- Static pressure and suction load with ± 1600 Pa based on DIN EN 12211,

- Alternating pressure-suction loads with ± 800 Pa based on DIN EN 12211,− 10 extreme Temperaturbeanspruchungen von Außenklima im Winter im Wechsel mit Außenklima im Sommer,
- simulated use with 10,000 hardware operations based on DIN EN 1191,
- Safety test with ± 2400 Pa based on DIN EN 12211,
- Simulation of an unplanned use by a pendulum impact test based on DIN EN 13049, with a height of fall of 700 mm.

The following findings could be obtained from the component test:

- The sufficient seating of the plastic window in the masonry by the frame screws used was ensured during the entire test.
- During the load tests, the maximum movement of the window frame in the fastening area laterally and at right angles to the window level was 1.9 mm for pressure-suction alternating loads of ± 800 Pa and 2.7 mm for wind loads of ± 1600 Pa.
- The comparison of the initial and final test for the loads to be expected as planned showed no significant changes (increase) in the maximum movements and practically no changes in position (≤ 0.2 mm) in the fastening area to be assessed. Due to the influences of the lower fastenings in combination with the support block for load transfer below, changes in position of ≥ 0.5 mm sometimes occurred at fastening point 7, but these did not affect the functionality of the window and the fastening.
- After the safety test with ± 2400 Pa, no function-impairing changes to the window construction were found. The window was adequately anchored in the structure.
- The frame bolts were partially permanently deformed by the pendulum impact test. The window was still adequately anchored in the building.
- The detected movements in the area of the connection joint under thermal load are common for the tested plastic window and are not negatively influenced by the fastenings in the area to be assessed.
- The movements during the simulated loads that are expected as planned neither overstrain the sealing to the wall system (if the principles are observed, such as those explained in the “Installation Guide” of the RAL Quality Association for Windows and House Doors), nor does the window function limited.

In summary, it can be deduced from the component test that the frame screws are of type

- Window frame screw FFS 7.5 x L, Ø 7.5 mm, head Ø 11.5 mm

- Window frame screw FFSZ 7.5 x L, Ø 7.5 mm, head Ø 8.5 mm

for fastening plastic windows with steel reinforcement in the profiles, with a white surface design and glazing up to 20 kg / m² in connection with perforated brick masonry of the type ISO - Plan plus 0.11 (Ziegelwerk Stengel GmbH) with compressive strength class 6 or bricks or substrates with the same or higher strength are suitable for absorbing the loads to be expected as planned, provided that these do not exceed the loads applied during the investigation..

When installing windows in vertically perforated brick masonry of the ISO - Plan plus 0.11 type with the screws mentioned above, the guidelines must be taken into account. B. are published in the "Guide to Installation" of the RAL Quality Association for Windows and House Doors. In addition, the special features relating to the arrangement and spacing of the fasteners as described in Section 3.1 must be observed. Furthermore, the processing specifications of the client with regard to the screw-in depths, the edge distances, the mounting base, etc. as well as the professional installation of the frame screws apply.

6 Validity of the test results

The values stated in this test report relate exclusively to the items described and tested under point 2.

7 Conditions and information on the use of ift test documentation

The rules for using the test reports are laid down in the enclosed ift leaflet “Conditions and information on the use of ift test documentation”.

ift Rosenheim-Germany 07.10.2014

Wolfgang Jehl, Dipl.-Ing. (FH)
Stv. Prüfstellenleiter
Bauteile

Thomas Stefan, Dipl.-Ing. (FH)
Prüfingenieur
Bauteilprüfung