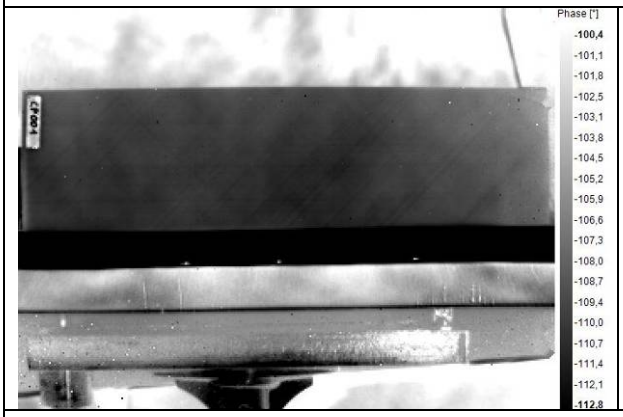
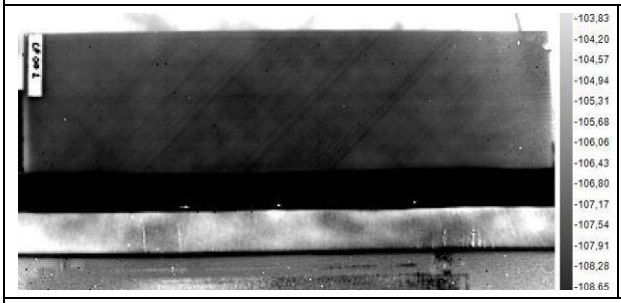
Annex B: Results on composite plates

<table>
<tr><th colspan="2">CP001</th></tr>
<tr><th colspan="2">Incoming inspection</th></tr>
<tr><td> 
</td><td><u>Average thickness</u> 2.11 mm
<u>Visual inspection:</u>
- slightly curved
<u>Lock-in thermography:</u>
- Uniform picture
- No pre-damage</td></tr>
<tr><th colspan="2">High Velocity Impact test</th></tr>
<tr><td colspan="2">No test</td></tr>
<tr><th colspan="2">Lock-in thermography after HVI test</th></tr>
<tr><td colspan="2">–</td></tr>
<tr><th colspan="2">Residual strength test</th></tr>
<tr><td> 

Failed plate after the test</td><td>The residual strength test on the undamaged test plate could not be conducted up to ultimate failure as the plate failed in the tabs. As a result, optimization on the tabs/bonding were carried out with test plates CP007a und CP007b.</td></tr>
</table>

CP002

Incoming inspection



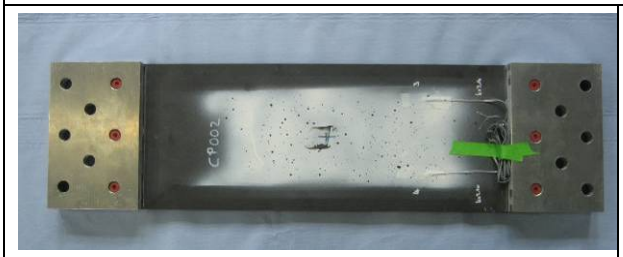
Average thickness 2.03 mm

Visual inspection:
- slightly curved

Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 100 g steel beam
Pre-loading: 0.25%, in tension
Velocity: 67 m/s (224.5 J)



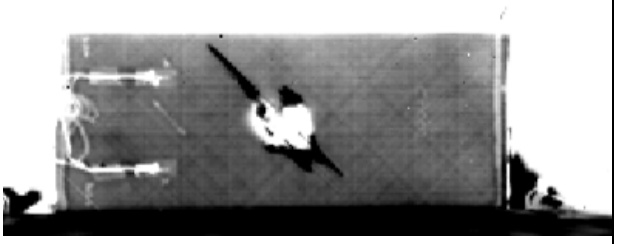
Impact side

Rear view

Notch damage + large delamination

Lock-in thermography after HVI test

No front view



Rear view

Residual strength test

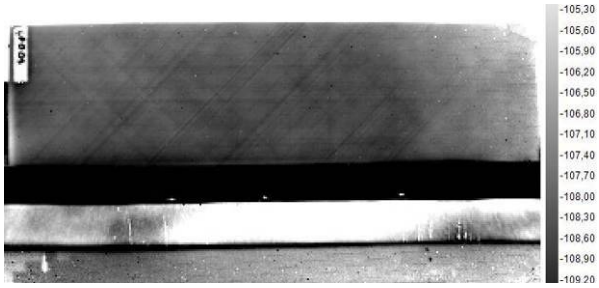
Failed plate after the test

Failure load= 208.8 kN

Residual strength factor: 0.48

CP003

Incoming inspection

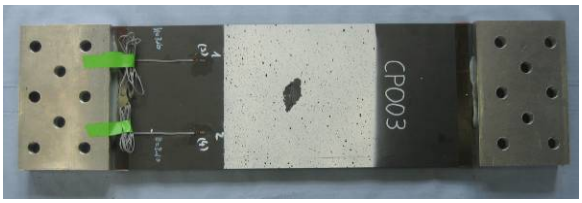


Average thickness 1.99 mm
Visual inspection:
- slightly curved

Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 100 g steel beam
Pre-loading: 0.05%, similar to no preloading
Velocity: 71 m/s (254.7 J)



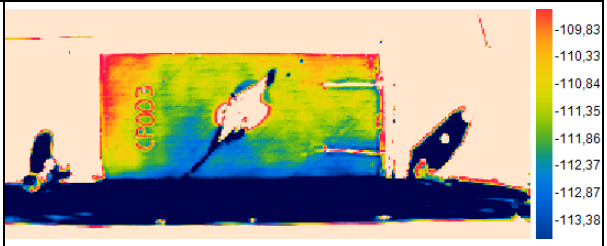
Impact side

Rear side

Notch damage + large delamination

Lock-in thermography after HVI test

Front view



Rear view

Residual strength test

Plate after the test

Failure load= 160.3 kN
Residual strength factor = 0.37

CP004

Incoming inspection

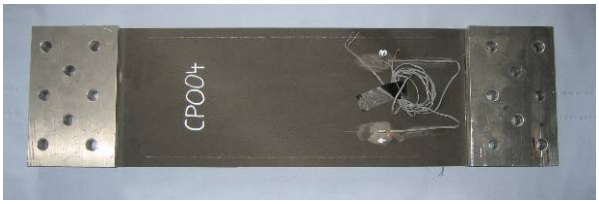
Average thickness 2.01 mm
Visual inspection:
- slightly curved

Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 100 rubber beam
Pre-loading: 0.25%, in tension
Velocity: 99.2 m/s (497 J)

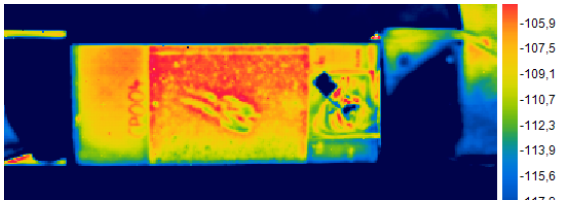
Impact side



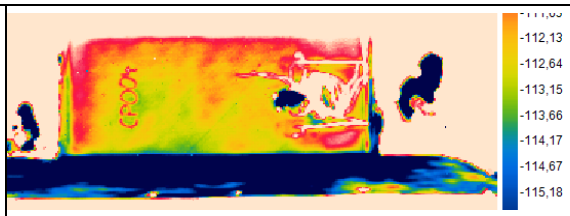
Rear view

No visible damage

Lock-in thermography after HVI test



Front view



Rear view

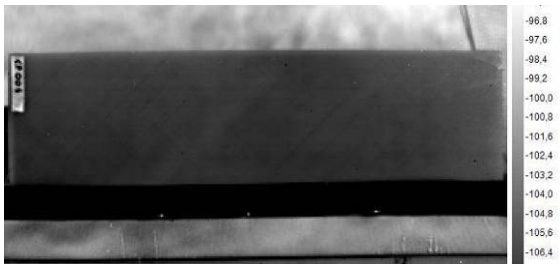
No damage detected

Residual strength test

No test	As no damage could be detected, no residual strength test was conducted

CP005

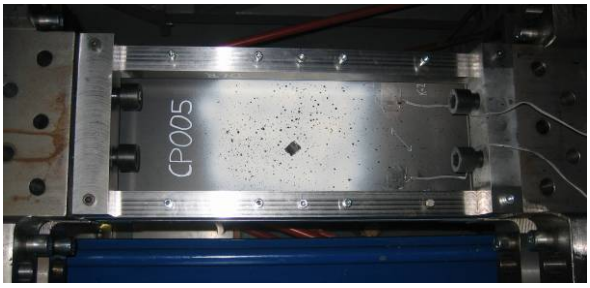
Incoming inspection



Average thickness 1.99 mm
Visual inspection:
- slightly curved
Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25%, in tension
Velocity: 103.7 m/s (68.9 J)

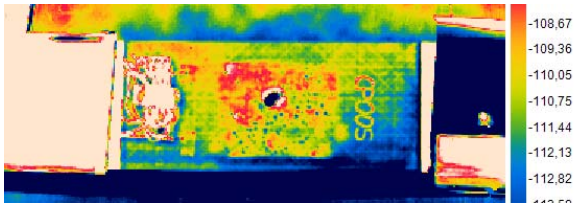


Impact side

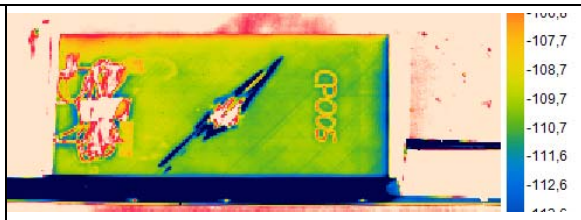
Rear side

Notch damage (square hole)

Lock-in thermography after HVI test



Front view



Rear view

Residual strength test

Failure load= 215.05 kN
Residual strength factor = 0.49

CP006

Incoming inspection

Average thickness 1.99 mm
Visual inspection:
- slightly curved

Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

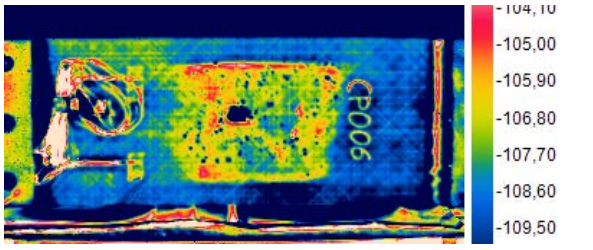
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25%, in tension
Velocity: 63.9 m/s (26.5 J)

Impact side

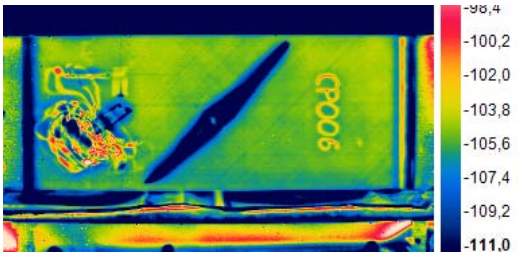
Rear side

Cube rebounded / Square flap damage with delamination

Lock-in thermography after HVI test



Front view



Rear view

Residual strength test

Failure load= 233 kN
Residual strength factor = 0.53

CP007a (cut from CP007)

Incoming inspection

Dimensions: 750 mm x 100 mm
Average thickness: 1.99 mm
Visual inspection:
- slightly curved (2 plies interchanged but number of 0°, 45° and 90° plies is correct)
Lock-in thermography:
- Non-uniform picture: a folding in one layer is assumed so that the plate was not used for the test campaign. The test plate CP007 was then cut into two pieces in order to improve tabs and bonding for the Q/S fixture.

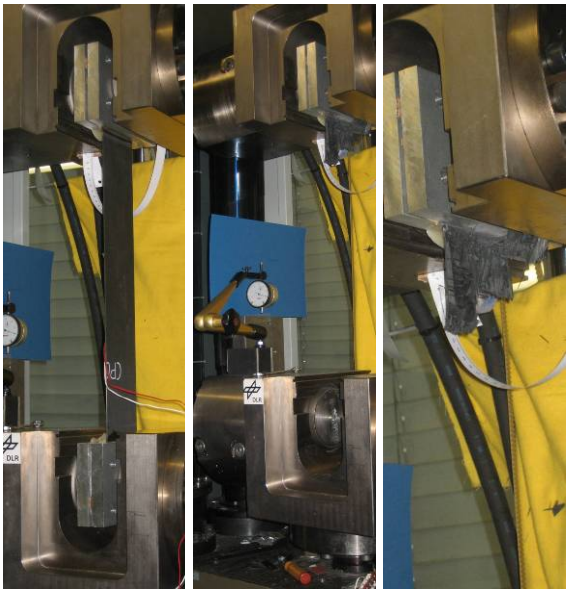
High Velocity Impact test

No test

Lock-in thermography after HVI test

–

Residual strength test



Pictures of the test plate after failure

A new “tabs/bonding” concept has been investigated in order to be able to conduct the test until the failure of a 200 mm wide undamaged plate. One of these concepts consists using a new adhesive (Epikote Resin 02306) to bond the aluminium tabs to the carbon test plate.

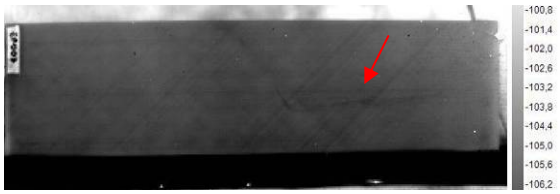
Failure in composite guage length.

Failure load= 217.8 kN (1.54% strain) for a 100 mm wide test plate

Estimated failure load (200 mm wide test plate) = 435.6 kN

CP007b (cut from CP007)

Incoming inspection



Dimensions: 750 mm x 100 mm
Average thickness: 1.99 mm
Visual inspection:
- slightly curved (2 plies interchanged)
Lock-in thermography:
Non-uniform picture: a folding in one layer is assumed so that the plate was not used for the test campaign. The test plate CP007 was then cut into two pieces in order to improve tabs and bonding for the Q/S fixture.

High Velocity Impact test

No test

Lock-in thermography after HVI test

–

Residual strength test

A new “tabs/bonding” concept has been investigated in order to be able to conduct the test until the failure of a 200 mm wide undamaged plate. One of these concepts consists in including a GRP tabs insert between the carbon test plate and the original aluminium tabs in order to attenuate the constraints concentration at the tabs edge. In comparison to the concept used for CP007a.

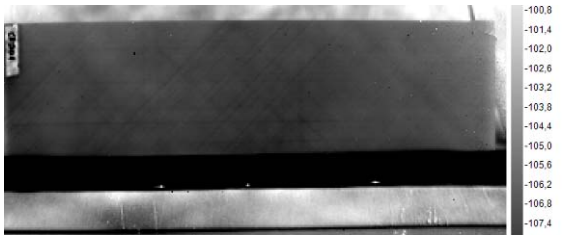
Failure at GRP tab/composite interface.

Failure load= 195.6 kN (1.45% strain) for a 100 mm wide test plate

Estimated failure load (200 mm wide test plate) = 391.2 kN

CP008

Incoming inspection

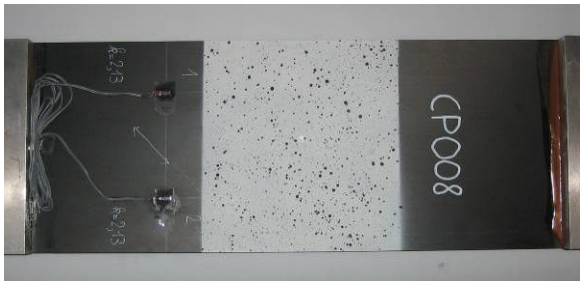


Average thickness: 1.99 mm
Visual inspection:
- slightly curved

Lock-in thermography:
- Uniform picture
- No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 18 g glass ball (Ø24 mm)
Pre-loading: 0.25%, in tension
Velocity: 63.8 m/s (36.6J)

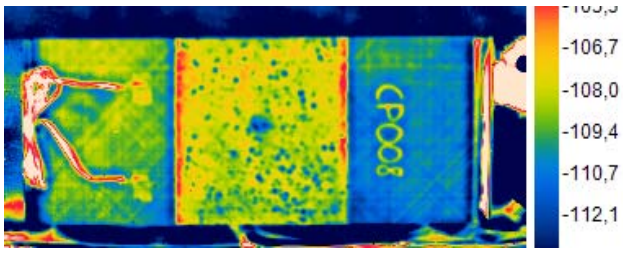


Impact side

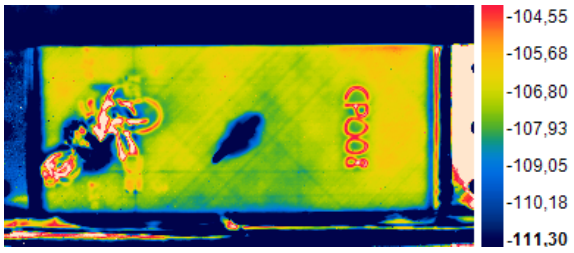
Rear side (zoom)

No damage at front, delamination damage back

Lock-in thermography after HVI test



Front view



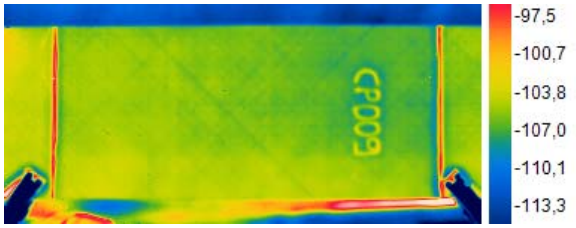
Rear view

Residual strength test

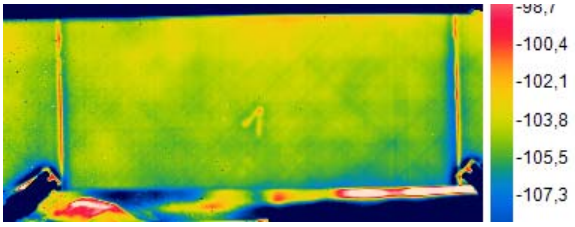
Failure load= 328.6 kN
Residual strength factor = 0.75

CP009

Incoming inspection



front



rear

Average thickness: 2.09 mm

Visual inspection: alright

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

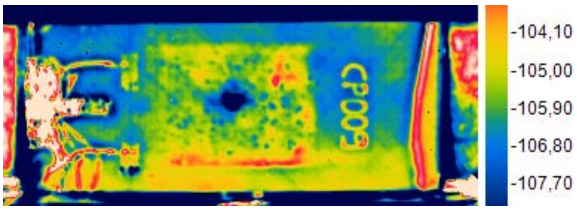
Test conditions:
Impactor: 18 g glass ball (Ø24 mm)
Pre-loading: 0.25%, in tension
Velocity: 67.6 m/s (41.1 J)

Impact side

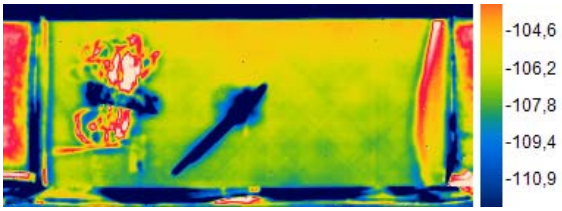
Rear side

Dent at front, delamination damage back

Lock-in thermography after HVI test



Front view



Rear view

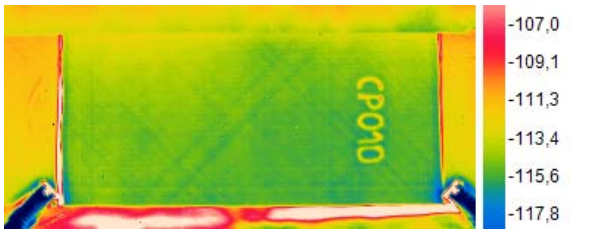
Residual strength test

Failure load= 287.1 kN

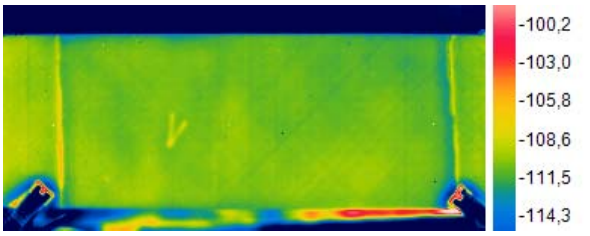
Residual strength factor = 0.66

CP010

Incoming inspection



front



rear

Average thickness: 3.07 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

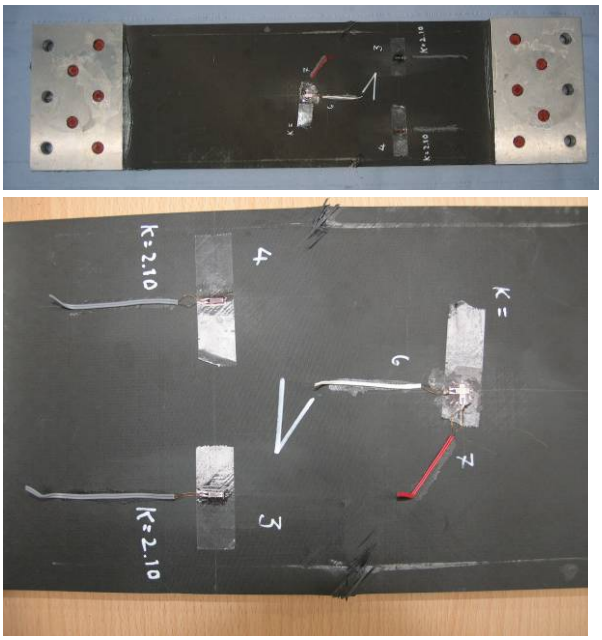
High Velocity Impact test

No test

Lock-in thermography after HVI test

–

Residual strength test (compression)

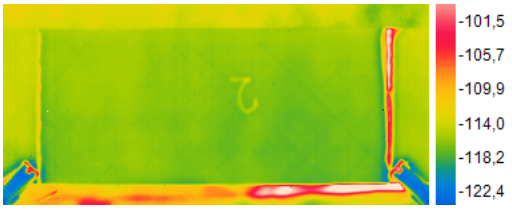


Buckle load: 38 kN (0.08% strain)
Failure load= 132.4 kN
Residual strength factor = 1

CP011

Incoming inspection

front



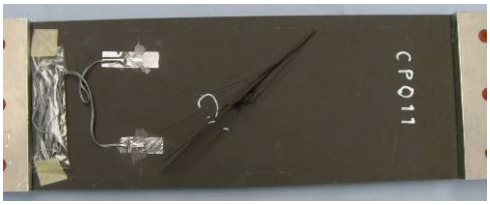
rear

Average thickness: 3.10 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.4 Pb (52 kN, 0.17%), in compression
Velocity: 135.9 m/s (127.2J)

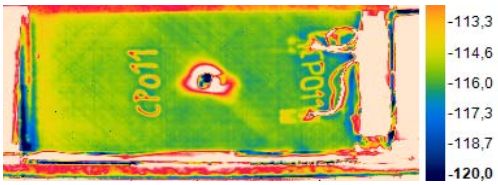
Impact side



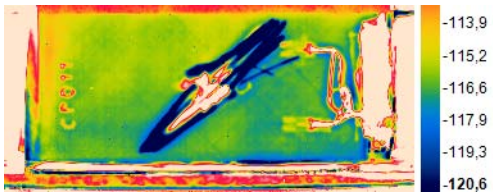
Rear side

Impact on convex face / Cube passed through / notch damage, large delamination at back face

Lock-in thermography after HVI test



Front view



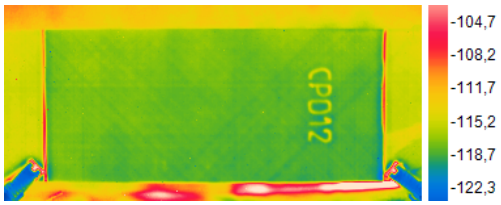
Rear view

Residual strength test (compression)

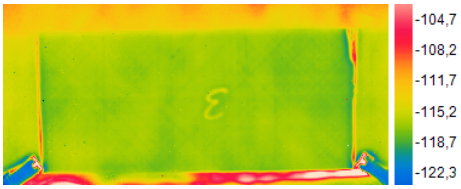
Failure load= 135.6 kN
Residual strength factor = 1.02

CP012

Incoming inspection



front



rear

Average thickness: 3.10 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

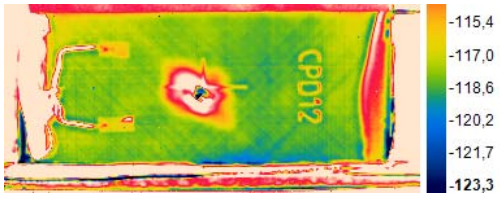
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.95 Pb (36 kN, 0.12%), in compression
Velocity: 135.0 m/s (122 J)

Impact side

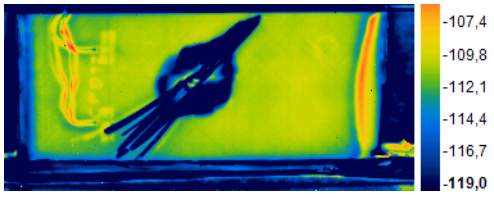
Rear side

Impact on convex face / Cube passed through / notch damage, large delamination at back face

Lock-in thermography after HVI test



Front view



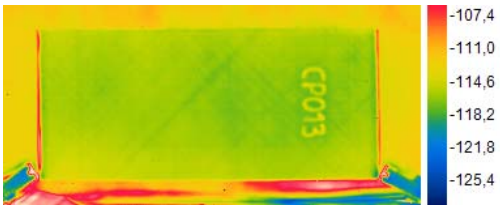
Rear view

Residual strength test (compression)

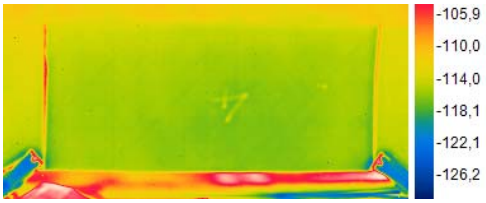
Failure load= 127.2 kN
Residual strength factor = 0.96

CP013

Incoming inspection



front



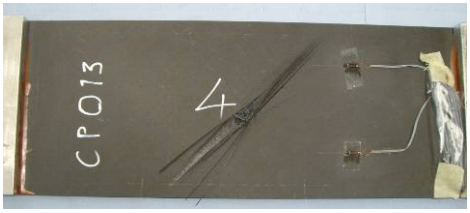
rear

Average thickness: 3.12 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading:~ 0 (2 kN, 0.05%), similar to no preloading
Velocity: 134 m/s (120.4 J)

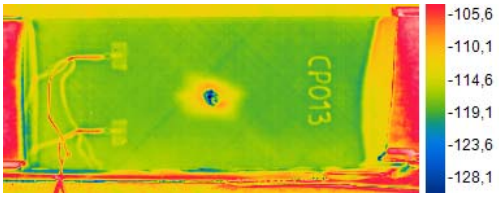
Impact side



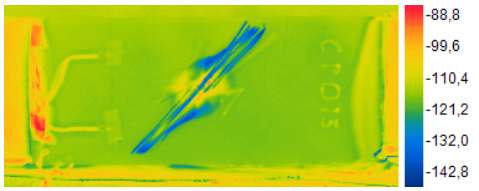
Rear side

Cube passed through / notch damage, delamination at back face

Lock-in thermography after HVI test



Front view



Rear view

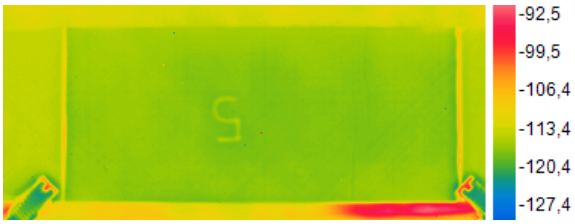
Residual strength test (compression)

Failure load= 132.8 kN
Residual strength factor = 1.00

CP014

Incoming inspection

front



rear

Average thickness: 3.1 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

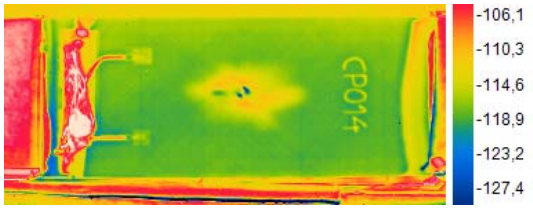
Test conditions:
Impactor: 20.2 g glass ball (Ø25 mm)
Pre-loading: ~ 0 (2 kN, 0.05%), similar to no preloading
Velocity: 85.6 m/s (74 J)

Impact side

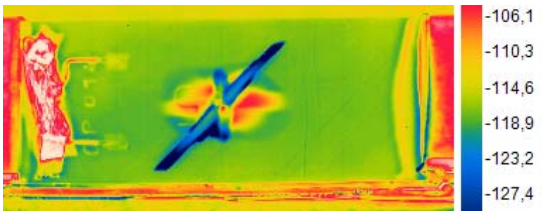
Rear side

Glass ball rebounded / Dent on front face, delamination damage on back face

Lock-in thermography after HVI test



Front view



Rear view

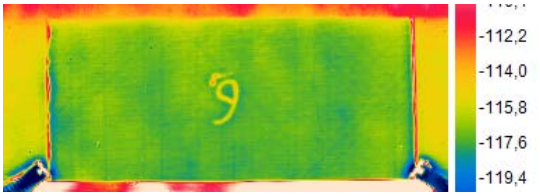
Residual strength test (compression)

Failure load= 111.7 kN
Residual strength factor = 0.84

CP015

Incoming inspection

front



rear

Average thickness: 3.11 mm

Visual inspection: alright

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 20.2 g glass ball (Ø25 mm)
Pre-loading: 0.95 Pb (36 kN, 0.12%), in compression
Velocity: 83.3 m/s (70.1 J)

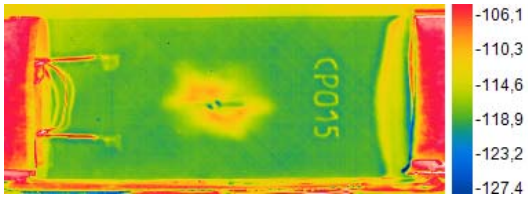
–

Impact side

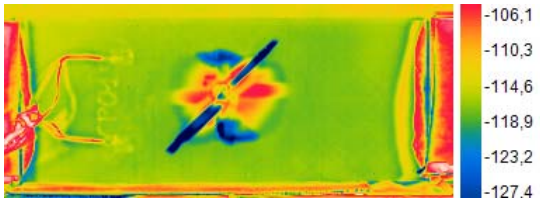
Rear side

Impact on convex face / Glass ball rebounded / Dent on front face and delamination on back face

Lock-in thermography after HVI test



Front view



Rear view

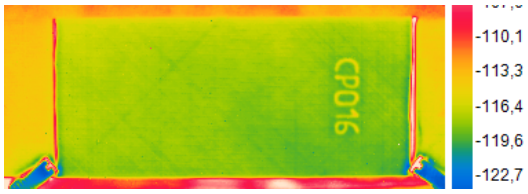
Residual strength test (compression)

Failure load= 88.4

Residual strength factor = 0.67

C016

Incoming inspection



front

rear

Average thickness: 3.14 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

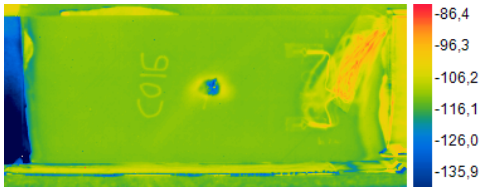
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.4 Pb (53.2 kN) ,in compression
Velocity: 129.2 m/s (111.8 J)

Impact side

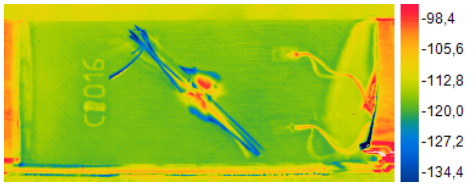
Rear side

Impact on convex face / Cube passed through / Square hole, delamination damage at back face

Lock-in thermography after HVI test



Front view



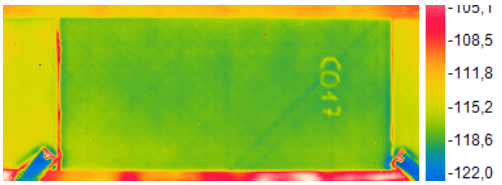
Rear view

Residual strength test (compression)

Failure load= 119 kN
Residual strength factor = 0.90

C017

Incoming inspection



front

rear

Average thickness: 3.09 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

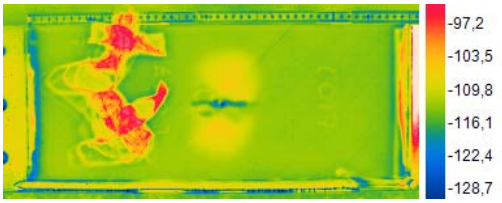
Test conditions:
Impactor: 19.3 g glass ball (Ø24.5 mm)
Pre-loading: 1.4 Pb (53.2 kN) ,in compression
Velocity: 82.2 m/s (65.2 J)


Impact side

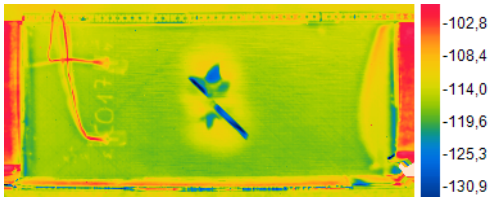

Rear side

Impact on convex face / Glass ball rebounded / Dent on front face and delamination on back face

Lock-in thermography after HVI test



Front view



Rear view

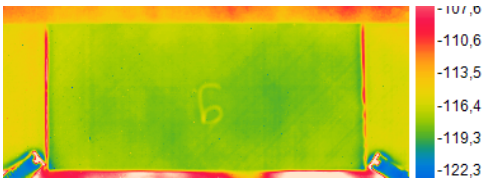
Residual strength test (compression)

Failure load= 85.1 kN
Residual strength factor = 0.64

C018

Incoming inspection

front



rear

Average thickness: 3.10 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

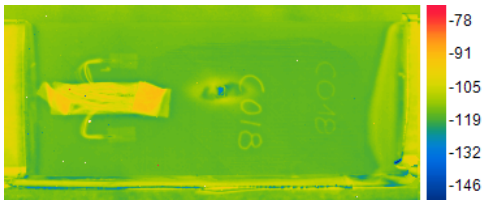
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: ~ 0 (5 kN), similar to no preloading
Velocity: 131.6 m/s (116 J)


Impact side

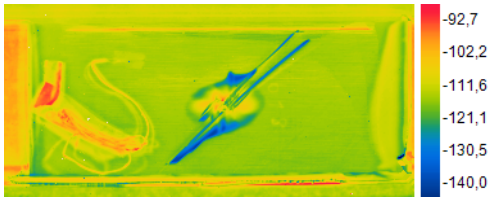

Rear side

Cube passed through / Dent on front face and delamination on back face

Lock-in thermography after HVI test



Front view



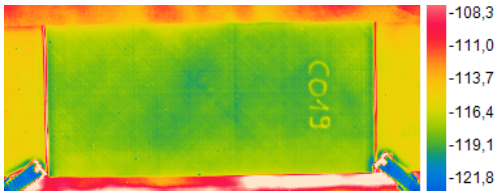
Rear view

Residual strength test (compression)

Failure load= 126.8 kN
Residual strength factor = 0.96

C019

Incoming inspection



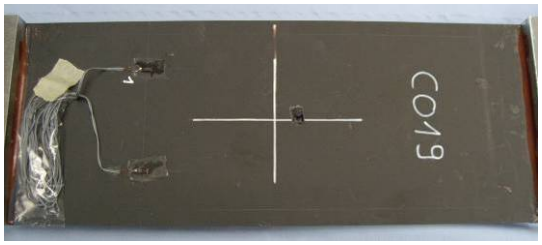
front

rear

Average thickness: 3.10 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

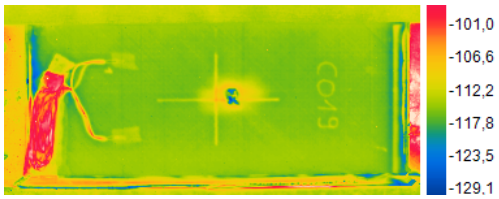
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: ~ 0 (2 kN), similar to no preloading
Velocity: 135.0 m/ s (122 J)


Impact side

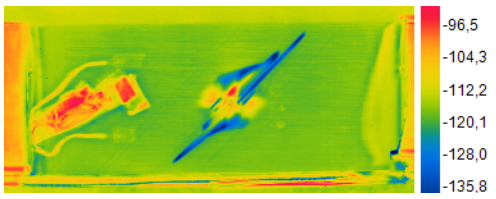

Rear side

Cube passed through / Dent on front face and delamination on back face

Lock-in thermography after HVI test



Front view



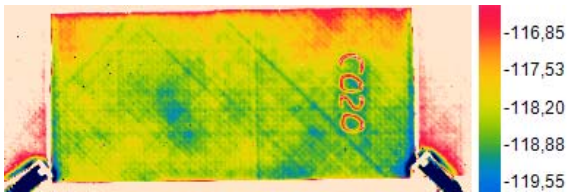
Rear view

Residual strength test (compression)

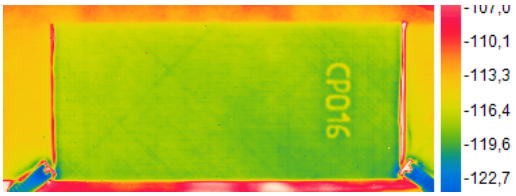
Failure load= 127 kN
Residual strength factor = 0.96

C020

Incoming inspection



front

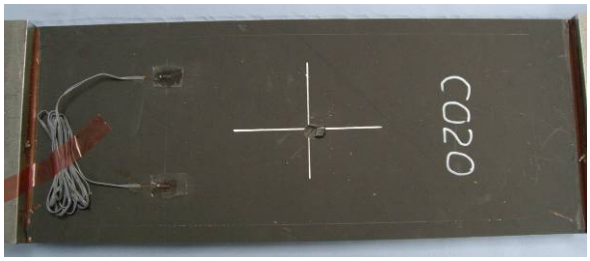


rear

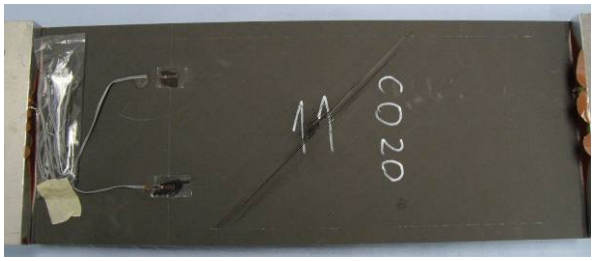
Average thickness: 3.11 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 126.6 m/s (107.4 J)



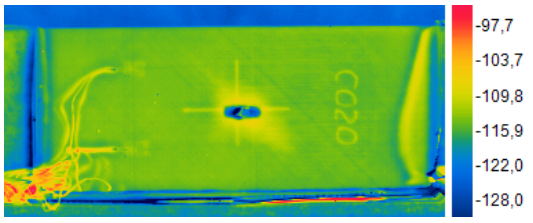
Impact side



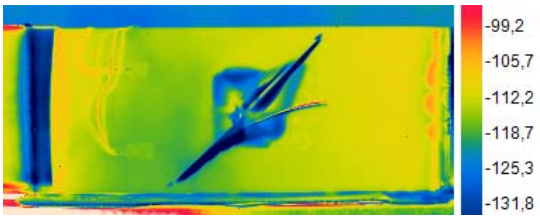
Rear side

Impact on convex face / Cube passed through / Dent on front face and delamination on back face

Lock-in thermography after HVI test



Front view



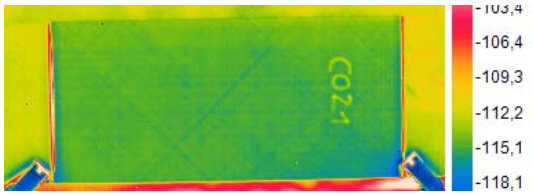
Rear view

Residual strength test (compression)

Failure load= 117.6 kN
Residual strength factor = 0.89

C021

Incoming inspection



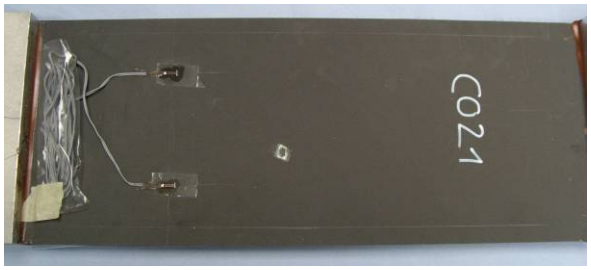
front

rear

Average thickness: 3.12 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

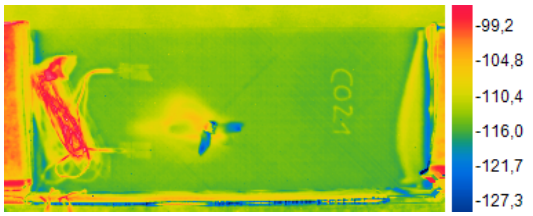
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 93.5 m/s (58.5 J)


Impact side

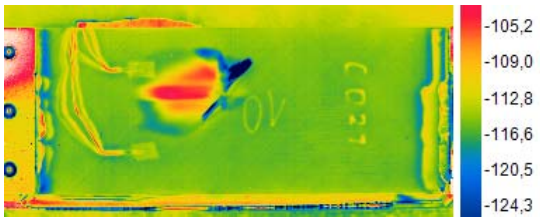

Rear side

Impact on concave face / Cube stopped / Front face damage and delamination at back face

Lock-in thermography after HVI test

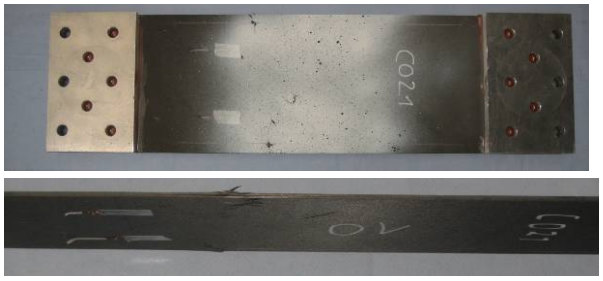


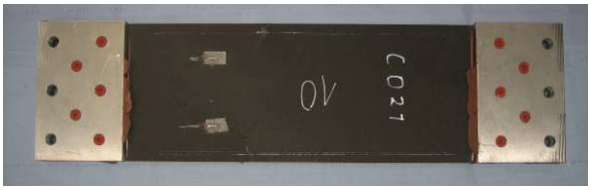
Front view



Rear view

Residual strength test (compression)

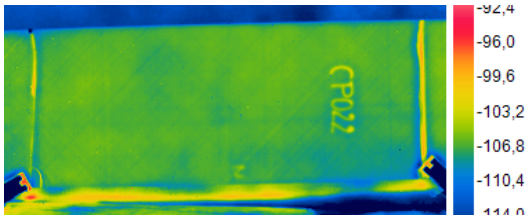




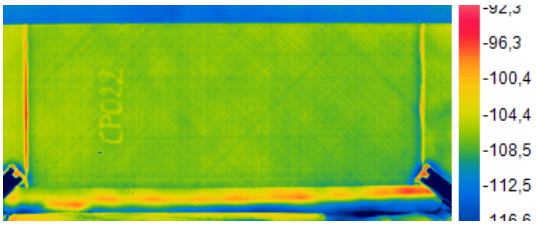
Failure load= 124.9 kN
Residual strength factor = 0.94

C022

Incoming inspection



front



rear

Average thickness: 2.06 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

No test

Lock-in thermography after HVI test

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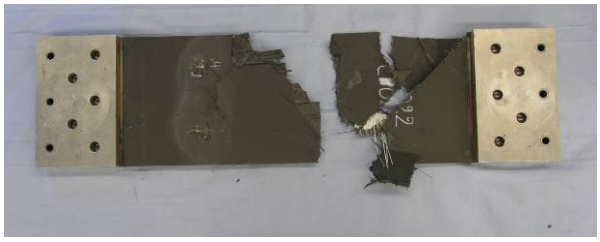
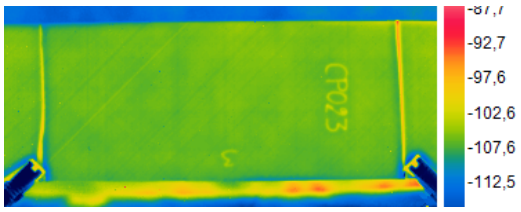
Residual strength test (tension)



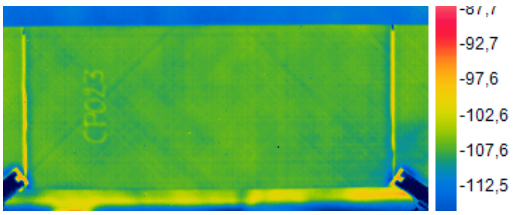
Failure load= 431.6 kN

C023

Incoming inspection



front

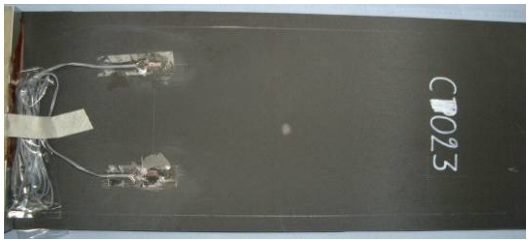


rear

Average thickness: 2.04 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 0.02%, similar to no preloading
Velocity: 69.7 m/s (51 J)

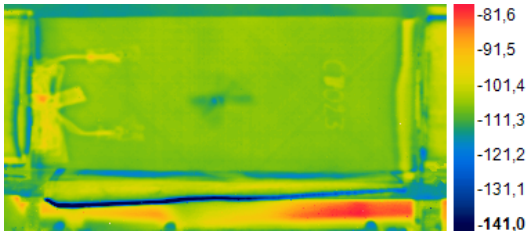


Impact side

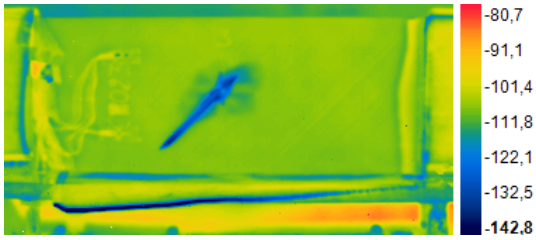
Rear side

Rebound with small mark at front / delamination at back face

Lock-in thermography after HVI test

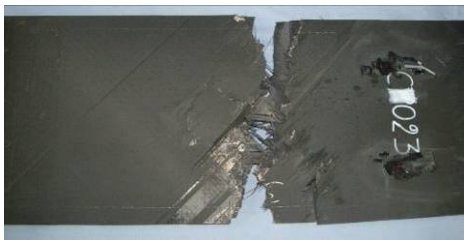


Front view



Rear view

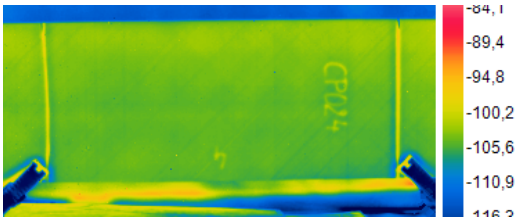
Residual strength test (tension)



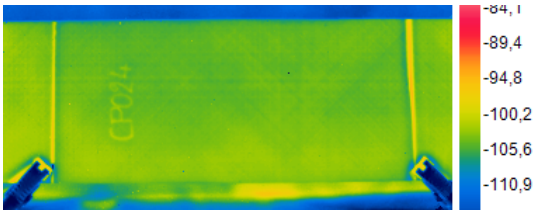
Failure load= 291 kN
Residual strength factor = 0.67

C024

Incoming inspection



front



rear

Average thickness: 1.96 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

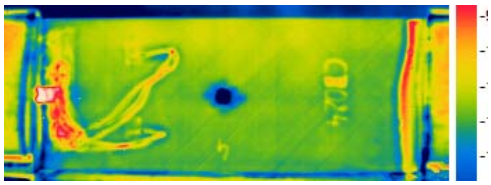
Test conditions:
Impactor: 20.9 g glass ball (Ø20.9 mm)
Pre-loading: 0.25%, in tension
Velocity: 67.6 m/s (47.7 J)

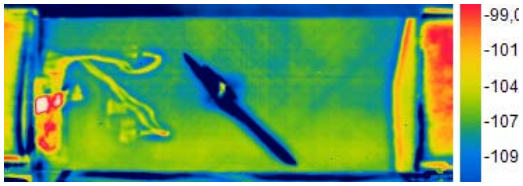

Impact side


Rear side

Rebound with small mark at front / delamination at back face / No film

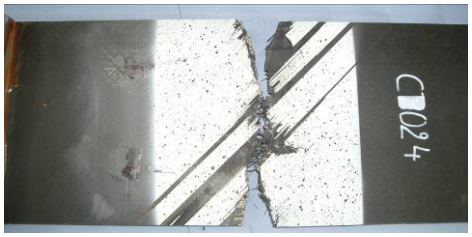
Lock-in thermography after HVI test


Front view



Rear view

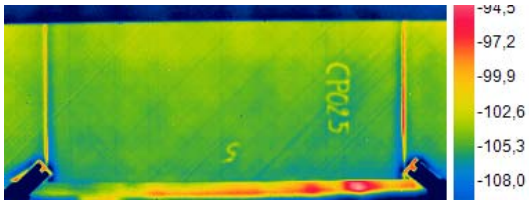
Residual strength test (tension)



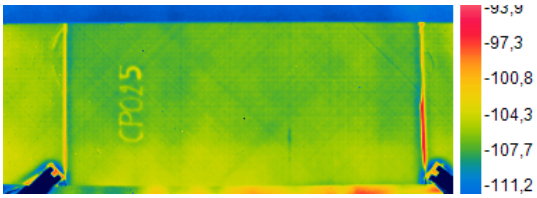
Failure load= 273.1 kN
Residual strength factor = 0.63

C025

Incoming inspection



front



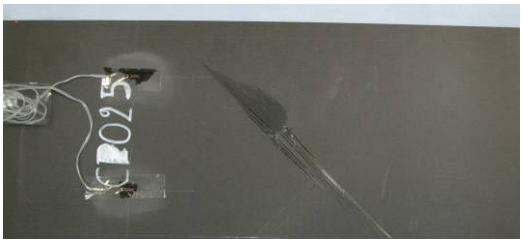
rear

Average thickness: 2.01 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02%, similar to no pre-loading
Velocity: 100.6 m/s (67.8 J)

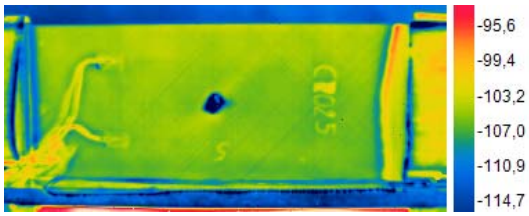
Impact side



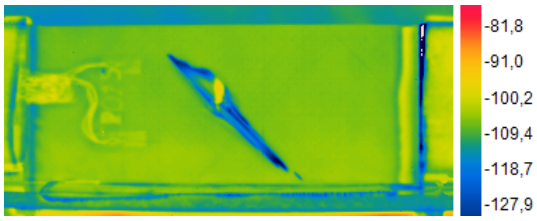
Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

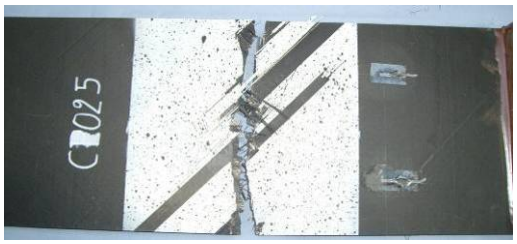


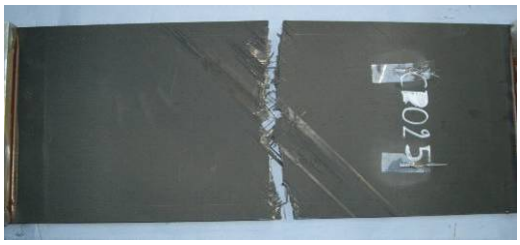
Front view



Rear view

Residual strength test (tension)

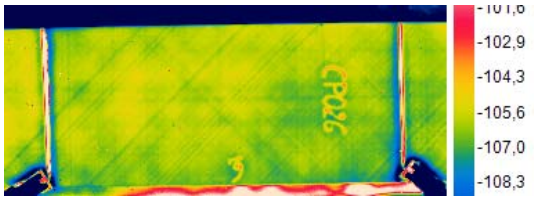




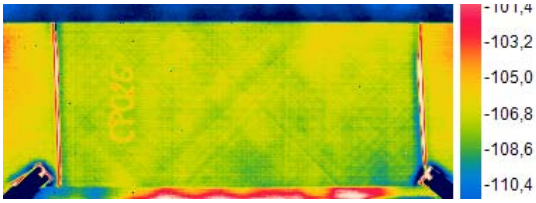
Failure load= 215.7 kN
Residual strength factor = 0.50

C026

Incoming inspection



front



rear

Average thickness: 2.02 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

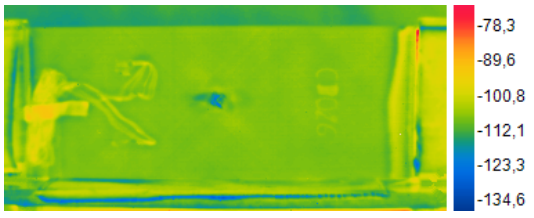
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25%, in tension
Velocity: 103.1 m/s (71.2 J)

Impact side

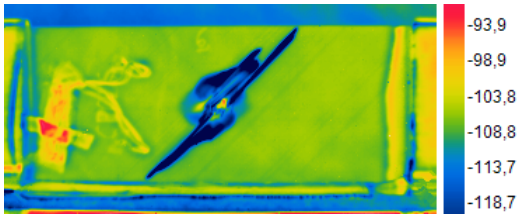
Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

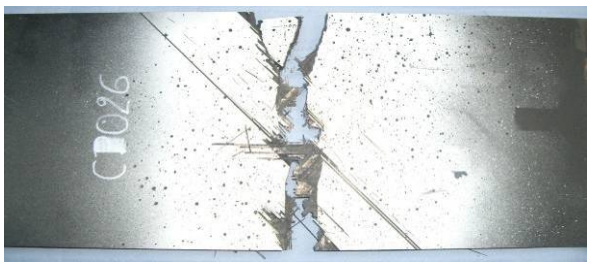


Front view



Rear view

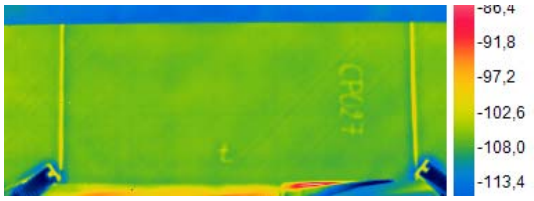
Residual strength test (tension)



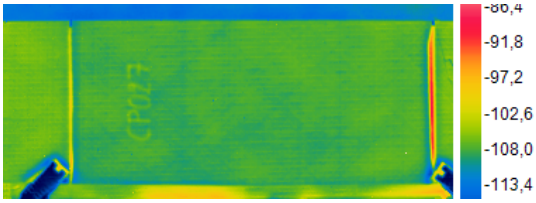
Failure load= 211.1 kN
Residual strength factor = 0.49

C027

Incoming inspection



front



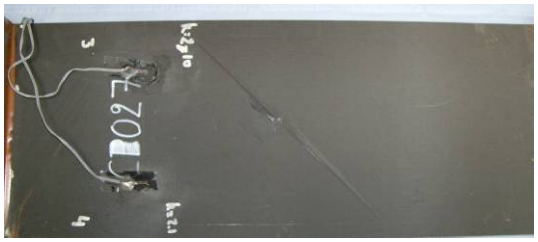
rear

Average thickness: 2.02 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02%, similar to no loading
Velocity: 98.5 m/s (65 J)

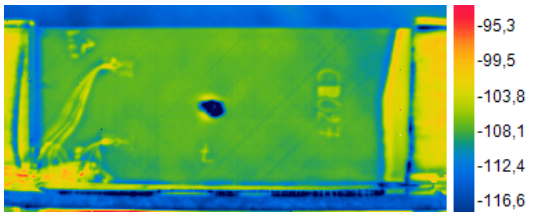
Impact side



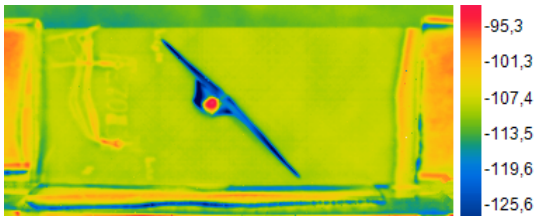
Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

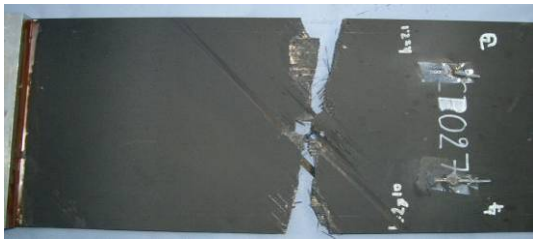


Front view



Rear view

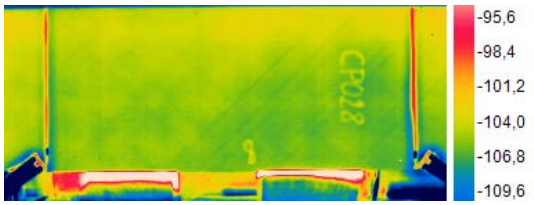
Residual strength test (tension)



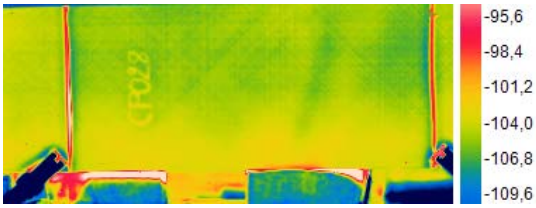
Failure load= 248.7 kN
Residual strength factor = 0.58

C028

Incoming inspection



front



rear

Average thickness: 1.98 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

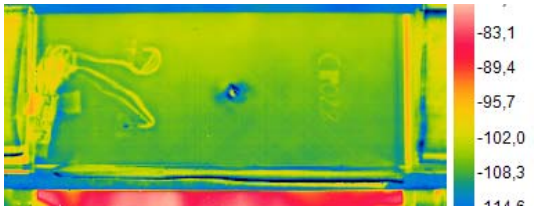
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02%, similar to no loading
Velocity: 97.5 m/s (63.6 J)


Impact side

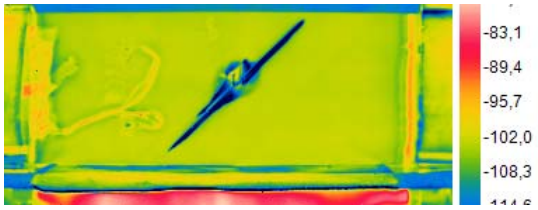

Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

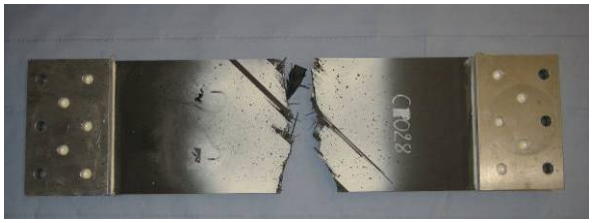


Front view



Rear view

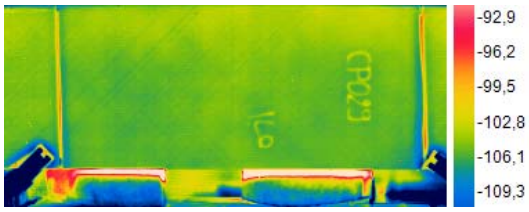
Residual strength test (tension)



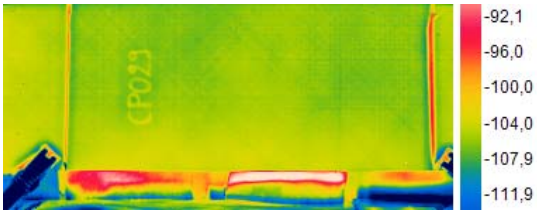
Failure load= 259.5 kN
Residual strength factor = 0.60

C029

Incoming inspection



front



rear

Average thickness: 1.99 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

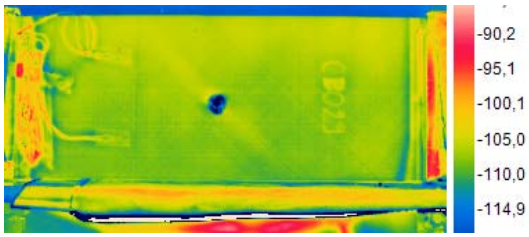
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02%, similar to no loading
Velocity: 96.7 m/s (62.7 J)


Impact side

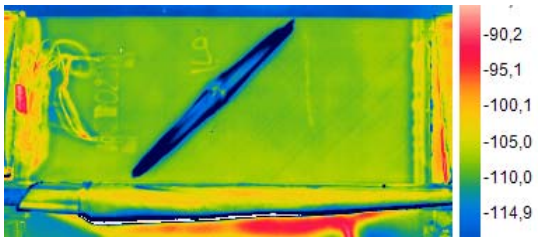

Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

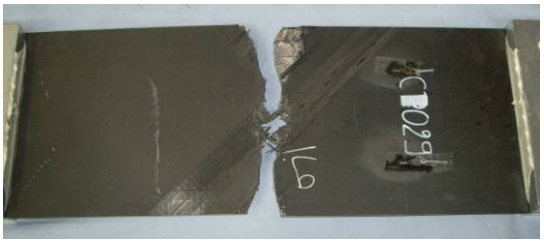


Front view



Rear view

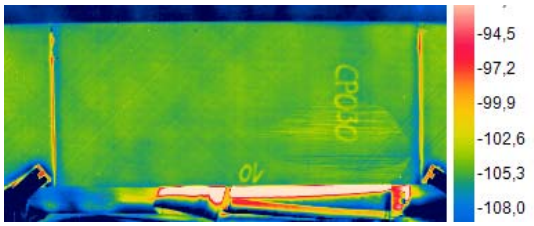
Residual strength test (tension)



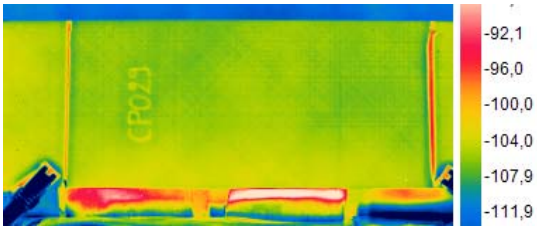
Failure load= 220.3 kN
Residual strength factor = 0.51

C030

Incoming inspection



front

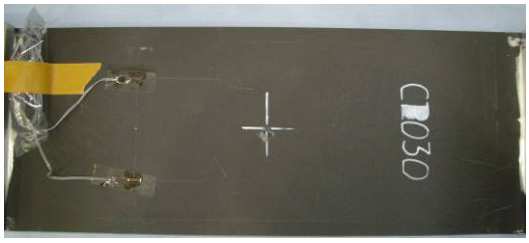


rear

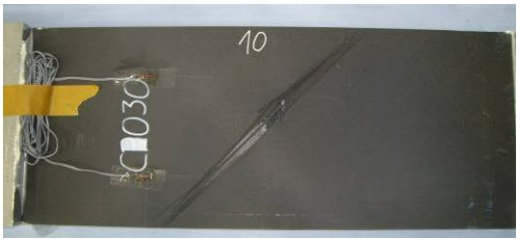
Average thickness: 2 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.15%, in tension
Velocity: 93.54 m/s (58.4 J)



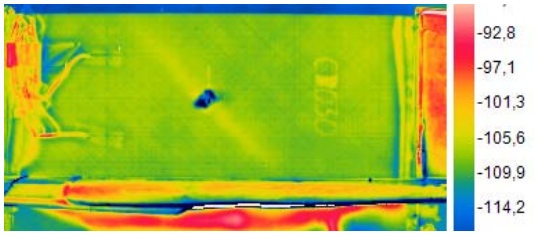
Impact side



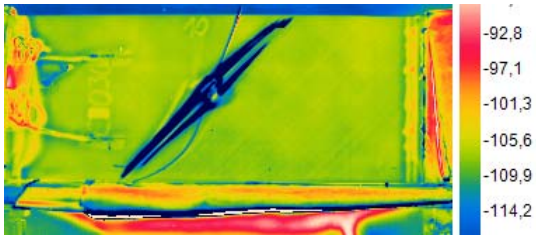
Rear side

Cube passed through / Square hole notch damage, delamination at back face

Lock-in thermography after HVI test

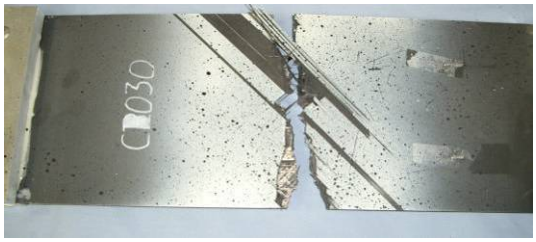


Front view



Rear view

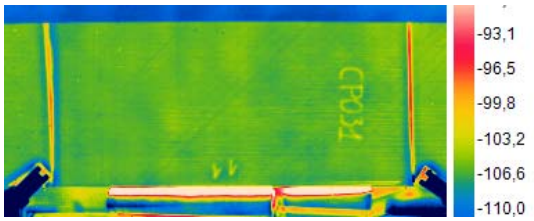
Residual strength test (tension)



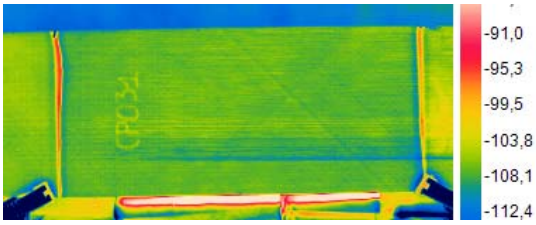
Failure load= 206.5 kN
Residual strength factor = 0.48

C031

Incoming inspection



front

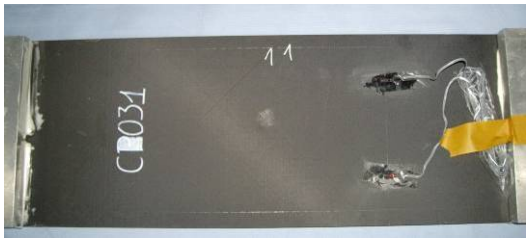


rear

Average thickness: 2.03 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

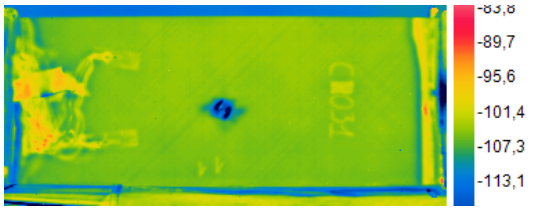
Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 0.15%, in tension
Velocity: 68.1 m/s (48.7 J)


Impact side

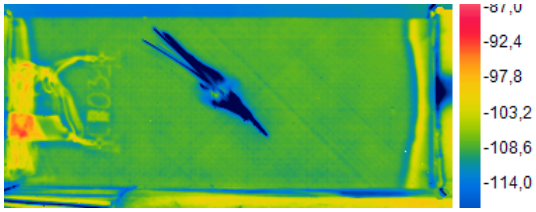

Rear side

Rebound with delamination damage at back face

Lock-in thermography after HVI test

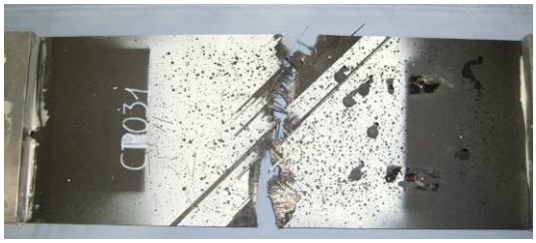


Front view



Rear view

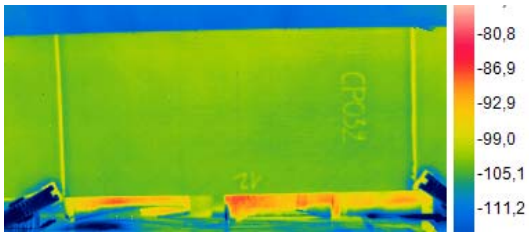
Residual strength test (tension)



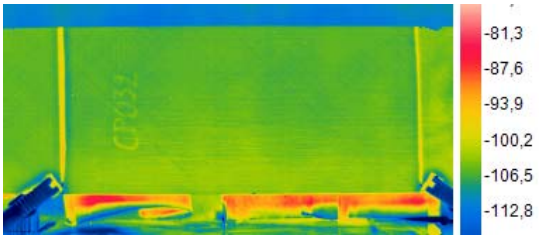
Failure load= 225.2 kN
Residual strength factor = 0.52

C032

Incoming inspection



front

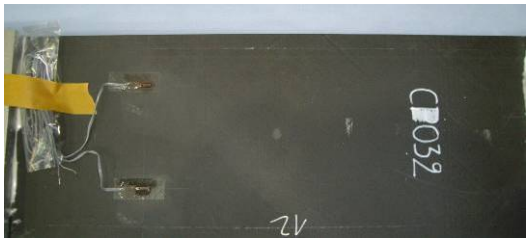


rear

Average thickness: 2 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 21.2 g glass ball (Ø25.2 mm)
Pre-loading: 0.02%, in tension
Velocity: 63.9 m/s (43.3 J)

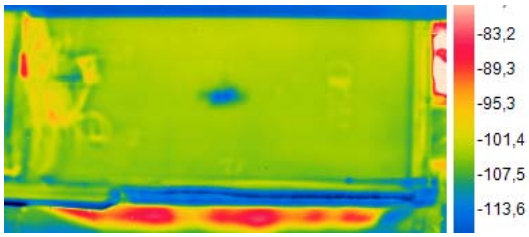


Impact side

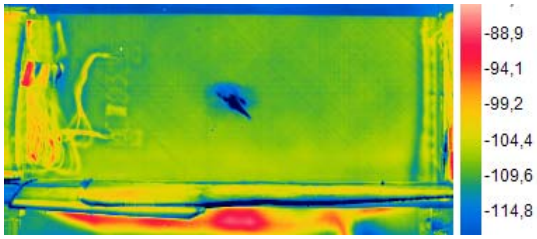
Rear side

Rebound with delamination damage at back face

Lock-in thermography after HVI test



Front view



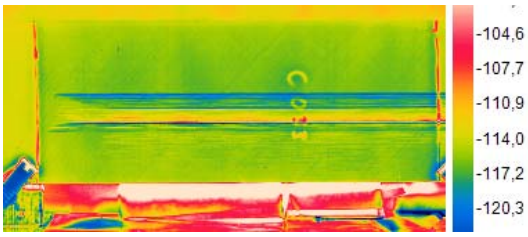
Rear view

Residual strength test (tension)

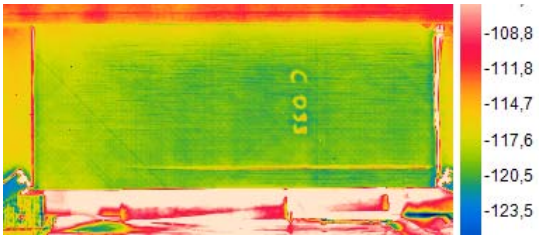
Failure load= 326.9 kN
Residual strength factor = 0.76

C033

Incoming inspection



front



rear

Average thickness: 3.04 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

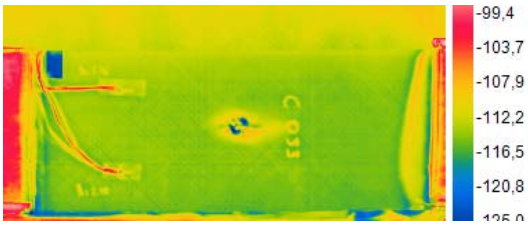
Test conditions:
Impactor: 19.3 g glass ball (Ø24.5 mm)
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 85.7 m/s (70.9 J)

Impact side

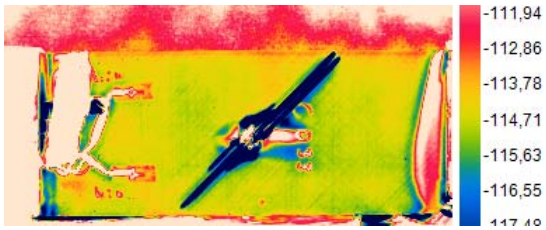
Rear side

Impact on concave face / Rebound, dent on front face , delamination damage at back face

Lock-in thermography after HVI test



Front view



Rear view

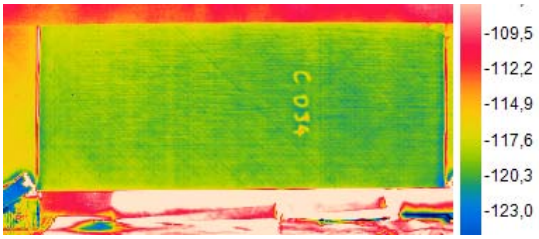
Residual strength test (compression)

Failure load= 87.7 kN
Residual strength factor = 0.74

C034

Incoming inspection

front



rear

Average thickness: 3.04 mm

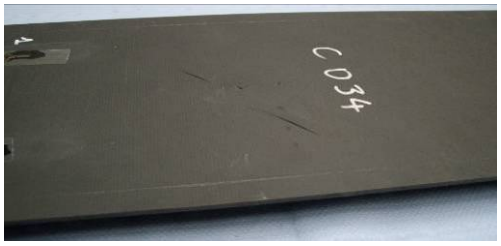
Visual inspection: alright

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 19.3 g glass ball (Ø24.5 mm)
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 83.4 m/s (67.1 J)

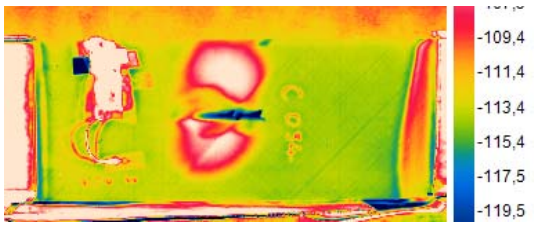
Impact side



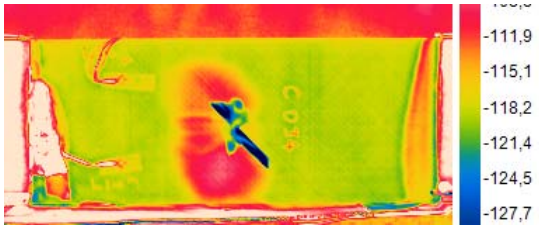
Rear side

Impact on convex face / Rebound, dent on front face , delamination damage at back face

Lock-in thermography after HVI test

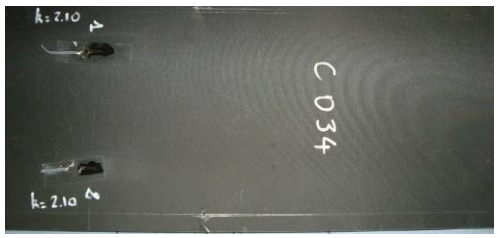


Front view



Rear view

Residual strength test (compression)



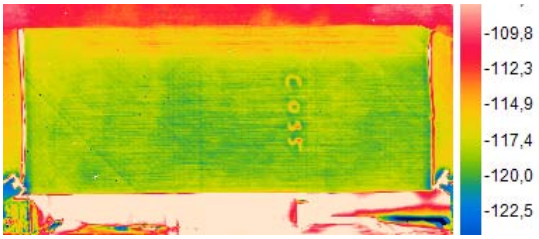
Failure load= 58.7 kN

Residual strength factor = 0.49

C035

Incoming inspection

front



rear

Average thickness: 3.06 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

–

Lock-in thermography after HVI test

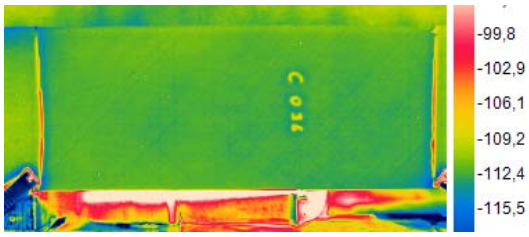
–

Residual strength test (compression)

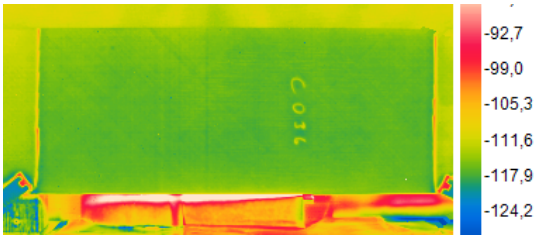
Failure load= 119.1 kN

C036

Incoming inspection



front



rear

Average thickness: 3.03 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

–

Lock-in thermography after HVI test

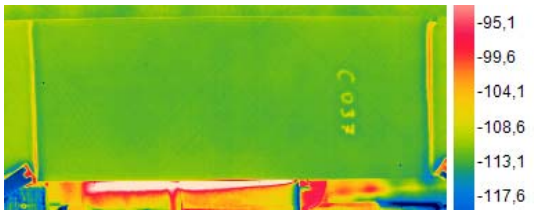
–

Residual strength test (compression)

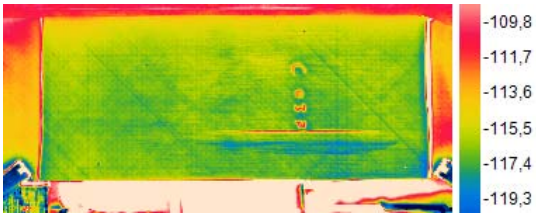
Failure load= 118.8 kN

C037

Incoming inspection



front



rear

Average thickness: 3.03 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

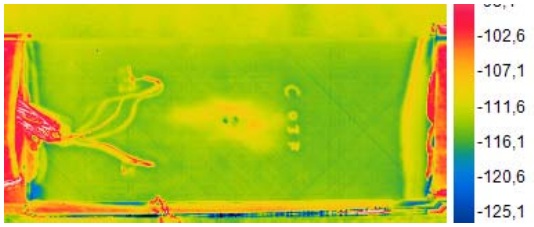
Test conditions:
Impactor: 20.4 g glass ball (Ø25 mm)
Pre-loading: 0.01%, similar to no loading
Velocity: 81.8 m/s (64.5 J)


Impact side

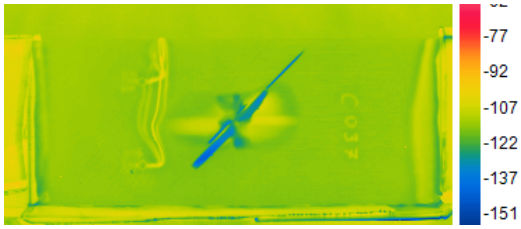

Rear side

Rebound, dent at front, delamination damage at back face

Lock-in thermography after HVI test



Front view



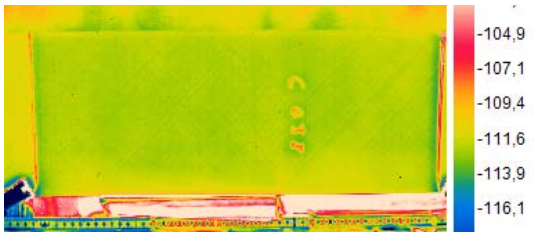
Rear view

Residual strength test (compression)

Failure load= 100.5 kN
Residual strength factor = 0.85

C038

Incoming inspection



front

rear

Average thickness: 3.06 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

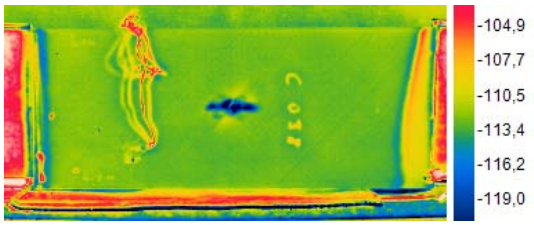
Test conditions:
Impactor: 18.9 g glass ball (Ø24.5 mm)
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 78.8 m/s (58.7 J)

Impact side

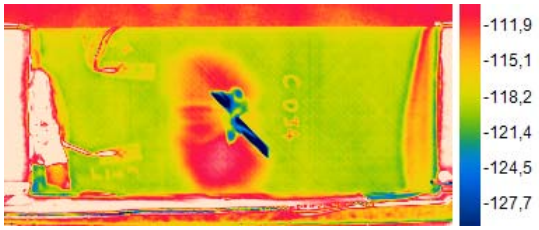
Rear side

Impact on concave face / Rebound / dent on front face, delamination damage at back face

Lock-in thermography after HVI test



Front view



Rear view

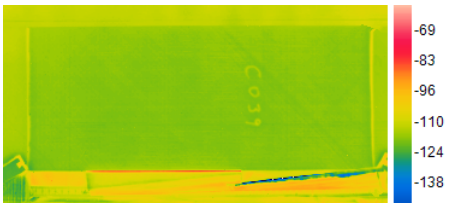
Residual strength test (compression)

Failure load= 96.9 kN
Residual strength factor = 0.82

C039

Incoming inspection

front



rear

Average thickness: 3.08 mm

Visual inspection: alright

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

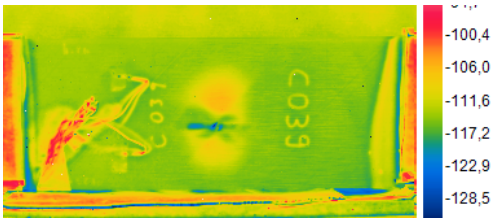
Test conditions:
Impactor: 18 g glass ball (Ø24.1 mm)
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 80.6 m/s (58.4 J)

Impact side

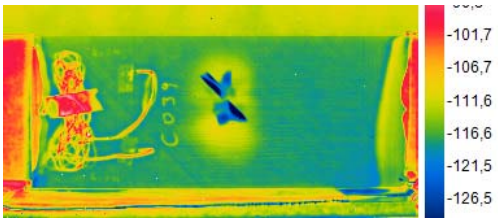
Rear side

Impact on convex face / Rebound with dent on front face / delamination at back face

Lock-in thermography after HVI test



Front view



Rear view

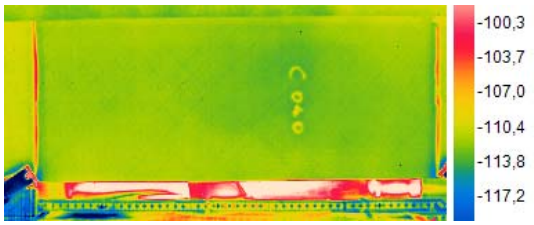
Residual strength test (compression)

Failure load= 80.7 kN

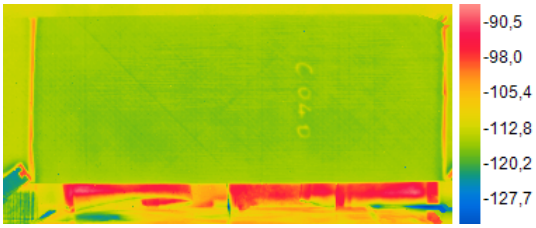
Residual strength factor = 0.68

C040

Incoming inspection



front

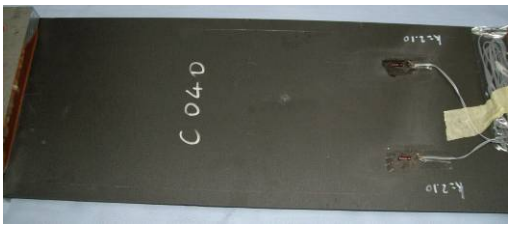


rear

Average thickness: 3.07 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 17.9 g glass ball (Ø23.9 mm)
Pre-loading: 1.4 Pb (53.2 kN), in compression
Velocity: 82.4 m/s (60.8 J)

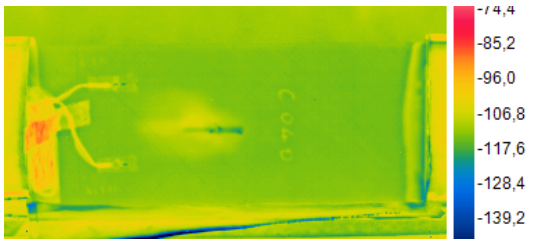


Impact side

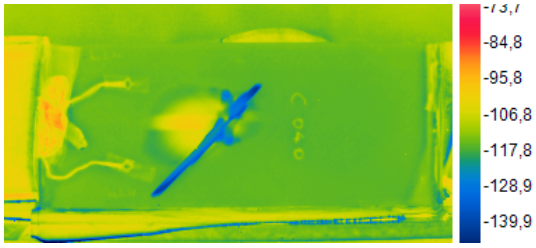
Rear side

Impact on concave face / Rebound with dent on front face and delamination at back face

Lock-in thermography after HVI test



Front view



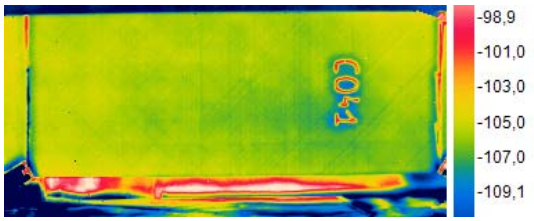
Rear view

Residual strength test (compression)

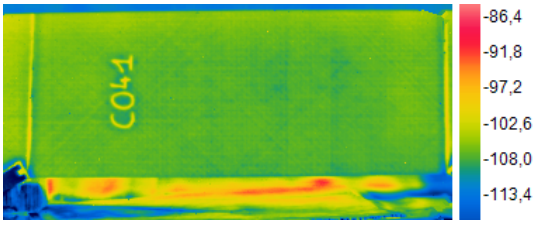
Failure load= 87.0 kN
Residual strength factor = 0.73

C041

Incoming inspection



front



rear

Average thickness: 1.97 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

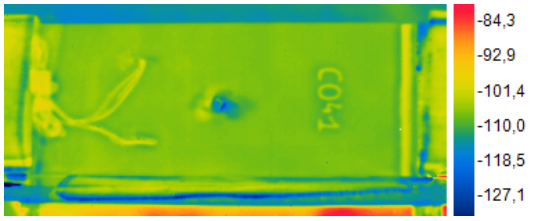
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25%, in tension
Velocity: 101.8 m/s (69.5 J)

Impact side

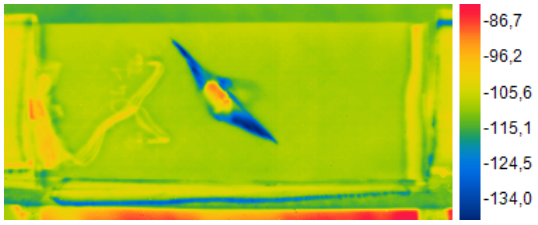
Rear side

Cube passed through / Square hole notch damage, delamination damage at back face

Lock-in thermography after HVI test

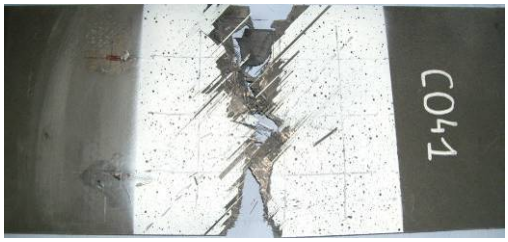


Front view



Rear view

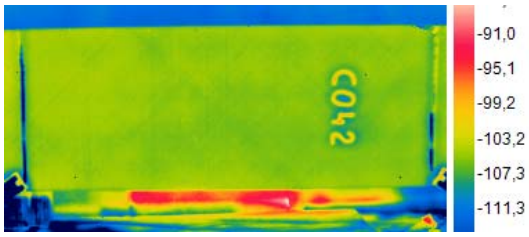
Residual strength test (tension)



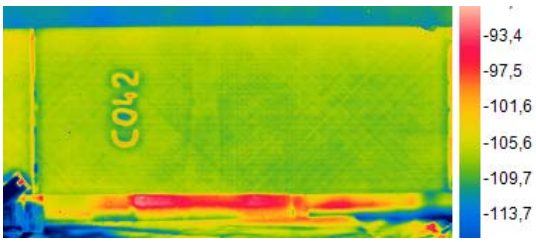
Failure load= 101.8 kN
Residual strength factor = 69.5

C042

Incoming inspection



front



rear

Average thickness: 1.98 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

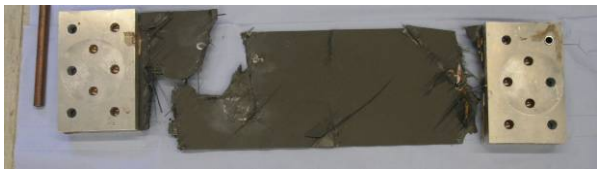
High Velocity Impact test

–

Lock-in thermography after HVI test

–

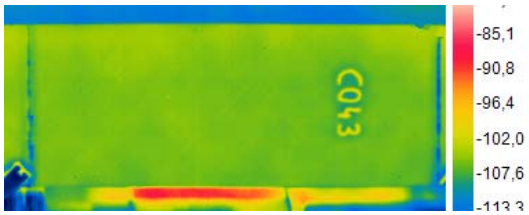
Residual strength test (tension)



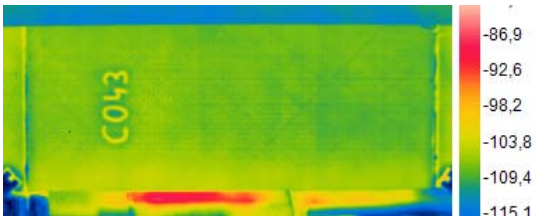
Failure load= 419.9 kN

C043

Incoming inspection



front



rear

Average thickness: 1.97 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

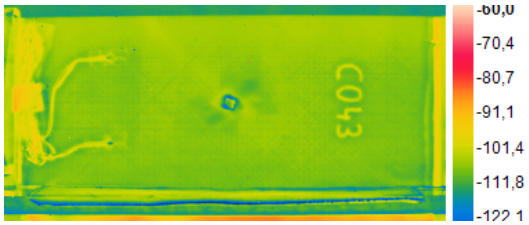
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02%, in tension
Velocity: 84.5 m/s (47.9 J)

Impact side

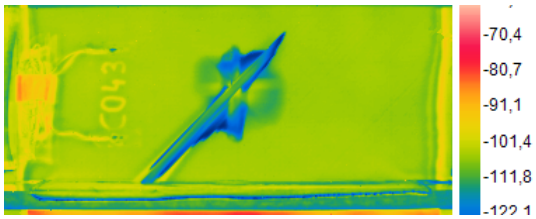
Rear side

Cube stopped / notch damage, delamination at back face

Lock-in thermography after HVI test



Front view



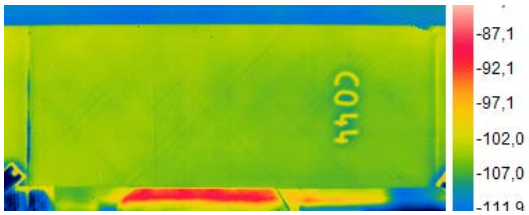
Rear view

Residual strength test (tension)

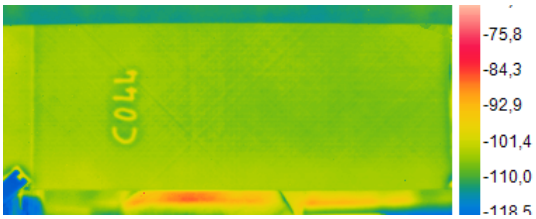
Failure load= 250.1 kN
Residual strength factor = 0.60

C044

Incoming inspection



front



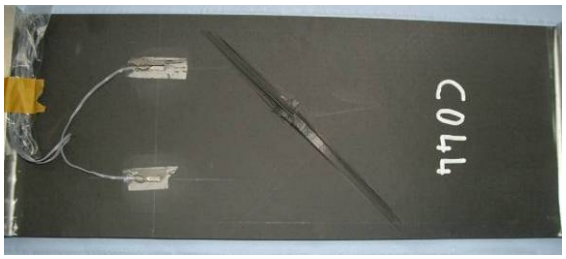
rear

Average thickness: 1.98 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25%, in tension
Velocity: 97.8 m/s (64.1 J)

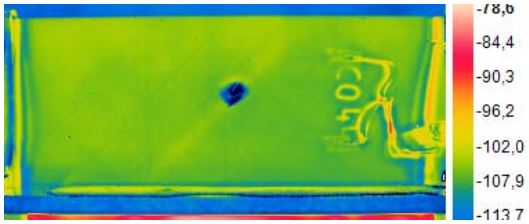
Impact side



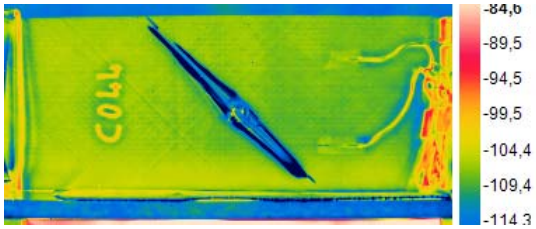
Rear side

Cube passed through / Square hole notch damage and delamination at back face

Lock-in thermography after HVI test

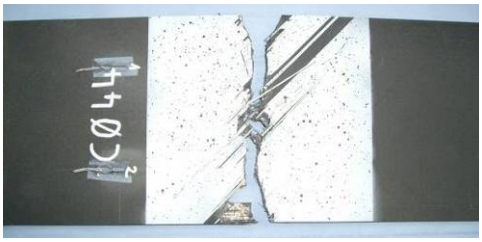


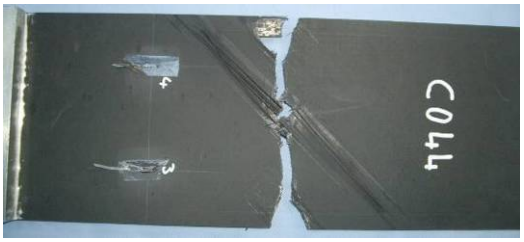
Front view



Rear view

Residual strength test (tension)

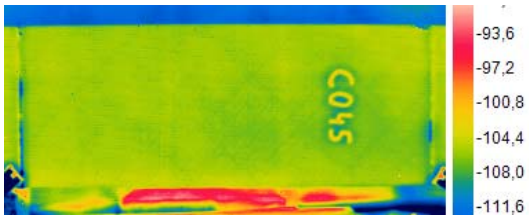




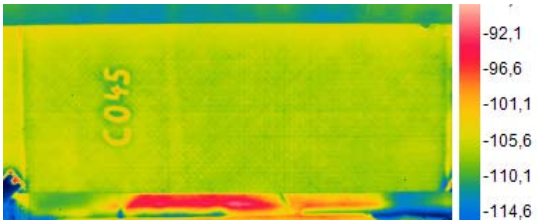
Failure load= 211.8 kN
Residual strength factor = 0.50

C045

Incoming inspection



front

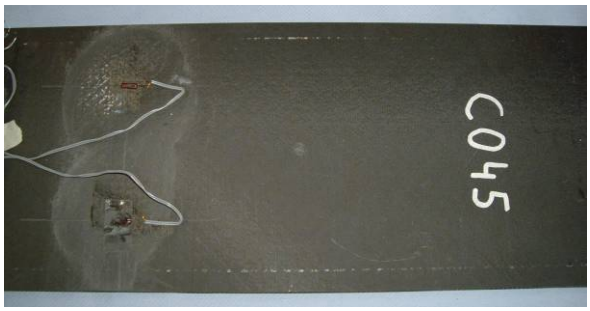


rear

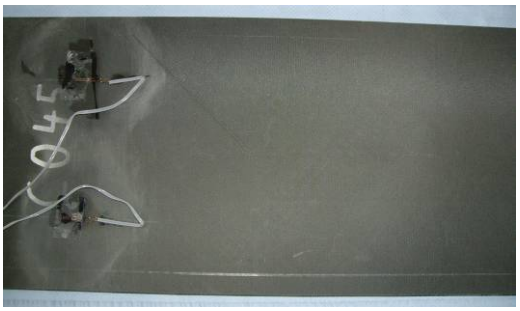
Average thickness: 1.99 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 21.3 g glass ball
Pre-loading: 0.02%, similar to no loading
Velocity: 64.9 m/s (44.8 J)



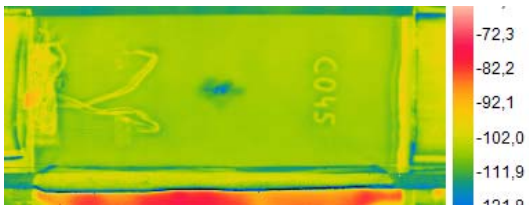
Impact side



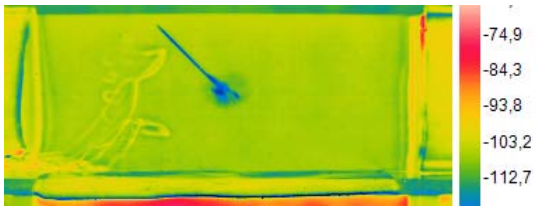
Rear side

Rebound, delamination at back face

Lock-in thermography after HVI test

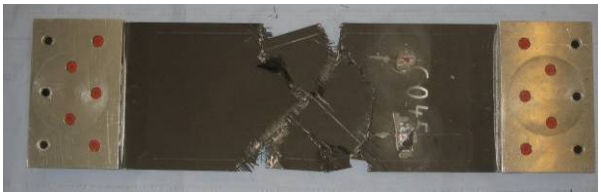


Front view



Rear view

Residual strength test (tension)

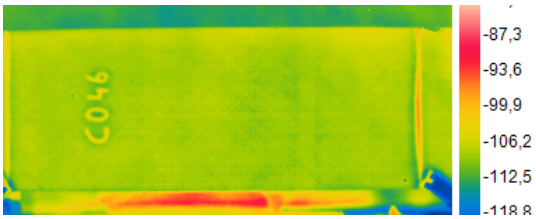


Failure load= 311.1 kN
Residual strength factor = 0.76

C046

Incoming inspection

front



rear

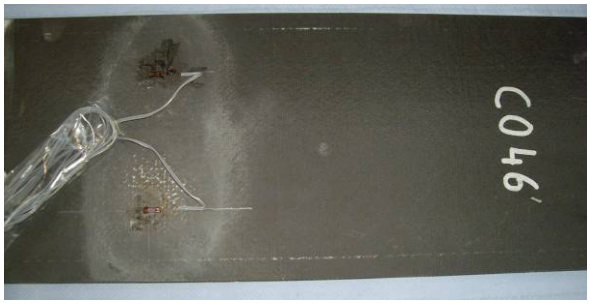
Average thickness: 2.05 mm

Visual inspection: alright

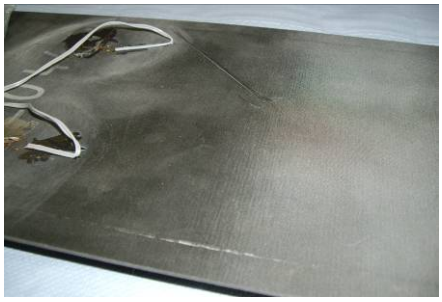
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 21.3 g glass ball (Ø25.2 mm)
Pre-loading: 0.02%, in tension
Velocity: 65.2 m/s (45.3 J)



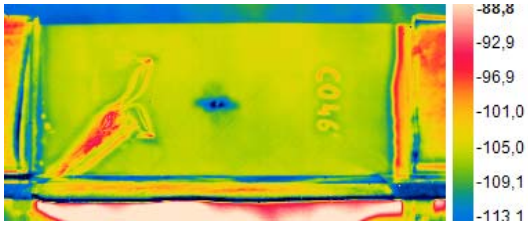
Impact side



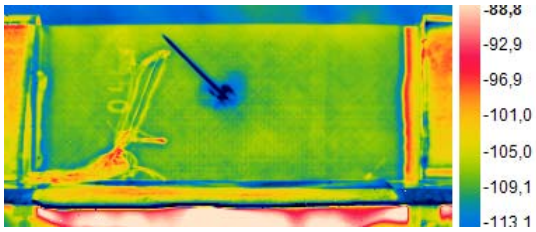
Rear side

Rebound, delamination at back face

Lock-in thermography after HVI test

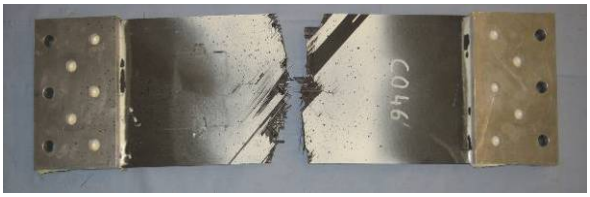


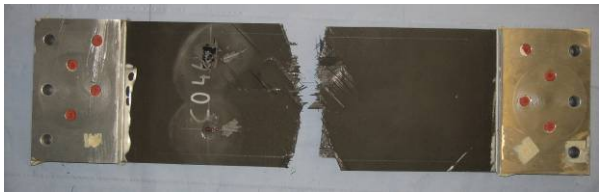
Front view



Rear view

Residual strength test (tension)



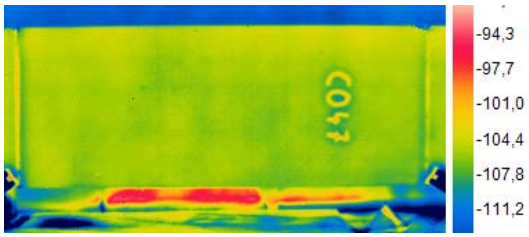


Failure load= 301.0 kN

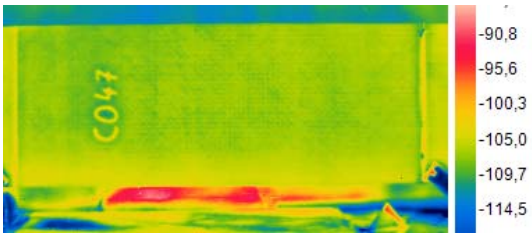
Residual strength factor = 0.74

C047

Incoming inspection



front



rear

Average thickness: 2.02 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

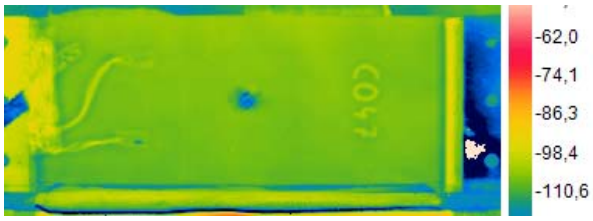
High Velocity Impact test

Test conditions:
Impactor: 21.3 g glass ball (Ø25.2 mm)
Pre-loading: 0.25%, in tension
Velocity: 67.6 m/s (47.7 J)

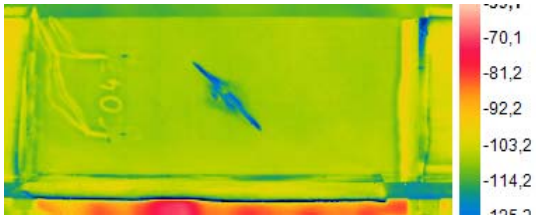
Impact side	Rear side

Rebound, delamination damage at back face

Lock-in thermography after HVI test

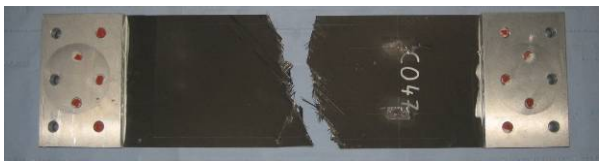


Front view

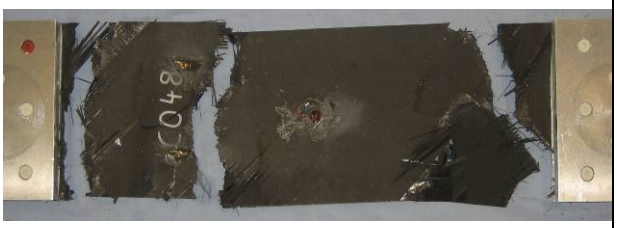


Rear view

Residual strength test (tension)



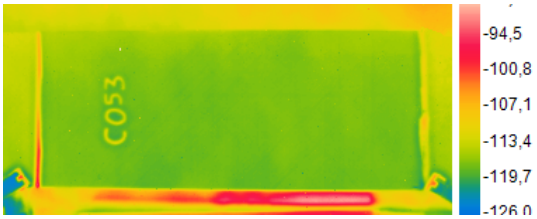
Failure load= 266.4 kN
Residual strength factor = 0.65

C048	
Incoming inspection	
front	rear
Average thickness: 2.02 mm Visual inspection: alright Lock-in thermography: Uniform picture / No pre-damage	
High Velocity Impact test	
–	
Lock-in thermography after HVI test	
–	
Residual strength test (tension)	
	
Failure load= 409.4 kN	

C053

Incoming inspection

front



rear

Average thickness: 3.09 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

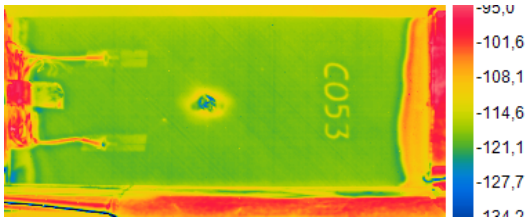
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 136.4 m/s (124.7 J)

Impact side

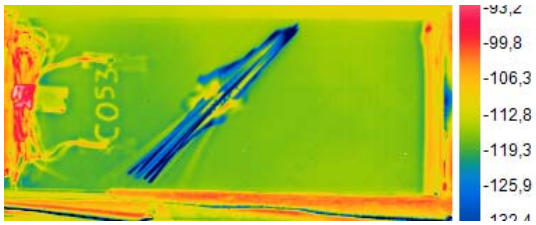
Rear side

Light convex buckle (ca. 1 mm) / Notch damage

Lock-in thermography after HVI test

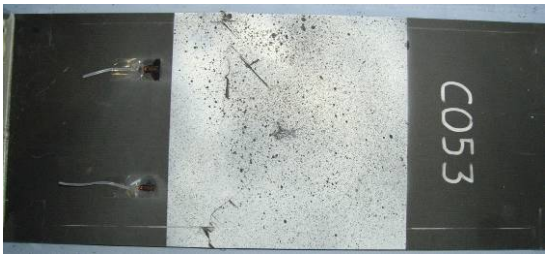


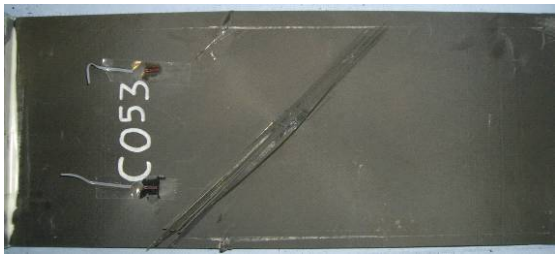
Front view



Rear view

Residual strength test (compression)

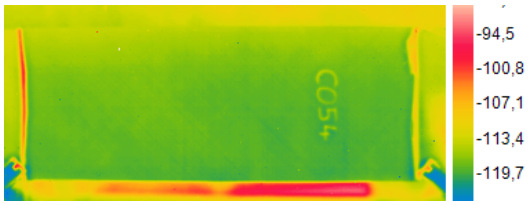




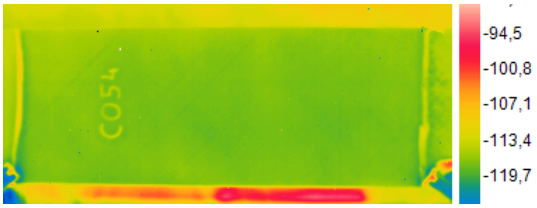
Failure load= 129.6 kN
Residual strength factor = 0.97

C054

Incoming inspection



front

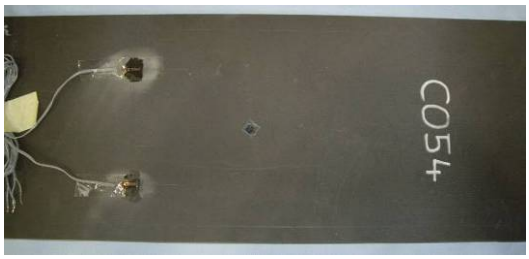


rear

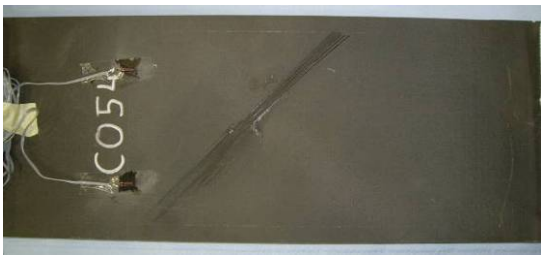
Average thickness: 3.06 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 129.2 m/s (111.8 J)



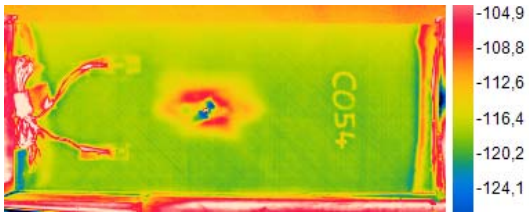
Impact side



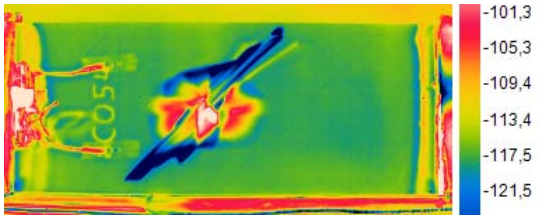
Rear side

Light convex buckle (ca. 1 mm) / Notch damage

Lock-in thermography after HVI test

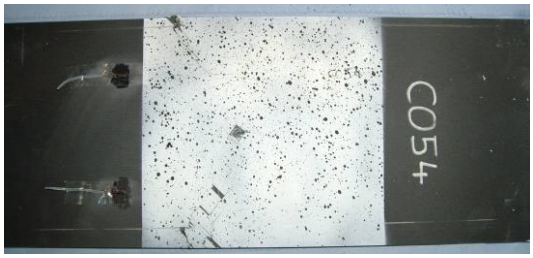


Front view



Rear view

Residual strength test (compression)

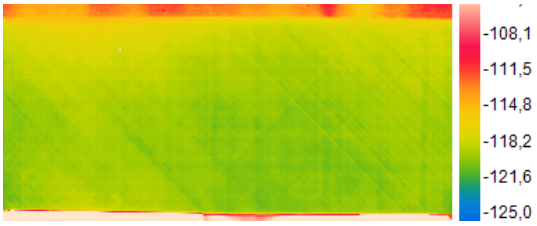


Failure load= 124.1 kN
Residual strength factor = 0.93

C055

Incoming inspection

front



rear

Average thickness: 3.11 mm

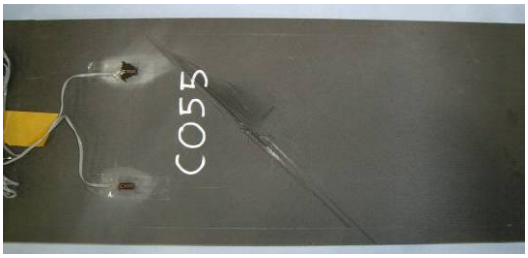
Visual inspection: alright

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 128.2 m/s (110.1 J)

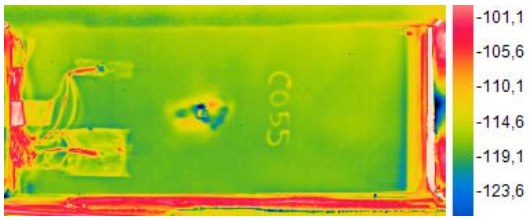
Impact side



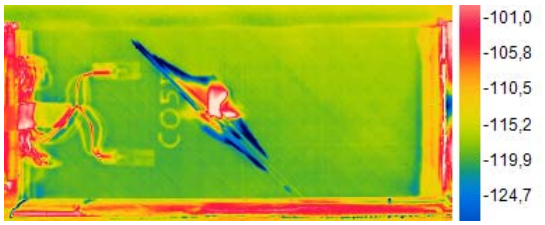
Rear side

Light convex buckle (ca. 1 mm) / Notch damage

Lock-in thermography after HVI test

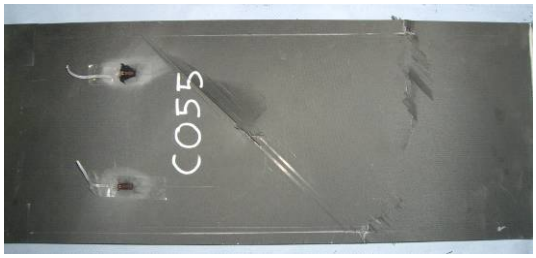


Front view



Rear view

Residual strength test (compression)

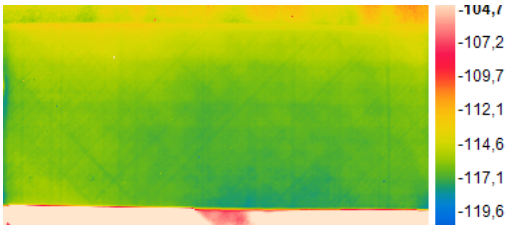


Failure load= 135.9 kN

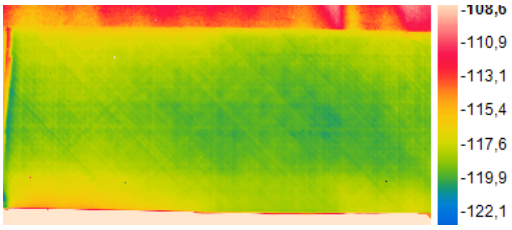
Residual strength factor = 1.02

C056

Incoming inspection



front



rear

Average thickness: 3.07 mm
Visual inspection: alright
Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

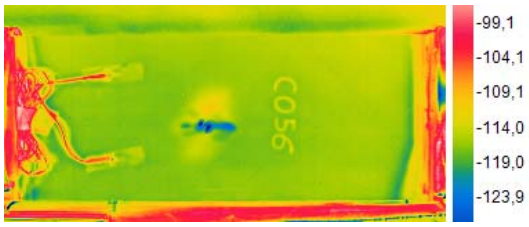
Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 79.7 m/s (66.8 J)

Impact side

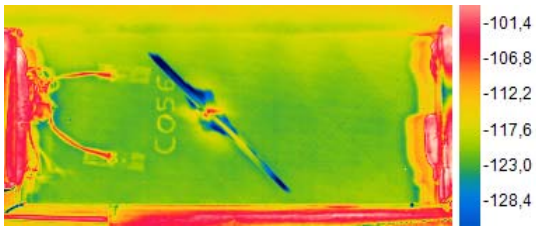
Rear side

Light convex buckle / Rebound, dent on front face, delamination at back face

Lock-in thermography after HVI test

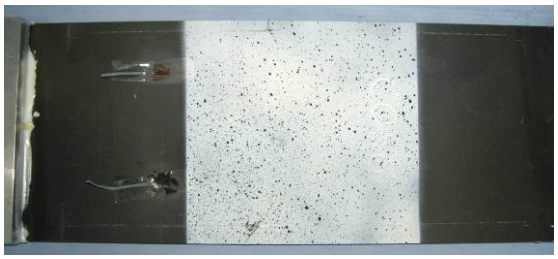


Front view



Rear view

Residual strength test (compression)

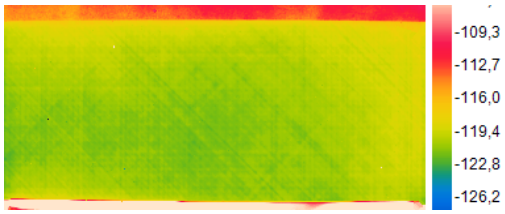


Failure load=93.9 kN
Residual strength factor = 0.70

C057

Incoming inspection

front



rear

Average thickness: 3.1 mm

Visual inspection: alright, harmless / Notice: harmless “snowflake” pattern on one side due to superficial air insertion in the plate

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

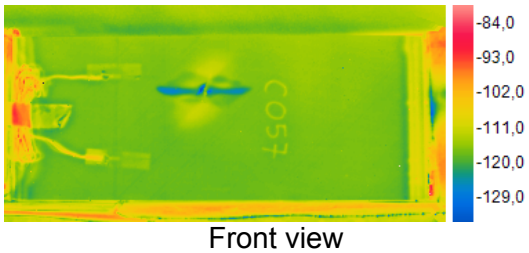
Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 80.0 m/s (67.2 J)

Impact side

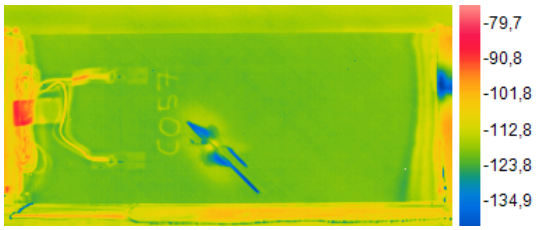
Rear side

Light convex buckle (ca. 1mm) / Rebound, dent on front face, delamination damage at back face

Lock-in thermography after HVI test

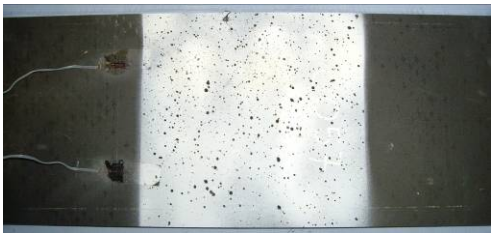


Front view



Rear view

Residual strength test (compression)

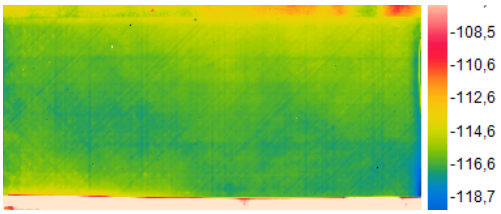


Failure load= 87.9 kN

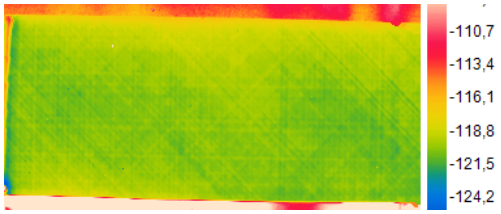
Residual strength factor = 0.66

C058

Incoming inspection



front



rear

Average thickness: 3.09 mm

Visual inspection: alright, harmless / Notice: harmless “snowflake” pattern on one side due to superficial air insertion in the plate

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

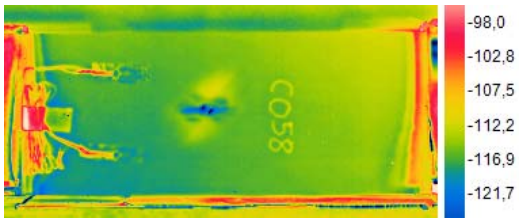
Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 0.5 Pb (20 kN), in compression
Velocity: 76.8 m/s (61.9 J)

Impact side

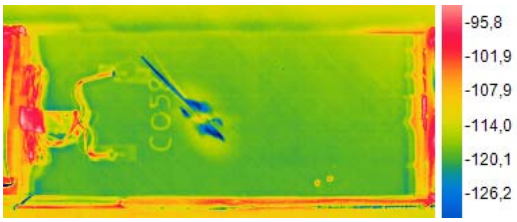
Rear side

Light convex buckle (ca. 1 mm) / Cube stopped / Front face damage and delamination at back face

Lock-in thermography after HVI test

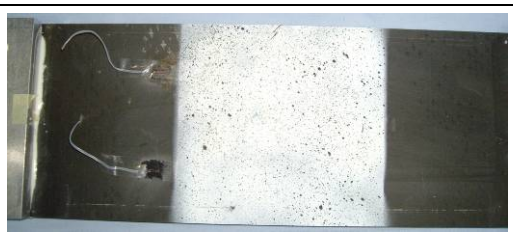


Front view



Rear view

Residual strength test (compression)

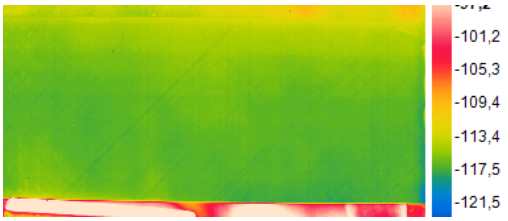


Failure load= 89.6 kN

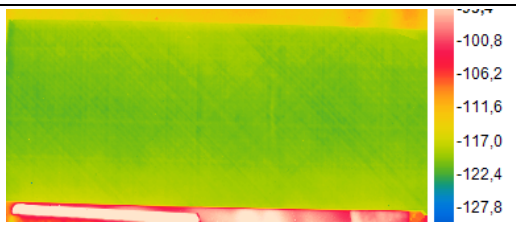
Residual strength factor = 0.67

C059

Incoming inspection



front



rear

Average thickness: 3.03 mm

Visual inspection: alright, harmless / Notice: harmless “snowflake” pattern on one side due to superficial air insertion in the plate

Lock-in thermography: Uniform picture / No pre-damage

High Velocity Impact test

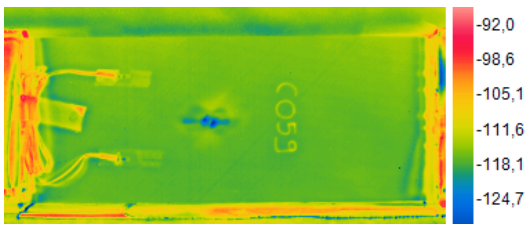
Test conditions:
Impactor: 21 g glass ball (Ø25.2 mm)
Pre-loading: 2kN, similar to no loading
Velocity: 77.6 m/s (63.3 J)

Impact side

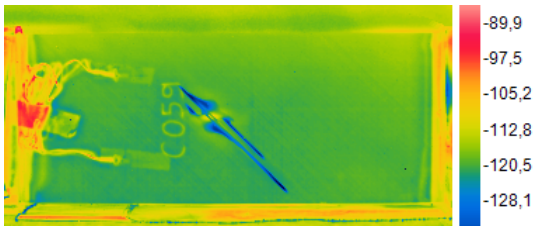
Rear side

Rebound / dent on front face, delamination damage at back face

Lock-in thermography after HVI test

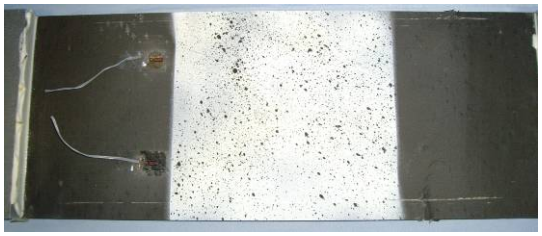


Front view



Rear view

Residual strength test (compression)



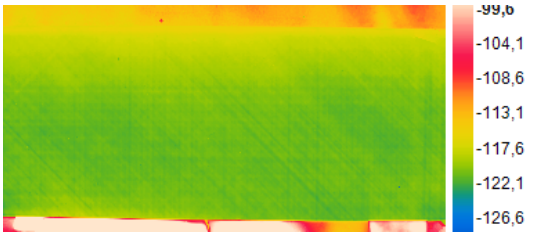
Failure load= 122.8 kN

Residual strength factor = 0.92

C060

Incoming inspection

front



rear

Average thickness: 3.03 mm

Visual inspection: alright, harmless / Notice: harmless “snowflake” pattern on one side due to superficial air insertion in the plate

Lock-in thermography: Uniform picture / No pre-damage

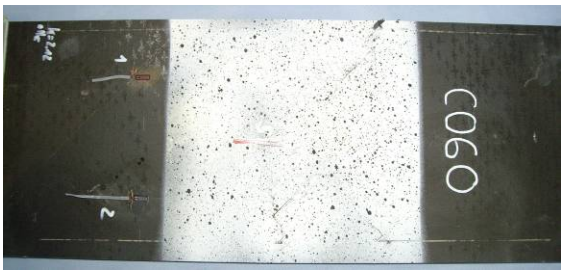
High Velocity Impact test

–

Lock-in thermography after HVI test

–

Residual strength test (compression)



Failure load= 133.2 kN

Annex C: Results on aluminium plates

<table>
<tr><th colspan="2">AP001</th></tr>
<tr><th colspan="2">Incoming inspection</th></tr>
<tr><td colspan="2">Plate perfectly flat
Thickness: 2 mm</td></tr>
<tr><th colspan="2">High Velocity Impact test</th></tr>
<tr><td colspan="2">No test</td></tr>
<tr><th colspan="2">Residual strength test (tension)</th></tr>
<tr><td> 
</td><td>Bearing failure in the tabs !!
Failure load= 158 kN
Residual strength factor = 1.0</td></tr>
</table>

AP002

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

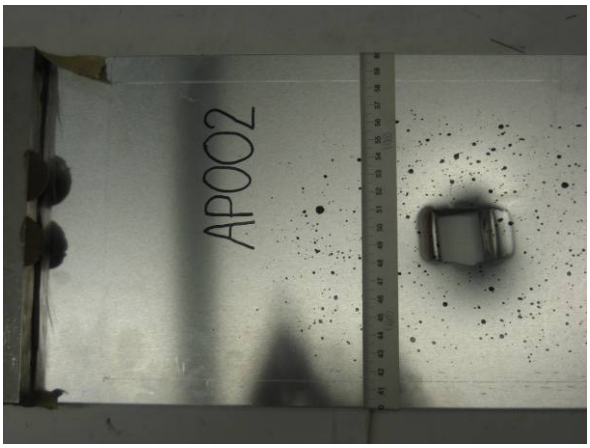
High Velocity Impact test

Test conditions:

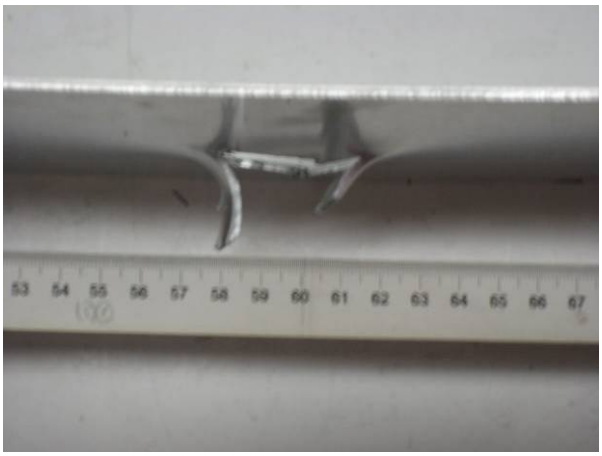
Impactor: 100.3 g steel beam

Pre-loading: 0.23%, in tension

Velocity: 100.7 m/s (507 J)



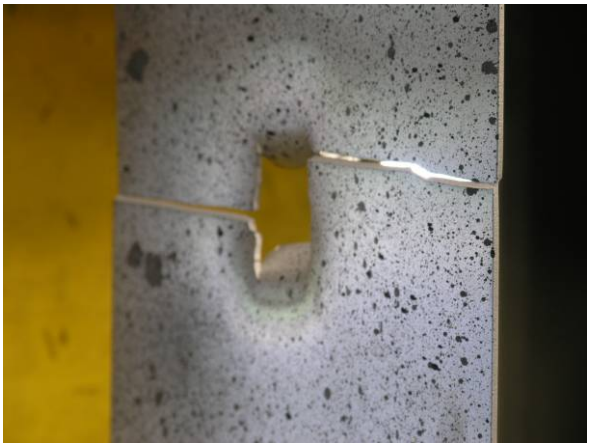
Impact side



Rear side

Beam passed through / rectangular notch ~ 30 mm

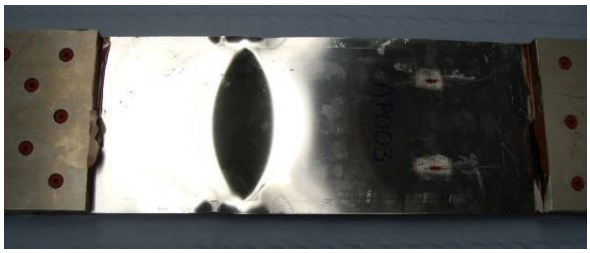
Residual strength test (tension)



Failure load= 138.4 kN

Residual strength factor = **0.76**

AP003
Incoming inspection
Plate perfectly flat Thickness: 2 mm
High Velocity Impact test
No test
Residual strength test (compression)



Buckle load: 20 kN

Max. load= 58.6 kN (3-cell buckle) / No ultimate fracture

Residual strength factor = 1.0

AP004

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

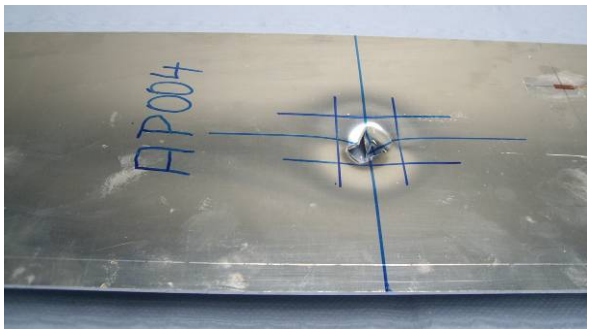
High Velocity Impact test

Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: 1.5 Pb (30 kN, 0.15%), in compression

Velocity: 133.9 m/s (120.1 J)

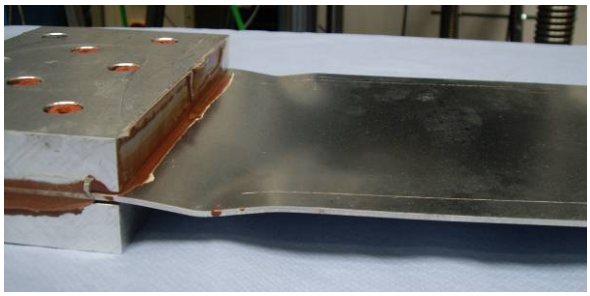


Impact side

Rear side

Impact on convex side / Cube passed through / Square hole with plastic deformation

Residual strength test (compression)



Max. load = 53 kN

Residual strength factor = 0.93

A005

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

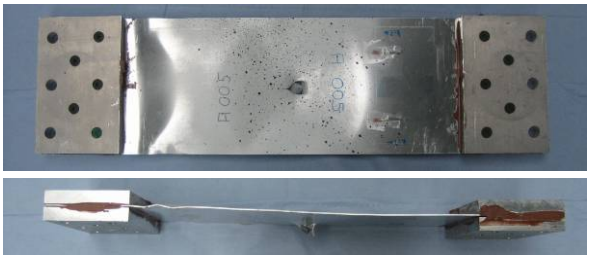
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.5 Pb (30 kN, 0.15 %), in
Velocity: 125.6 m/s (106.5 J)

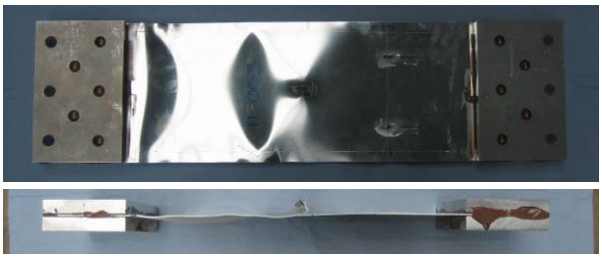
Impact side

Rear side

Impact on convex face / Cube stopped in plate / square hole with plastic deformation

Residual strength test (compression)





Max. load= 56.9 kN

Residual strength factor = 0.996

A006

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

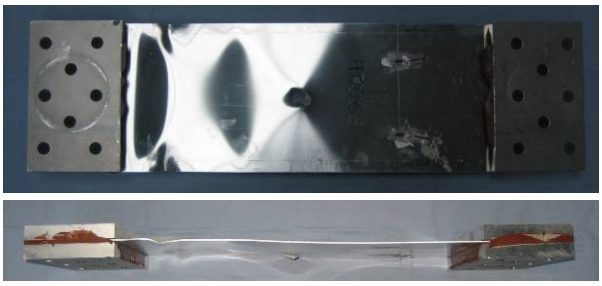
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: ~ 0 (2 kN), no preloading
Velocity: 121.7 m/s (99.2 J)

Impact side

Rear side

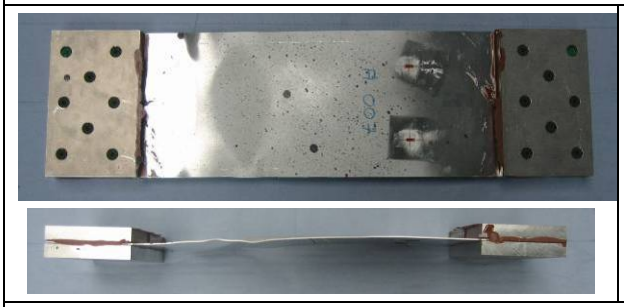
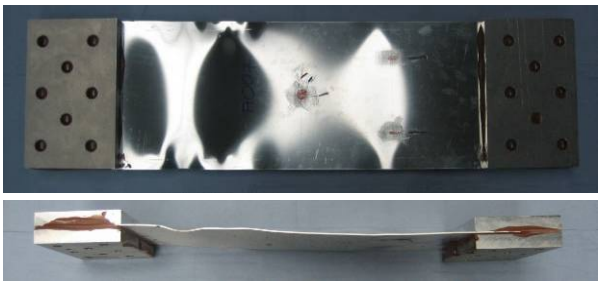
Cube passed through plate / large square hole with plastic deformation

Residual strength test (compression)



Max. load = 54.3 kN

Residual strength factor = 0.95

A007
Incoming inspection
Plate perfectly flat Thickness: 2 mm
High Velocity Impact test
No test
Residual strength test (compression)
 
3-cell bukle Max. load= 55.5 kN Residual strength factor = 1.0

A008

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

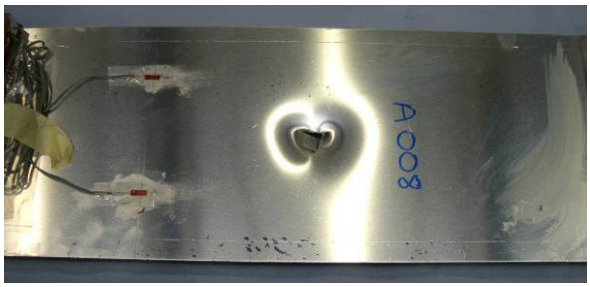
High Velocity Impact test

Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: ~ 0 in compression (2 kN), similar to no pre-loading

Velocity: 123.2 m/s (102.4 J)



Impact side

Rear side

Cube stopped by plate / crack with plastic deformation

Residual strength test (compression)

Extended rails

Max. load = 56.9 kN

Residual strength factor = 0.996

A009

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: ~ 0 (2 kN in compression), similar to no preloading

Velocity: 131.4 m/s (115.7 J)

Impact side

Rear side

Cube passed through plate / large square hole with plastic deformation

Residual strength test (compression)

Extended rails

Max. load= 57.9 kN

Residual strength factor = 1.01

A010

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

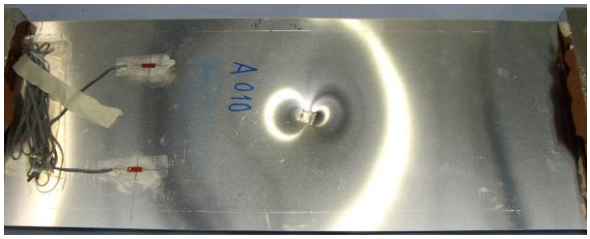
High Velocity Impact test

Test conditions:

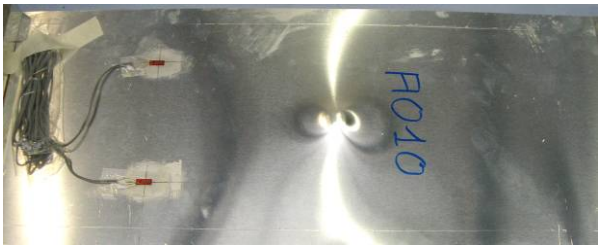
Impactor: 13.4 g steel cube

Pre-loading: 1.5 Pb, in compression

Velocity: 129.0 m/s (111.6 J)



Impact side



Rear side

Impact on convex face / Cube stopped / square indentation in buckle

Residual strength test (compression)

Extended rails

Max. load= 55.4 kN

Residual strength factor = 0.97

A011

Incoming inspection

Plate perfectly flat
Thickness: 2 mm

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 1.5 Pb, in compression
Velocity: 129.7 m/s (112.7 J)

Impact side

Rear side

Impact on concave face / Cube passed through / large square hole with plastic deformation

Residual strength test (compression)

Extended rails
Max. load= 56.6 kN
Residual strength factor = 0.99

A012

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: 2 kN in compression, similar to no pre-load

Velocity: 123.2 m/s (102.4 J)

Impact side

Rear side

Cube stopped with rebound/ indentation with very small crack from cube corner

Residual strength test (compression)

Extended rails, rail bolt deformed

Max. load= 55.7 kN

Residual strength factor = 0.98

A013	
Incoming inspection	
Plate perfectly flat Thickness: 2 mm	
High Velocity Impact test	
–	
Residual strength test (tension)	
	
Max. load= 170 kN	

A014

Incoming inspection

Plate perfectly flat
Thickness: 2 mm

High Velocity Impact test

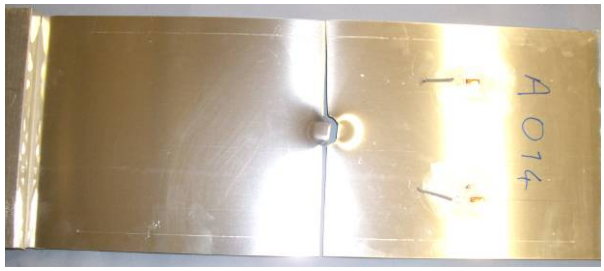
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02% in tension, similar to no pre-load
Velocity: 133.7 m/s (119.7 J)

Impact side

Rear side

Rebound / indentation with small edge crack (23 mm)

Residual strength test (tension)



Max. load= 144.4 kN
Residual strength factor = 0.82

A015

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

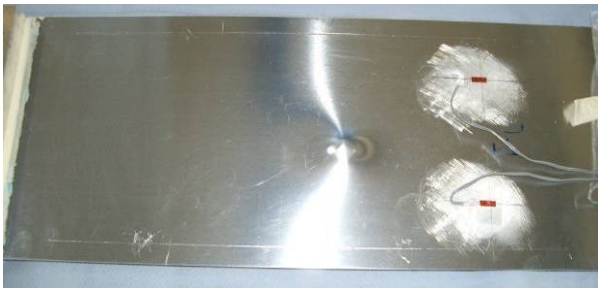
Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: 0.02% in tension, similar to no pre-load

Velocity: 142.7 m/s (136.3 J)

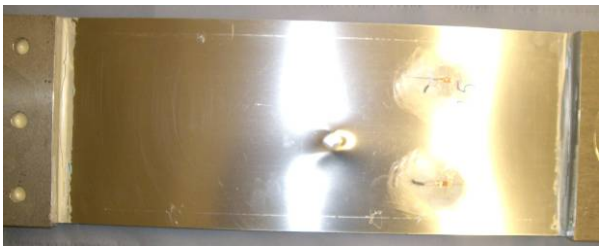
Impact side



Rear side

Rebound / indentation with no crack

Residual strength test (tension)



Large plastic deformation in the QS test

Max. load= 163.0 kN

Residual strength factor = 0.92

A016

Incoming inspection

Plate perfectly flat
Thickness: 2 mm

High Velocity Impact test

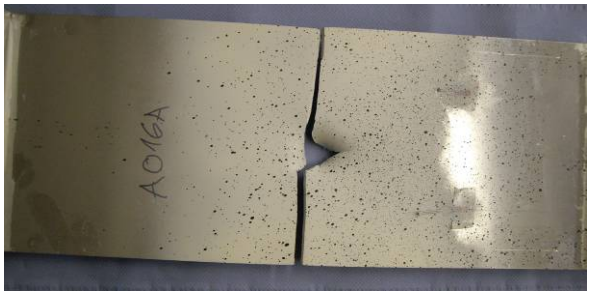
Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25 % in tension
Velocity: 145.1 m/s (141.1 J)

Impact side

Rear side

Cube passed through / Notch damage, square hole (35 mm)

Residual strength test (tension)



Max. load= 123.7 kN
Residual strength factor = 0.70

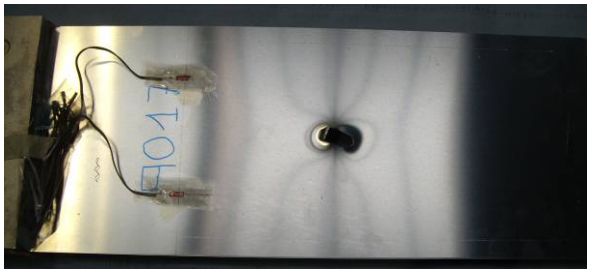
A017

Incoming inspection

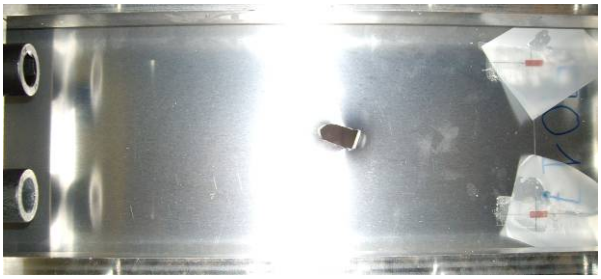
Plate perfectly flat
Thickness: 2 mm

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.02 % in tension, similar to no pre-loading
Velocity: 171.5 m/s (197.1 J)



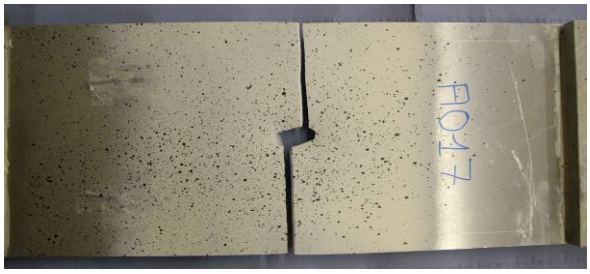
Impact side

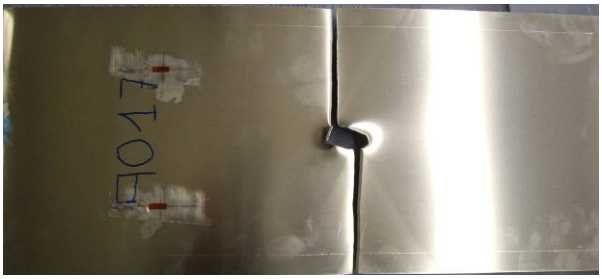


Rear side

Cube passed through / Notch damage, square hole (15 mm)

Residual strength test (tension)





Max. load= 148.4 kN
Residual strength factor = 0.84

A018

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

High Velocity Impact test

Test conditions:

Impactor: 13.4 g steel cube

Pre-loading: 0.25 % in tension

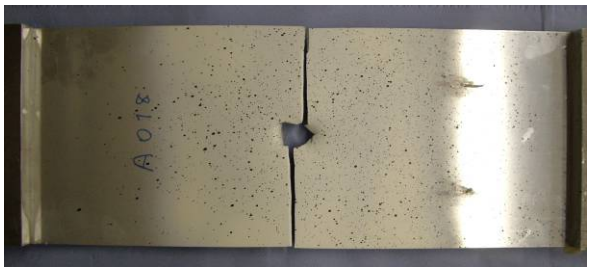
Velocity: 141.6 m/s (134.4 J)

Impact side

Rear side

Cube passed through / Notch damage, square hole (23 mm)

Residual strength test (tension)



Max. load= 151.7 kN

Residual strength factor = 0.86

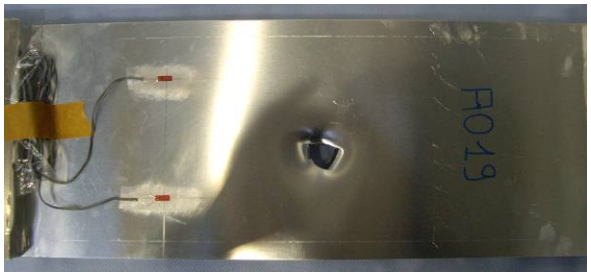
A019

Incoming inspection

Plate perfectly flat
Thickness: 2 mm

High Velocity Impact test

Test conditions:
Impactor: 13.4 g steel cube
Pre-loading: 0.25 % in tension
Velocity: 141.2 m/s (133.6 J)

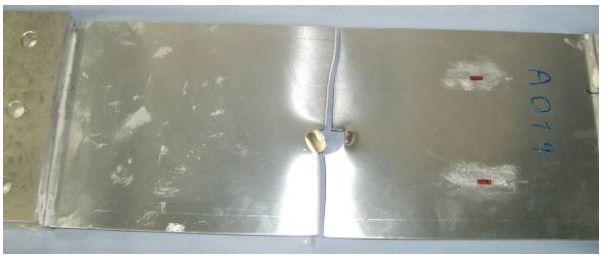


Impact side

Rear side

Cube passed through / Notch damage, square hole (23 mm)

Residual strength test (tension)



Max. load= 143.8 kN
Residual strength factor = 0.82

A020

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

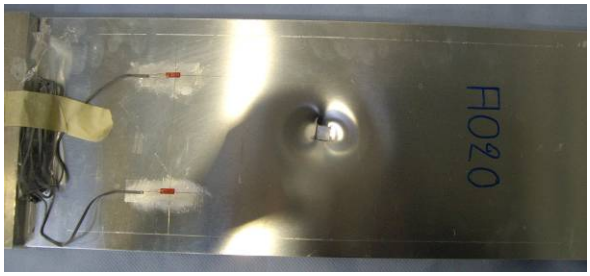
High Velocity Impact test

Test conditions:

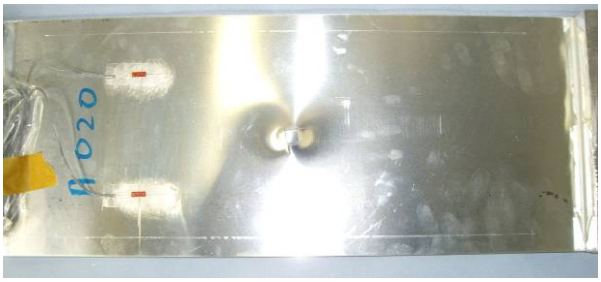
Impactor: 13.4 g steel cube

Pre-loading: 0.02 % in tension, similar to no pre-loading

Velocity: 147.9 m/s (146.6 J)



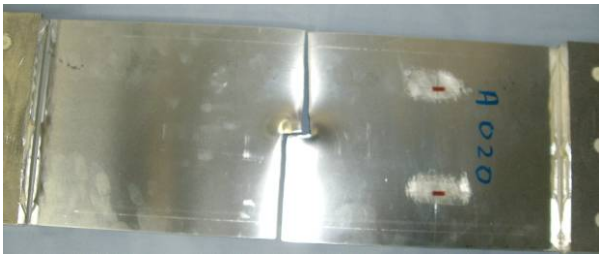
Impact side



Rear side

Cube rebounded / Indentation with 3 cracks, 12 mm in size

Residual strength test (tension)



Max. load= 143.8 kN

Residual strength factor = 0.82

A021

Incoming inspection

Plate perfectly flat

Thickness: 2 mm

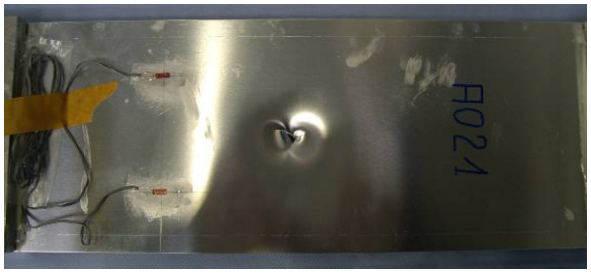
High Velocity Impact test

Test conditions:

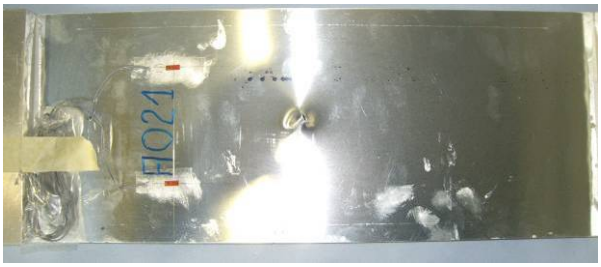
Impactor: 13.4 g steel cube

Pre-loading: 0.25 % in tension

Velocity: 92.9 m/s (57.9 J)



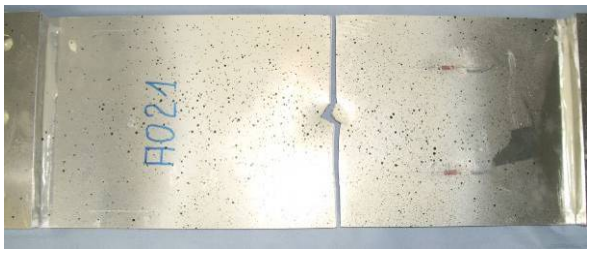
Impact side

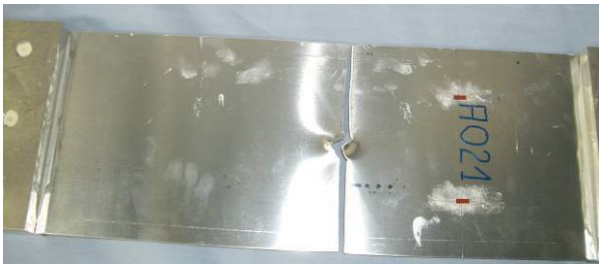


Rear side

Cube rebounded / Indentation with 20 mm wide crack

Residual strength test (tension)





Max. load= 143.8 kN

Residual strength factor = 0.82

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