DEKRA Rail

Testing of scaffolding anchors for tensile and shear force

4 December 2018

DEKRA

Testing of scaffolding anchors for tensile and shear force

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Release	:	Gerrit van Keulen, Project Manager
Date	:	4 december 2018
Version	:	definitief 1.0

Management Summary

Scaffolding anchors from McNetiq are subject to tensile and sliding tests before being released by the Deutsche Institut für Bautechnik (DIBt).

The tests have been carried out in order to be able to assess whether the scaffolding anchors comply with the requirements laid down in NEN-EN 13155:2003+A2:2009. In accordance with the standard, the scaffolding anchors shall be subjected to both tensile and shearing tests under various conditions. The tensile tests were carried out on the 15th of November 2018. Prof. K. Hameyer was present as the representative for DIBT. The slide tests were carried out on 21 November 2018.
Mr. Bas Gravendeel was present for McNetiq on both test days.
This report contains a description of the measurements carried out and the results of the tensile and shear tests.

Table of contents

1 Introduction

For release by the German DIBt institute, McNetiq scaffolding anchors must be subjected to tensile and shear tests. There is no specific standard (yet) for scaffolding anchors. As a guideline, the standard as it applies to lifting equipment is sought, the NEN-EN 13155:2003+A2:2009. The activities described in this report were commissioned by returning our quotation DR/18/180293/001, signed by the client, by e-mail on 18 July 2018.

2 Set-up of activities

DEKRA Rail has ordered the necessary equipment for carrying out the tests. The list of tools is shown in appendix 1. In accordance with the standards, the plates have a flatness of less than 0.1 mm per 500 mm. The tests were carried out with both, a perpendicular and a shearing force. The tests were also carried out with different starting points. Appendix 2 contains a list of all the tests to be carried out. A scaffolding anchor was heated to 80 degrees Celsius for a number of tests.
A blank and a coated plate of 20 mm thickness were tested at a temperature of -20 °C.

3 Methode

The tests were carried out on the MTS test bench with a calibrated load cell. This test bench was last calibrated on 1 October 2018. In terms of accuracy, the machine is in class 0.5 for both tensile and compressive testing. This means that the deviations in both tensile and compressive readings are less than 0.5%.
The boards with the different wall thicknesses are mounted on a wood package of at least 54 mm on the tensile part of the test bench. The plates are pressed onto the wood package by means of two clamping plates. The magnet to be tested is mounted to the fixed frame of the test stand by means of its eyebolt attachment.
After the magnet has been switched on, the plate is pulled down at a speed of 0.5 mm per minute. The movement of the bench is stopped after the magnet comes loose from the plate. Pictures 1 and 2 show the test fixture as used during the tensile tests.

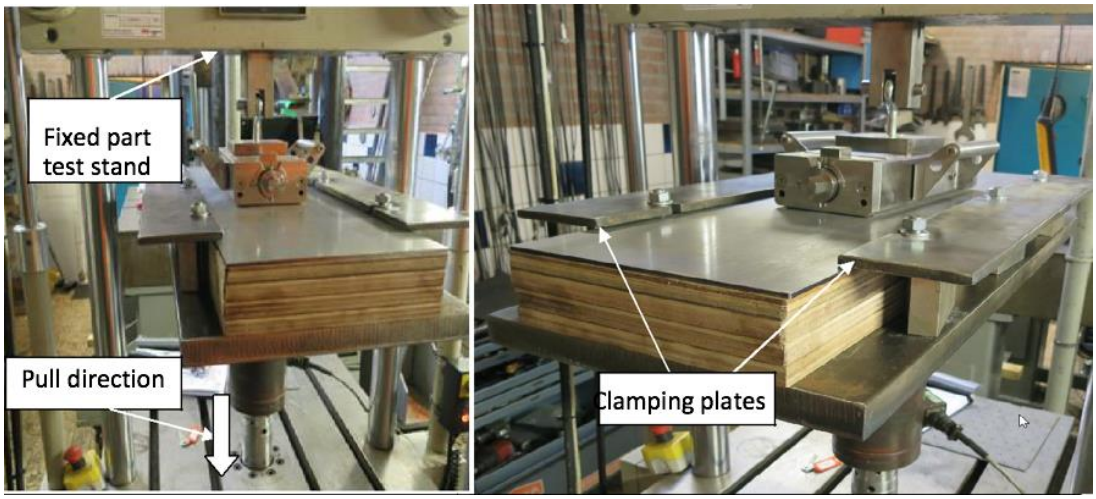


Photo 1 and 2: Installation for tensile tests.

The air gap tests were carried out using copper foil of 0.5 mm, 1 mm and 1 mm respectively. mm and 2 mm thick. The tensile force and displacement of the cylinder are determined by Instron software.
The maximum tensile force is determined per test using the force/displacement diagram made of each measurement. Figure 1 shows an example of a force/displacement diagram. For the measurement in the figure below, the maximum tensile force is determined at 21.3 kN.

Figure 1: Force versus displacement measurement wall thickness 20 mm.

The determination of the shear force was carried out on the same MTS test bench. The plates to be tested were placed vertically. Pictures 3 and 4 show the test setup as used during the sliding tests. In order to avoid having to lift the magnet every time the sheets are changed, the magnet is suspended from the fixed frame of the test bench using the green lashing strap. After switching on the magnet on the plate to be tested, the anchor is loaded by the blue lashing strap attached to the pulling cylinder.

During the tensile test, the green lashing strap is relaxed so that the scaffold anchor can move when the maximum shearing force is reached.

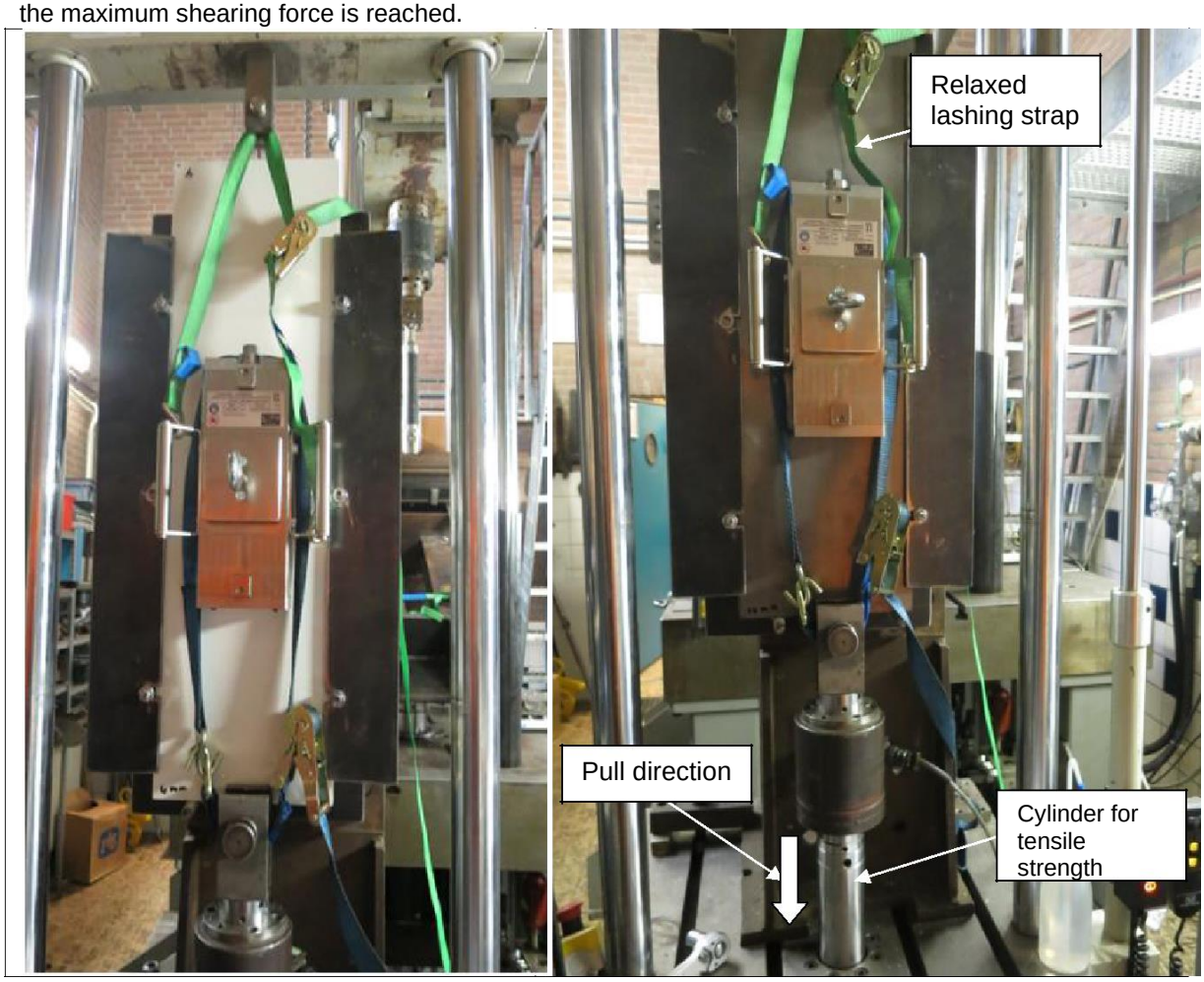


Photo 3 and 4: Test setup for determining the shear force with coated and uncoated plate.

In Annex 3 some pictures of the test set-ups are shown.

3.1 Tested anchor bolts

The tests in which the scaffolding anchor was used at ambient temperature were carried out with the anchor with serial number 2018-023. The tests in which the scaffold anchor was preheated at 80 °C before the test was carried out were carried out with the anchor with serial number 2018-018.

The certificates of both anchors tested are shown in appendices 6 and 7.

3.2 Certification DEKRA rail b.v.

DEKRA Rail has ISO 9001-2015 certification for the entire company and ISO17025 accreditation for parts.

The equipment used to determine the measurement results is calibrated annually. The type numbers and calibration dates are listed in appendix 1.

4 Results

4.1 Results of tensile tests

Table 1 shows the results of the tensile tests on the blank plates.

Airgap[mm]	Wall thickness			
	20 mm	10mm	8mm	6mm
0	21,3	16,0	10,4	3,2
0,5	10,1	8,3	7,5	3,0
1	6,9	6,1	5,3	2,6
2	3,0	2,6	3,0	1,6

Table 1: Perpendicular tensile force [kN] at different wall thicknesses and air gaps.

The ambient temperature during these tests was 24 °C.

Figure 1 shows these results in graphical form.

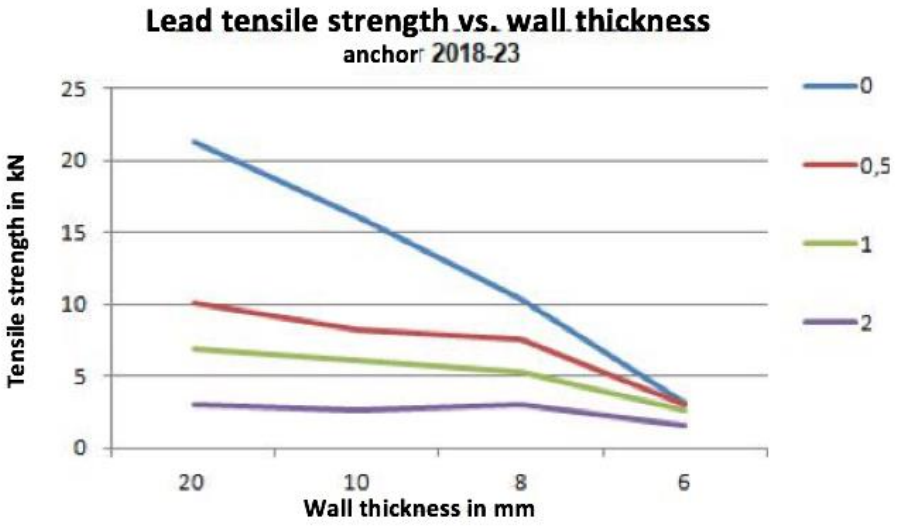


Figure 2: Results of tensile strength blank plate with different wall thicknesses.

These tests were carried out with anchor 2018-23.
Figure 3 shows the measured values as provided by the manufacturer in the manual

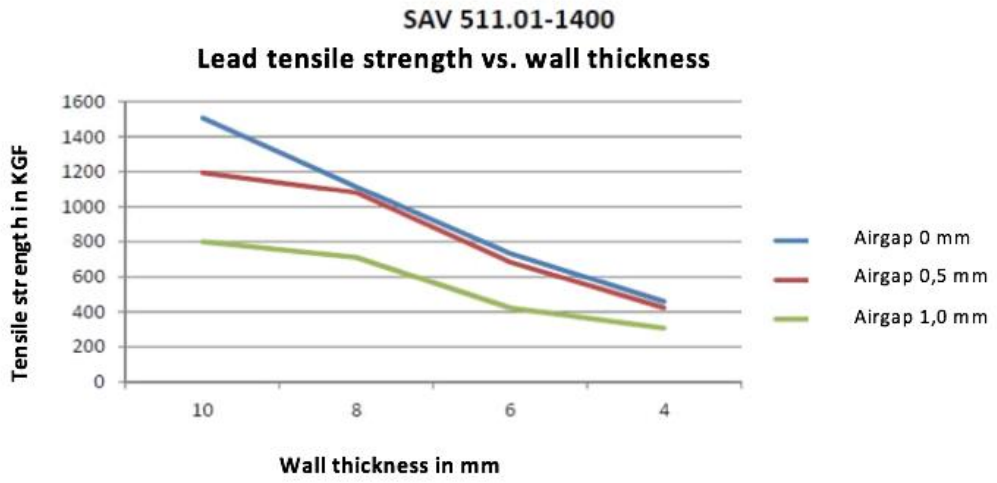


Figure 3: Lead straight force vs. wall thickness according to the manufacturer's specifications.

Table 2 shows the results of the tensile tests on the bare plate 20 mm thick with the preheated magnet on a plate at ambient temperature. And on a plate, that had been cooled to -30 C and the magnet at ambient temperature. The exact temperatures at the time of testing deviated slightly from the prescribed temperature of +80 °C and -20 °C respectively.

Airgap [mm]	Panel 24 °C / magnet 75 °C	panel -16 °C/ magnet 24 °C
0	19,9	21,0
0,5	8,3	10,0
1	5,9	
2	2,6	

Table 2: Perpendicular tensile force [kN] with magnet or plate at different temperatures.

Appendix 4 shows a number of force/displacement diagrams of the tensile tests.

4.2 Results of shear testing

Table 3 shows the results of the measurements to determine the shear forces on the uncoated sheets with different wall thicknesses, wetted, and cooled at -16 °C. The results are shown in the table below. The magnetic temperature at all slide tests was 22 °C.

Airgap/panel condition	Wall thickness			
	20 mm	10 mm	6 mm	4 mm
0 mm	3,7	3,5	2,0	1,3
-16 °C	3,2			
22 °C nat	3,2			

Table 3: Shear strength [kN] bare plate at different wall thicknesses and air gaps.

Table 4 shows the results of the measurements to determine the shear forces on the coated sheets with different wall thicknesses, wetted, and cooled at -16 °C. The results are shown in the table below.

Airgap/panel condition	Wall thickness			
	20 mm	10 mm	4 mm	
0 mm	3,2	2,9	1,2	
-11 °C	4,0			
22 °C nat	2,7			

Table 4: Shear strength [kN] coated plate at different wall thicknesses and air gaps

Appendix 5 shows a number of force/displacement diagrams for the sliding tests.

Annex 1: Used equipment and materials

Device/ Instrument	Further Description	Identification	Last calibration	Next calibration
MTS Loadcell	100 kN	CTO 5.33.49.6	1-10-2018	01-10-2019
Slide gauge	150 mm	1.6.2053	14-02-2018	14-02-2019
Layer thickness meter	Fischer Deltascope MP3	5.2.70	12-09-2018	12-09-2019
Height meter	Trimos MT1000MA	8.1.34	09-01-2018	09-01-2019
Temperature meter	Keithley 871A	CTO 1.23.7	12-09-2017	12-09-2019
Oven	Hielkema Grenlo GHS 12540			
Climate room	Minimum temperature -30 °C			

Table 5: Used equipment/instruments.

Materials used

Steel panel	Amount
845 x 250 x 20 mm S235 vlgs EN13155 flat-edged	2
845 x 250 x 10 mm S235 vlgs EN13155 flat-edged	1
845 x 250 x 8 mm S235 vlgs EN13155 flat-edged	1
845 x 250 x 6 mm S235 vlgs EN13155 flat-edged	1
845 x 250 x 4 mm S235 vlgs EN13155 flat-edged	1
845 x 250 x 20 mm S235 vlgs EN13155 100 µm coating	2
845 x 250 x 10 mm S235 vlgs EN13155 100 µm coating	1
845 x 250 x 4 mm S235 vlgs EN13155 100 µm coating	1
Ground panel 850x350x30 v.v. threaded holes and threaded ends	1
strip 700x100x10 v.v. sleufgaten	2

Copper foil	Amount
140 x 10 x 0.5 mm	2
140 x 10 x 1 mm	2
140 x 10 x 2 mm	2

Table 6: Materials purchased

Annex 2: Pull tests carried out

Test-number	Tensile testing		Temp. Magnet / panel [°C]	Used anchor	Test file number	Measured Force [kN]
	P1,	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring)		2018-23		
	20 mm	steel panel 845 x 250 x 20 mm S235 vlgs EN13155 flat-edged				
1		airgap 0 mm	24		15	21,3
2		Copper foil 0,5 mm, 140 mm long and 10 mm wide	24		16	10,1
3		Copper foil 1 mm, 140 mm long and 10 mm wide	24		17/18	6,8/6,9
4		Copper foil 2 mm, 140 mm long and 10 mm wide	24		19/20	3,0/3,0
	P2,	Temperature meter (10 < T < 30) Temperature meter Magnet at 80 degrees C (measuring)		2018-18		
	20 mm	Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 flat-edged				
5		airgap 0 mm	75		21	19,9
6		Copper foil 0,5 mm, 140 mm long and 10 mm wide	74		22	8,3
7		Copper foil 1 mm, 140 mm long and 10 mm wide	72		23	5,9
8		Copper foil 2 mm, 140 mm long and 10 mm wide	70		24	2,6
	P3,	Temperature meter (10 < T < 30) Temperature meter Magnet at Room temperature(measuring)		2018-23		
	10 mm	Steel panel 845 x 250 x 10 mm S235 vlgs EN13155 flat-edged				
9		airgap 0 mm	24		25/59/60	17,0/15,3/15,8
10		Copper foil 0,5 mm, 140 mm long and 10 mm wide	24		26/61/62	-8,3/8,2
11		Copper foil 1 mm, 140 mm long and 10 mm wide	24		27/63/64	6,1/5,6/6,7
12		Copper foil 2 mm, 140 mm long and 10 mm wide	24		28/65/66	3,0/2,4/2,5

	P3, 8 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 8 mm S235 vlgs EN13155 flat-edged		2018-23		
13		airgap 0 mm	24		29	10,4
14		Copper foil 0,5 mm, 140 mm long and 10 mm wide	24		30	7,5
15		Copper foil 1 mm, 140 mm long and 10 mm wide	24		31	5,3
16		Copper foil 2 mm, 140 mm long and 10 mm wide	24		32	3,0
	P3, 6 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 6 mm S235 vlgs EN13155 flat-edged		2018-23		
17		airgap 0 mm	24		33/34	3,3/3,1
18		Copper foil 0,5 mm, 140 mm long and 10 mm wide	24		35	3,0
19		Copper foil 1 mm, 140 mm long and 10 mm wide	24		36	2,6
20		Copper foil 2 mm, 140 mm long and 10 mm wide	24		37/38	1,6/1,6
	extra 20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 Flat-edged	22	2018-23		
1’		Airgap 0 mm	Plaat – 16 °C		40	21
2’		Copper foil 0,5 mm, 140 mm long and 10 mm wide	Plaat – 16 °C		39	10

Table 7: Measurements made for the determination of the tensile strength.

Annex 3: Sliding tests carried out

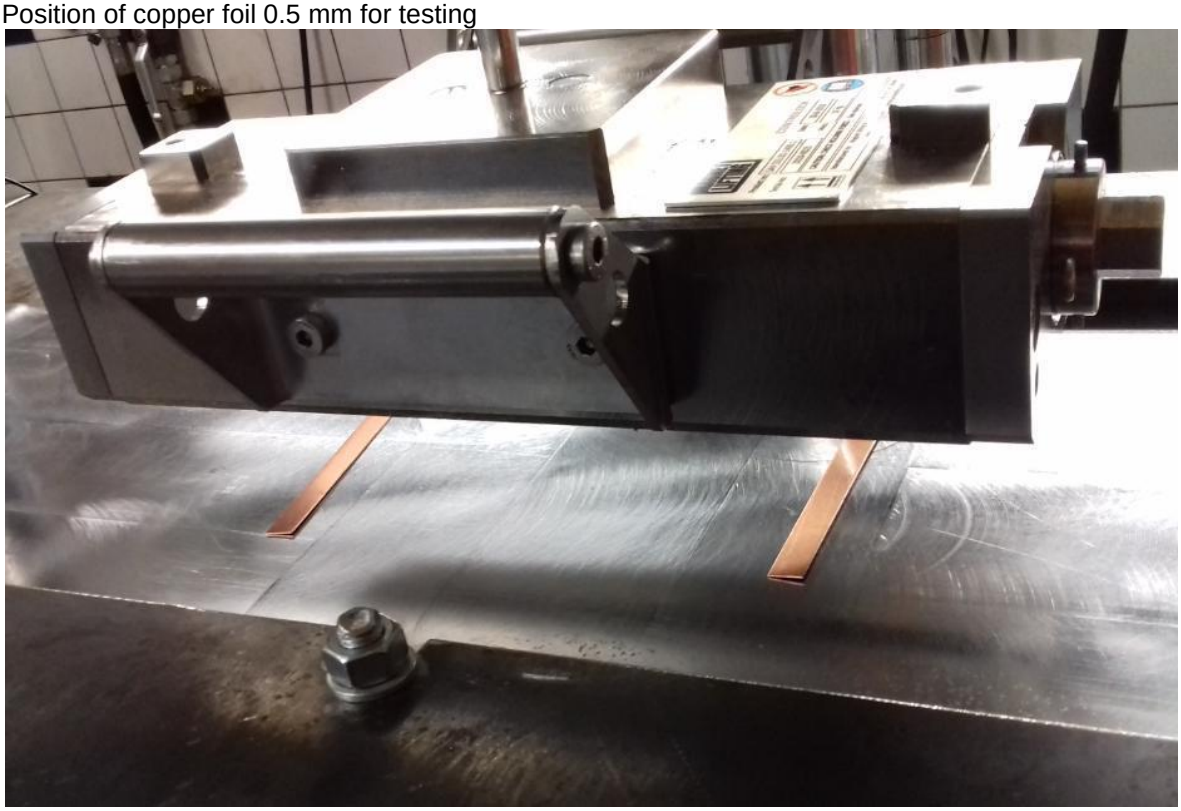
Test - nummer	Slide test		Temp. Magnet / panel [°C]	Used anchor	Test file number	Measured Force [kN]
21	P4, 20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 flat-edged airgap 0 mm	22	2018-23	45	3,7
22	20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 100 µm coating airgap 0 mm	22	2018-23	46	3,2
23	P5, 10 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 10 mm S235 vlgs EN13155 flat-edged Airgap 0 mm	22	2018-23	51	3,5
24	10 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 10 mm S235 vlgs EN13155 100 µm coating Airgap 0 mm	22	2018-23	47	2,9
25	P5, 4 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 4 mm S235 vlgs EN13155 flat-edged Airgap 0 mm	22	2018-23	50	1,3
		Steel panel 845 x 250 x 6 mm S235 vlgs EN13155 flat-edged	22		49	2,0

26	4 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 4 mm S235 vlgs EN13155 100 µm coating airgap 0 mm	22	2018-23	48	1,2
27	P6, 20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 flat-edged, -20 degrees C airgap 0 mm	22 Plaat – 16 °C Plaat – 16 °C	2018-23	53 56	2,0 2,6
28		Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 100 µm coating, -20 degrees C airgap 0 mm	22 Plaat – 16 °C	2018-23	52	4,0
29	P7, 20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 flat-edged airgap 0 mm Water spray bottle	22	2018-23	54	3,2
30	20 mm	Temperature meter (10 < T < 30) Temperature meter Magnet at room temperature (measuring) Steel panel 845 x 250 x 20 mm S235 vlgs EN13155 100 µm coating airgap 0 mm 1e Water spray bottle 2e	22 22	2018-23	55 56	2,8 2,6

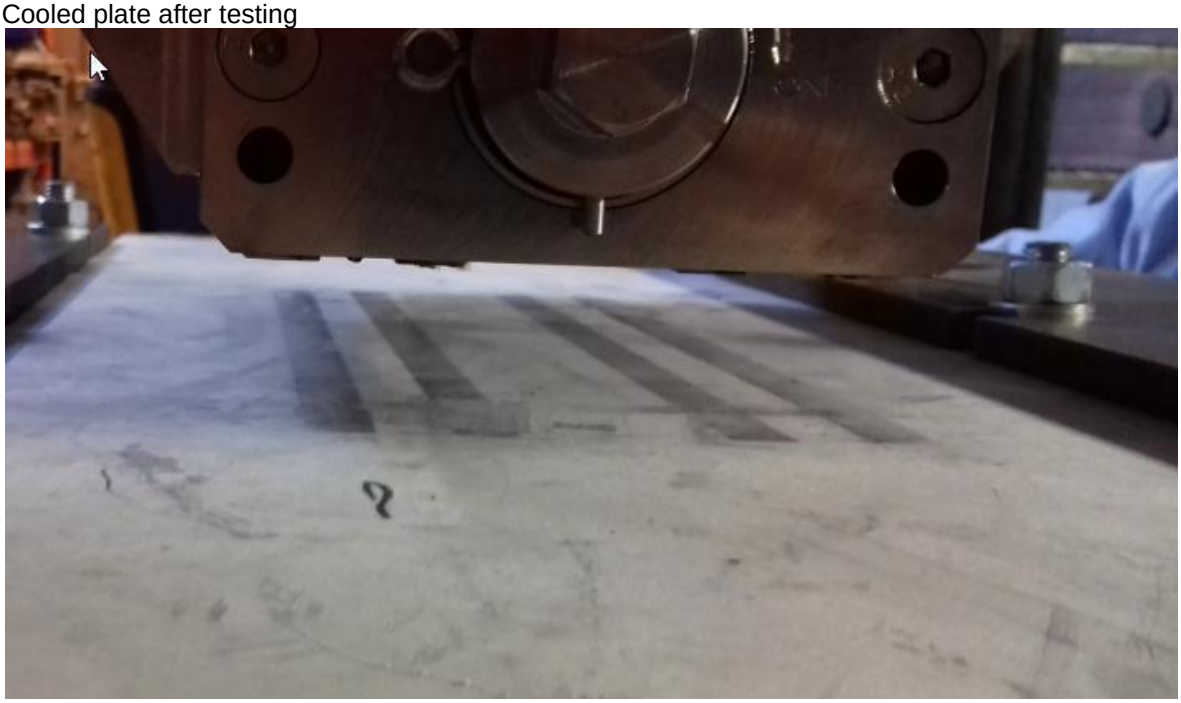
Table 8: Measurements made for the purpose of determining the shear strength.

Annex 3: Photographs of the test setup

Position of copper foil 0.5 mm for testing

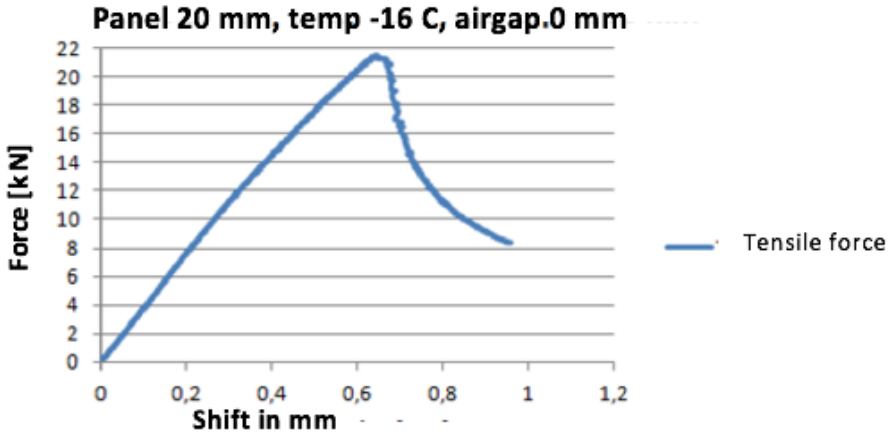


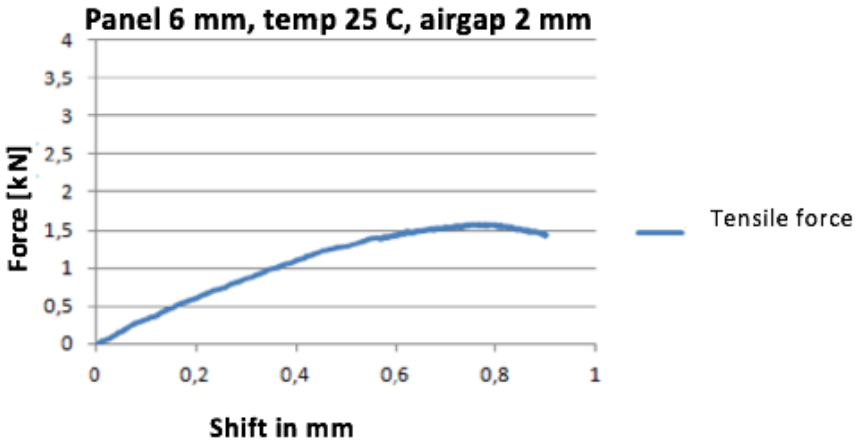
Cooled plate after testing

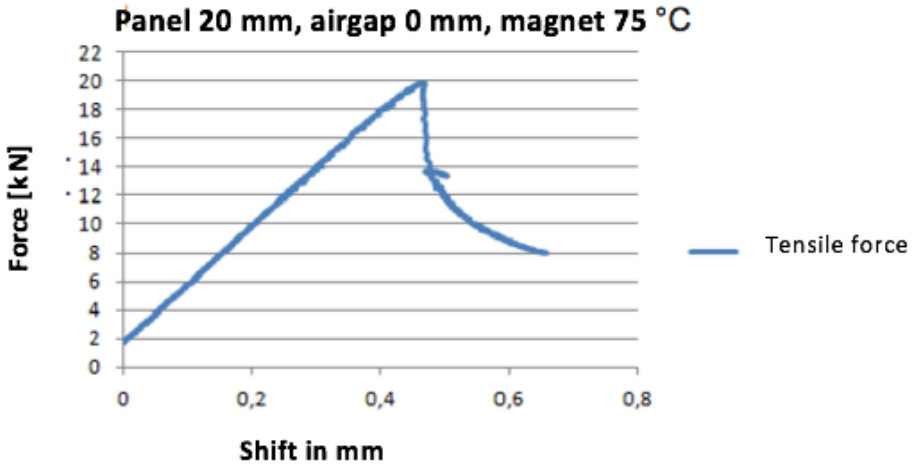


Slide test wetted plate

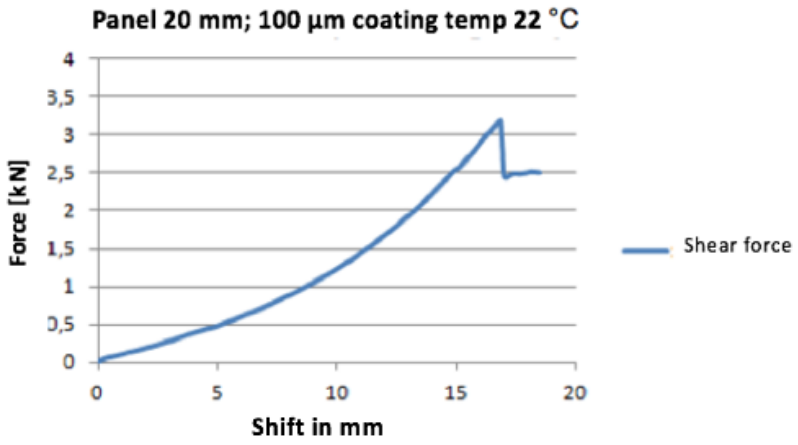
Annex 4: Force versus displacement tensile force determination

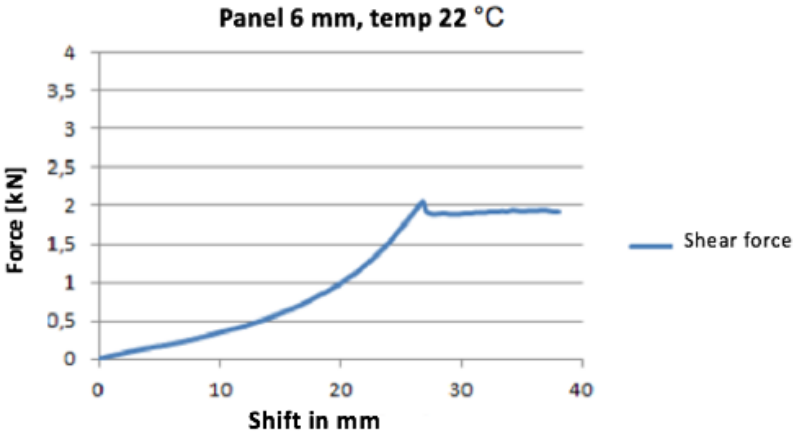


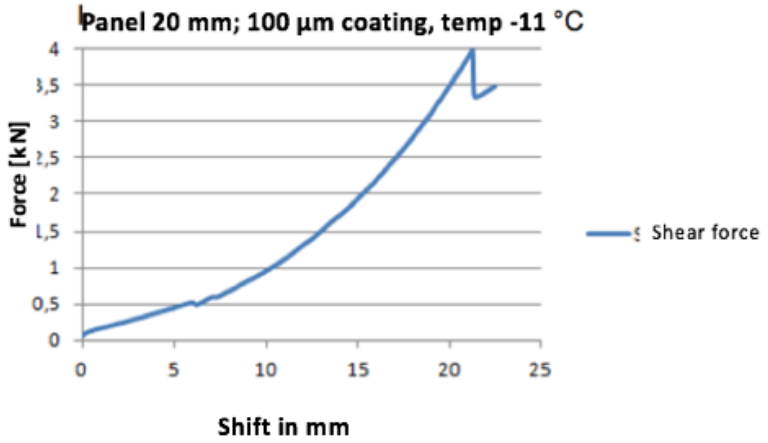




Annex 5: Force versus displacement shear force determination







Annex 6: Certificate scaffold anchor 2018-0018

MAGNET LIFTING

CE

TEST CERTIFICATE
PRÜFZERTIFIKAT
TESTCERTIFICAAT
CERTIFICAT D'ESSAIS

TESTCERTIFIKAT
PRØVECERTIFIKAT
TESTSERTIFIKAT
TARKASTUSTODISTUS

CERTIFICADO DE ENSAYO
CERTIFICATO DI CONTROLLO
CERTIFICADO DE AFERIÇÃO
Πιστοποιητικό δοκιμών
CERTYFIKAT TESTU

Lift magnet model Hebemagnet Typ Hijsmagneet type Aimant, modèle	Lyftmagnet typ Løftemagnet typ Leftemagnet type Nostomagneetti typpi	Imán elevador, modelo Magnete di sollevamento tipo Iman elevador modelo	Magnes podnoszący Typové označení magnetu	Controlock Magnetic Anchor
Code number Kodenummer Codenummer No. de code	Kodenummer Kodenummer Kodnummer Koodinumero	Número de código Numero di codice Número de código Kód číslo	Numer kodu	551.01-1400.1
Serial no. Serienr. Serienr. No. de série	Serienummer Serienummer Serienummer Sarjanumero	Número de serie Numero di serie0 Número de série	Numer seryjny Výrobní číslo	2018-0018
Break-away force Abreißkraft Losbreekkracht Force de décollement	Løsrivelsekraft Trækkraft Dragkraft Irrotusvoima	Fuerza de arranque Forza di distacco Força de arranque Odtrhová síla	Siła oderwania	2.240
Date Datum	Dato Päiväys	Fecha Data	Datum	12-9-2018
Tested by: Geprüft von: Getest door: Testé par:	Testet av: Afprøvet af: Testad av: Tarkastaja:	Ensayado por: Controllato da: Testado por: Przetestowany przez:	Testoval	RS
Airgap: Luftspalt: Luchtspleet: Entrefer:	Luftspalte: Luftmellemrum: Luftspringa: Ilmarako:	Abertura: Spazio: Folga:	Szczelina powietrzna: Vzduchová mezera:	0 mm

This is to certify the breakaway force indicated above of this lifting magnet according to the procedure described overleaf.
Our test equipment is calibrated periodically by a certified body.

Hiermit bescheinigen wir die oben eingetragene Abreißkraft dieses Lasthebemagneten gemäß der auf der Rückseite beschriebenen Prozedur.
Unser Prüfstand wird periodisch von einer offiziellen Prüfanstalt kalibriert.

Hiermee documenteren wij de losbreekkracht van deze magneet volgens de aan de ommezijde beschreven procedure.
Onze testbank wordt periodiek door een officiële instantie gekalibreerd.

Nous certifions la force d'arrachement de ce porteur magnétique suivant la procédure décrite au verso.
Notre banc de test est calibré périodiquement par un organisme certifié.

Vi erklærer at denne løftemagneten har oppnådd ovenstående løsrivelsekraft under den løsrivelsestesten som er beskrevet på baksiden.
Vår test utstyret er kalibrert med jevne mellomrom av et offisielt organ.

Vi erklärer, at denne løftemagnet har nået ovenstående løsrivningskraft under den trækprøve, der er beskrevet på bagsiden.
Vores testudstyr er kalibreret periodisk af et officielt organ.

Vi försäkar härmed at denna lyftmagnet uppnått ovenstående dragkraft vid det på andra sidan beskrivna dragtestet.
Vår testutrustning är kalibrerad regelbundet av ett officiellt organ.

Vakuutamme, että tämä nostomagneetti on saavuttanut yllämainitun irrotusvoiman kääntöpuolella kuvatussa irrotuskokeessa.
Testauslaitteistomme on virallisen tahon tarkastama.

Certificamos que este imán elevador ha alcanzado la fuerza de arranque arriba mencionada durante el ensayo descrito al dorso.
Nuestros aparatos de ensayo estan bajo control de un organismo certificado.

Si dichiara che questo magnete di sollevamento ha raggiunto la forza di distacco sopra indicata, durante il collaudo relativo descritto sul retro.
I nostri dispositivi di test sono sottoposti al controllo da parte di organo competente autorizzato.

Declaramos que este iman elevador alcançou a força de arranque acima mencionada durante o ensaio descrito no verso.
A nossa aparelhagem de testes está sob controlo de uma instância certificada.

Niniejszym zaświadcza się wskazaną powyżej siłę oderwania magnesu podnoszącego zgodnie z procedurą opisaną na odwrocie.
Nasz sprzęt testowy jest okresowo kalibrowany przez certyfikowany posmiot.

Deklarujeme, že elektromagnet dosáhl během testování výše uvedených parametrů. Naše testovací zařízení prochází pravidelnou kalibrací od certifikovaného subjektu.

Magnet Lifting B.V.
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Tel.: +31 497 383835 – Fax: +31 497 339099
info@magnetlifting.com - www.magnetlifting.com

3625926.1

Annex 7: Certificate scaffold anchor 2018-0023

MAGNET LIFTING

CE

TEST CERTIFICATE
PRÜFZERTIFIKAT
TESTCERTIFICAAT
CERTIFICAT D'ESSAIS

TESTCERTIFIKAT
PRØVECERTIFIKAT
TESTSERTIFIKAT
TARKASTUSTODISTUS

CERTIFICADO DE ENSAYO
CERTIFICATO DI CONTROLLO
CERTIFICADO DE AFERIÇÃO
Πιστοποιητικό δοκιμών
CERTYFIKAT TESTU

Lift magnet model Hebemagnet Typ Hijsmagneet type Aimant, modèle	Lyftmagnet typ Løftemagnet typ Liftemagnet type Nostomagneetti typpi	Imán elevador, modelo Magnete di sollevamento tipo Iman elevador modelo	Magnes podnoszący Typové označení magnetu	Controlock Magnetic Anchor
Code number Kodenummer Codenummer No. de code	Kodenummer Kodenummer Kodnummer Koodinumero	Número de código Numero di codice Número de código Kód číslo	Numer kodu	551.01-1400.1
Serial no. Seriennr. Serienr. No. de série	Serienummer Serienummer Serienummer Sarjanumero	Número de serie Numero di serie0 Número de série	Numer seryjny Výrobní číslo	2018-0023
Break-away force Abreißkraft Losbreekkracht Force de décollement	Løsrivelsekraft Trækkraft Dragkraft Irrotusvoima	Fuerza de arranque Forza di distacco Força de arranque Odtrhová síla	Síla oderwania:	2.195
Date Datum	Dato Pälväys	Fecha Data	Datum	12-9-2018
Tested by: Geprüft von: Getest door: Testé par:	Testet av: Afprøvet af: Testad av: Tarkastaja:	Ensayado por: Controllato da: Testado por: Przetestowany przez:	Testował	RS
Airgap: Luftspalt: Luchtspleet: Entrefer:	Luftspalte: Luftmellemrum: Luftspringa: Ilmarako:	Abertura: Spazio: Folga:	Szczelina powietrzna: Vzduchová mezera:	0 mm

This is to certify the breakaway force indicated above of this lifting magnet according to the procedure described overleaf.
Our test equipment is calibrated periodically by a certified body.

Hiermit bescheinigen wir die oben eingetragene Abreißkraft dieses Lasthebemagneten gemäß der auf der Rückseite beschriebenen Prozedur.
Unser Prüfstand wird periodisch von einer offiziellen Prüfanstalt kalibriert.

Hiermee documenteren wij de losbreekkracht van deze magneet volgens de aan de ommezijde beschreven procedure.
Onze testbank wordt periodiek door een officiële instantie gekalibreerd.

Nous certifions la force d'arrachement de ce porteur magnétique suivant la procédure décrite au verso.
Notre banc de test est calibré périodiquement par un organisme certifié.

Vi erklærer at denne løftemagneten har oppnådd ovenstående løsrivelsekraft under den løsrivelsestesten som er beskrevet på baksiden.
Vår test utstyret er kalibrert med jevne mellomrom av et offisielt organ.

Vi erklærer, at denne løftemagnet har nået ovenstående løsrivningskraft under den trækprøve, der er beskrevet på bagsiden.
Vores testudstyr er kalibreret periodisk af et officielt organ.

Vi försäkar härmed at denna lyftmagnet uppnått ovenstående dragkraft vid det på andra sidan beskrivna dragtestet.
Vår testutrustning är kalibrerad regelbundet av ett officiellt organ.

Vakuutamme, että tämä nostomagneetti on saavuttanut yllämainitun irrotusvoiman kääntöpuolella kuvatussa irrotuskokeessa.
Testauslaitteistomme on virallisen tahon tarkastama.

Certificamos que este imán elevador ha alcanzado la fuerza de arranque arriba mantionada durante el ensayo descrito al dorso.
Nuestros aparatos de ensayo estan bajo control de un organismo certificado.

Si dichiara che questo magnete di sollevamento ha raggiunto la forza di distacco sopra indicata, durante il collaudo relativo descritto sul retro.
I nostri dispositivi di test sono sottoposti al controllo da parte di organo competente autorizzato.

Declaramos que este imán elevador alcançou a forca de arranque acima mencionada durante o ensaio descrito no verso.
A nossa aparelhagem de testes está sob controlo de uma instância certificada.

Niniejszym zaświadcza się wskazaną powyżej siłę oderwania magnesu podnoszącego zgodnie z procedurą opisaną na odwrocie.
Nasz sprzęt testowy jest okresowo kalibrowany przez certyfikowany podmiot.

Deklarujeme, že elektromagnet dosáhl během testování výše uvedených parametrů. Naše testovací zařízení prochází pravidelnou kalibrací od certifikovaného subjektu.

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