SUMMARY AND INDEX OF TESTS AND REPORTS OF STOFIX/STONEL SYSTEM 11.10.2016 A. Juola

Mainly in chronological order. Lifetime prediction reports located in the last

1. The Climatic testing of the STONEL -element — Tampere University of Tech 8/1996 — Climatic Testing 1996
   DOC050315-05032015090422.pdf
   a. Stonel cladding, total 6 m2, including expansion joints
   b. + 40... -20°C, 112 x 8h cycles, including wetting
   c. Panel bending test after the cyclic testing
   d. Result: No damages after the cyclic testing.
   e. Result: Exposed panels were improved their strength during the cyclic test.

2. INTERTEC: Thin Brick Curtain Wall Rain Screen System — Intertec 4/2009 — Intertek Test Report (USA).pdf
   a. Stonel cladding, two samples
   b. Product testing and evaluation acc. US standards
   c. Air Leakage, Pressure Equalization, Static Water Penetration
   d. Dynamic Water Penetration and Structural Performance

3. TEST REPORT No. VTT-S-08072-12 — VTT 10/2012 — VTT-S-08072-12.pdf
   a. 2,2 x 2,2 m Stonel cladding 4,8 m2
   b. Standard fixing system: SK165 (k660)* + JK120 (k600) + J50 (k600) + AK25 (k600) + Stonel panel
   c. Wind load test 5.4.1 of ETAG 034-1
   d. Cyclic increase of the suction up to rupture
   e. Result: 3200 Pa wind suction resistance, weakest components are J50 and AK25

4. TEST REPORT No. VTT-S-01879-13 — VTT 2/2013 — VTT-S-01879-13.pdf
   a. Fixing and panel combination strength tests acc. to ETAG 034-1 5.4.2
   b. Standard fixing system: SK165 (k660) + JK120 (k660) + J50 (k600) + AK25 (k600) + Stonel panel
   c. Horisontal load capacity of vertical fixing rails J50
      i. Loaded from the distance of 70...130 mm from the JK 120 fixing location
      ii. Design horisontal load capacity of J50 rail is 1,2 kN/fixing point and 3,3kN/m2 (fixing points in 600 x 600 mm mesh), note the distance of fixing location near to JK120
      iii. With loose fixing screws, capacity is 2,7 kN/m2
   d. Vertical load capacity (down wards) of system
   e. Horisontal load capacity of horisontal fixing rails AK25
      i. Design horisontal load capacity is 1.58 kN / two fixing points and 2.2 kN/m2 (fixing points in 600 x 600 mm mesh)
   f. load capacity for combined horisontal and downward loads of system
   g. bending strength of the brick cladding in both directions, Stonel/Stofix panels
      i. Design vertical load capacity is 3.0 kN /two fixing points and ca. 4.2 kN/m2 (fixing points in 600 x 600 mm mesh)

5. Evaluation report No. VTT-S-xxx-13 — VTT xx/2013 — Evaluation report Stonel.pdf
   a. Evaluation report of Stonel façade cladding kit according to ETAG 034 for ETA approval
   b. Report describing the Stonel system and its characteristics
   c. Based on test reports VTT-S-08072-12 and VTT-S-01879-13
   d. No signed document available

6. European Technical Approval ETA-13/0624 — VTT 6/2013 — STONEL ETA3.pdf
   a. ETA of Stonel façade cladding , based on Evaluation report VTT-S-xxx-13
   b. Manufacturing plant: Ratamestarintie 2, Oulainen, Finland
   c. Main summary:
      i. Cladding resisted wind suction up to — 3200 Pa
      ii. Design horizontal load capacity — 2,2 kN/m2 (2,8 fixings/m2)
      iii. Design vertical load capacity — 4,2 kN/m2 (2,8 fixings/m2)

7. WINTECH Technical Report R14425 — WINTECH 12/2014 — R14425 Rev 2.pdf
   a. 5,8 x 6,0 m, total 34,8 m2
   b. Two storey high building wall with Stofix cladding system
   c. Steel metal frame with CP Board backing structure, PIR insulated 120 mm on it
   d. Stofix cladding system with window soffit and corner details, horizontal + vertical expansion joints
   e. Reinforced fixing system for high wind loads: SK115 (k540) + J60 (k600) + AK25 (max. k300) + Stofix panel
   f. British CWCT Sequence B & Seismic Test AAMA 501.4:2000

i.	Air Leakage (Infiltration & Exfiltration)	CWCT Section 5	600 + 100 Pa	Pass, Class A4
ii.	Water Penetration (Static pressure)	CWCT Section 6	600 Pa	Pass, Class R7
iii.	Water Penetration (Dynamic Aero Engine)	CWCT Section 7	600 Pa	Pass
iv.	Wind Resistance (Serviceability)		CWCT Section 11	2400 Pa Pass
v.	Repeat Air Leakage (Infiltration& Exfiltration)	CWCT Section 5	600 + 100 Pa	Pass
vi.	Repeat Water Penetration (Static pressure)	CWCT Section 6	600 Pa	Pass, Class R7
vii.	Repeat Water Penetration (Dynamic Aero Engine)	CWCT Section 7	600 Pa	Pass
viii.	Wind Resistance (Safety)	CWCT Section 12	3600 Pa	Pass
ix.	Impact Resistance (Retention of Performance)	CWCT TN 76	S1 120Nm	Pass, Cat B + TN76; Class 3
x.	Impact Resistance (Safety to Persons) Negligible Risk	CWCT TN 76	S1 500Nm + H2 10Nm	Pass, Cat B + TN76;
xi.	Structural Movement – Seismic Testing	AAMA 501.4:2000		No damage

8. SP REPORT 4P06753rev2EN, Fire test of a façade cladding — SP 12/2014 — SP Fire 105 Brandtest – ENG.pdf
   a. Swedish wall scale fire testing SP Fire 105
   b. Full scale two storey testing, 4 x 6 m, total 24 m2 with two windows
   c. Stofix cladding mounted on a lightweight concrete
   d. Insulated 20 mm mineral wool + 100 mm PIR + 50 mm mineral wool
   e. Stofix standard fixing: SK165 (k700) + J60 (k600) + AK25 (k600) + Stofix panel
   f. Result: Passed, No damages to the wall, fire did not enter to the second floor

9. BRE Global Test Report, 303931 Issue 2 BRE 7/2015 Stofix BS 8414-2 test report 303931 version 2.pdf
    a. British full scale fire testing BS 8414-2
    b. Full scale three storey fire testing, (1,5+2,9)m x 8,1 m, 35 m2, fire chamber
    c. Steel metal frame with CP board backing structure, Phenolic insulated 120 mm on it
    d. Vertical and horizontal cavity barrier details for fire stopping
    e. Stofix cladding system with soffit and corner details, horizontal + vertical expansion joints
    f. Stofix standard fixing: SK115 (k720) + J60 (k600) + AK25 (k600) + Stofix panel
    g. 30 min full fireworks + 30 min observation time
    h. Result: Passed. Part of the insulation melted and damaged, fire breaks stop the firing on the second floor
    i. No bricks or panels detached, three cracks on the façade

10. BRE Global Classification Report, P100576 -1000 BRE 7/2015 Stofix P100576-1000 BR 135 Classification Report Version 2.pdf
    a. British BR 135 Classification report of the BS 8414-2 testing
    b. Result: The Stofix system is compliant with BR135:2003, Annex B

11. TEST REPORT No. VTT-S-01793-16 VTT 4/2016 Stofix Oy VTT Impact and point load testing ETAG 034.pdf
    a. Test wall of 2,4 x 1,8 m, installed on a rigid construction of wooden studs, k600 horizontally.
    b. Stofix standard fixing with longest brackets and weakest horizontal rail (worst case scenario): SK225 (k720) + JK120 + J60 (k600) + AK15 (k600) + Stofix panel
    c. Horizontal point load resistance testing acc. to ETAG 034-1 5.4.3
        i. 500 N horizontal two-point load, describing a ladder leaning against the wall
        ii. Result: Passed, no deformation
    d. Hard and soft body impact tests acc. to ETAG 034-1 5.4.4
        i. Hard body impacts up to 10 J (1 kg steel ball)
        ii. Soft body impacts up to 60 J (3 kg sack) and up to 400 J (50 kg sack)
        iii. Result: Stofix cladding can be used in Category I zones in accordance with ETAG 034-1:2012 – A zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use.

12. VTT CLASSIFICATION REPORT, VTT-S-01162-16 VTT 3/2016 Stofix Oy VTT Fire classification EN 13501-1+A1.pdf
    a. Fire classification report EN 13501-1:2007+A1:2009, refers to tests:
    b. EN 13823 Single burning item test, VTT-S-01161-16 (Stofix Oy VTT SBI test EN 13823.pdf)
        i. Three samples: (500 + 1000)mm x 1500 mm, 2,2 m2
        ii. 3 x 21 min tests of single burning item
        iii. Stofix system mounted on a shipboard, without insulation (worst case scenario)
        iv. Stofix standard fixing: SK50 (k720) + J60 (k600) + AK15 (k600) + Stofix panel
    c. EN ISO 1716:2010 Determination of the heat combustion, VTT-S-01160-16 (Stofix Oy VTT Heat combustion test EN ISO 1716.pdf)
        i. Samples: Stofix factory bonding grout and Stofix site bonding grout
    d. Results: A2-s1, d0 classification for Stofix Brick Slip Cladding System

13. TEST REPORT No. VTT-S-02078-16 VTT 6/2016 VTT-S-02078-16 Stofix Oy.pdf
    a. SAMPLE 1, Cyclic environmental tests
        i. Medium scale wall cladding, 2,77 x 2,76, total 7,6 m2
        ii. Stofix cladding system with window soffit and corner details, vertical expansion joint
        iii. Steel metal frame with CP board backing structure, mineral wool insulated 200 mm on it
        iv. Stofix standard fixing with longest brackets and weakest horizontal rail (worst case scenario): SK225 (k660) + JK120 + J60 (k600) + AK15 (k600) + Stofix panel
        v. Hygrothermal cycling, ETAG 034-1 clause 5.4.6
            1. 80 cycles of Heat +70°C – Rain +15°C
            2. 5 cycles of Heat +50°C – Cold -20°C
            3. Total duration 25 days
            4. Result: No visible changes
        vi. Freeze-thaw cycling, ETAG 17 clause 5.7.2.2
            1. 30 cycles of Water +23°C (8h) – Freeze -20°C (2+14h)
            2. Total duration 30 days
            3. Result: No visible changes (detachment, blistering, loss of adhesion or cracks). No residual bowing.
        vii. Water tightness testing ETAG 034-1 clause 5.3.1 which refers to EN 12865 Procedure A
            1. Raining under pulsating air pressure, 0 Pa, 150 Pa, 300 Pa, 450 Pa, 600 Pa
            2. Result: Water penetrates through the cladding in 35 seconds with zero pressure
            3. Brick and mortar are porous, Stofix is not watertight material
            4. Shape of Stofix fixing system and flashings will drain the immersed water out of the façade, insulation is not wetted
        viii. Bending test of the exposed cladding panels, ETAG 034-1 clause 5.4.2, Annex C.2
            1. After the tests above, pieces of the cladding panels were cut from the test SAMPLE 1
            2. Reference panels cut from unexposed Stofix panels, same batch
            3. Cut panel size 300 x 600 mm, vertical and horizontal directions
            4. Result: No remarkable change of behavior on the cladding panels after cyclic tests
    b. SAMPLE 2, Wind load test ETAG 034-1 5.4.1
        i. Medium scale wall cladding, 2,27 x 2,27, total 5,2 m2
        ii. Stofix cladding system installed on steel metal studs, inside a wooden frame, no insulation
        iii. Stofix standard fixing with longest brackets and weakest horizontal rail (worst case scenario): SK225 (k660) + JK120 + J60 (k600) + AK15 (k600) + Stofix panel
        iv. Cyclic increase of the suction up to rupture
        v. Result: 2750 Pa wind suction resistance
        vi. Weakest component is AK15, no deformation of J60 vertical rail

14. TEST REPORT No. VTT-S-02764-16 VTT 6/2016 VTT-S-02764-16 signed.pdf
    a. Fixing and panel combination strength tests ETAG 034-1 5.4.2
    b. Stofix standard fixing with longest brackets and weakest horizontal rail (worst case scenario): SK225 (k720) + JK120 + J60 (k600) + AK15 (k600) + Stofix panel
    c. Horizontal load tests of system
        i. Result: Characteristic horizontal load capacity 3,17 kN/m2
    d. Load tests of system for combined (30%) horizontal and vertical load
        i. Result: Characteristic combined load capacity 3,57 kN/m2
    e. Vertical load tests of system
        i. Result: Characteristic vertical load capacity 5,1 kN/m2

15. TEST REPORT No. VTT-S-02765-16 VTT 6/2016 VTT-S-02765-16.pdf
    a. Horisontal load tests of the Stofix Brick Slip Cladding System with wind barrier structure
    b. Stofix fixing with wind barrier gypsum board and Z-rail used
    c. Longest brackets and weakest horizontal rail used (worst case scenario):
    d. SK225 (k720) + JK120 + L50 (k600) + Gypsum board + Z20 (k600) + AK15 (k600)
    e. Result: The wind barrier substructure is not critical. AK 15 and AK 25 will determine the wind load capacity.

16. TEST REPORT No. VTT-S-02766-16 VTT 6/2016 VTT-S-02766-16.pdf
    a. Load tests for vertical J-rails and for screws used for ETAG 034 approval
    b. Horisontal load capacity of vertical insulation J60- rails, fixed with spacing k720 mm
        i. Result: Characteristic horizontal load capacity of J60 rails (k600) is 6,0 kN/m2
    c. Shear tests for joint with screws (hexagonal M8x12 8.8 Zn ISO 7830) with friction connection in a slot between J60 rail and SK/JK bracket
        i. Result: Characteristic horizontal load capacity of the connection is 1,15 kN/screw and 2,67 kN/m2 fixed in mesh 600 x 720 mm
    d. Pull out tests for drill screws (Würth 6.3 x 38 stainless, DIN 7504-K PH AISI410 Ruspert) fixed in the 1.25 mm thick J60 rail profile
        i. Result: Characteristic pullout load capacity is 2,10 kN/screw and 5,35 kN/m2 fixed in mesh 600 x 600 mm
    e. Pull out tests for drill screw (Saphir JT2-3-5.5 x 19 14), screw joint between 1.25 mm thick vertical J60 rail and horizontal AK15 rail
        i. Result: Characteristic pullout load capacity is 2,07 kN/m2 and 5,75 kN/m2 fixed in mesh 600 x 600 mm **
    f. Shear tests for drill screw (Saphir JT2-3-5.5 x 19 14), screw joint between 1.25 mm thick vertical J60 rail and horizontal AK15 rail
        i. Result: Characteristic shear load capacity is 4,07 kN/screw and 11,3 kN/m2 fixed in mesh 600 x 600 mm
    g. Shear tests for drill screw (Saphir JT2-3-5.5 x 19 14), screw joint between 1.25 mm thick vertical J60 rail and 2.0 mm thick JK extension bracket
        i. Result: Characteristic shear load capacity is 4,20 kN/screw and 9,7 kN/m2 fixed in mesh 600 x 720 mm

17. CUSTOMER REPORT VTT-CR-05165-15 VTT 10.2.2016 Stofix lifetime prediction report Helsinki – London.pdf
    a. Expected performance life span of Stofix prefabricated brick slip panel system in Helsinki and London
    b. A research report of life span of material candidates used in part of Stofix Cladding fixing system
    c. Material candidates:
        i. Galvanized steels
        ii. Zn – Al alloy coated steels
        iii. Zn – Al – Mg alloy coated steels
        iv. Ferritic stainless steel grades
    d. Outside environmental conditions of Helsinki and London, classificated to Corrosivity category C3 ISO 9223
    e. Location of the Stofix cladding steels is in the ventilated cavity and sheltered from rain even if the brick cladding is porous
    f. Environmental conditions of Stofix cladding is C2 in Helsinki and London (Page 18)
        i. Predicted zinc loss rate is 0,6 um/year in Helsinki
        ii. Predicted zinc loss rate is 0,7 um/year in London
    g. Lifetime of the Stofix standard galvanized grade Z600 g/m2 (which was selected due to this report):
        i. 70 years in Helsinki
        ii. 60 years in London
    h. Lifetime calculation is made with linear corrosion rate to give safety factor against possible scratch and cut edge corrosion
    i. Lifetime of the Stofix stainless grade option (which was selected due to this report):
        i. EN 1.4521 may survive over 60 years in Helsinki and London

18. CUSTOMER REPORT VTT-CR-05614-15 VTT 10.12.2015 Stofix old building inspection report.pdf
    a. Inspection of Stofix prefabricated brick slip panel systems installed in Finland
    b. Inspection of three old building facades in Helsinki and Tampere
    c. Cladding manufactured by Stonel Oy on years 2000 – 2002
    d. Galvanizing layer thickness of the used components have been only Z275 g/m2
    e. Galvanized steel components were systematically inspected and measured
    f. Results:
        i. No frost damages seen, some (total 4 points) panel lower edges were damaged by impact
        ii. Exposure to atmospheric weathering had not caused significant changes in the appearance of the galvanizing
        iii. Only few points of the local rusting was seen where the zinc layer was damaged, but the rusting was stopped by the sacrificial effect of the galvanizing
        iv. The performance of the of galvanized steel in Sfofix cladding is in line with the Stofix lifetime prediction report

19. CUSTOMER REPORT VTT-CR-04655-15 VTT 7.12.2015 Stofix corrosion classification – case Ruskin.pdf
    a. Climatic corrosion classification of Stofix factory prefabricated brick slip cladding system – case Ruskin
    b. Simulation research of Stofix cladding cavity environmental conditions in Ruskin Square building located in London
    c. Analysis of the wall structure and cavity air change rate in the worst case location of the building
    d. Results: maximum 0,35…0,7 um zinc loss rate annually, categorized to C2 environmental conditions

*) SK165 vertical centers documented k600 mm, but from the photos we can see it is k660 mm

**) Note there is a writing error in the report text showing 2,7 kN/m2 (wrong) in the results and 2,07 kN/m2 (right) in the Appendix 6. 5,75 kN/m2 is right.