



DRUM CLIP

Manual

Version EN 3.0 | June 2022

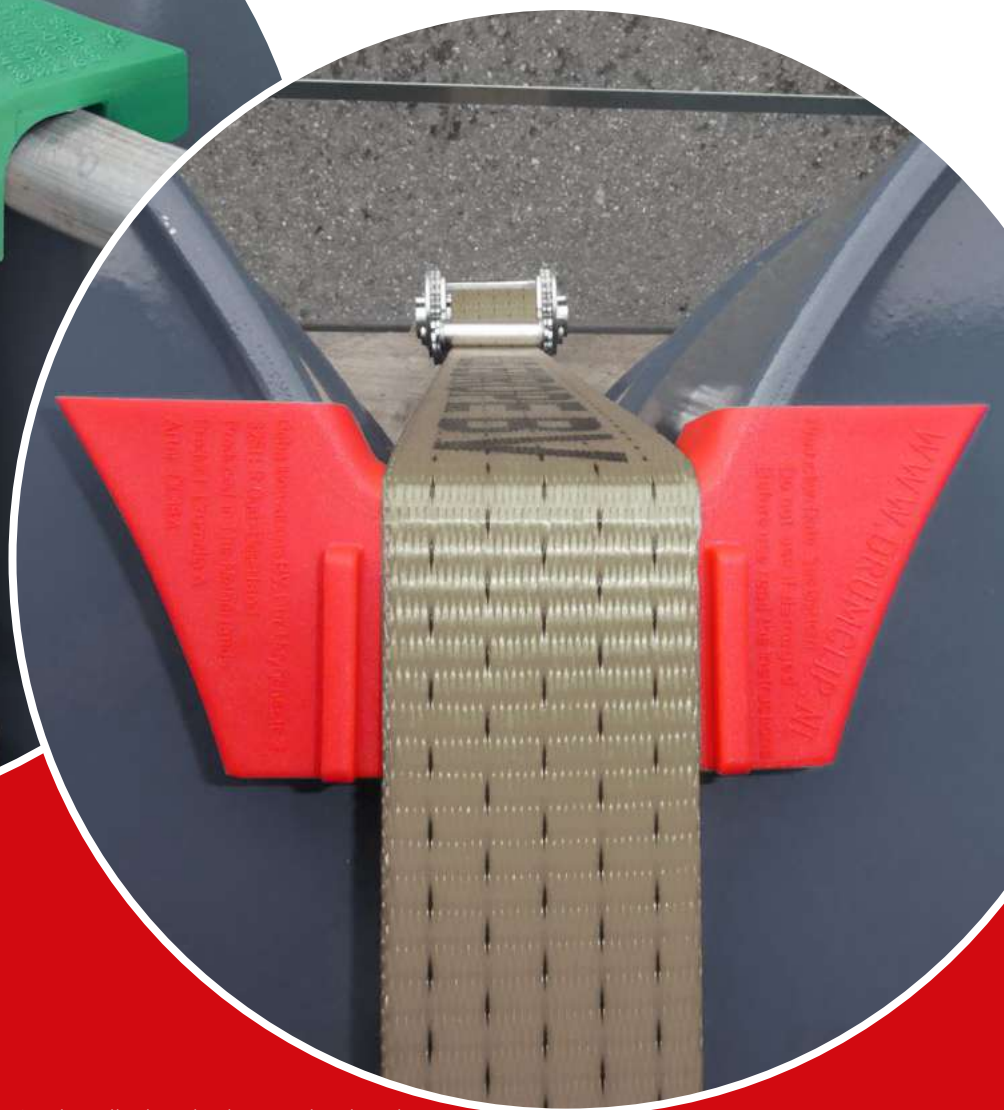




Table of contents

1. Introduction	3
1.1 General introduction	3
1.2 How is this manual structured?	3
2. Applications	4
3. Tight head UN200 litre drum	6
3.1 DRUMCLIP DC18A RED	6
3.2 Technical information DRUMCLIP DC18A RED	8
3.3 Certification DRUMCLIP DC18A RED	10
3.4 Requirements DRUMCLIP DC18A RED	15
3.5 Operating Instructions DRUMCLIP DC18A RED	20
3.6 Test Report TÜV Rheinland DRUMCLIP DC18A RED	27
3.7 Test Report ISTA DRUMCLIP DC18A RED	63
3.8 Test Report EUMOS DRUMCLIP DC18A RED	96
4. Open head UN200 litre drum	104
4.1 DRUMCLIP DC19B GREEN	104
4.2 Technical information DRUMCLIP DC19B GREEN	106
4.3 Certification DRUMCLIP DC19B GREEN	108
4.4 Requirements DRUMCLIP DC19B GREEN	113
4.5 Operating Instructions DRUMCLIP DC19B GREEN	117
4.6 Test Report TÜV Rheinland DRUMCLIP DC19B GREEN	122
4.7 Test Report ISTA DRUMCLIP DC19B GREEN	141
4.8 Test Report EUMOS DRUMCLIP DC19B GREEN	174
5. Plastic drums	182
5.1 DRUMCLIP DC19B GREEN	182
5.2 Technical information DRUMCLIP DC19B GREEN	184
5.3 Certification DRUMCLIP DC19B GREEN	186
5.4 Requirements DRUMCLIP DC19B GREEN	187
5.5 Operating instructions DRUMCLIP DC19B GREEN	191
5.6 Test Report ISTA DRUMCLIP DC19B GREEN	194
5.7 Test Report EUMOS DRUMCLIP DC19B GREEN	228

1. Introduction

1.1 General introduction

This Manual has been written for everyone who has to deal with the Drumclip. The Drumclip is a patented, innovative plastic tool for securing drums on a pallet and in a trailer. There are two types of Drumclips. The Drumclips are both DIN EN 12195-1, ISTA 3E Pallet Stability and EUMOS 40509 certified, in combination with different strapping configurations.

Where considered necessary, a specific type of Drumclips is mentioned.

This Manual describes all relevant information regarding the Drumclip. How to work with the Drumclip is described in the various operating instructions. The certifications and associated reports are included in the manual, as are all the necessary requirements for using the Drumclip.

This Manual serves as a guide for the professional use of the Drumclip as a load securing product. The procedures described for the use of the Drumclip are binding and must be followed.

1.2 How is this manual structured?

After this introduction, Chapter 2 gives an overview of which type of Drumclip has been certified for which application (type of drum) and with what requirements. This Manual then provides the relevant Drumclip prescribed for each type of drum. This will be done in 3 separate chapters. Chapter 3 deals with the closed head edge UN200 litre drum, also called the Tight-Head Drum. Chapter 4 discusses the open head UN200 litre drum, also called the Open-Head Drum. And Chapter 5 discusses the plastic drum, also called Plastic Drum.

Each chapter includes descriptions, certifications, test methods related to these certifications, the operating instructions for the relevant Drumclip (these operating instructions are leading when the Drumclip is used) and the supplies needed to use the Drumclip. All test reports can be found in the appendices.

2. Applications

The Drumclip makes it easier to secure drums on a pallet, in a trailer or in a container. This means that the Drumclip can be used for transporting drums on land and at sea (not certified).

The use of the Drumclip for pallet stability of the pallet load with drums is certified according to ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe. The use of the Drumclip for the overland transport of drums is tested and certified by TÜV Rheinland according to DIN EN 12195-1 for sliding tarpaulin trailers among others. No additional products are required other than the tension strap with which the pallets with drums are secured on the trailer and an anti-slip mat in the trailer under the pallets. More information on the test and certification can be found in Chapters 3.6, 3.7, 3.8, 4.6, 4.7, 4.8, 5.6 and 5.7.

Table A schematically shows:

- 1) Which type of Drumclip is needed for the different types of drums;
- 2) With what requirements can the relevant Drumclip be secured to the drums and pallet; and
- 3) Which application is certified.

2. Applications

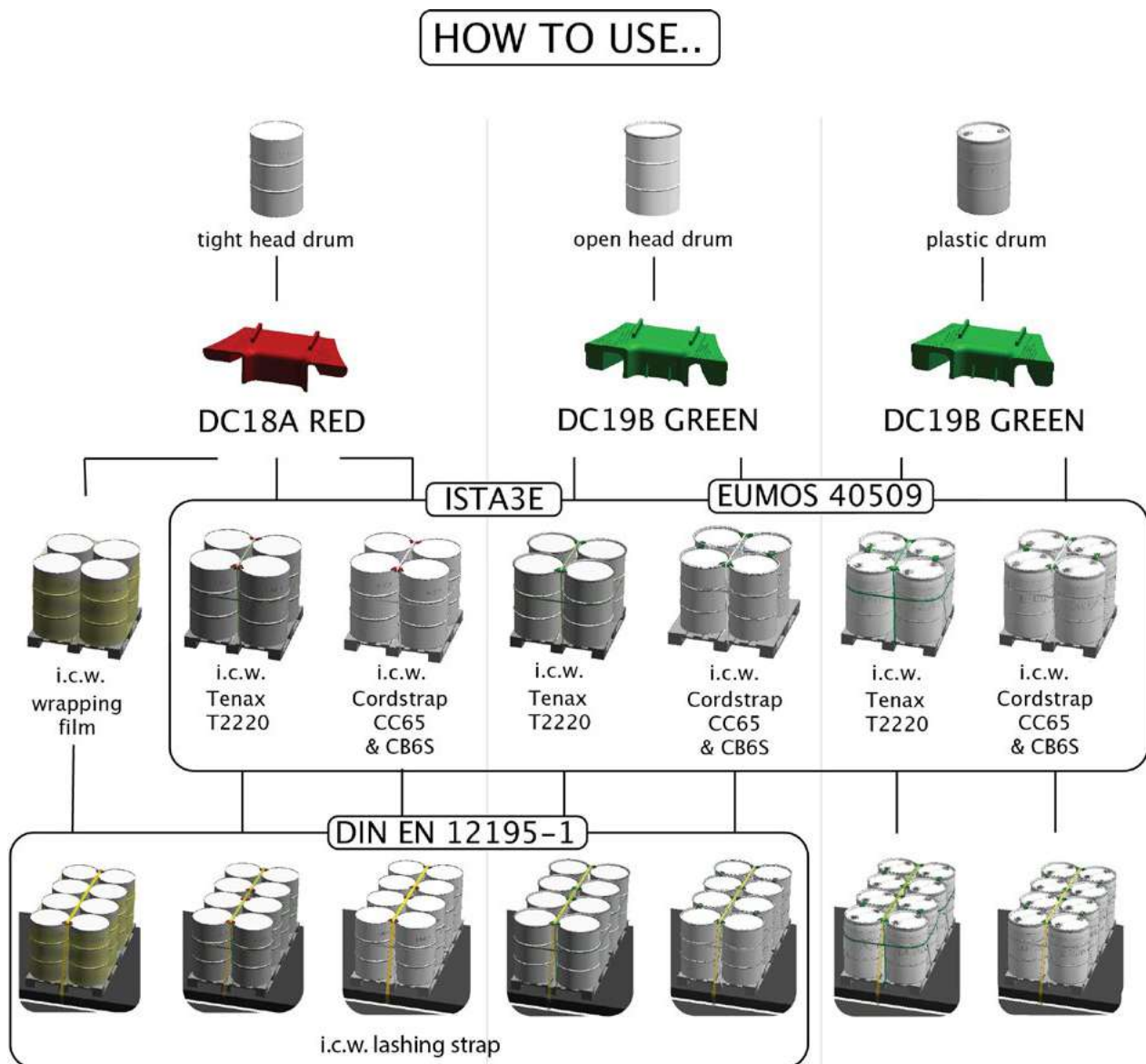


Table A: Overview of Drumclip Applications

3. Tight head UN200 litre drum

Drums with a closed head (UN200 litre drums) can be recognised by their closed top side (see Figure 1). The DRUMCLIP DC18A RED was designed for these drums.



Figure 1: UN200 litre tight head drum

3.1 DRUMCLIP DC18A RED

The DRUMCLIP DC18A RED is a plastic tool which should be used exclusively for tight head UN200 litre drums and not for other drums.

Figures 2, 3, 4, 5 and 6 below show the application of the DRUMCLIP DC18A RED on a tight head UN200 litre drum.

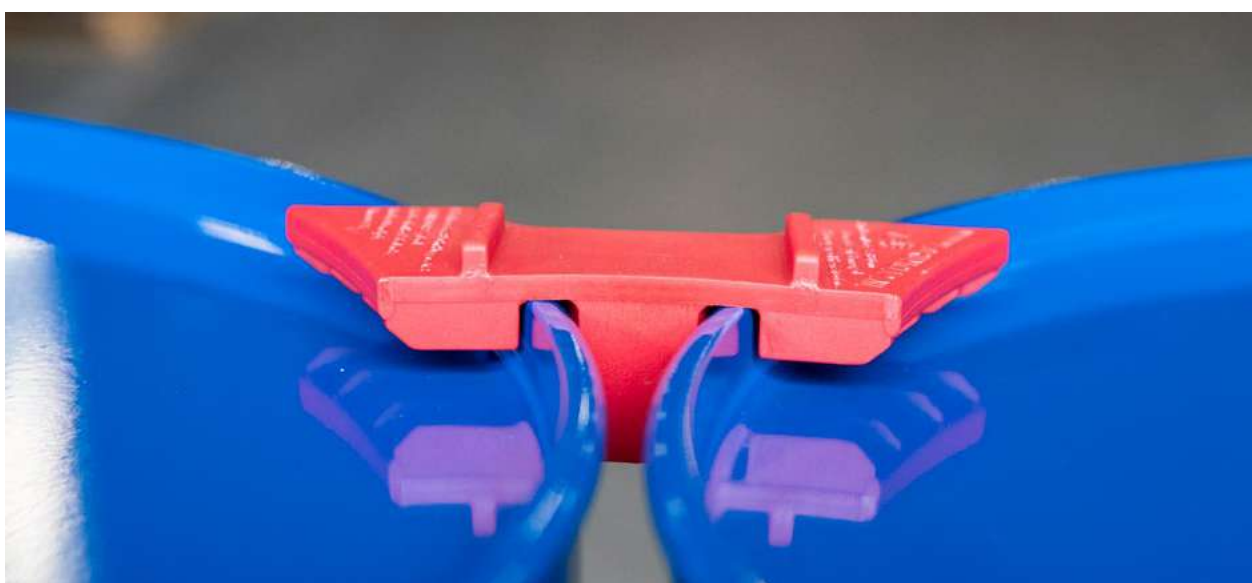


Figure 2: DRUMCLIP DC18A RED between 2 tight head UN200 litre drums

3. Tight head UN200 litre drum



Figure 3: DRUMCLIP DC18A RED secured with Cordstrap CC65 & CB6S strap



Figure 4: DRUMCLIP DC18A RED secured with Signode Tenax T2220 Polyester strap

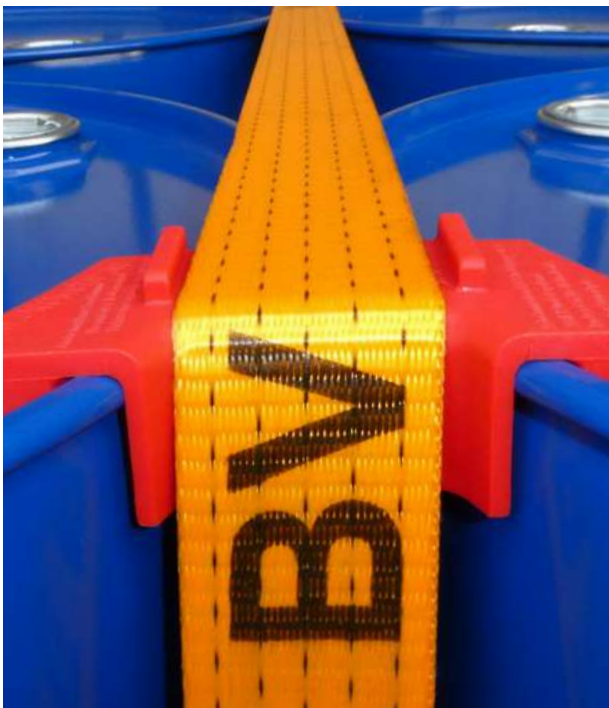


Figure 5: DRUMCLIP DC18A RED secured with universal lashing strap (front view).



Figure 6: DRUMCLIP DC18A RED secured with universal lashing strap (top view).

3. Tight head UN200 litre drum

3.2 Technical information DRUMCLIP DC18A RED

The DRUMCLIP DC18A RED is made of a glass-fibre reinforced plastic. The base material is mixed with a red dye. The ambient temperature at which the Drumclip may be used lies between -10°C and $+50^{\circ}\text{C}$. The dimensions are shown in Figures 7a and 7b.

Each Drumclip shows the following text:

Geba Innovations BV
 Chr. Huygenstraat 3
 3261 LR Oud-Beijerland
 Produced in The Netherlands
 Product: DRUMCLIP A
 Art. No.: DC18A

Each Drumclip has a unique article number that can be found under the text. The Drumclip can be used for a maximum of two years after production. Therefore there is a production date on every Drumclip. The Drumclip is certified for 2 years after the production date. Once these 2 years have passed, the Drumclip can no longer be used. The date stamp can be found in the following location in Figure 8.

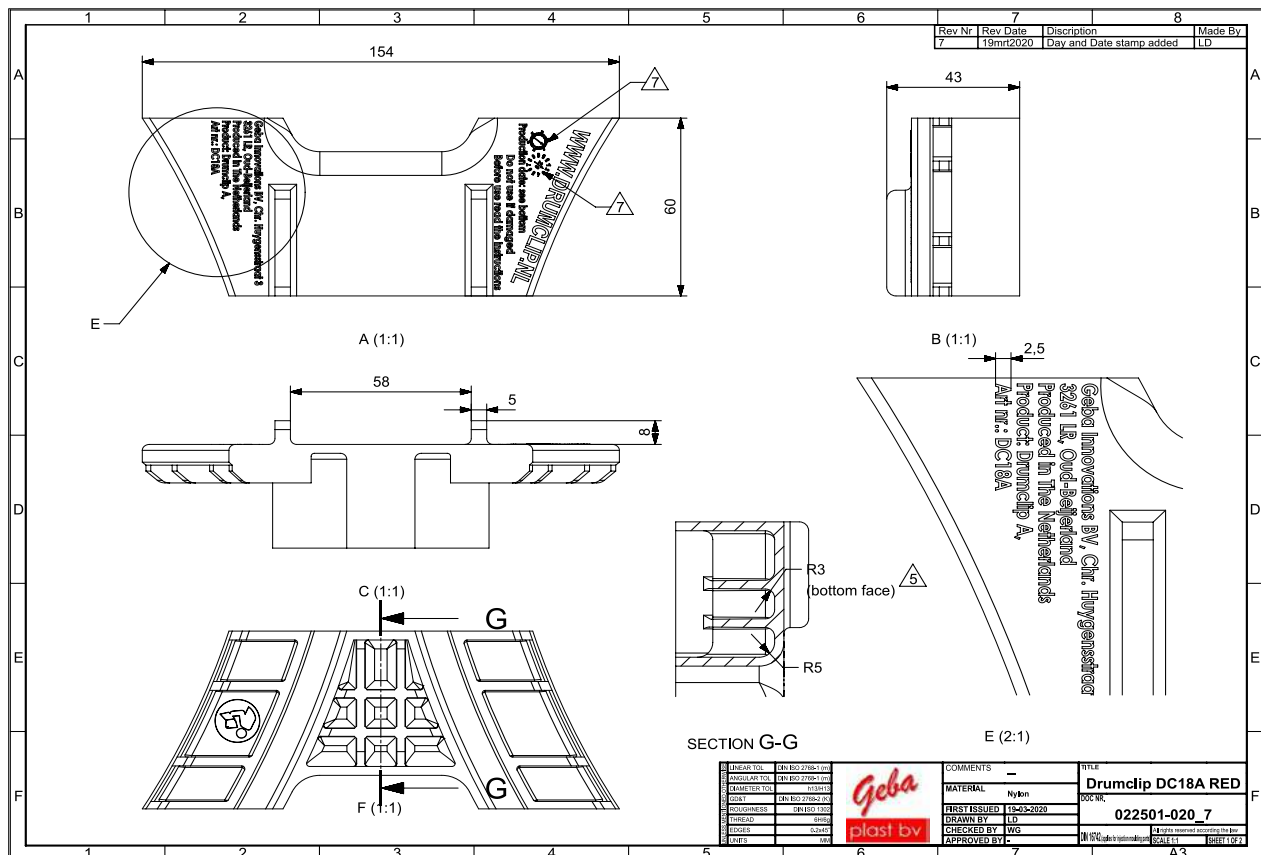


Figure 7a: 2D drawing DRUMCLIP DC18A RED

3. Tight head UN200 litre drum

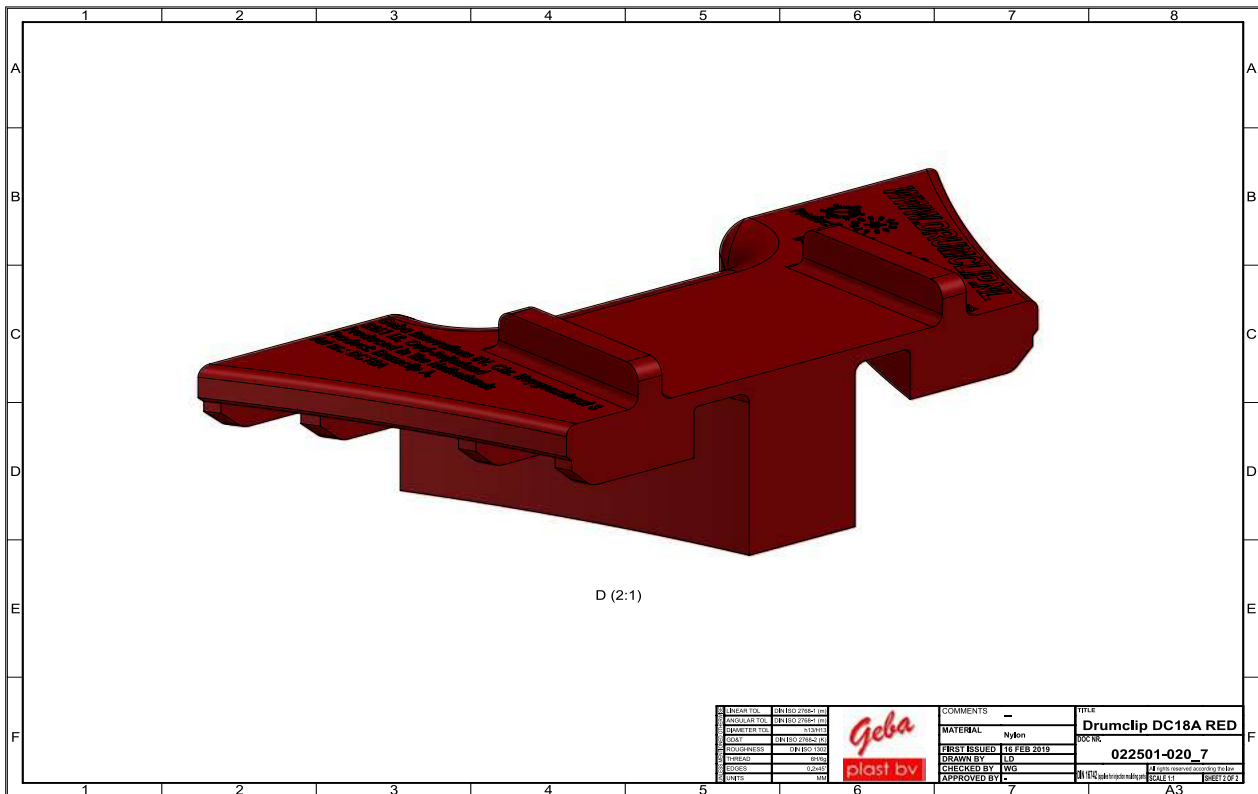


Figure 7b: Isometric view DRUMCLIP DC18A RED

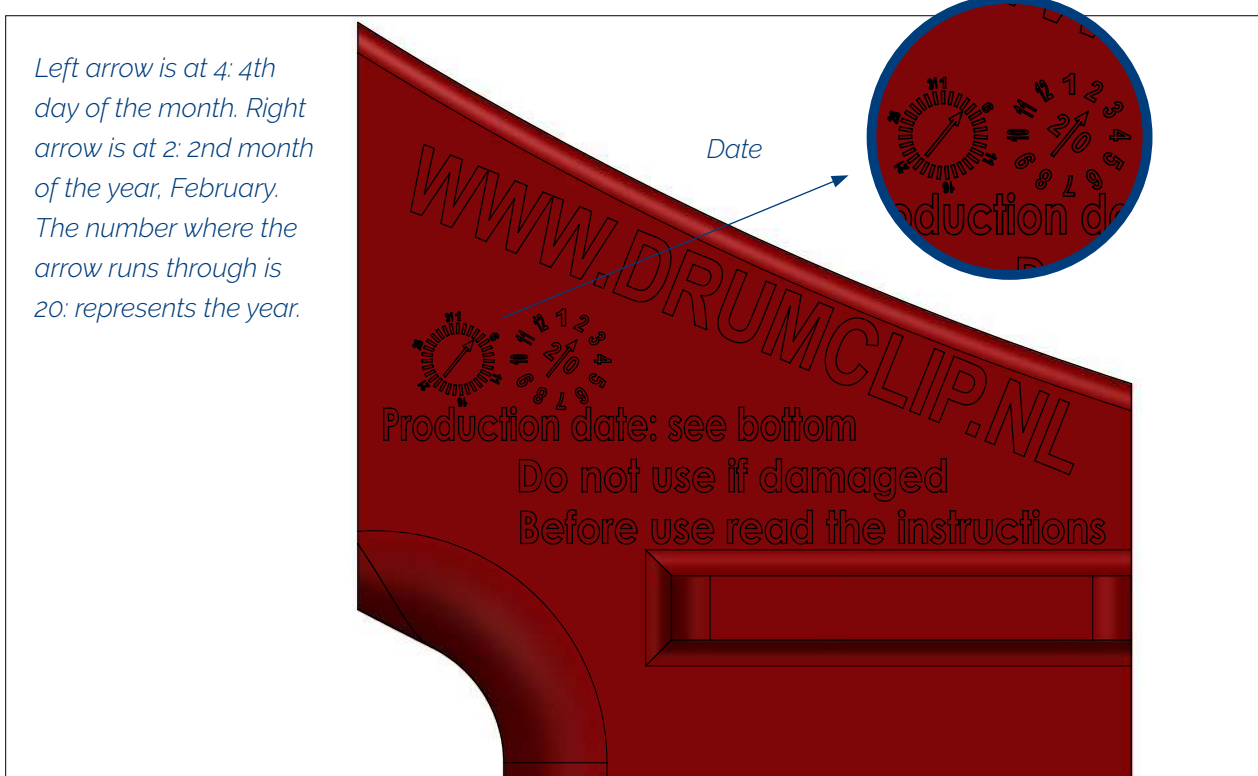


Figure 8: Stamp of production date DC18A RED




3. Tight head UN200 litre drum

3.3 Certification DRUMCLIP DC18A RED

3.3.1 DIN EN 12195-1 | Load Securing


The Drumclip has been tested by TÜV Rheinland, in accordance with DIN EN 12642 Annex B for the guidelines according to Load Securing DIN EN 12195-1. The certificate can be found in Figures 9a, b and c. The complete test report can be found in Chapter 3.6 Test report TÜV Rheinland. | DRUMCLIP DC18A RED.

3. Tight head UN200 litre drum


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Certificate

10TVS9350029-03



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Herewith we certify / *Hiermit bescheinigen wir*

Geba Innovations B.V.
Christiaan Huygensstraat 3
NL-3261 LR Oud-Beijerland

for the utility for securing tight head drums /
für das Hilfsmittel zur Spundfassssicherung

DRUMCLIP (Type: DC18A RED)


the effective securing of cargo according to the procedures of DIN EN 12642 annex B and requirements of DIN EN 12195-1 /
die wirksame Ladungssicherung gemäß den Ausführungen der DIN EN 12642 Anhang B und den Anforderungen der DIN EN 12195-1.

The “Drumclip”, a support utility for the safe transport of tight head drums on road vehicles, requires the availability of stable load units (strapping of the barrels and palette with stretch foil or by strapping with a horizontal and vertical strap), load restraint assembling with web lashings and loading application with anti slip mats. Details can be found in the manufacturer's operating instructions. The manufacturer's instructions must be observed. /
Der „Drumclip“, ein Hilfsmittel zur Transportsicherung von Spundfässern auf Straßenfahrzeugen, erfordert das Vorhandensein von stabilen Ladeeinheiten (durch Umreifung der Fässer und Palette mit Stretchfolie oder durch Zurren mit einem horizontalen und vertikalen Band), die Abspannung durch textile Spanngurte und einer Verladung unter Verwendung von Antirutschmatten. Details dazu sind der Bedienungsanleitung des Herstellers zu entnehmen. Die Anweisungen des Herstellers sind zu beachten.

Technologiezentrum Verkehrssicherheit
TÜV Rheinland Kraftfahrt GmbH
Am Grauen Stein, 51105 Köln, Deutschland


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Seite 1 von 3 Seiten

3. Tight head UN200 litre drum



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 Seite 2 von 3 Seiten

Figure 9b

3. Tight head UN200 litre drum



Figure 9c

3. Tight head UN200 litre drum

3.3.2 ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe

The Drumclip is certified for pallet stability according to ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe. According to these certifications, the right pallet stability can be created in combination with the right strap and Drumclip. Either Signode or Cordstrap can be chosen. The Drumclip is certified with both manufacturers ISTA 3 E Pallet Stability, DIN EN 12195-1 and EUMOS 40509. The complete test reports can be found in Chapter 3.7 Test report ISTA | DRUMCLIP DC18A RED and 3.8 Test report EUMOS | DRUMCLIP DC18A RED.

ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe		Signode	(Figure 10a)
Item	Description	Specifications	
Pallet type	CP-9	Chemicals Pallet,1140x1140x156mm.	
Drums	Tight head UN200	4 pieces	
Straps	Signode Tenax 2220 Strapping	Polyester width: 19mm, thickness: 0,89mm 1x horizontal, 1x vertical (2 in total)	
Machine setting	Signode BXT3-19	2500 N	
Type of Drumclip	DC18A	2 Pieces	

ISTA 3 E Pallet Stability and EUMOS 40509 Transport safety		Cordstrap	(Figure 10b)
Item	Description	Specifications	
Pallet type	CP-9	Chemicals Pallet,1140x1140x156mm.	
Drums	Tight head UN200	4 pieces	
Straps	Cordstrap CC65	Polyester width: 19mm, thickness: 0,97mm 1x horizontal, 1x vertical (2 in total)	
Buckle	CB6S	Galvanised steel (2 pieces)	
Machine setting	CT25	see specifications Cordstrap Figure 12	
Type of Drumclip	DC18A	2 Pieces	

3. Tight head UN200 litre drum



Figure 10a



Figure 10b

3.4 Requirements DRUMCLIP DC18A RED

The certification DIN EN 12195-1 Load Securing, ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safety of the DRUMCLIP DC18A RED was obtained in combination with supplies from both Signode and Cordstrap. See also Chapter 2 Applications.

3.4.1 Signode

Signode's requirements for meeting the above certifications are:

- Signode Tenax T2220 Polyester straps (Figure 11a)
- Signode BXT3 – 19 strapping machine (Figure 11b)

3. Tight head UN200 litre drum



Tenax 2220 (19*0,89)

PRODUCT DATA SHEET

This is to certify that the product supplied by us is manufactured according to quality procedures in compliance with ISO 9001, ISO14001, EN 13891 and EN 13394.

Made of 100% of recycled PET

Produced in Netherlands

Product description	Product designation:	Tenax 2220 (19*0,89)
	Item code:	670273
	Material type:	Polyester
	Production technology:	Strand
	Surface:	Flat
	Colour:	Green

Strap properties	Minimum	Nominal	Maximum
Width (mm):	18.4	19	19.6
Thickness (mm):	0.84	0.89	0.94
Elongation (%):	10		15
Break Strength (daN):	675	750	


Coils details	Coil Type:	standard
	Coil Inside Diameter (mm):	408
	Coil Outside Diameter (mm):	610
	Coil Width (mm):	153
	Net Coil Weight (kg):	24.684
	Meters per coil:	1100

Pallet details	Package Dimensions (LxWxH):	1200 x 1200 x 1100
	Number of Coils per Pallet:	24
	Approx. Gross Weight per Pallet (kg):	646


Date of issue: 19/02/2020

Figure 11a

3. Tight head UN200 litre drum



Technical Data Sheet BXT3-19



Strapping tool		BXT3-19
Operation mode		auto / semi / manual
Tension force range	Standard	1300 – 4500N (290 – 1000 lbf)
	Soft	400 – 1600 (90 – 340 lbf)
Variable tension speed range		0 – 120 mm/s (4,7 in/s)
Weight (incl. battery)		4,3 kg (9,5 lb)
Dimensions (L x W x H)		370 x 143 x 135 mm
		15.5" x 5.6" x 5.3"
Working temperature		-10°C to +40°C (14-104 °F)
Relative humidity		up to 90%
Battery / Charger		
Charger type		Bosch
Battery charger voltage		100 or 110 or 230 V
Charging time		25-35 min.
Battery type		Bosch Li-ion 18V, 4.0 Ah
Cycles per battery charge		
-	Low tension	800
-	Medium tension	500
-	High tension	300
Strap		
Strap		PET (Polyester) PP (Polypropylene)
Width		15-16, 18-19 mm (5/8", 3/4")
Thickness		0,8-1,3 mm (.031"-0.51")
Features		
Real time indication of applied tension force		✓
Variable tension speed		✓
Favorite strapping function		✓
Display color indication for tool status information		✓
Strap alignment indication		✓
Strap dust blow out vent		✓
Battery protection		✓
0-Tension welding		✓



Figure 11b

3. Tight head UN200 litre drum

3.4.2 Cordstrap

Cordstrap's requirements for meeting the above certifications are:

- Cordstrap CC65 & CB6S (see Figure 12)





Specifications Cordstrap Composite Strapping Solution: CC65 & CB6

Performance Specifications	
Performance System (strap & buckle) System Breaking Strength*	900 daN / 2025 lbf
Performance Strap Linear Breaking Strength* Elongation Elongation at Break	625 daN / 1405 lbf <7% 11% - 17%
Certification	German Lloyd

Strap Specifications	
Dimensions Width* Thickness*	19mm / 3/4" 0,97 mm / 1/32"
Material	High tenacity polyester filament yarn and Homopolymer Polypropylene
Coil Length per Coil** Core Diameter	500 m / 1640 ft 200 mm / 8"
Packaging Carton Box Dimensions* Box Weight* Product Code	2 coils per box 390 x 390 x 354 mm / 15.3/8" x 15.3/8" x 14" 20 kg / 44 lbs 7266000
Pallet Box Dimensions* Box Weight* Product Code	30 coils per box 1181 x 781 x 890 mm / 46.9" x 31.1" x 35" 296 kg / 653 lbs 7266900

Buckle Specifications	
Dimensions Width*	19 mm / 3/4"
Material	Galvanized steel wire
Packaging Carton Box** Dimensions* Box Weight* Product Code	500 pieces per box 266 x 166 x 272 mm / 10.1/2" x 6.5/8" x 8.5/8" 9 kg / 20 lbs 7354500



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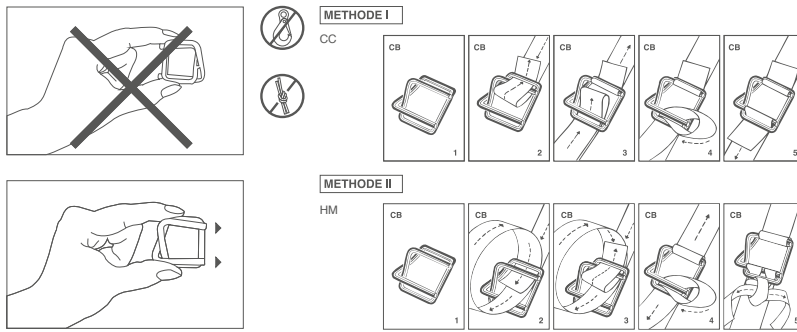
Continued product development



Training at Cordstrap Training Centers

Quality assurance

Figure 12 - page 1

3. Tight head UN200 litre drum







Recommended Tensioner(s)	
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,3 kg / 2.9 lbs 7514000
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CTT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,4 kg / 3.1 lbs 7514600
Accessories	
Coil Dispenser with Buckle Tray Product Code Portable Version Product Code Static Version	7538000 7544000
Edge Protection	Different types and sizes available. Your Cordstrap cargo securing specialist can advise you about the best Edge Protection for your application.
Pallet Needle Product Code	7551000

*Tolerance of +/- 10%
**Tolerance of +/- 2%

We recommend storing all Cordstrap Products in a cool dry environment out of direct sunlight and between 5°C and 25°C / 41°F and 77°F

All information provided is based on accuracy at time of creation



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Training at Cordstrap Training Centers

Quality assurance

Figure 12 - page 2

3. Tight head UN200 litre drum

3.5 Operating Instructions DRUMCLIP DC18A RED

Main steps to be taken before using the Drumclip.

- Check the Drumclip for any damages.
- Check the production date on the upper side of the Drumclip. The Drumclip must not be used for more than 2 years after the production date.
- The Drumclip may be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks with a gross weight of 3,500 kg or more.
- Drumclips must be stored in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.
- The maximum temperature at which the Drumclip can be used is -10C Degrees Celsius + 50 Degrees Celsius.

There are 3 operating instructions of the DRUMCLIP DC18A RED including a step-by-step plan.

- Figure 13a is the operating instruction in combination with wrapping film.
- Figure 13b is the operating instruction in combination with Signode Tenax T2220
- Figure 13c is the operating instruction in combination with Cordstrap CC65 & CB6S

The operation instructions must always be followed.

3. Tight head UN200 litre drum



Operating Instructions DC18A RED for tight head drums in combination with wrapping film

Operating Instructions DRUMCLIP DC18A RED

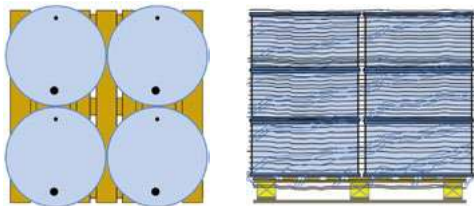
The DRUMCLIP DC18A RED is an innovative tool that makes it **safer** and **easier** to secure 200-litre tight head drums to a pallet and/or trailer, without the use of additional pallets or other equipment. The DC18A has been tested with a 0.8g brake delay in combination with wrapping film. This solution is DIN EN 12195-1 certified. This combination can be used for transport and pallet stabilisation of UN 200 litre tight head drums on pallets.

Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks of 3,500 kg or more.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.
- The Drumclip has been tested according to DIN EN12195-1, load securing by TUV Rheinland.
- The Drumclip is designed for use in sliding sail trailers (tautliners).

Step 1

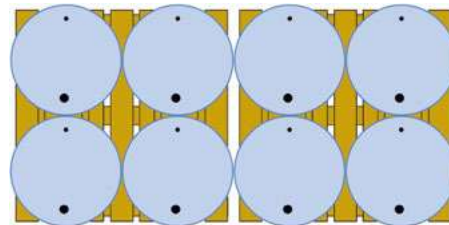
Place four drums on a wooden pallet. Wrap the drums by use of a pallet wrapper, while also wrapping the pallet. Provide at least 8 wraps of film around the drums and the pallet. Use film that is at least 28µ thick and 500mm wide. Do this with each pallet with drums to be transported.



Step 2

Place the pallets of drums (using a forklift truck) on the trailer in double rows.

Place the pallets on anti-slip mats that have a minimum friction resistance of 0.6u.



Double row

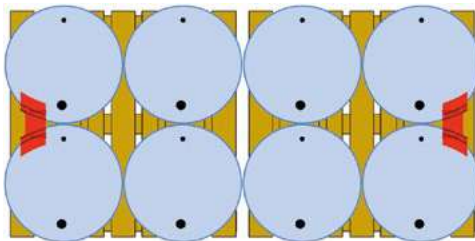
3. Tight head UN200 litre drum



Operating Instructions DC18A RED for tight head drums in combination with wrapping film

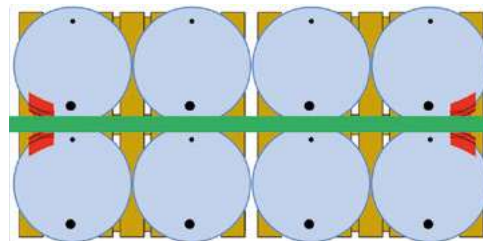
Step 3

On each side of the trailer, place a Drumclip over the flanged edges of two drums that are on the same pallet. Make sure that the flanges of the drums fall well into the flange channels of the Drumclip and that the wide side of the Drumclips face outwards.



Step 4

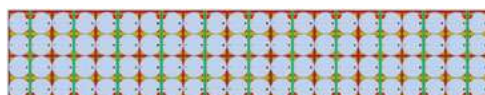
Use a tension strap with a minimum StF value of 350 DaN for a double row of drums. In this way, drums can be secured as shown in the illustration. Consult the guidelines for the lashing strap here. Place the strap over the drums and the Drumclips, so that the strap is between the strap guides of the Drumclip. Make sure that the strap is not twisted.



Step 5

Then attach the strap hooks to the anchor point on the vehicle. Use an ergo ratchet and a lashing strap (50mm LC=2,500 daN) to secure the pallets with drums to the vehicle. Lead the strap into the ergo ratchet and hand-tension with a force of SHF daN (50 kilograms). The strap should be at a 90-degree angle to the direction of travel and attached to the vehicle in line with the Drumclips. Perform steps 3, 4 and 5 for each row of pallets and drums.

A fully loaded trailer looks like this:



Double row

3. Tight head UN200 litre drum



Operating Instructions DC18A RED for tight head drums in combination with Signode

Operating Instructions DRUMCLIP DC18A RED

in combination with two Signode Tenax T2220 (19x0.89mm) straps.

The DRUMCLIP DC18A RED is an innovative tool, that makes it **safer** and **easier** to secure 200-litre tight head drums on a pallet and/or trailer, without the use of additional pallets or other equipment. The DC18A has been tested with a 0.8g brake delay in combination with straps (Signode Tenax 2220). This solution is DIN EN 12195-1, ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe certified. This combination is suitable for transport and pallet stabilisation of UN 200 litre tight head drums on pallets.

Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks of 3,500 kg or more.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1

Place four drums on a wooden pallet. Place two Drumclips opposite each other between two drums, with the wide side facing outwards. Use two Signode Tenax T2220 straps. One strap is stretched horizontally in the middle of

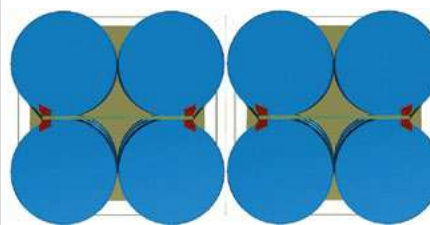


the drums. The other strap is stretched vertically across the two drum clips and under the pallet. Both straps should be tensioned with a force of 2,500 N. Do this with each pallet of drums to be transported.



Step 2

Place the pallets with drums (with a forklift truck) on the trailer (in single or double rows) in such a way that the Drumclips are visible at the side of the trailer (the tension strap will be put on these later). Place the pallets on anti-slip mats that have a minimum friction resistance of 0.6u.



Double row

3. Tight head UN200 litre drum



Operating Instructions DC18A RED for tight head drums in combination with Signode

Step 3

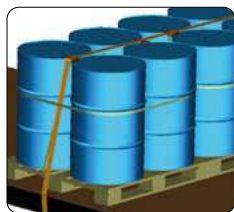
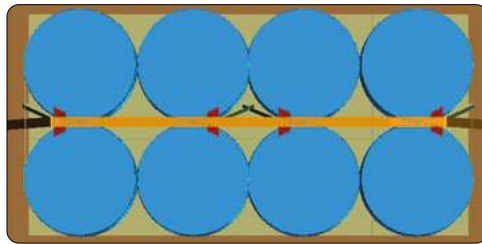
Use a securing strap with a minimum StF value of 350 DaN for a double row of drums. This way drums can be secured as shown in the illustration. Consult the guidelines of the lashing strap here.

Place the strap across the drums and the Drumclips, so that the strap is between the strap guides of the Drumclip. Make sure the strap is not twisted. The strap should be placed on both sides of the vehicle under the horizontal strap that goes around the drums.

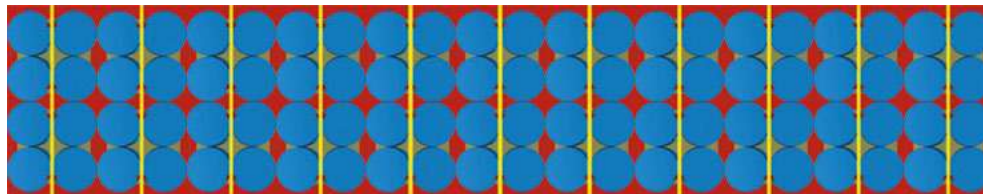
Then attach the strap hooks to the anchor points on the vehicle. Use an ergo ratchet and a lashing strap (50mm LC=2,500 daN) to secure the drumpallets to the vehicle.

Lead the strap into the ergo ratchet and hand-tension with a force of SHF daN (50 kilograms).

The strap should be at a 90-degree angle to the direction of travel and attached to the vehicle in line with the Drumclips.



A fully loaded trailer looks like this:



Double row

3. Tight head UN200 litre drum



Operating Instructions DC18A RED in combination with Cordstrap for tight head drums

Operating Instructions DRUMCLIP DC18A RED

In combination with two Cordstrap CC 65 Composite Strapping (19mm; ¾”), straps and two CB6S Buckle (19mm, ¾”).

The DRUMCLIP DC18A RED is an innovative tool that makes it **safer** and **easier** to secure 200-litre tight head drums on a pallet and/or trailer without the use of additional pallets or other equipment. The DC18A has been tested with a 0.8g brake delay in combination with straps (Cordstrap CC65 Composite Strapping + CB6S Buckle). This solution is DIN EN 12195-1, ISTA 3 E Pallet Stability and EUMOS 4050g Transport Safe certified. This combination is suitable for transport and pallet stabilisation of UN 200 litre tight head drums on pallets.

Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks of 3,500 kg or more.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1

Place four 200-litre tight head drums on a wooden pallet.

Place two Drumclips opposite each other between two drums on the outside of the drums with the wide side facing outwards. Use two Cordstrap CC 65 Composite Strapping and two CB 6S Buckles. One strap is stretched horizontally in the middle of the drums. The other strap is stretched vertically across the two Drumclips and under the pallet. The Buckle is used to connect the straps. Make sure that the position of the Buckle is not on the outside of the trailer or on top of the drums.



For the correct positioning of the buckle and the tension of the straps we recommend consulting the Cordstrap strapping instructions. The above step should be carried out for each pallet of drums.



3. Tight head UN200 litre drum



Operating Instructions DC18A RED in combination with Cordstrap for tight head drums

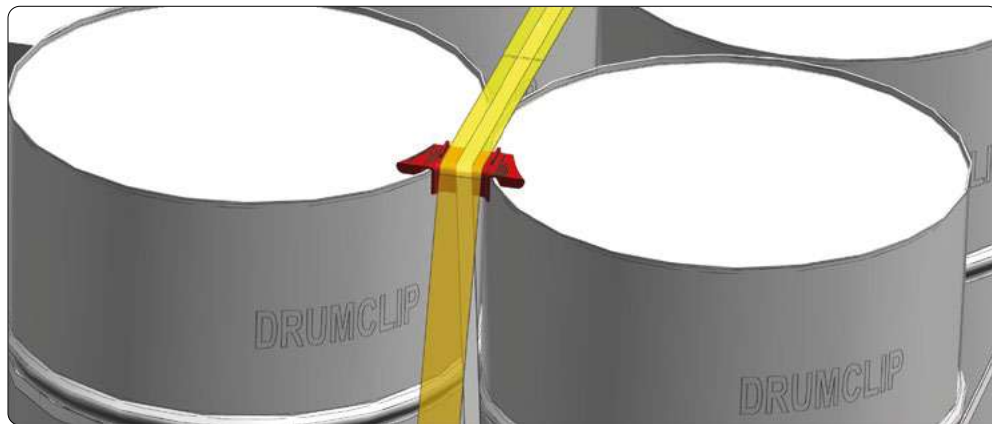
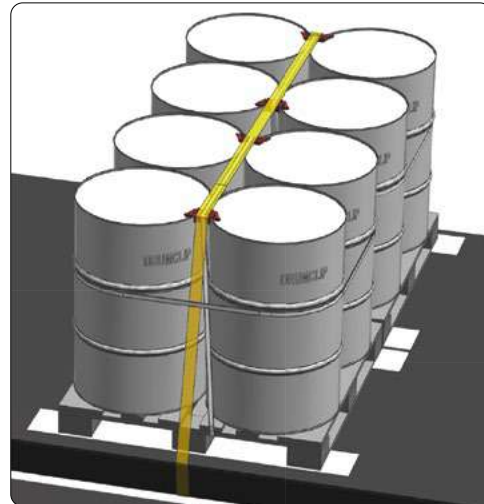
Step 2

Place the pallets with drums (using the forklift truck) in the trailer (in single or double rows). Place the pallets on anti-slip mats with a minimum friction resistance of 0.6 Mu.

Step 3

Use a tension strap with a minimum StF value of 350 DaN for a double row of drums. In this way, the drums can be secured as shown in the illustration. Consult the guidelines for the tensioning strap here.

Place the strap across the drums and the Drumclips, so that the strap is between the strap guides of the Drumclip. Make sure the strap is not twisted. The strap should be placed on both sides of the vehicle under the horizontal strap that goes around the drums.



Step 4

Then attach the strap hooks to the anchor points on the vehicle. Use an ergo ratchet and a strap (50mm LC=2,500 daN) to secure the drum pallets to the vehicle.

Lead the strap into the ergo ratchets and hand-tension with a force of SHF daN (50 kilograms). The strap should be at a 90-degree angle to the direction of travel and attached to the vehicle in line with the Drumclips.

3. Tight head UN200 litre drum

3.6 Test Report TÜV Rheinland | DRUMCLIP DC18A RED

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Technischer Bericht: 195XS0017-03
/ Technical Report

**„Beurteilung der Eignung eines Ladungssicherungskonzepts
für den Transport von Stahlfässern – fahrdynamische Untersuchungen“**
/ Assessment of the suitability of a load securing concept
for the transport of steel drums - vehicle dynamics investigations

September / September 2020

Auftraggeber / Client:
Fa. InVaGo BVBA,
NL-3261 PB Oud Beijerland

Bearbeitung / Handling:
TÜV Rheinland Kraftfahrt GmbH
Technologiezentrum
Verkehrssicherheit (TVS)
Typprüfstelle Fahrzeuge/Fahrzeugteile
Am Grauen Stein
51105 Köln

Dieser Technische Bericht dient ausschließlich der Dokumentation von Prüfergebnissen
/ This technical report is intended exclusively for the documentation of test results.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

1. Allgemeine Angaben / General information

- 1.1. Technischer Bericht / Technical report : 195XS0017-03
- 1.2. Bauteil / Component : Drumclip
- 1.3. Typ / Type : DC18A RED
- 1.4. Prüfgrundlage / Test basis : in Anlehnung an DIN EN 12195-1 (Stand: 11/2010)
Beurteilung der Eignung eines Beladungssicherungskonzepts für den Transport von Stahlfässern –
fahrdynamische Untersuchung / following DIN EN 12195-1 (2010-11) Assessment of the suitability of a load securing concept for the transport of steel drums - a vehicle dynamics study
- 1.5. Auftraggeber / Client : InVaGo BV
Poortlaan 6
NL-3261 PB Oud Beijerland
- 1.6. Prüflabor / Testing laboratory : TÜV Rheinland Krafftahrt GmbH
Technologiezentrum Verkehrssicherheit
Typprüfstelle Fahrzeuge/Fahrzeugteile
Am Grauen Stein
D - 51105 Köln
- 1.7. Antrag vom / Application from : Oktober 2018,
Oktober 2019,
Juni 2020
- 1.8. Prüfmuster eingegangen am / Test sample received on : entfällt / not applicable
- 1.9. Art der Prüfmuster / Type of test sample : Drumclip, Typ DC18A RED
- 1.10. Kennzeichnung / Marking : www.drumclip.nl
- 1.11. Prüfdatum / Test date : 03. November 2018, Rotterdam
09. November 2018, Köln / Cologne
26. Oktober 2019, Rotterdam
13. Juni 2020, Rotterdam

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



1.12. Prüforte / *Test locations*

: C. Steinweg-Handelsveem BV
Theemsweg 26
NL-3197 KM Botlek Rotterdam
Haven 5111

TÜV Rheinland Krafftahrt GmbH
Technologiezentrum Verkehrssicherheit
Typprüfstelle Fahrzeuge/Fahrzeugteile
Am Grauen Stein
D - 51105 Köln

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



2. Prüfungen / Tests

Die Prüfungen gliedern sich auf in Versuche aus dem Jahr 2018, die in Abschnitt 2.1. näher beschrieben sind (in Prüfbericht 195XS0017-01 bereits dokumentiert) und die Versuche aus dem Jahr 2019, die in Abschnitt 2.2. näher beschrieben sind (in Prüfbericht 195XS0017-02 bereits dokumentiert) sowie neue Versuche aus dem Jahr 2020, die in Abschnitt 2.3. dokumentiert sind. Allen Tests gemein ist, dass die gleiche Art der Fasssicherung eingesetzt wurde /

The tests are divided into tests from 2018, which are described in detail in section 2.1. (already documented in test report 195XS0017-01) and the tests from 2019, described in detail in section 2.2. (already documented in test report 195XS0017-02) and new tests from 2020, which are documented in section 2.3.. Common to all tests is that the same type of drum securing was used.

2.1. Erste Prüfungen in 2018 / First tests in 2018

Auf Wunsch des Auftraggebers wurde 2018 eine neuartige Fasssicherung (Drumclip, Typ DC18A RED) im Fahrversuch auf ihre Eignung als Hilfsmittel zur Ladungssicherung untersucht / *At the customer's request in 2018 a new type of drum securing device (Drumclip, type DC18A RED) was tested in a driving test to determine its suitability as a load securing aid.*

2.1.1. Anforderungen an die einzusetzenden Ladungssicherungsmittel / Requirements for the load securing equipment to be used

Für die Prüfung wurden Spundfässer mit der UN Zulassung 1A1/X1.6/250 mit einem Fassungsvermögen von ca. 216 l verwendet. Jeweils vier Fässer wurden auf einer Holzpalette 1.200 x 1.200 mm² abgestellt. Die Fässer wurden dann entweder händisch bis 4/5 der Höhe oder maschinell über die komplette Höhe 8-fach mit Folie umwickelt. Die Palette wurde bei der Wicklung mit einbezogen. Dadurch entstand eine Ladeinheit mit Palette. Die Spezifikation der Folie ist Anlage 1 zu entnehmen. Die Fässer waren gleichmäßig mit Wasser befüllt. Das Gesamtgewicht je Ladeinheit betrug 800 kg. Zwischen Trailerboden und Palette wurde Antirutschmaterial ($\mu \geq 0,6$) eingesetzt /

For the test, bung drums with UN approval 1A1/X1.6/250 and a capacity of approx. 216 l were used. Four drums each were placed on a wooden pallet 1,200 x 1,200 mm². The drums were then wrapped with foil either manually up to 4/5 of the height or mechanically over the entire height 8 times. The pallet was included in the wrapping. This resulted in a loading unit with pallet. The specification of the foil can be found in Appendix 1. The drums were evenly filled with water. The total weight per loading unit was 800 kg. Anti-slip material ($\mu \geq 0.6$) was used between the trailer floor and the pallet.

Die Fasssicherung wurde bei den jeweils äußeren beiden Fässern der Ladeinheiten aufgesetzt und über einen Spanngurt (LC = 2.500 daN) niedergezurrt. Der Gurt verlief mittig über die Fasssicherung und senkrecht nach unten /

The drum safety device was attached to the outer two drums of the load units and lashed down using a lashing belt (LC = 2,500 daN). The lashing belt ran centrally over the drum safety device and vertically downwards.



Drumclip (verschiedene Ansichten) / Drumclip (different views)

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Sicherung der Fässer / drum securing

2.1.2. Prüfkräfte / Test forces

Als Prüfgrundlage wurde die DIN EN 12195-1 „Berechnung von Sicherungskräften“ herangezogen. In Kapitel 4.2 der Norm sind als Beschleunigungsbeiwerte für nicht kippgefährdete Transportmittel für Fahrzeuge ab 3.500 kg die folgenden Werte zu finden /
DIN EN 12195-1 "Calculation of securing forces" was used as the test basis. In Chapter 4.2 of the standard, the following values can be found as acceleration coefficients for non-tilt-endangered means of transport for vehicles from 3,500 kg upwards:

Sichern in Securing for	Beschleunigungsbeiwerte / Acceleration coefficients			
	a_x		a_y	a_z
	Nach vorne To the front	Nach hinten To the rear	Nur Rutschen Sliding only	Nach unten Downwards
Längsrichtung Longitudinal direction	0,8	0,5	./.	./.
Querrichtung Transverse direction	./.	./.	0,5	./.
Vertikal	./.	./.	./.	1,0

Übersicht zu den Beschleunigungsbeiwerten / Overview of the acceleration coefficients

Diese europäische Norm gilt nicht für Fahrzeuge mit einem Gesamtgewicht bis einschließlich 3.500 kg, da bei diesen höhere Beschleunigungen auftreten können /
This European standard does not apply to vehicles with a total weight of up to and including 3,500 kg, as these vehicles may have higher accelerations.

2.1.3. Beladungen / Loads

Insgesamt wurden 3 verschiedene Sicherungsvarianten untersucht, die nachfolgend beschrieben sind / A total of 3 different securing variants were tested, which are described in the following.

Variante 1 / Variant 1:

- 4 Fässer, **händisch** mit Folie umwickelt (Folie geht auch um die Palette), auf einer Palette / 4 drums, **manually wrapped with foil** (foil was also wrapped around the pallet), on a pallet
- 2 Paletten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 pallets side by side with anti-slip material beneath ($\mu \geq 0.6$)
- die jeweils äußeren beiden Fässer wurden durch jeweils ein Drumclip verbunden / the two outer drums were connected by a drum clip each

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief über die Drumclips / the row of drums was lashed down with a lashing belt (LC = 2,500 daN), the strap ran over the drum clips

Variante 2 / Variant 2:

- 4 Fässer, **maschinell** mit Folie umwickelt (Folie geht auch um die Palette), auf einer Palette / 4 drums, **machine-wrapped** with foil (foil was also wrapped around the pallet), on a pallet
- 2 Paletten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 pallets side by side with anti-slip material beneath ($\mu \geq 0.6$)
- auf die Fässer wurden zwei Paletten gelegt / two pallets were placed on the drums
- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief über die Paletten / the row of drums was lashed down with a lashing belt (LC = 2,500 daN), the strap ran over the pallets

Variante 3 / Variant 3:

- 4 Fässer, **maschinell** mit Folie umwickelt (Folie geht auch um die Palette), auf einer Palette / 4 drums, **machine-wrapped** with foil (foil was also wrapped around the pallet), on a pallet
- 2 Paletten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 pallets side by side with anti-slip material beneath ($\mu \geq 0.6$)
- die jeweils äußeren beiden Fässer wurden durch jeweils ein Drumclip verbunden / the two outer drums were connected by a drum clip each
- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief über die Drumclips / the drum row was lashed down with a lashing strap (LC = 2,500 daN), the strap ran over the drum clips



Variante 1 mit Drumclip, handgewickelt / Variant 1 with Drumclip, manually wrapped



Variante 2 mit Paletten, maschinell gewickelt / Variant 2 with pallets, machine-wrapped



Variante 3 mit Drumclip, maschinell gewickelt / Variant 3 with Drumclip, machine-wrapped

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Variante 2 mit Paletten /
Variant 2 with pallets



Variante 3 mit Drumclip /
Variant 3 with Drumclips

Für die Versuche in Rotterdam wurde ein Sattelzug mit den Sicherungsvarianten 1, 2 und 3 beladen. Bei den Versuchen in Köln war das Fahrzeug nur mit der Sicherungsvariante 3 beladen.
For the tests in Rotterdam, a semi-trailer truck was loaded with the securing variants 1, 2 and 3. During the tests in Cologne, the vehicle was loaded with securing variant 3 only.



Sattelzug in Rotterdam, hier mit Sicherungsvariante 1 & 2 beladen /
Semitrailer truck in Rotterdam, here loaded with safety variant 1 & 2



Sattelzug in Köln, nur mit Sicherungsvariante 3 beladen /
Semitrailer truck in Cologne, loaded with securing variant 3 only

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

2.1.4. Prüfergebnisse / Test results

Im Folgenden sind die einzelnen Ergebnisse und Auffälligkeiten der Versuche dargestellt. Die unter 2.1.4.1. bis 2.1.4.3. beschriebenen Versuche wurden in Rotterdam durchgeführt, die unter 2.1.4.4. beschriebenen in Köln. Weitere Bilder sowie Filme zu den einzelnen Versuchen sind in Anlage 5 (USB-Datenträger) zu finden /

The individual results and peculiarities of the tests are presented below. The tests described under 2.1.4.1. to 2.1.4.3. were carried out in Rotterdam, the tests described under 2.1.4.4. in Cologne. Further pictures and films of the individual tests can be found in Appendix 5 (USB-stick).

2.1.4.1. Versuch 1 (Fahrversuch Bremsen) / Test 1 (Driving test braking)

Das Fahrzeug war mit den Varianten 1 & 2 beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Im ersten Versuch konnte nur eine Längsverzögerung von maximal 0,77 g erreicht werden. Damit wurde die gewünschte Längsbeschleunigung von 0,8 g nicht erreicht. Der Fahrversuch konnte dennoch zur Beurteilung der Ladungssicherung verwendet werden, da es zu einem Versagen der Folie der Variante 1 kam. Die Ladung wurde frei und war nicht mehr gesichert. Das Ergebnis führte dazu, dass zwei neue Ladeeinheiten zusammengestellt und maschinell gewickelt wurden (Variante 3) /

The vehicle was loaded with the variants 1 & 2. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to standstill. In the first attempt, only a maximum longitudinal deceleration of 0.77 g could be achieved. Thus, the desired longitudinal acceleration of 0.8 g was not achieved. Nevertheless, the driving test could be used to assess the load securing, as the foil of variant 1 failed. The load became free and was no longer secured. The result was that two new loading units were assembled and machine-wrapped (variant 3).

2.1.4.2. Versuch 2 & 3 (Fahrversuch Kreisfahrt) / Test 2 & 3 (Driving test circular drive)

Das Fahrzeug wurde mit den Varianten 2 & 3 beladen. Als Versuch war eine Kreisfahrt mit steigender Geschwindigkeit bis zum Erreichen einer Querbeschleunigung von 0,5 g geplant. Mit dem eingesetzten Testfahrer konnte in zwei Durchläufen nur eine Querbeschleunigung von maximal 0,33 g erreicht werden. Damit wurde die gewünschte Querbeschleunigung nicht erreicht. Der Fahrversuch konnte somit zur Beurteilung der Ladungssicherung nicht verwendet werden. Das Ladungsverhalten war über die gesamte Versuchsdauer neutral. Es kam zu keiner Verschiebung der Ladung /

The vehicle was loaded with the variants 2 & 3. The attempt was a circular drive with increasing speed until a lateral acceleration of 0.5 g was reached. The test driver could only achieve a maximum lateral acceleration of 0.33 g in two runs. This meant that the desired lateral acceleration was not achieved. The driving test could therefore not be used to assess load securing. The load behaviour was neutral over the entire duration of the test. There was no displacement of the load.

2.1.4.3. Versuch 4 bis 6 (Fortsetzung Fahrversuch Bremsen) / Test 4 to 6 (Continuation of driving test braking)

Das Fahrzeug war mit den Varianten 2 & 3 beladen. In Versuch 4 wurde eine Längsverzögerung von maximal 0,53 g erreicht. Die Ladung verhielt sich neutral. Es kam zu keiner Verschiebung der Ladung. In Versuch 5 wurde eine Längsverzögerung von maximal 0,82 g erreicht. Der Fahrversuch konnte somit zur Beurteilung der Ladungssicherung verwendet werden. Die Ladung verhielt sich neutral. Es kam zu keiner Verschiebung der Ladung.

In Versuch 6 wurde eine Längsverzögerung von maximal 0,85 g erreicht. Der Fahrversuch konnte somit zur Beurteilung der Ladungssicherung verwendet werden. Bei der Ladung der Variante 2 kam es zu einem Versagen der Folie. Die Ladung wurde frei und war nicht mehr gesichert. Die Ladung der

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Variante 3 verhielt sich neutral. Durch Anstoß der dahinter angeordneten frei werdenden Ladung der Variante 2 kam es zu einer leichten Verschiebung /

The vehicle was loaded with variants 2 & 3. In test 4 a maximum longitudinal deceleration of 0.53 g was achieved. The load behaved neutrally. There was no displacement of the load.

In test 5 a maximum longitudinal deceleration of 0.82 g was achieved. The driving test could therefore be used to assess the load securing. The load behaved neutrally. There was no displacement of the load.

In test 6 a maximum longitudinal deceleration of 0.85 g was achieved. The driving test could therefore be used to assess the load securing. In the case of load variant 2, the foil failed. The load became free and was no longer secured. The load of variant 3 behaved neutrally. A slight displacement was caused by the impact of the released load of variant 2 that was located behind.

2.1.4.4. Versuch 7 & 8 (Fortsetzung Fahrversuch Kreisfahrt) / Test 7 & 8 (Continuation of driving test circular drive)

Das Fahrzeug war nur mit Variante 3 beladen. Sowohl Fahrer wie auch Testfahrzeug waren getauscht worden. Als einziger Versuch war eine Kreisfahrt mit steigender Geschwindigkeit bis zum Erreichen einer Querbeschleunigung von 0,5 g geplant. Mit dem eingesetzten Testfahrer konnte in zwei Durchläufen eine Querbeschleunigung von maximal 0,52 g erreicht werden. Der Fahrversuch konnte somit zur Beurteilung der Ladungssicherung verwendet werden. Das Ladungsverhalten war über die gesamte Versuchsdauer neutral. Es kam zu keiner Verschiebung der Ladung /

The vehicle was loaded with variant 3 only. Both driver and test vehicle had been exchanged. The only test planned was a circular drive with increasing speed until a lateral acceleration of 0.5 g was reached. The test driver could achieve a maximum lateral acceleration of 0.52 g in two runs. The driving test could thus be used to assess the load securing. The load behaviour was neutral over the entire duration of the test. There was no displacement of the load.

Nachfolgend sind die im Fahrversuch gemessenen Werte zusammengefasst dargestellt:

Fahrmanöver	Sicherungsvarianten	Anforderung nach DIN EN 12642	v _{max} [km/h]	Max. Beschleunigung [m/s ²] / [g]	Ergebnis	Bemerkung
Versuch 01 Bremsung	1 & 2	0,8 g über 50 ms bei v > 35 km/h	39	7,55 / 0,77	Nicht erfüllt	Ladung Var. 1 frei
Versuch 02 Kreisfahrt	2 & 3	0,5 g bei v > 30 km/h	25	2,9 / 0,30	Nicht erfüllt	. / .
Versuch 03 Kreisfahrt	2 & 3	0,5 g bei v > 30 km/h	28	3,2 / 0,33	Nicht erfüllt	. / .
Versuch 04 Bremsung	2 & 3	0,8 g über 50 ms bei v > 35 km/h	35	5,20 / 0,53	Nicht erfüllt	. / .
Versuch 05 Bremsung	2 & 3	0,8 g über 50 ms bei v > 35 km/h	38	8,04 / 0,82	Erfüllt	. / .
Versuch 06 Bremsung	2 3	0,8 g über 50 ms bei v > 35 km/h	39	8,34 / 0,85	Nicht erfüllt Erfüllt	Ladung frei
Versuch 07 Kreisfahrt	3	0,5 g bei v > 30 km/h	27	4,71 / 0,48	Nicht erfüllt	. / .
Versuch 08 Kreisfahrt	3	0,5 g bei v > 30 km/h	28	5,10 / 0,52	Erfüllt	. / .

Übersicht der fahrdynamischen Anforderungen und Ergebnisse

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



The values measured in the driving test are summarized below:

Driving manoeuvres	Variants of securing	Requirements acc. to DIN EN 12642	v_{max} [km/h]	Max. acceleration [m/s ²] / [g]	Result	Remark
Test 01 Braking	1 & 2	0,8 g for 50 ms at $v > 35$ km/h	39	7,55 / 0,77	Not fulfilled	Load Var. 1 free
Test 02 Circle drive	2 & 3	0,5 g at $v > 30$ km/h	25	2,9 / 0,30	Not fulfilled	./.
Test 03 Circle drive	2 & 3	0,5 g at $v > 30$ km/h	28	3,2 / 0,33	Not fulfilled	./.
Test 04 Braking	2 & 3	0,8 g for 50 ms at $v > 35$ km/h	35	5,20 / 0,53	Not fulfilled	./.
Test 05 Braking	2 & 3	0,8 g for 50 ms at $v > 35$ km/h	38	8,04 / 0,82	Passed	./.
Test 06 Braking	2	0,8 g for 50 ms at $v > 35$ km/h	39	8,34 / 0,85	Not fulfilled	Load free
	3				Passed	
Test 07 Circle drivep	3	0,5 g at $v > 30$ km/h	27	4,71 / 0,48	Not fulfilled	./.
Test 08 Circle drive	3	0,5 g at $v > 30$ km/h	28	5,10 / 0,52	Passed	./.

Overview of the driving dynamics requirements and results

2.2. Weitere Prüfungen in 2019 / Further tests in 2019

Auf Wunsch des Auftraggebers wurden am 26.10.2019 Zwecks Erweiterung des Verwendungsbereichs weitere Sicherungsvarianten der Fasssicherung Drumclip des Typs DC18A RED mit Hilfe von Fahrversuchen untersucht /

At the customer's request further securing variants of the drum securing device Drumclip type DC18A RED were investigated on 26th of October 2019 by means of further road tests in order to extend the range of application.

2.2.1. Anforderungen an die einzusetzenden Ladungssicherungsmittel / Requirements for the load securing equipment to be used

Folgende Anforderungen entsprechen den Bedingungen unter Absatz 2.1.1.: die Fasssicherung (Drumclip), die Fassart (Spundfässer), die Anzahl der Fässer pro Palette, die Palettenausführung, die Fassfüllung, die generellen Gewichte sowie die Reibwerte zwischen Palette und Fässern /

The following requirements meet the requirements under 2.1.1.: the drum safety device (Drumclip), the drum type (bung drums), the number of drums per pallet, the pallet version, the drum filling, the general weights and the values of friction between pallet and drums.

Die Fasssicherung erfolgte in zwei weiteren Varianten, bei denen im Gegensatz zu den vorherigen Versuchen von 2018 die Fässer statt mit Folie mit Straps gesichert waren. Für eine einfachere Gesamtübersicht wurden diese auf Basis der vorherigen Varianten (1 bis 3) weiter hochgezählt / The drums were secured in two further variants, in which, in contrast to the previous tests from 2018, the drums were secured with straps instead of foil. For a simpler overall view, these were further counted up on the basis of the previous variants (1 to 3).

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Variante 4 / Variant 4:

- 4 Fässer, mit einem horizontalen und einem vertikalen Strap umspannt (Spannkraft jeweils 2.500 N), auf einer Palette. Durch den vertikalen Strap bilden die Fässer und die Palette eine Ladeeinheit / 4 drums, spanned with a horizontal and a vertical strap (tension force 2,500 N each), on a pallet. Due to the vertical strap, the drums and the pallet form one load unit.
- jeweils zwei Fässer einer Ladeeinheit sind durch einen Drumclip verbunden (zwei Drumclips pro Ladeeinheit - diese sind notwendig, um den vertikalen Strap um die Ladeeinheit zu spannen) / two drums of each load unit are connected by a Drumclip (two drum clips per load unit - these are necessary to tighten the vertical strap around the load unit).
- 2 Ladeeinheiten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 load units with anti-slip material beneath ($\mu \geq 0,6$) side by side
- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und hinter dem horizontalen Strap (kontaktlos) vertikal nach unten / The row of drums was lashed down with a lashing belt (LC = 2,500 daN), the belt ran centrally over the outer Drumclips and vertically downwards behind the horizontal strap (contactless).



Horizontaler und vertikaler Strap,
Spanngurt hinter dem horizontalen Strap /
Horizontal and vertical strap,
lashing belt behind the horizontal strap



Spanngurt mittig auf äußerem Drumclip,
Spanngurt hinter dem horizontalen Strap /
Lashing belt centered on outer drum clip,
lashing belt behind the horizontal strap



Zwei Drumclips pro Ladeeinheit /
Two Drumclips per load unit



Detailansicht zwei Drumclips pro Ladeeinheit /
Detailed view of two Drumclips per load unit

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Variante 5 / Variant 5:

- 4 Fässer, mit einem horizontalen Strap umspannt (Spannkraft jeweils 2.500 N), auf einer Palette. Durch Fehlen des vertikalen Straps ist die Palette nicht in die Ladeeinheit eingebunden / 4 drums, strapped with a horizontal strap (tension force 2,500 N each), on a pallet. Due to the absence of the vertical strap, the pallet is not tied to the load unit.
- 2 Paletten, beladen mit Fässern, mit unterlegtem Anti-Rutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 pallets, loaded with drums, with anti-slip material beneath ($\mu \geq 0.6$), side by side.
- die jeweils äußeren beiden Fässer der Fassreihe sind durch einen Drumclip verbunden (ein Drumclip pro Ladeeinheit) / The two outermost drums of the drum row are connected by a Drumclip (one Drumclip per load unit).



Fässer mit horizontalem Strap /
Drums with horizontal strap



Ein Drumclip pro Ladeeinheit /
One Drumclip per load unit



Detailansicht ein Drumclip pro Ladeeinheit /
Detail view one Drumclip per load unit

Bei Untersuchung der Variante 5 wurden die Fassreihen unterschiedlich niedergezurrt, deshalb wurde diese nochmals in Variante 5a und Variante 5b aufgeteilt /
When variant 5 was examined, the rows of drums were lashed down differently, so it was divided again into variant 5a and variant 5b.

Variante 5a / Variant 5a:

- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und **hinter** dem horizontalen Strap (kontaktlos) / The row of drums was lashed down with a lashing belt (LC = 2,500 daN), the belt ran centrally over the outer Drumclips and **behind** the horizontal strap (contactless).

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Variante 5a: Spanngurt **hinter** dem Strap /
Variant 5a: Lashing belt **behind** the strap



Spanngurt mittig auf äußeren Drumclip;
Spanngurt **hinter** dem horizontalen Strap /
Lashing belt centered on outer Drumclip;
lashing belt **behind** the horizontal strap

Variante 5b / Variant 5b:

- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und **vor** dem horizontalen Strap **über** den Strap / The row of drums was lashed down with a lashing belt (LC = 2,500 daN), the belt ran centrally over the outer Drumclips and **in front of** the horizontal strap **over** the horizontal strap.



Variante 5b: Spanngurtverlauf **über** den Strap /
Variant 5b: Course of lashing belt **over** the strap



Spanngurt mittig auf äußeren Drumclip,
Spanngurt **über** dem horizontalen Strap /
Lashing belt centered on outer Drumclip,
lashing belt **over** the horizontal strap

Die Spezifikationen des Straps und des Umreifungsgerätes sind Anlage 2 zu entnehmen / The specifications of strap and strapping tool can be found in Annex 2.

Ein Spanngurtverlauf über dem horizontalen Strap (Variante 5b) ist nach Einschätzung des zuständigen Sachverständigen nicht zulässig, wenn der Spanngurt auf den horizontal verlaufenden Strap drückt und dadurch die Vorspannungen von Strap und Gurt beeinflusst werden können. Zum einen wird die Spannkraft des Straps dadurch undefiniert erhöht. Die zusätzliche Belastung des Straps könnte dann zu einem Nachgeben oder gar Versagen führen, wodurch eine sichere Umspannung der Fässer zu einer Ladeinheit nicht mehr gewährleistet wäre. Zum anderen wird bei Nachlassen der Spannung im Strap auch die Vorspannung im Zurrurt abfallen. Diese ist jedoch bei der hier angewandten Sicherungsart „Niederzurren“ für eine ausreichende Ladungssicherung von zentraler Bedeutung /

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

In the opinion of the competent expert, it is not permissible for the tensioning belt to run over the horizontal strap (variant 5b) if the tensioning belt presses on the horizontal strap and the pretensioning of strap and belt can be influenced by this. On the one hand, the tension force of the strap is increased in an undefined manner. The additional load on the strap could then lead to yielding or even failure, as a result of which safe loop lashing of the drums to form a cargo unit would no longer be guaranteed. On the other hand, if the tension in the strap is reduced, the pretension in the lashing belt will also be reduced. However, with the "tie-down lashing" securing method used here, for adequate load securing this is of central importance.

2.2.2. Prüfkräfte / Test forces

Die Prüfkräfte sind in Absatz 2.1.2. erläutert / The test forces are explained in paragraph 2.1.2..

2.2.3. Messinstrumente / Measuring instruments

Die Beschleunigungs- und die Verzögerungswerte wurden unabhängig voneinander durch die Firmen IPS Technology und durch die TÜV Rheinland Kraftfahrt GmbH (TRK) gemessen. Die Firma IPS Technology verwendete hierfür die Messeinrichtung SAVER9X_{GPS} (Seriennummer: 1006-112, Hersteller: Lansmont). Die TRK führte die Messung mit der VBOX 3i (Gerätenummer: 8614, Hersteller: Racelogic) durch. Nachfolgend ist die Position der Messinstrumente dargestellt / The acceleration and deceleration values were measured independently by IPS Technology and TÜV Rheinland Kraftfahrt GmbH (TRK). IPS Technology used the SAVER9X_{GPS} measuring device (serial number: 1006-112, manufacturer: Lansmont). The TRK carried out the measurement with the VBOX 3i (serial number: 8614, manufacturer: Racelogic). In the following the position of the measuring instruments is shown.



Positionen der Messeinrichtungen / Positions of the measuring instruments: 1. SAVER9X_{GPS};
2. VBOX 3i

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

2.2.4. Prüfergebnisse / Test results

Im Folgenden sind die einzelnen Ergebnisse und Auffälligkeiten der Versuche dargestellt. Weitere Bilder sowie Filme zu den einzelnen Versuchen sind in Anlage 5 (USB-Datenträger) zu finden / *The individual results and peculiarities of the tests are presented below. Further pictures and films of the individual tests can be found in Appendix 5 (USB-stick).*

2.2.4.1. Fahrversuch Bremsen / Driving test braking

Insgesamt wurden acht Versuche durchgeführt. Die Versuche wurden auf Basis der vorherigen Versuche (1 bis 8) von 2018 weiter hochgezählt / *A total of eight tests were carried out. The tests numbering was further increased on the basis of the previous tests (1 to 8) from 2018.*

Versuch 9 / Test 9:

Das Fahrzeug war mit Variante 4 beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /

The vehicle was loaded with variant 4. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to a standstill. No longitudinal deceleration of $\geq 0.8 g$ over a period of ≥ 80 ms could be achieved.

Therefore, an assessment based on the test was not possible.

Versuch 10 / Test 10:

Das Fahrzeug war mit den Varianten 4 und 5a beladen. Es konnte eine Längsverzögerung von $\geq 0,8 g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

Bei der Variante 4 wurde eine Verschiebung der Beladung von < 20 mm festgestellt. Die Positionen der Drumclips, Straps und des Spanngurtes wiesen keine Veränderung auf.

Die Variante 5a wurde frei und war nicht mehr gesichert (Fail-Versuch) /

The vehicle was loaded with variants 4 and 5a. A longitudinal deceleration of $\geq 0.8 g$ over a period of ≥ 80 ms could be achieved.

In the case of variant 4, a shift of the load of < 20 mm was detected. The positions of the Drumclips, straps and the lashing belt were not changed.

Variant 5a became free and was no longer secured (fail test).

Versuch 11 / Test 11:

Das Fahrzeug war mit Variante 4 beladen. Es konnte eine Längsverzögerung von $\geq 0,8 g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

Es wurde eine Verschiebung der Beladung von < 20 mm festgestellt. Die Positionen der Drumclips, Straps und des Spanngurtes wiesen keine Veränderung auf /

The vehicle was loaded with variant 4. A longitudinal deceleration of $\geq 0.8 g$ over a period of ≥ 80 ms was achieved.

A shift of the load of < 20 mm was detected. The positions of the Drumclips, straps and the lashing belt were not changed.

Versuch 12 / Test 12:

Das Fahrzeug war mit den Varianten 4 und 5b beladen. Die Variante 5b war aufgrund des Spanngurtverlaufs **über** dem horizontalen Strap durch den Sachverständigen bereits als nicht zulässig eingeordnet worden. Auf Kundenwunsch wurde die Variante dennoch gefahren. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8$ g über eine Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /

*The vehicle was loaded with variants 4 and 5b. Variant 5b had already been classified as not permissible by the expert due to the run of the lashing belt **over** the horizontal strap. However, at the customer's request, the variant was nevertheless tested/driven. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to standstill. No longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms could be achieved.*

Therefore, an assessment based on the test was not possible.

Versuch 13 / Test 13:

Das Fahrzeug war mit den Varianten 4 und 5b beladen. Die Variante 5b war aufgrund des Spanngurtverlaufs **über** dem horizontalen Strap durch den Sachverständigen bereits als nicht zulässig eingeordnet worden. Auf Kundenwunsch wurde die Variante dennoch gefahren. Es konnte eine Längsverzögerung von $\geq 0,8$ g über eine Zeitspanne von ≥ 80 ms erreicht werden.

Bei der Variante 4 wurde eine Verschiebung der Beladung von < 30 mm festgestellt. Die Positionen der Drumclips, Straps und des Spanngurtes wiesen keine Veränderung auf.

Bei der Variante 5b änderten sich die Position der Beladung, der Drumclips, der Straps und des Spanngurtes nicht /

*The vehicle was loaded with variants 4 and 5b. Variant 5b had already been classified as not permissible by the expert due to the run of the lashing belt **over** the horizontal strap. However, at the customer's request, the variant was nevertheless tested/driven. A longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms was achieved.*

A shift of the load of < 30 mm was detected. The positions of the Drumclips, straps and the lashing belt were not changed.

In variant 5b the position of the load, the drum clips, the straps and the lashing belt did not change.

Versuch 14 / Test 14:

Das Fahrzeug war mit der Variante 5b beladen. Diese war aufgrund des Spanngurtverlaufs **über** dem horizontalen Strap durch den Sachverständigen bereits als nicht zulässig eingeordnet worden. Auf Kundenwunsch wurde die Variante dennoch gefahren. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremesen. Es konnte keine Längsverzögerung von $\geq 0,8$ g über einen Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb ist eine Beurteilung anhand des Versuches nicht möglich /

*The vehicle was loaded with variant 5b. This had already been classified as not permissible by the expert due to the run of the lashing belt **over** the horizontal strap. However, at the customer's request, the variant was nevertheless tested. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to standstill. No longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms could be achieved.*

Therefore, an assessment based on the test is not possible.

Versuch 15 / Test 15:

Das Fahrzeug war mit Variante 5b beladen. Diese war aufgrund des Spanngurtverlaufs **über** dem horizontalen Strap durch den Sachverständigen bereits als nicht zulässig eingeordnet worden. Auf Kundenwunsch wurde die Variante dennoch gefahren. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremesen. Es konnte keine Längsverzögerung von $\geq 0,8$ g über einen Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb ist eine Beurteilung anhand des Versuches nicht möglich /

*The vehicle was loaded with variant 5b. This had already been classified as not permissible by the expert due to the run of the lashing belt **over** the horizontal strap. However, at the customer's request,*

Typprüfstelle Fahrzeuge/Fahrzeugteile

Technologiezentrum Verkehrssicherheit
TÜV Rheinland Kraftfahrt GmbH
Am Grauen Stein, 51105 Köln, Deutschland

195XS0017-03 de&en.docx

Seite 16

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

the variant was nevertheless tested/driven. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to standstill. No longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms could be achieved. Therefore, an assessment based on the test was not possible.

Versuch 16 / Test 16:

Das Fahrzeug war mit Variante 5b beladen. Diese war aufgrund des Spanngurtverlaufs **über** dem horizontalen Strap durch den Sachverständigen bereits als nicht zulässig eingeordnet worden. Auf Kundenwunsch wurde die Variante dennoch gefahren. Es konnte eine Längsverzögerung von $\geq 0,8$ g über eine Zeitspanne von ≥ 80 ms erreicht werden.

Die Positionen der Beladung, der Drumclips, der Straps und des Spanngurtes änderten sich nicht /
*The vehicle was loaded with variant 5b. This had already been classified as not permissible by the expert due to the run of the lashing belt **over** the horizontal strap. However, at the customer's request, the variant was nevertheless tested. A longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms could be achieved. The position of the load, the Drumclips, the straps and the lashing belt did not change.*

2.2.4.2. Fahrversuch Kreisfahrt / Driving test circular drive

Die Beladungen verhielten sich bei den Kreisfahrten, welche bei den vorherigen Prüfungen im November 2018 durchgeführt wurden, vollkommen neutral. Die Sicherungsvariante 4 bildet (wie die Sicherungsvarianten 1 bis 3) Ladeeinheiten, bestehend aus den Fässern und einer Palette. Deswegen wurde bei Kreisfahrten mit der Variante 4 ein gleiches Ladungsverhalten wie bei den Kreisfahrten der Varianten 1 bis 3 erwartet. Somit wurde bei den Prüfungen im Oktober 2019 von weiteren Kreisfahrten abgesehen. In Folge dessen konnte die Position der Ladung auf dem Sattelzug vernachlässigt werden, da nur Bremsversuche durchgeführt wurden /

The loadings behaved completely neutral during the circular driving tests carried out during the previous tests in November 2018. Securing variant 4 (like securing variants 1 to 3) forms load units consisting of the drums and a pallet. For this reason, the same load behavior was expected for circular driving with variant 4 as for circular driving with variants 1 to 3. Consequently, the tests in October 2019 did not include any further circular driving tests. As a result, the position of the load on the semi-trailer truck could be neglected as only braking tests were carried out.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Nachfolgend sind die im Fahrversuch gemessenen Werte zusammengefasst dargestellt:

Fahrmanöver	Sicherungsvarianten	v_{max} [km/h]	a_{max} [g] (IPS)	$t_{a \geq 0,8g} \geq 80$ ms [Ja / Nein] (TÜV)	Ergebnis	Bemerkung
Versuch 09 Bremsung	4	43	0,55	Ja	keine Wertung	a_{max} zu niedrig
Versuch 10 Bremsung	4 5a	43	1	Ja	Var. 4 positiv Var. 5a negativ	Var. 5a frei
Versuch 11 Bremsung	4	43	0,95	Ja	Var. 4 positiv	./.
Versuch 12 Bremsung	4 5b	43	0,8	Nein	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 13 Bremsung	4 5b	43	0,87	Ja	Var. 4 positiv Var. 5b negativ	Var. 5b Zurrung
Versuch 14 Bremsung	5b	43	1,06	Nein	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 15 Bremsung	5b	43	/	Nein	keine Wertung	a_{max} unklar $t_{a \geq 0,8g}$ zu kurz
Versuch 16 Bremsung	5b	43	0,97	Ja	Var. 5b negativ	Var. 5b Zurrung

Übersicht der Fahrdynamischen Anforderungen und Ergebnisse

The values measured in the driving test are summarized below.

Driving manoeuvres	Variants of securing	v_{max} [km/h]	a_{max} [g] (IPS)	$t_{a \geq 0,8g} \geq 80$ ms [Yes / No] (TÜV)	Result	Remark
Test 09 Breaking	4	43	0,55	Yes	No assessment	a_{max} too low
Test 10 Breaking	4 5a	43	1	Yes	Var. 4 positive Var. 5a negative	Var. 5a free
Test 11 Breaking	4	43	0,95	Yes	Var. 4 positive	./.
Test 12 Breaking	4 5b	43	0,8	No	No assessment	$t_{a \geq 0,8g}$ too short
Test 13 Breaking	4 5b	43	0,87	Yes	Var. 4 positive Var. 5b negative	Var. 5b Lashing
Test 14 Breaking	5b	43	1,06	No	No assessment	$t_{a \geq 0,8g}$ too short
Test 15 Breaking	5b	43	/	No	No assessment	a_{max} unclear $t_{a \geq 0,8g}$ too short
Test 16 Breaking	5b	43	0,97	Yes	Var. 5b negative	Var. 5b Lashing

Overview of the driving dynamics requirements and results

2.3. Weitere Prüfungen in 2020 / Further tests in 2020

Auf Wunsch des Auftraggebers wurden am 13.06.2020 Zwecks Erweiterung des Verwendungsbereichs weitere Sicherungsvarianten der Fasssicherung Drumclip des Typs DC18A RED mit Hilfe von Fahrversuchen untersucht /

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

At the customer's request further securing variants of the drum securing device Drumclip type DC18A RED were investigated on 13th of June 2020 by means of further road tests in order to extend the range of application.

2.3.1. Anforderungen an die einzusetzenden Ladungssicherungsmittel / Requirements for the load securing equipment to be used

Folgende Anforderungen entsprechen den Bedingungen unter Absatz 2.1.1.: die Fasssicherung (Drumclip, Typ DC18A RED), die Fassart (Spundfässer), die Anzahl der Fässer pro Palette, die Palettenausführung, die Fassfüllung, die generellen Gewichte sowie die Reibwerte zwischen Palette und Fässern /

The following requirements meet the requirements under 2.1.1.: the drum safety device (Drumclip, type DC18A RED), the drum type (bung drums), the number of drums per pallet, the pallet version, the drum filling, the general weights and the values of friction between pallet and drums.

Die Fasssicherung erfolgte in einer weiteren Variante, bei denen im Gegensatz zu den vorherigen Versuchen von 2018 und 2019 die Fässer, statt mit Folie oder mit Straps, mit Cordstrap® gesichert waren. Für eine einfachere Gesamtübersicht wurde diese auf Basis der vorherigen Varianten (1 bis 5) weiter hochgezählt / *The drums were secured in one further variant, in which, in contrast to the previous tests from 2018 and 2019, the drums were secured with Cordstrap® instead of foil or straps. For a simpler overall view, this were further counted up on the basis of the previous variants (1 to 5).*

Variante 6 / Variant 6:

- 4 Fässer, händisch mit einem horizontalen und einem vertikalen Cordstrap® umspannt (Spannkraft jeweils 2.000 N), auf einer Palette. Durch den vertikalen Cordstrap® bilden die Fässer und die Palette eine Ladeinheit / *4 drums, manually strapped with a horizontal and a vertical Cordstrap® (tension force 2,000 N each), on a pallet. Due to the vertical Cordstrap®, the drums and the pallet form one load unit).*
- jeweils zwei Fässer einer Ladeinheit sind durch einen Drumclip verbunden (zwei Drumclips pro Ladeinheit - diese sind notwendig, um den vertikalen Cordstrap® um die Ladeinheit zu spannen) / *two drums of each load unit are connected by a Drumclip (two drum clips per load unit - these are necessary to tighten the vertical Cordstrap® around the load unit)*
- Der Cordstrap-Verschluss darf die anderen Cordstrap®, den Spanngurt und die Fässer nicht berühren und muss dementsprechend positioniert werden (um Beschädigungen zu vermeiden) / *The cordstrap fastener is not to contact the other Cordstrap®, the lashing belt and the drums and must be positioned accordingly (to prevent damage).*
- 2 Ladeinheiten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / *2 load units with anti-slip material beneath ($\mu \geq 0.6$) side by side*
- die Fassreihe wurde mit einem Spanngurt (LC = 2.500 daN) niedergezurrt. Der Gurt verlief mittig über die äußeren Drumclips und hinter dem horizontalen Cordstrap® (kontaktlos) vertikal nach unten / *The row of drums was lashed down with a lashing belt (LC = 2,500 daN). The belt ran centrally over the outer Drumclips and vertically downwards behind the horizontal Cordstrap® (contactless).*

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Horizontaler und vertikaler Cordstrap®, Spanngurt hinter dem horizontalen Cordstrap® / Horizontal and vertical Cordstrap®, lashing belt behind the horizontal Cordstrap®



Zwei Drumclips pro Ladeinheit / Two Drumclips per load unit



Cordstrap-Verschlüsse kontaktlos positioniert / Cordstrap fasteners positioned without contact

Die Spezifikation des Cordstrap®, des Cordstrap-Verschlusses und des Spanngeräts sind Anlage 3 zu entnehmen / The specification of the Cordstrap®, the cordstrap fastener and the tensioner can be found in Annex 3.

2.3.2. Prüfkräfte / Test forces

Die Prüfkräfte sind in Absatz 2.1.2. erläutert / The test forces are explained in paragraph 2.1.2..

2.3.3. Messinstrumente / Measuring instruments

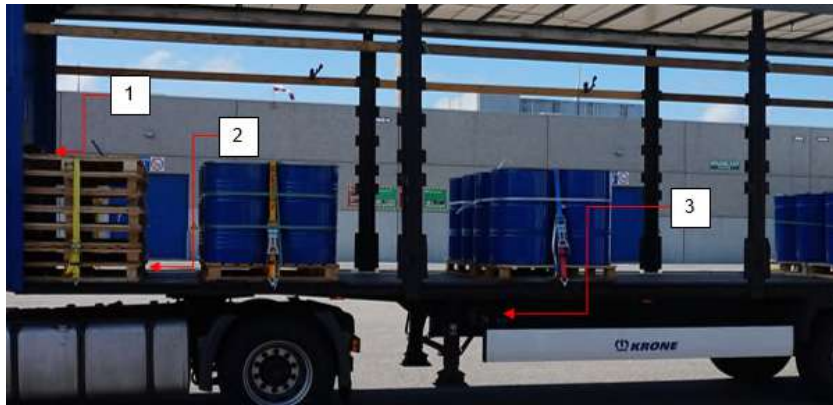
Die Beschleunigungs- und die Verzögerungswerte wurden unabhängig voneinander durch zwei verschiedenen Messeinrichtungen des TÜV Rheinland Kraftfahrt GmbH (TRK) gemessen. Die eine Messeinrichtung umfasst zwei Beschleunigungssensoren, einen Universalverstärker und die Software Catman. Die andere Messeinrichtung umfasst eine VBOX 3i mit einem dazugehörigen Beschleunigungssensor. Folgend sind die Positionen der Beschleunigungssensoren dargestellt / The acceleration and deceleration values were measured independantly by two different measuring devices of TÜV Rheinland Kraftfahrt GmbH (TRK). The one measuring device comprises two acceleration sensors, a universal amplifier and the Catman software. The other measuring device comprises a VBOX 3i with an associated acceleration sensor. In the following the positions of the accelerometers are shown.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Positionen der Beschleunigungssensoren / Positions of the acceleration sensors:

2.3.4. Prüfergebnisse / Test results

Im Folgenden sind die einzelnen Ergebnisse und Auffälligkeiten der Versuche dargestellt. Weitere Bilder sowie Filme zu den einzelnen Versuchen sind in Anlage 5 (USB-Datenträger) zu finden / The individual results and peculiarities of the tests are presented below. Further pictures and films of the individual tests can be found in Appendix 5 (USB-stick).

2.3.4.1. Fahrversuch Bremsen / Driving test braking

Insgesamt wurden fünf Versuche durchgeführt. Die Versuche wurden auf Basis der vorherigen Versuche (1 bis 16) weiter hochgezählt / A total of five tests were carried out. The tests numbering was further increased on the basis of the previous tests (1 to 16).

Versuch 17 / Test 17:

Das Fahrzeug war mit Variante 6 beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /

The vehicle was loaded with variant 6. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to a standstill. No longitudinal deceleration of $\geq 0.8 g$ over a period of ≥ 80 ms could be achieved.

Therefore, an assessment based on the test was not possible.

Versuch 18 / Test 18:

Das Fahrzeug war mit Variante 6 beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /

The vehicle was loaded with variant 6. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to a standstill. No longitudinal deceleration of $\geq 0.8 g$ over a period of ≥ 80 ms could be achieved.

Therefore, an assessment based on the test was not possible.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Versuch 19 / Test 19:

Das Fahrzeug war mit Variante 6 beladen. Es konnte eine Längsverzögerung von $\geq 0,8$ g über eine Zeitspanne von ≥ 80 ms erreicht werden.

Es wurde keine Verschiebung der Beladung festgestellt. Die Positionen der Drumclips, der Cordstrap® und des Spanngurts wiesen keine Veränderung auf /

The vehicle was loaded with variant 6. A longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms was achieved.

No shift of the load was detected. The positions of the Drumclips, the Cordstrap® and the lashing belt were not changed.

Versuch 20 / Test 20:

Das Fahrzeug war mit Variante 6 beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8$ g über eine Zeitspanne von ≥ 80 ms erreicht werden.

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /

The vehicle was loaded with variant 6. It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to a standstill. No longitudinal deceleration of ≥ 0.8 g over a period of ≥ 80 ms could be achieved.

Therefore, an assessment based on the test was not possible.

Versuch 21 / Test 21:

Das Fahrzeug war mit Variante 6 beladen. Es konnte eine Längsverzögerung von $\geq 0,8$ g (- 0,05 g) über eine Zeitspanne von ≥ 80 ms erreicht werden.

Es wurde keine Verschiebung der Beladung festgestellt. Die Positionen der Drumclips, der Cordstrap® und des Spanngurts wiesen keine Veränderung auf /

The vehicle was loaded with variant 6. A longitudinal deceleration of ≥ 0.8 g (- 0,05 g) over a period of ≥ 80 ms was achieved.

No shift of the load was detected. The positions of the Drumclips, the Cordstrap® and the lashing belt were not changed.

2.3.4.2. Fahrversuch Kreisfahrt / Driving test circular drive

Die Sicherungsvariante 6 bildet (wie die Sicherungsvarianten 1 bis 4) Ladeeinheiten, bestehend aus den Fässern und einer Palette. Deshalb wurden bei den aktuellen Prüfungen im Juni 2020, wie bei den Prüfungen im Oktober 2019, von Kreisfahrten abgesehen (beschrieben im Absatz 2.2.4.2.). In Folge dessen konnte die Position der Ladung auf dem Sattelzug vernachlässigt werden, da nur Bremsversuche durchgeführt wurden /

Securing variant 6 (like securing variants 1 to 4) forms load units consisting of the drums and a pallet. For this reason, the current tests in June 2020, as well as the tests in October 2019, did not include circular driving tests (described in paragraph 2.2.4.2.). As a result, the position of the load on the semi-trailer truck could be neglected as only braking tests were carried out.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Nachfolgend sind die im Fahrversuch gemessenen Werte zusammengefasst dargestellt:

Fahrmanöver	Sicherungsvarianten	$v \geq 40$ km/h	$t_{a \geq 0,8g} \geq 80$ ms [Ja / Nein] (TÜV)	Ergebnis	Bemerkung
Versuch 17 Bremsung	6	erfüllt	nicht erfüllt	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 18 Bremsung	6	erfüllt	nicht erfüllt	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 19 Bremsung	6	erfüllt	erfüllt	positiv	./.
Versuch 20 Bremsung	6	erfüllt	nicht erfüllt	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 21 Bremsung	6	erfüllt	erfüllt	positiv	$a = 0,8 g - 0,05 g$

Übersicht der Fahrdynamischen Anforderungen und Ergebnisse

The values measured in the driving test are summarized below.

Driving manoeuvres	Variants of securing	$v \geq 40$ km/h	$t_{a \geq 0,8g} \geq 80$ ms [Yes / No] (TÜV)	Result	Remark
Test 17 Breaking	6	pass	not passed	No assessment	$t_{a \geq 0,8g}$ too short
Test 18 Breaking	6	pass	not passed	No assessment	$t_{a \geq 0,8g}$ too short
Test 19 Breaking	6	pass	passed	positiv	./.
Test 20 Breaking	6	pass	not passed	No assessment	$t_{a \geq 0,8g}$ too short
Test 21 Breaking	6	pass	passed	positiv	$a = 0,8 g - 0,05 g$

Overview of the driving dynamics requirements and results

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



3. Anlagen / annexes

- Anlage / annex 0: Änderungen, 1 Seite
Alterations, 1 page
- Anlage / annex 1: Spezifikation: Folie, 1 Seite
Specification: Foil, 1 page
- Anlage / annex 2: Spezifikation: Strap und Umreifungsmaschine, 2 Seiten /
Specification: Strap and strapping machine, 2 pages
- Anlage / annex 3: Spezifikation: Cordstrap®, Cordstrap-Verschluss und Spanngerät, 2 Seiten
Specification: Cordstrap®, cordstrap fastener and tensioner, 2 pages
- Anlage / annex 4: Technische Zeichnung (Drumclip, Typ DC18A RED), 2 Seiten
Technical drawing (Drumclip, type DC18A RED), 2 pages
- Anlage / annex 5: USB-Stick (Fotos, Filme, Messwerte, Technischer Bericht), 1 Seite /
USB-stick (photos, films, measurements, Technical Report), 1 page

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

4. Zusammenfassung / Summary

Auf Wunsch des Auftraggebers wurde eine neuartige Fasssicherung (Drumclip, Typ DC18A RED) in verschiedenen Versuchsreihen auf ihre Eignung zur Ladungssicherung untersucht. Diese Art der Sicherung erforderte das Vorhandensein von:

- stabilen Ladeeinheiten
 - durch mindestens 8-fache Umwicklung der Stahlfässer unter Einbeziehung der Palette mit Folie,
 - oder
 - durch Umspannen der Stahlfässer mit einem horizontalen und einem vertikalen Strap (Spannkraft jeweils 2.500 N), um eine Einbeziehung der Palette in die Ladeeinheit zu gewährleisten, die Spezifikationen des Straps und des Umreifungsgerätes sind Anlage 2 zu entnehmen,
Hinweis: wegen des vertikalen Straps sind zwei Fasssicherungen pro Ladeeinheit zu verwenden!
 - oder
 - durch händisches Umspannen der Stahlfässer mit einem horizontalen und einem vertikalen Cordstrap® (Spannkraft jeweils 2.000 N), um eine Einbeziehung der Palette in die Ladeeinheit zu gewährleisten, die Spezifikationen des Cordstrap®, des Cordstrap-Verschlusses und des Spanngeräts sind Anlage 3 zu entnehmen,
Hinweis: wegen des vertikalen Cordstrap® sind zwei Fasssicherungen pro Ladeeinheit zu verwenden! Der Cordstrap-Verschluss darf die anderen Cordstrap®, den Spanngurt und die Fässer nicht berühren und muss dementsprechend positioniert werden (um Beschädigungen zu vermeiden)!
- einer Verladung unter Verwendung von Antirutschmatten ($\mu \geq 0,6$),
- jeweils einem Spanngurt mit einer Belastbarkeit von 2.500 daN,
- eine Abspannung des Gurtes nach unten unter 90° zur Fahrtrichtung.
Hinweis: ein Spanngurtverlauf mit Kontakt zum horizontalen Strap ist unzulässig!

Bei Erfüllung dieser Anforderungen ist ein sicherer Einsatz des Drumclips des Typs DC18A RED möglich /

At the customer's request a new type of drum securing device (Drumclip, type DC18A RED) was tested in various test series to determine its suitability for load securing. This type of securing required the presence of:

- *stable loading units*
 - *by wrapping the steel drums at least 8 times, including the pallet, with foil,*
 - or*
 - *by strapping the steel drums with a horizontal and a vertical strap (tension force 2,500 N each) to ensure that the pallet is included in the load unit, the specifications of strap and strapping tool can be found in Annex 2,*
Note: Because of the vertical strap, two drum securing devices must be used per loading unit!
 - or*
 - *by manually strapping the open head drums with a horizontal and a vertical Cordstrap® (tension force 2,000 N each) to ensure that the pallet is included in the loading unit, the specifications of the Cordstrap®, the cordstrap fastener and the tensioner can be found in Annex 3,*
Note: Because of the vertical Cordstrap®, two drum securing devices must be used per loading unit! The cordstrap fastener is not to contact the other Cordstrap®, the lashing belt and the drums and must be positioned accordingly (to prevent damage)!

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

- using anti-slip mats for loading ($\mu \geq 0.6$),
- one lashing belt each with a load capacity of 2,500 daN,
- a belt tensioning downwards at 90° to the direction of travel.

Note: It is not permitted for the lashing belt to run in contact with the horizontal strap!

If these requirements are met, Drumclip type DC18A RED could be used safely.

Die im Bericht enthaltenen Fotos stellen nur eine Auswahl dar. Die weiteren zu den Versuchen vorhandenen Fotos, Filme und Diagramme wurden dem Kunden elektronisch zur Verfügung gestellt / The photos contained in the report are only a selection. The other photos, films and diagrams available for the tests were made available to the customer electronically.

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ *Technical Report*



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Das geprüfte Ladungssicherungskonzept erfüllt für die dokumentierte Sicherungssituation die Anforderungen der DIN EN 12195-1. Diese europäische Norm gilt nicht für Fahrzeuge mit einem zulässigen Gesamtgewicht bis einschließlich 3.500 kg, da bei diesen durchaus höhere Beschleunigungen auftreten können /

The tested load securing concept fulfils the requirements of DIN EN 12195-1 for the documented securing situation. This European standard does not apply to vehicles with a permissible gross weight of up to and including 3,500 kg, as higher accelerations can occur in these vehicles.

Der Technische Bericht umfasst 27 Seiten sowie die Anlagen 0 bis 5 und darf ohne schriftliche Genehmigung des Prüflaboratoriums nicht auszugsweise vervielfältigt werden. Er verliert seine Gültigkeit, wenn sich die unter Punkt 1.3. genannte Prüfgrundlage ändert /

The Technical Report comprises 27 pages and Annexes 0 to 5 and may not be reproduced in whole or in part without the written permission of the testing laboratory. It loses its validity if the test basis mentioned under point 1.3. changes.

Köln, den 28.09.2020 /
Cologne, 28th of September 2020
hsm

Prüflaboratorium
Typprüfstelle Fahrzeuge/Fahrzeugteile
im Technologiezentrum Verkehrssicherheit
der TÜV Rheinland Kraftfahrt GmbH



Dipl.-Ing. Th. Husemann

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 0

0. Änderungen / Alterations

- 0.1. Es wird berichtigt / *Is corrected* : - - -
- 0.2. Es wird geändert / *Is changed* : - editorielle Änderungen / *editorial changes*
- 0.3. Es wird hinzugefügt / *Is added* : - Variante der Ladungssicherung mit Cordstrap® / *Variant of load securing with Cordstrap®*
- 0.4. Es entfällt / *Is not applicable* : - - -

3. Tight head UN200 litre drum

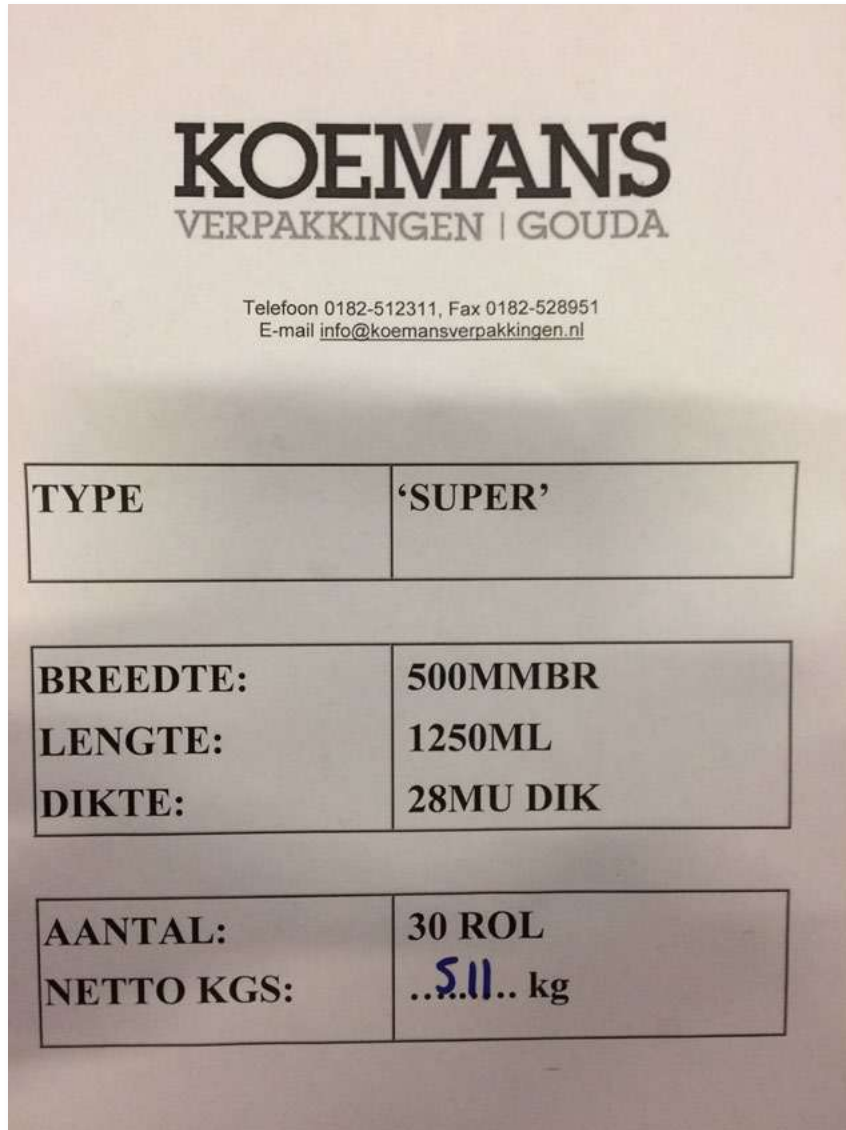
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Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Folienspezifikation / Foil specification



Minimale Anzahl der Wicklungen / Minimum no.of wrap-windings: **8-fach / 8 times**

3. Tight head UN200 litre drum

TÜV Rheinland Group




Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Umreifungsgerät / strapping machine

Signode Akku Umreifungsgerät BXT 3-19

				
		BXT3-13	BXT3-16	BXT3-19
		light	Universal	heavy
Strap type		PET + PP	PET + PP	PET + PP
Strap width		9 - 13 mm	13 - 16 mm	16 - 19 mm
Strap thickness		PEI: 0.4 - 0.8 mm; PP: 0.5 - 0.8 mm	0.5 - 1.0 mm	0.8 - 1.3 mm
Weight		3.6 kg	3.8 kg	4.3 kg
Tension force		150 - 1200 N	400 - 2500 N	400 - 4500 N
Variable Tension Speed		0 - 290 mm/s	0 - 220 mm/s	0 - 120 mm/s
Cycles / Charge		up to 800	up to 800	up to 800
Battery		Bosch Li-Ion 18V, 2.0Ah	Bosch Li-Ion 18V, 2.0Ah	Bosch Li-Ion 18V, 4.0Ah
Charging time battery		15 - 30 min	15 - 30 min	25 - 35 min
Motor technology		Single motor technology, brushless	Single motor technology, brushless	Single motor technology, brushless
Dimension (L x W x H)		370 x 141 x 135 mm	370 x 141 x 135 mm	370 x 143 x 135 mm

Quelle / Source: <https://www.signode-bxt.com/en/product/tools/>

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 2

Strap

Strapart / Strap type: Signode Tenax 2220

Material / Material: Polyester

Breite / Width: 19 mm

Dicke / Thickness: 0,89 mm / 0.89 mm

Vorspannung / Pre-tension: 2.500 N / 2,500 N

Verschweißlevel / Welding time level: 4



TENAX®

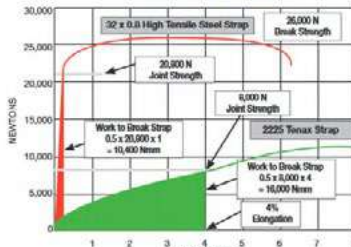
High performance polyester strapping

Technical specification and applications

		Type	Size (mm) Width x Thickness	Strength N	Standard m/coil	Jumbo m/coil	Super Jumbo m/coil
General Duty	1616	8.9 x 0.52	2,000	4,050			
	1716	10.5 x 0.52	2,220	3,350			
	1716	10.5 x 0.61	2,670	2,743			
	1816	11.9 x 0.44	2,220	3,200			
	1818	11.9 x 0.52	2,670	2,743			
	1822	11.9 x 0.71	3,560	1,981			
Heavy Duty	2030	15.62 x 0.76	4,900	1,600	4,400		
	2040	15.62 x 0.89	6,300	1,300	3,800	6,250	
	2080	15.62 x 1.02	7,100	1,200	3,300		
	2220	19.05 x 0.89	7,500	1,100	3,100	5,100	
	2225	19.05 x 1.27	11,100	800	2,200	3,600	
	2480	25 x 1.02	11,500	750	2,100		
	2680	32 x 1.00	14,700	600		2,700	
	2625	32 x 1.27	18,850	450		2,100	

Tenax® strapping load and elongation curves

HIGH TENSILE



Tenax® strapping range head and tool compatibility

	STD/DY	AST	AMT	AMPPT	VFX	VT	EXT	EXT2	EXT2	EXT2-32	MH	AK300/Z.20	Z.32
Operation	M	M	P	P	P	P	B	B	B	B	E	E	E
Seal	50Y	50AD	AMT	50AD	AMT	friction weld							

Tenax® coil specification

Coil	Weight	Coils / Pallet
Standard	25kg	12 or 24
Jumbo	70kg	6
Super Jumbo	115kg	4

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 3

Cordstrap®, Cordstrap-Verschluss und Spanngerät / Cordstrap®, cordstrap fastener and tensioner

Specifications Cordstrap Composite Strapping Solution: CC65 & CB6

Performance Specifications	
Performance System (strap & buckle) System Breaking Strength*	900 daN / 2025 lbf
Performance Strap Linear Breaking Strength*	625 daN / 1405 lbf
Elongation	<7%
Elongation at Break	11% - 17%
Certification	German Lloyd
Strap Specifications	
Dimensions Width*	19mm / 3/4"
Thickness*	0,97 mm / 1/32"
Material	High tenacity polyester filament yarn and Homopolymer Polypropylene
Coil Length per Coil** Core Diameter	500 m / 1640 ft 200 mm / 8"
Packaging Carton Box Dimensions* Box Weight* Product Code	2 coils per box 390 x 390 x 354 mm / 15.3/8" x 15.3/8" x 14" 20 kg / 44 lbs 7266000
Pallet Box Dimensions* Box Weight* Product Code	30 coils per box 1181 x 781 x 890 mm / 46.9" x 31.1" x 35" 296 kg / 653 lbs 7266900
Buckle Specifications	
Dimensions Width*	19 mm / 3/4"
Material	Galvanized steel wire
Packaging Carton Box** Dimensions* Box Weight* Product Code	500 pieces per box 266 x 166 x 272 mm / 10.1/2" x 6.5/8" x 8.5/8" 9 kg / 20 lbs 7354500

3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Anlage / Annex 3

Recommended Tensioner(s)	
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32"- 3/64" 1,3 kg / 2.9 lbs 7514000
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CTT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32"- 3/64" 1,4 kg / 3.1 lbs 7514600
Accessories	
Coil Dispenser with Buckle Tray Product Code Portable Version Product Code Static Version	7538000 7544000
Edge Protection	Different types and sizes available. Your Cordstrap cargo securing specialist can advise you about the best Edge Protection for your application.
Pallet Needle Product Code	7551000
*Tolerance of +/- 10% **Tolerance of +/- 2%	
We recommend storing all Cordstrap Products in a cool dry environment out of direct sunlight and between 5°C and 25°C / 41°F and 77°F	

Spanngerät CT25 / tensioner CT25

Für die Prüfungen wurde das Spanngerät CT25 verwendet. Das Verhältnis der Hebellänge zum Bolzendurchmesser beträgt 10:1, sodass eine Handkraft von 200 N auf den Hebel eine Spannkraft der Cordstrap® von 2.000 N erzeugt. Folgend sind die Längenverhältnisse des Spanngeräts dargestellt / *The tensioner CT25 was used for the tests. The ratio of the lever length to the bolt diameter is 10:1, so a manual force of 200 N on the lever produces a tension force of 2,000 N on the Cordstrap®. In the following the length ratios of the tensioner are shown.*



Bolzendurchmesser / Bolt diameter



Hebellänge / Lever length

3. Tight head UN200 litre drum

TÜV Rheinland Group

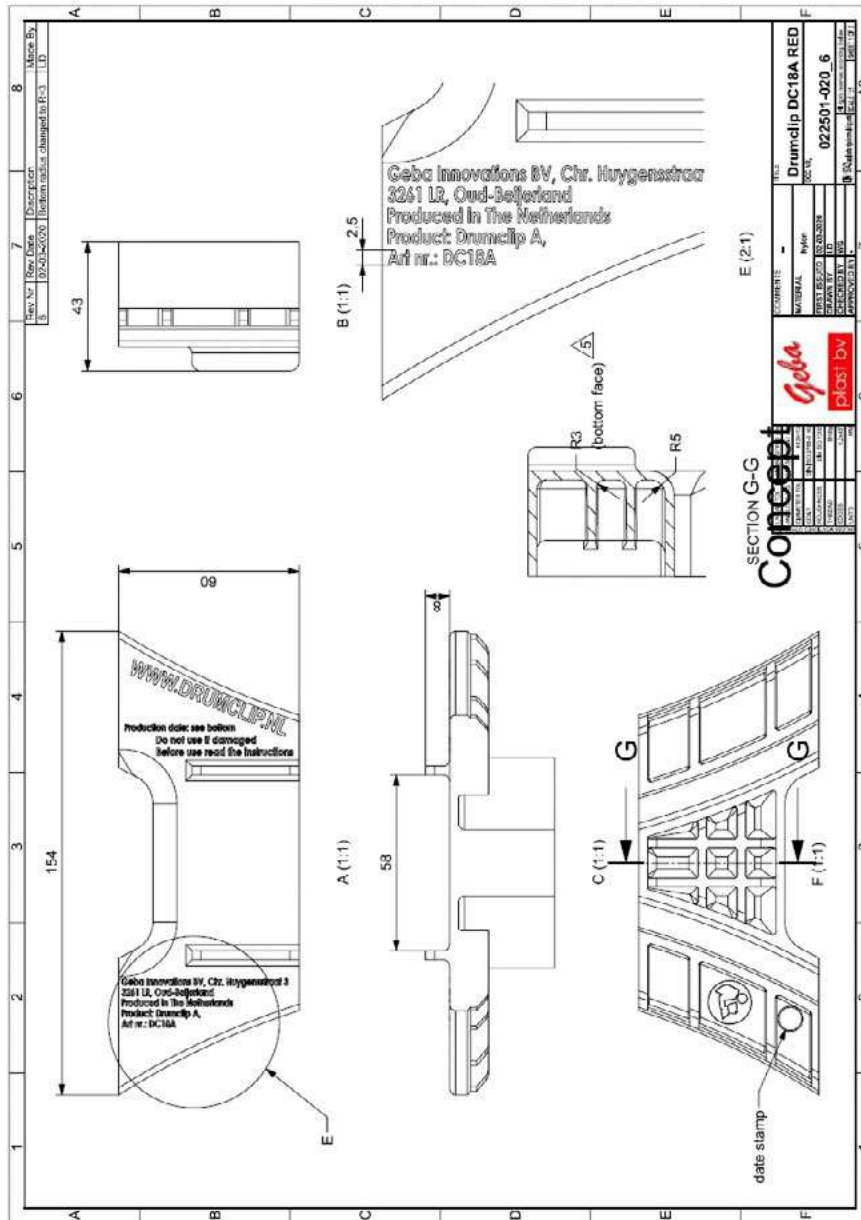
Technischer Bericht: 195XS0017-03
/ Technical Report



Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA

Anlage / Annex 4

Technische Zeichnung Drumclip Typ DC18A RED / technical drawing Drumclip type DC18A RED





3. Tight head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 195XS0017-03
/ Technical Report

Bauteil / Component : Drumclip DC18A RED
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 5

USB-Datenträger / USB-stick

3. Tight head UN200 litre drum

3.7 Test Report ISTA | DRUMCLIP DC18A RED

3.7.1 With Signode

Test Report

IPS 7898-80

ISTA 3E PERFORMANCE TEST

DRUMCLIP DC18A RED

with

TIGHT HEAD BARREL DRUMS

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KvK: 17136987

CHERISHING INDUSTRIAL PRODUCTS 



IPS Technology
Packaging Tooling Testing



3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 2/21

Reference : IPS 7898 - 80
Description : Test Report ISTA 3E Drumclip DC18A Red with Tight Head Barrel Drums
Date : August 19, 2019
Author(s) : Marten Ries

Client : Geba Innovations B.V.
Chr. Huygensstraat 3
3261 LR Oud-Beijerland
The Netherlands

Contacts : Wouter Geldhof

Test performed by : Marten Ries
Test Date(s) : August 16, 2019
Test Facility : IPS Technology, Eindhoven The Netherlands
ISTA Certified Testing Laboratory, Member ID: 9778 (Appendix A)

Table of Contents

1. Scope of test.....	3
2. Product Damage Tolerance and Package Degradation Allowance.....	5
3. Test plan.....	6
3.1 Atmospheric Conditioning.....	6
3.2 Shock; horizontal impact 1,2ms.....	7
3.3 Shock; 1st Rotational Edge Drop	8
3.4 Compression Test; Machine Apply and Release	9
3.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	10
3.6 Shock; 2nd Rotational Edge Drop	12
4. Test Results.....	13
4.1 Atmospheric Conditioning.....	13
4.2 Shock; Horizontal Impact.....	13
4.3 Shock; 1 Rotational Edge Drop	13
4.4 Compression; Machine Apply and Release.....	13
4.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	13
4.6 Shock; 2nd Rotational Edge Drop	14
5. Inspection after test	14
6. Conclusions	15
Appendix A. ISTA Certified Testing Laboratory	16
Appendix B. Test Equipment: Impact Tester.....	17
Appendix C. Test Equipment: Shaker	18
Appendix D. Impact speed	19
Appendix E. Compression test graph.....	20
Appendix F. Power Spectral Densities Profile	21

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CHERISHING INDUSTRIAL PRODUCTS



3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 3/21

1. Scope of test

The goal of this transport simulation test, performed according to the ISTA 3E-2017 Standard for Unitized Loads, is to validate the capability of the Drumclip system for sufficient load stability subjected to rough mechanical handling; forklift truck handling and warehousing stacking.

Four Standard Tight Head Barrel Drums 200L are placed on a pallet and secured with two Drumclips and secured with two polyester lashings.

Securing of the pallets during Full Truckload (FTL) will be done with help of strapping belts and is not in scope of this test.



Figure 1. Test configuration

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 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 4/21

Details of tested configuration:

The tested configuration is built up with components listed below:

Item	Remark
Standard Tight Head Barrel Drums 200L. Quantity: 4	Drums fully filled with water. Used condition.
Pallet type: CP-9	Chemie Pallet, 1140x1140x156mm, used condition.
Lashing: Signode Tenax 2040 Strapping. Quantity: 2	Polyester Strapping 16mm, thickness 0,89mm Location of the strapping shown in Figure 1.
Drumclip type: DC18A RED	Quantity used: 2x

Lashing is assembled with Plastic Strapping Handtool: Strapex STB75.

Pre-tension on strapping: 2100N, Weldingtime level: 4

Parameter	Value
Total mass DUT:	892 kg
Dimensions:	1170x1170x1030mm (LxWxH).
Sample Numbers to be tested:	1

Remark:

The drums are exceeding the base dimensions of the pallet.

The Tenax strapping will be applied just before the execution of the test program.

Identification of sides (according to ISTA 3E) see Figure 2.



Figure 2. Faces of DUT identified.

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 5/21

2. Product Damage Tolerance and Package Degradation Allowance

The product will be tested in the prepared configuration. Replacement of components of DUT is not allowed.

Product Damage Allowance:

During horizontal impact tests the drums will impact the ridged wall of the Horizontal Impact Tester. The drums are exceeding the dimensions of the pallet base.

It will be expected that damage to the drums cannot be avoided during the execution of these tests. Damage to the drums caused by these impacts is within the allowance criteria.

Package Degradation Allowance:

During and after the test the integrity of the DUT must be guaranteed.

- All drums are placed on the pallet bottom during and after the execution of the test.
- The forklift truck can interface the pallet during and after the execution of the test.
- The Drumclip is not broken-heavily damaged (validation by Geba Innovations)

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 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 6/21

3. Test plan

The test plan is based on the ISTA 3E -2017 procedure.

According ISTA 3E the test sequence will be executed as stated in the table below.

<i>Performance Test Schedule</i>	<i>Description</i>	<i>Note</i>
1 st	Atmospheric preconditioning	Ambient level
2 nd	Shock; horizontal impact	1,2 m/s
3 rd	Shock: rotational edge drop	Drop height 150mm
4 th	Compression	Apply and release method
5 th	Vibration: random	Overall Grms= 0.54
6 th	Shock: rotational edge drop	Drop height 150mm

3.1 Atmospheric Conditioning

The sample will be conditioned to ambient laboratory level.

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 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80

Page : 7/21

3.2 Shock; horizontal impact 1,2ms

The DUT will be exposed to horizontal impacts in order and under the conditions as stated in the table below.

Sequence No.	Specific Face	Impact Speed
1	Face 6	1,2 m/s
2	Face 5	1,2 m/s
3	Face 2	1,2 m/s
4	Face 4	1,2 m/s

Horizontal impact testing will be performed with the IPS Technology horizontal impact tester.

Specifications of the horizontal impact tester can be found in Appendix B.



Figure 3.DUT on horizontal impact tester.

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
 Page : 8/21

3.3 Shock; 1st Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
 During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
 The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 4. Set-up Rotational Edge Drop Test

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 Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 9/21

3.4 Compression Test; Machine Apply and Release

The DUT will be exposed to a; 'Machine Apply and Release' compression test according to the ISTA 3E test protocol. For the calculation for compression (Apply and Release method) the formula $AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) (L-1)\} \times 1,4 \times 9,8$ is applicable.

Wt	Total weight of packaged product (Kilograms)	892 Kg	
S	Total number of <u>potential</u> unitized loads in a warehouse stack or a vehicle stack	4	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	36.793 N	= 3750 Kg

The test will be performed with an additional (empty) pallet on top of the DUT. This will be done in order to simulate the reality of stacking load. Figure is showing the compression test setup.



Figure 5. Test set-up Compression Test

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
 Page : 10/21

3.5 Vibration; ISTA Steel Spring Truck Random Vibration

The DUT will be exposed to a vibration test without compressive load, to simulate transport vibrations. The test is performed under 'loose load' conditions. For the test setup see Figure .
 The during of 60minutes will be equivalent to a transport of 480km.

Orientation	Vibration Profile acc.	Duration
Face 3 down (bottom face)	ISTA Steel Spring Truck	60 minutes

Specifications of the vibration test equipment can be found in Appendix C.

The Power Spectral Densities ISTA Steel Spring Truck profile is given in the figure below.

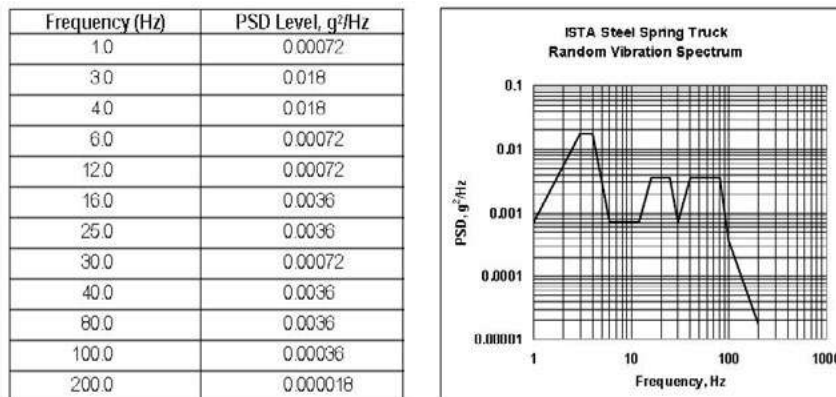


Figure 2. Power Spectral Densities – Steel Spring Truck Random Vibration



3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 11/21



Figure 6. Test setup for vibration test

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
 Page : 12/21

3.6 Shock; 2nd Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
 During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
 The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 7. Set-up Rotational Edge Drop Test

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 **IPS Technology**
 Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 13/21

4. Test Results

The tests are executed according to test plan. In the following chapters the test results can be found per test.

4.1 *Atmospheric Conditioning*

The DUT has been conditioned to ambient laboratory level.



4.2 *Shock; Horizontal Impact*

The horizontal impact test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. The impact speed is measured at 1,2 m/s. See for the speed graph Appendix D.

4.3 *Shock; 1 Rotational Edge Drop*

The Rotational Edge Drop Sequence is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence.

4.4 *Compression; Machine Apply and Release*

No remarkable event occurred before, during or after the Test Sequence.

A screenshot of the compression test is shown in a graph in Appendix E.

4.5 *Vibration; ISTA Steel Spring Truck Random Vibration*

The vibration test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. A screenshot of the PSD during the test is shown in Appendix F.

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 14/21

4.6 Shock; 2nd Rotational Edge Drop

The Rotational Edge Drop Sequence is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence.

5. Inspection after test

After execution of the complete test cycle no remarkable – unexpected damages to the DUT and its components could be found. The expected damage to the drums could be found only on face 4. The condition of the CP-9 pallet was still in useable condition.



Figure 8. Damage to drums; only face 4.

Examination of the condition by personnel of Geba Innovations B.V. of the Drumclips after the test showed no visible damage or wear.

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 15/21

6. Conclusions

The test has been executed according to the test plan.
No remarkable-unexpected events and/or damage has occurred before, during or after the test to the DUT.

The Drumclip system in combination with the defined lashing configuration is fully capable to ensure safe individual pallet mechanical pallet handling and warehouse stacking.

Eindhoven, August 20, 2019

Checked and approved by:



Marten Ries
Sr. Project Engineer

Marijn Sijbers
Test Engineer

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 16/21

Appendix A. ISTA Certified Testing Laboratory



This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778 Valid through: February 1, 2020
Location: Eindhoven, Netherlands

IPS Technology


A.J. Gruber
ISTA President


Eric Hiser
ISTA Vice President - Technical

Figure 9. IPS Technology ISTA Laboratory Certification

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CHERISHING INDUSTRIAL PRODUCTS 

 **IPS Technology**
Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 17/21

Appendix B. Test Equipment: Impact Tester

**Fabrikant**

IPS Technology

Oppervlakte

245x250 cm

Max. productmassa

1300 kg

Opspanning

Horizontaal

Botssnelheden

2-10 km/h

Datalogging

Snelheidsmeetsysteem registreert de snelheid bij botsing

Optioneel

Versnellingsmetingen aan het product met een drie-assige versnellingsopnemer

Normen (o.a.):

ASTM D 5487
ISO 2244

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
Page : 18/21

Appendix C. Test Equipment: Shaker



- Manufacturer : Lansmont model 10000 TTV II
- Max. specimen size : 152 x 152 cm
- Max. specimen weight : 2200 kg
- Max. amplitude (peak to peak) : 6,4 cm
- Frequency-range : 3 - 300 Hz
- Frequency-rang at max. load : 3 - 200 Hz
- Acceleration range : 0 - 8 g
- Max. acceleration at max. load : 2 g
- Automatic displacement or acceleration control
- Automatic sweep generator and random vibration facilities (Lansmont TouchTest Vibration system)
- Accelerometer

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Packaging Tooling Testing

3. Tight head UN200 litre drum

Reference : IPS 7898 - 80

Page : 19/21

Appendix D. Impact speed

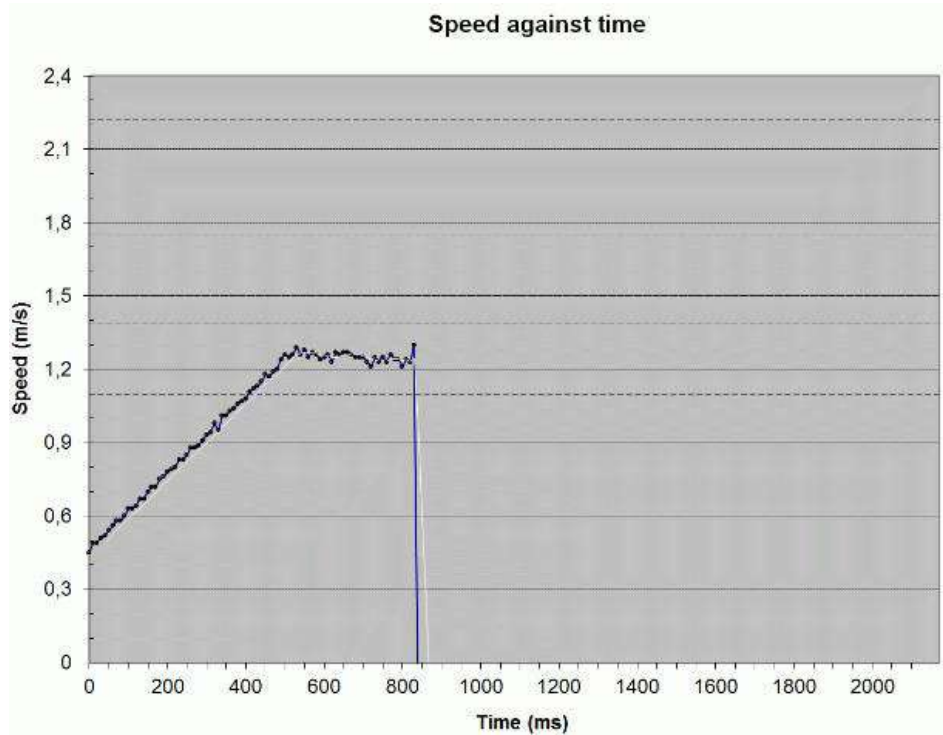


Figure 10. Impact speed >1,2m/s

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3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
 Page : 20/21

Appendix E. Compression test graph



Sample ID	Peak Force (kg)	Defl @ Pk (cm)	PreLoad (kg)	Test Speed (cm/min)	Temp (deg C)	%RH	Time	Date
ISTA 3F DRUMCLIP SAMPLE DC19A RFD #2	3757	1.61	22.0	1.30	19.5	64.7	11:19 AM	16-Aug-19

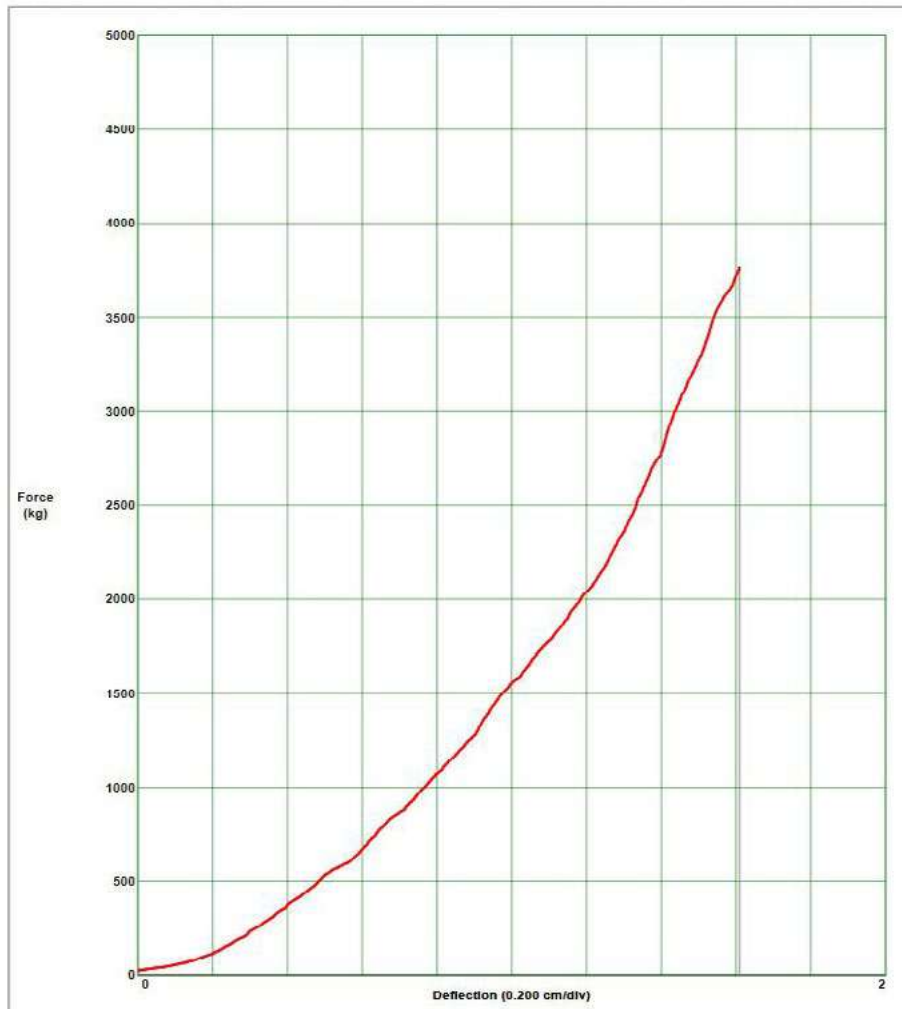


Figure 11. Compression test graph – Apply and release compression test

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3. Tight head UN200 litre drum

Reference : IPS 7898 - 80
 Page : 21/21

Appendix F. Power Spectral Densities Profile

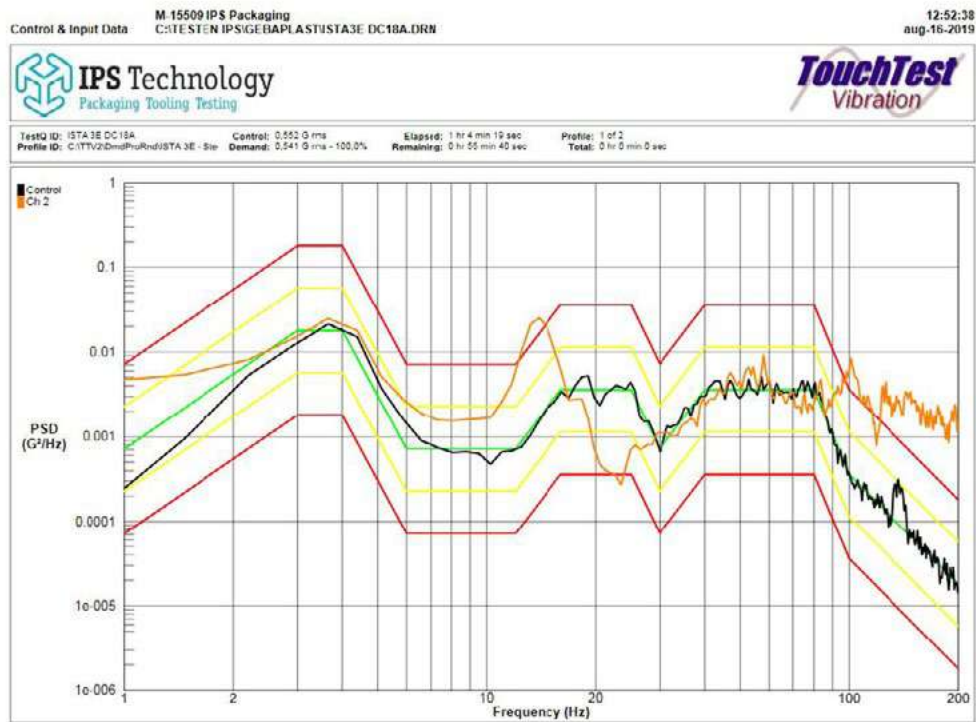


Figure 12. Power Spectral Densities - ISTA Steel Spring Truck Random Vibration; 1 hr 4min.



Figure 13. Location accelerometer Ch2. for response monitoring (examination only)

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 Packaging Tooling Testing

3. Tight head UN200 litre drum

3.7.2 With Cordstrap



Transport simulation on Metal drums - Cordstrap CC65 and CB6S – Drumclip DC18A RED

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The IPS-report may be released for viewing to relevant parties.

IPS Technology is an independent packaging and tooling design agency. Aside from designing IPS also performs research, delivers advice on packaging issues and performs packaging test in its own test facility.



Test conducted on 24 February 2022

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3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

CUSTOMER INFORMATION

Client: Geba Innovations **ATTN:** Wouter Geldhof
Project name: Transport simulation on metal drums - Cordstrap CC65 and CB6S -
2x Drumclips DC18A RED

LAB INFORMATION

Testing Lab: IPS-Technology
Location: Boschdijk 760, 5624 CL Eindhoven, The Netherlands
ISTA Member: ST-9778
Date of Test: 24 February 2022
Test performed by: Otto van den Berg



This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778

Valid through: February 1, 2024

Location: Eindhoven, NB, Netherlands

IPS Technology


A.J. Gruber
ISTA President


Eric Hiser
ISTA Vice President - Technical

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRODUCT & PACKAGING INFORMATION

Packed product(s) and packaging description	4 metal drums on a wooden pallet, strapped with Cordstrap CC65 and Cb6S and 2x Drumclip DC18A RED.
Packed pallet dimension	120 x 120 x 102 [mm]
Packed pallet weight	701 [kg]
Packed pallet degradation allowance	If no conditions are provided by the customer, IPS will adopt a "PPDA" as follows: The packed pallet may show damaging marks, but still needs to bundle, protect and support the content in a functional way.
Product Damage Tolerance	Individual packages and products contained are not within the scope of this test, and are not opened or checked.

CONCLUSIONS

Testing is done according to plan and no incidents occurred during testing.

Pallet is functional, strapping and Drumclips are in place. Drums are bundled, protected and supported as stated in the "PPDA" above.

The package therefore **PASSES** the test.

Eindhoven, 24 February 2022

Test Engineer:
Otto van den Berg

Checked by:
Johan Bruins




3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ISTA 3E version 2017

TEST RESULTS

Overview Recommendations	Testing is performed according to plan and without incidents.
Packaging Condition	Packaging is functional after all tests.
Product Condition (if inspected)	Drumclips are undamaged and in the correct position. Cordstraps are undamaged.

		OBSERVATIONS	
		Items in Grey are not performed. Items in red are not completed.	
	Test	Value	
BLOCK 1	Temp and Humidity		23°C and 50% Humidity
BLOCK 2	Shock: Horizontal Impact	1.2m/s	
BLOCK 3	Shock: Rotational edge drop	150mm	
BLOCK 4	Compression: Apply and release	2944 kg	
BLOCK 5	Vibration: Random	1 hour	
BLOCK 6	Shock: Rotational edge drop	150mm	



Package after testing



Extra

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRE-TEST INSPECTION

Product Condition

Drums have some dents. Pallet is undamaged. Drumclips and Cordstraps are new and installed after arrival at IPS testlab.

Packaging Condition before testing

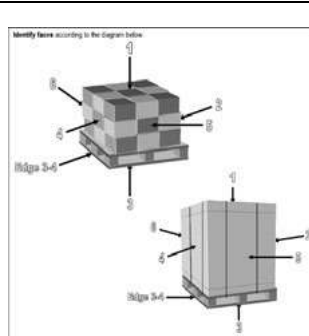
NEW re-packaged with new materials before testing.

Additional Notes

Re-strapping is done by Geba employee with appropriate tools, conform packaging guidelines of Geba.



Package as received



Identification of sides



Pallet re-strapped

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

TEST SUMMARY

Described in this test report is a transport simulation test. The goal of this test, performed according the ISTA 3E version 2017 standard for Unitized Loads, is to validate how the packed pallet, and the Cordstrap and Drumclip in particular, handle shocks and vibrations during transport. An engineer of Geba Innovations is present during testing. Before testing, the pallet is re-straped using new Drumclips and new Cordstraps, with the proper tools according to the packaging guidelines of Geba. All testing is done without the transport belt over the pallet as prescribed by the Geba packaging guidelines. After the test the pallet, Cordstrap and Drumclips are inspected by engineers of IPS Technology.

Further inspection (done by the customer) is not within the scope of this test report.

The following tests are conducted in sequence:

Items in grey are not performed as agreed by the customer.

Sequence Number	Test category	Test Type	Test Level	For ISTA Certification
1	Atmospheric Preconditioning TEST BLOCK 1	Temperature and Humidity	Ambient	Required
*	Atmospheric Conditioning TEST BLOCK 1	Controlled Temperature and Humidity	Temperature and Humidity chosen from chart	Optional
2	Shock (alternative methods allowed) TEST BLOCK 2	Inclined Impact	1.2 m/s	Required
		Horizontal impact	1.2 m/s	
3	Shock TEST BLOCKS 3	Rotational edge drop	150 mm	Required
4	Compression (alternative methods allowed) TEST BLOCK 4	Apply and release	Truck or Truck & Air dependent	Required
		Apply and hold		
		Weight and load spreader		
5	Vibration BLOCK 5	Random	Overall Grms levels of 0.54	Required
6	Shock TEST BLOCK 6	Rotational Edge Drop	150 mm	Required

3. Tight head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ATMOSPHERIC PRECONDITIONING

The package is preconditioned to laboratory ambient temperature and humidity (23°C, 50% RH) for at least 12 hours prior to testing.

SHOCK: HORIZONTAL IMPACT

Rolling floor | water tank counter weight | steel wall

The packed pallet is exposed to horizontal impacts to all four sides. Impact velocity is 1.2 m/s.



Test setup face 6



Test setup face 5

Test observations

No remarkable events occurred during testing.

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

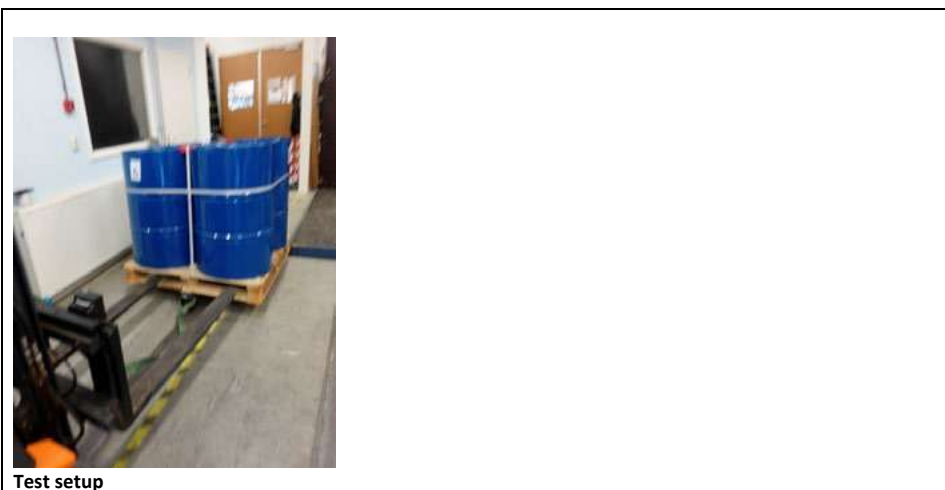
Date of report: 25 February 2022

ISTA 3E version 2017

SHOCK: FIRST ROTATIONAL EDGE DROP

Wooden beam | Wooden block | Rope

Based on the mass of the packed pallet, 767 kg, the drop height is set at 150 mm. During the drop test, the side opposite to the drop side is supported by a timber with a height of 100 mm. Two long edges and a short edge are tested.



Test setup

Test observations

No remarkable events occurred during testing.

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

COMPRESSION: APPLY AND RELEASE

Compression tester: **Lansmont Corp** | Type: 152-50K | Last calibrated/valid until: 20-11-2017/20-11-2020

The packed pallet is exposed to a 'Apply and Release' compression test according to the ISTA 3E test protocol and calculation.

$$AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) \times (L-1)\} \times 1,4 \times 9,8$$

$$AR = \{[701 \times (2-1) + (701/1) \times (1-1)] \times 3 - (701/ 1) \times (1-1)\} \times 1,4 \times 9,8$$

Wt	Total weight of packaged product (Kilograms)	701 Kg	
S	Total number of <u>potential</u> unitized loads in a vehicle stack	2	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	28853 N	= 2944 Kg



Test setup



Test observations

The test is performed with a pallet on top of the packet pallet. This is done in order to simulate a stacking load "footprint" of similar packed pallets.

The package withstood the compression test without problems.

3. Tight head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80
Date of report: 25 February 2022

RANDOM VIBRATION: STEEL TRUCK PROFILE

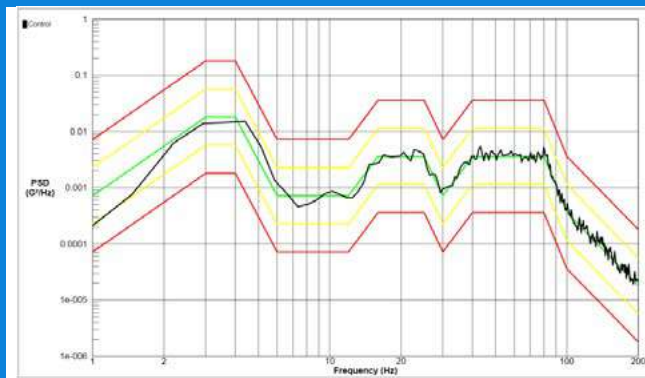
Vibration table: Lansmont Corp. | Type: 10000 TTV | Last calibrated/valid until: 24-11-2020 / 24-11-2023

The packed pallet is placed on the vibration table and is handled as 'loose load' shipment, not attached to the table. This is not in compliance with the Geba packaging guidelines. The duration of 60 minutes is specified by the customer and is equivalent to 480 km truck transport.

Test profile and settings

Frequency (Hz)	PSD Level (g^2/Hz)
1.0	0.00072
3.0	0.018
4.0	0.018
6.0	0.00072
12.0	0.00072
16.0	0.0036
25.0	0.0036
30.0	0.00072
40.0	0.0036
80.0	0.0036
100.0	0.00036
200.0	0.000018

Typical graph of ISTA 3E Steel spring truck Spectrum



Test setup



Test observations

No remarkable events occurred during testing.

3. Tight head UN200 litre drum



Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ISTA 3E version 2017

SHOCK: SECOND ROTATIONAL EDGE DROP

Wooden beam | wooden block | rope

Test setup similar to first drop test.



Test setup

Test observations

No remarkable events occurred during testing.

3. Tight head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80
Date of report: 25 February 2022

POST TEST PICTURES

After the test the packaging and the product is photographed to show how the packaging and product endured the testing.



Post test observations
Recommendations



After execution of the complete test cycle no remarkable/unexpected damages to the packed pallet or its components are found.

END OF REPORT

3. Tight head UN200 litre drum

3.8 Test Report EUMOS | DRUMCLIP DC18A RED



3.8.1 With Signode

Standard EUMOS 40509 - TEST REPORT			
	Customer	Date	
	DRUMCLIP	10-5-2022	
	Project	Reference	Revision
	Drumclip Test	TH DC 18 A 2 S2	01
			

1. Load unit descriptive data

- *Dimensions (mm):* 1000 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H 590 x L575 x W575
- *Nature of the Products:* tighthead drums
- *Description of Primary Pack:* 4 metal Tighthead drums SIGNODE 2 Straps 2 drumclips DC 18 A red
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

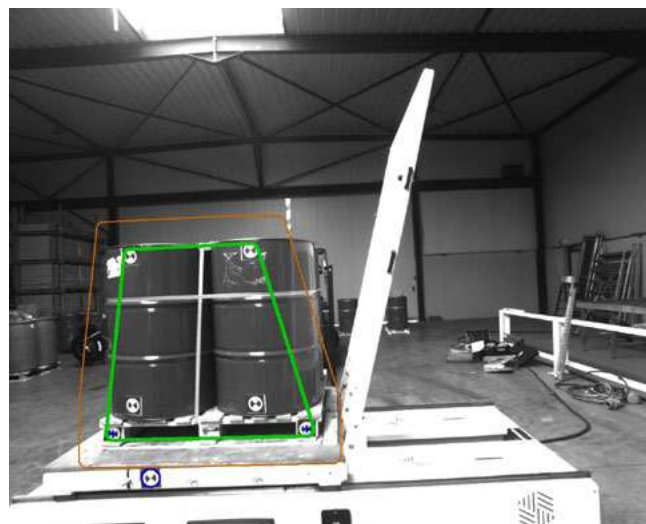
3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip Test	Reference TH DC 18 A 2 S2	Revision 01
			

2. Test related data



2.1. Orientation of the test: Length

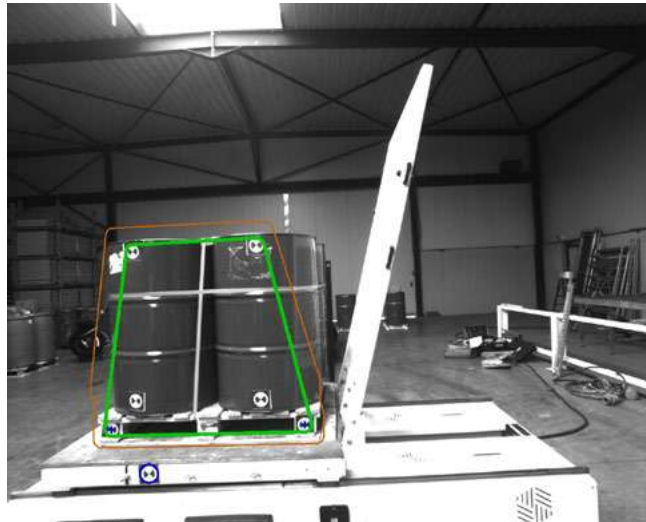
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.80G
- *Testing History:* non



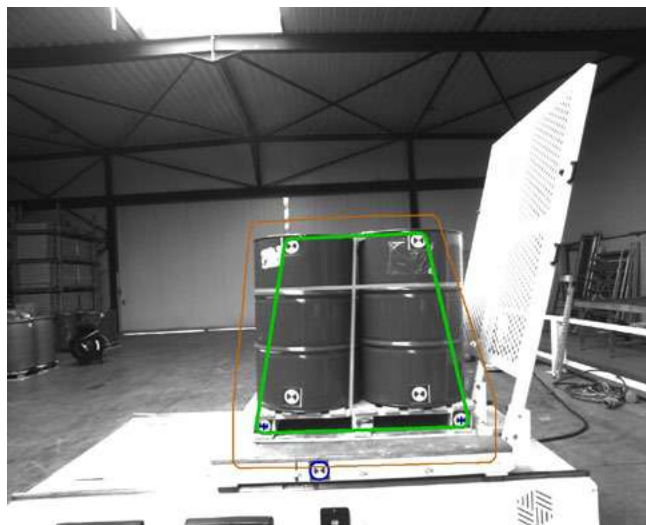
Load Before Test

3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip Test	Reference TH DC 18 A 2 S2	Revision 01
			





Permanent Deformation



Max Elastic Deformation

3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing / lashing services Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip Test	Reference TH DC 18 A 2 S2	Revision 01
			 EUMOS 40 509


3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*



3. Tight head UN200 litre drum



3.8.2 With Cordstrap

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP		Date 10-5-2022
	Project Drumclip test	Reference TH DC 18 A 2 A 2	Revision 01

1. Load unit descriptive data

- *Dimensions (mm):* 1000 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H 590 x L575 x W575
- *Nature of the Products:* tighthead drums
- *Description of Primary Pack:* 4 metal Tighthead drums Strap CB 65 cordstrap
2 drumclips DC 18 A red
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

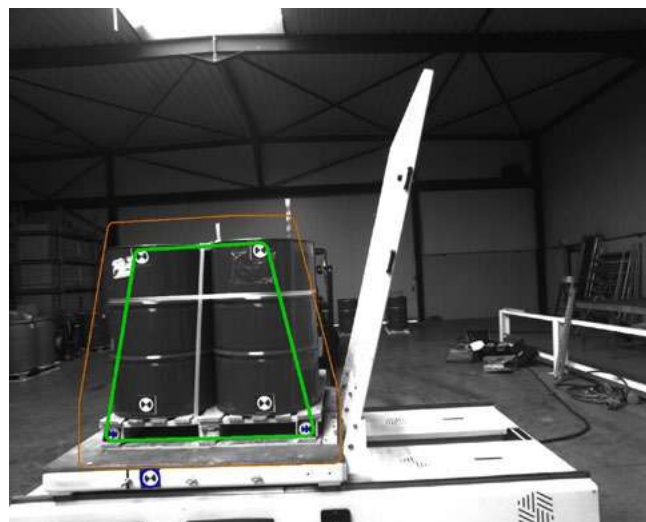
3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference TH DC 18 A 2 A 2	Revision 01
			

2. Test related data



2.1. Orientation of the test: Length

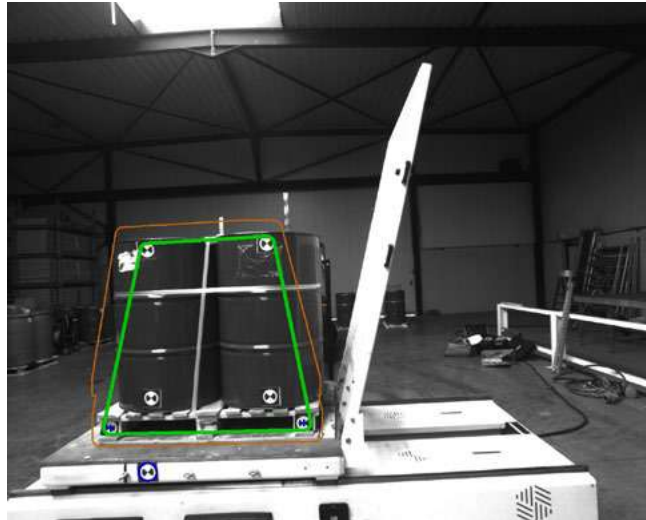
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.80G
- *Testing History:* non



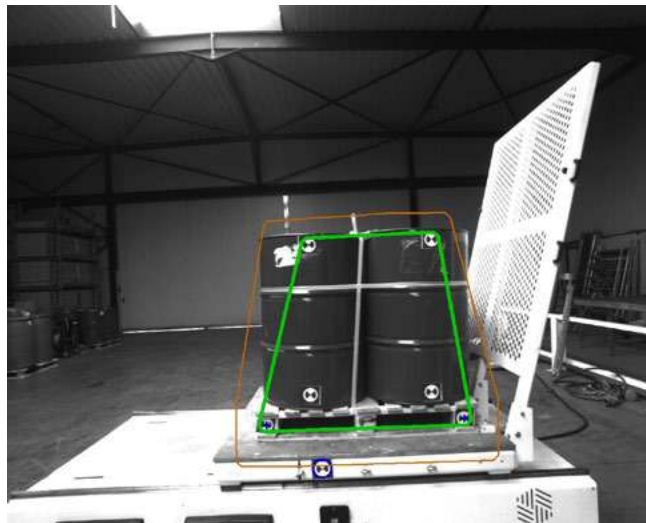
Load Before Test

3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference TH DC 18 A 2 A 2	Revision 01
			





Permanent Deformation



Max Elastic Deformation

3. Tight head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing / lashing services Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference TH DC 18 A 2 A 2	Revision 01
			 EUMOS 40 509

3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*



4. Open head UN200 litre drum

Drums with an open head (UN200 litre drums) can be recognised by an open top edge that can be closed with a loose lid and a sealing ring (see Figure 14). The DRUMCLIP DC19B GREEN has been designed for these drums.



Figure 14: UN200 litre open head drum

4.1 DRUMCLIP DC19B GREEN

DRUMCLIP DC19B GREEN is a plastic tool that should be used for open head UN200 litre drums. The DRUMCLIP DC19B GREEN can also be used for securing Plastic drums (see Chapter 5) to pallets (not for use of plastic drums during transport). Figures 15, 16, 17 and 18 below show the use of DRUMCLIP DC19B GREEN on an open head UN200 litre drum.



Figure 15: DRUMCLIP DC19B GREEN between 2 open head UN200 litre drums

4. Open head UN200 litre drum



Figure 16: DRUMCLIP DC19B GREEN secured with Cordstrap CC65 & CB6S strap



Figure 17: DRUMCLIP DC19B GREEN secured with Signode Tenax T2220 Polyester strap



Figure 18: DRUMCLIP DC19B GREEN secured with universal lashing strap.

4. Open head UN200 litre drum

4.2 Technical information DRUMCLIP DC19B GREEN

The DRUMCLIP DC19B GREEN is made of a glass-fibre reinforced plastic base material mixed with a green dye. The ambient temperature at which the Drumclip may be used lies between -10°C and $+50^{\circ}\text{C}$. The technical specifications are shown in Figures 19a and 19b. Each Drumclip can be recognised by the text:

Geba Innovations BV
 Chr. Huygenstraat 3
 3261 LR Oud-Beijerland
 Produced in The Netherlands
 Product: DRUMCLIP B
 Art. Nr: DC19B

Each Drumclip has a unique article number that can be found under the text. The Drumclip can be used for a maximum of two years after production. Therefore, there is a production date on every Drumclip. The Drumclip is certified for 2 years after the production date. Once these 2 years have passed, the Drumclip may no longer be used. The date stamp is shown in the following location in Figure 20.

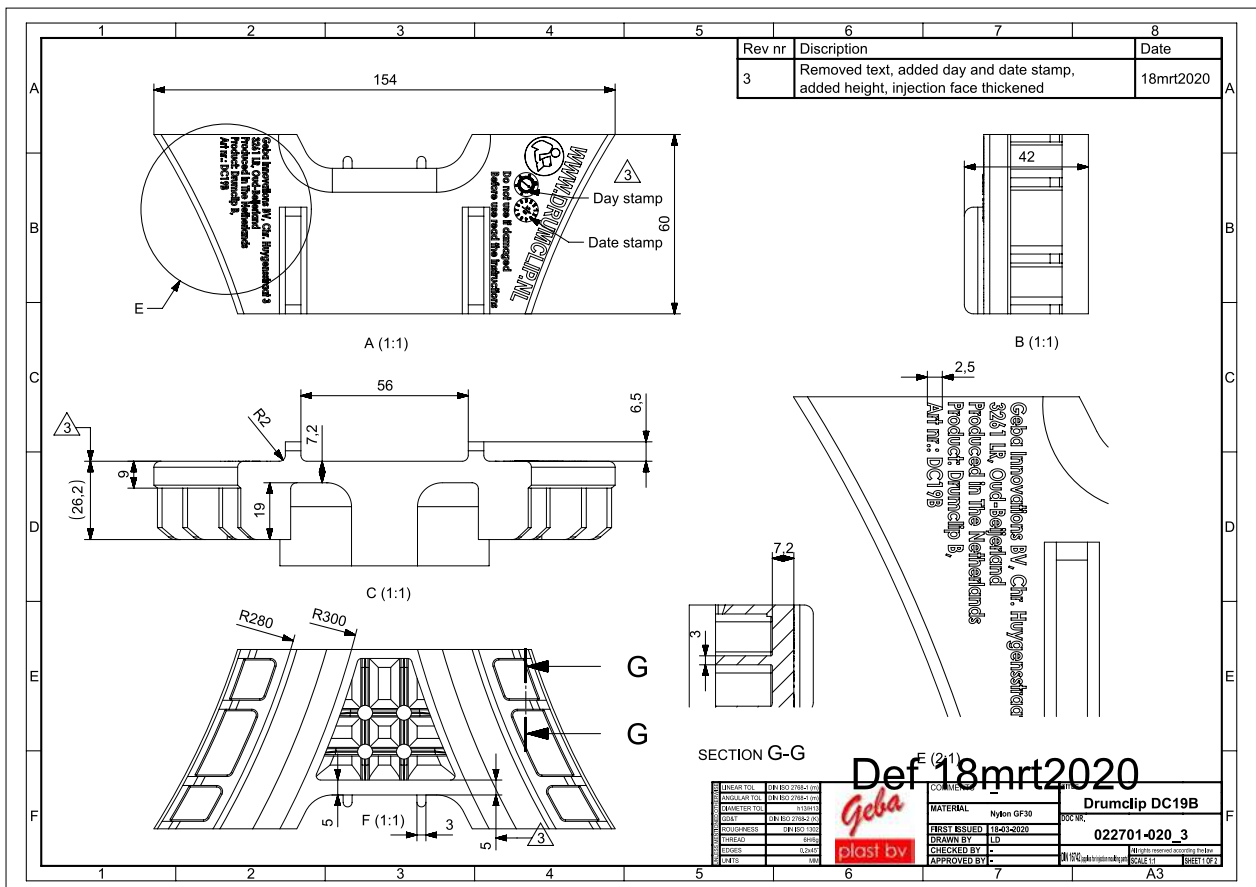


Figure 19a: 2D drawing DRUMCLIP DC19B GREEN

4. Open head UN200 litre drum

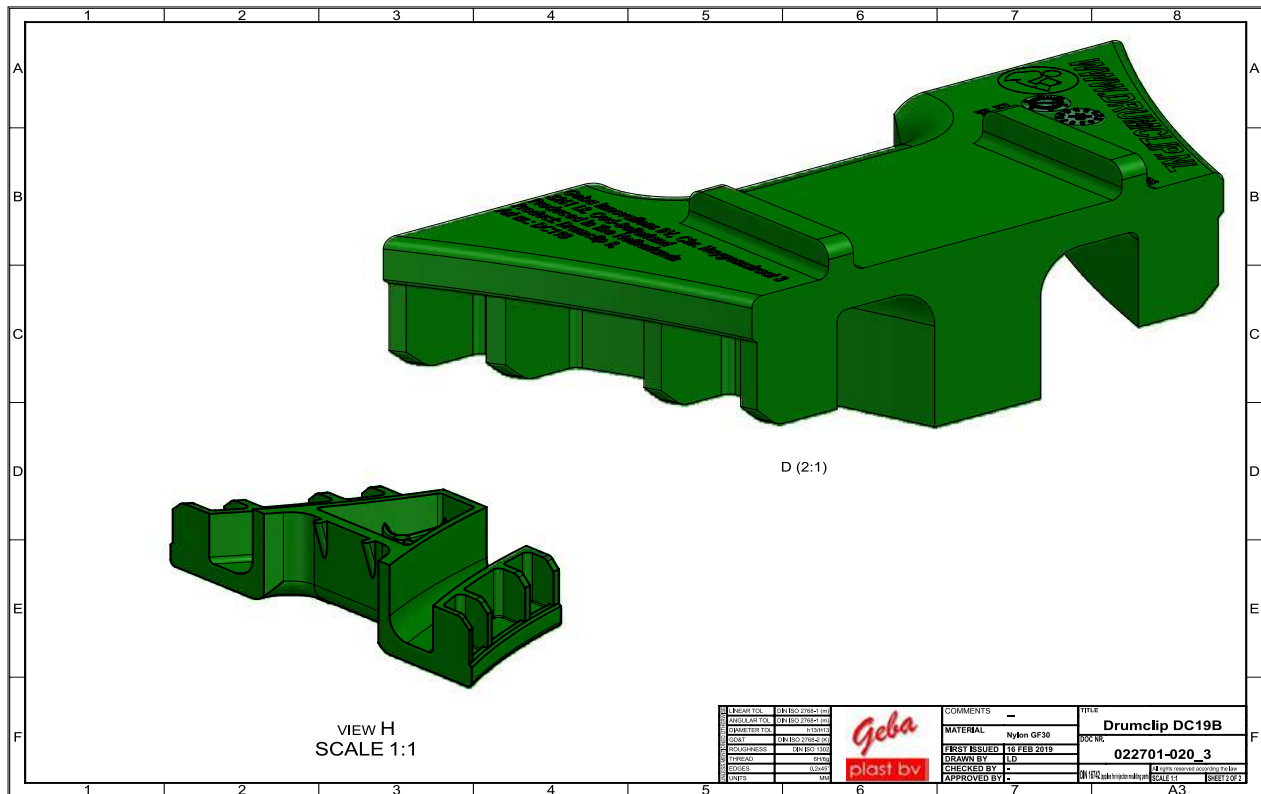


Figure 19b: Isometric view DRUMCLIP DC19B GREEN



Figure 20: Stamp production date DC19B GREEN

4. Open head UN200 litre drum

4.3 Certification DRUMCLIP DC19B GREEN

4.3.1 DIN EN 12195-1 | Load securing

The Drumclip has been tested by TÜV Rheinland, in accordance with DIN EN 12642 Annex B for the guidelines according to load securing DIN EN 12195-1. The certificate can be found in Figure 21a, b and c. The complete test report can be found in Section 4.6 Test report TÜV Rheinland | DRUMCLIP DC19B GREEN.

4. Open head UN200 litre drum

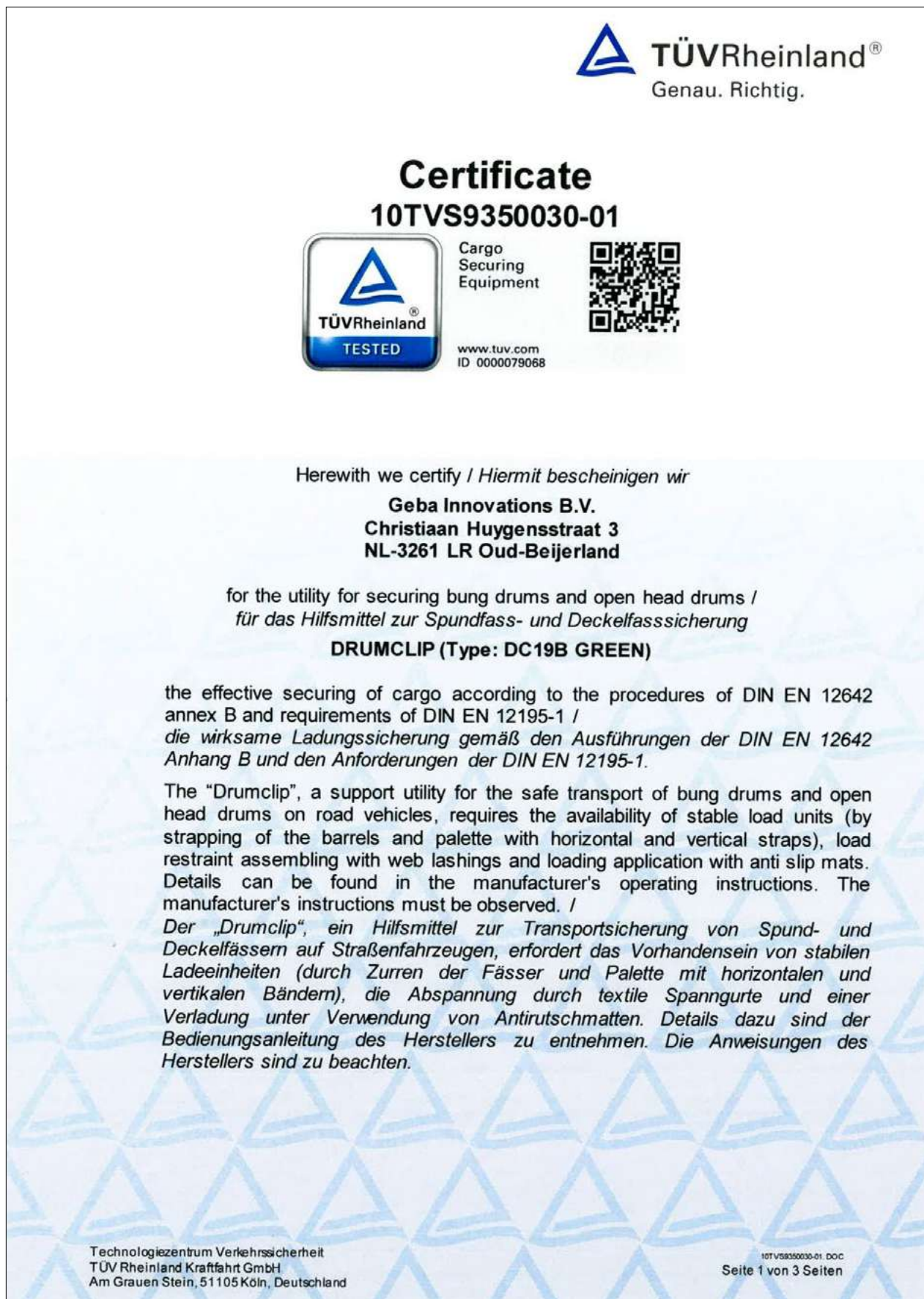



Figure 21a


4. Open head UN200 litre drum



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Certificate

10TVS9350030-01




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Technologiezentrum Verkehrssicherheit
TÜV Rheinland Kraftfahrt GmbH
Am Grauen Stein, 51105 Köln, Deutschland

10TVS9350030-01.DOC
Seite 2 von 3 Seiten

Figure 21b

4. Open head UN200 litre drum

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Genau. Richtig.

Certificate

10TVS9350030-01



Cargo
Securing
Equipment



www.tuv.com
ID 0000079068

The product has been tested by TÜV Rheinland Kraftfahrt GmbH for its suitability as a load securing aid. In addition to the basically required driving dynamics tests, tests were also carried out on mechanical safety, ageing resistance, pollutant content and completeness and comprehensibility of the instructions for use.

Furthermore, the manufacture of the product is subject to annual monitoring by TÜV Rheinland LGA Product GmbH /
Das Produkt wurde durch die TÜV Rheinland Kraftfahrt GmbH auf seine Eignung als Ladungssicherungshilfsmittel getestet. Dazu wurden neben den grundsätzlich erforderlichen fahrdynamischen Prüfungen zusätzlich Prüfungen zu mechanischer Sicherheit, Alterungsbeständigkeit, Schadstoffinhalt und Vollständigkeit & Verständlichkeit der Gebrauchsanleitung durchgeführt. Weiterhin unterliegt die Fertigung des Produktes einer jährlichen Überwachung durch die TÜV Rheinland LGA Produkte GmbH.

The test results are documented in the following reports / *Die Prüfergebnisse sind in folgenden Berichten dokumentiert: 205XS0164-01 (TRK), 40-2021-02-000563-G001 (FUI TRLP).*

This certificate is valid until / *Dieses Zertifikat ist gültig bis: 18.03.2025*

Cologne, March 22nd, 2022 / Köln, 22. März 2022



Uwe Ziegler
Head of Department
EG/ECE FMVSS
Mobility



Thomas Husemann
Head of Department
Vehicle and Component Testing
Mobility

Technologiezentrum Verkehrssicherheit
TÜV Rheinland Kraftfahrt GmbH
Am Grauen Stein, 51105 Köln, Deutschland

10TVS9350030-01.DOC
Seite 3 von 3 Seiten

4. Open head UN200 litre drum

4.3.2. ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safety

The Drumclip is certified for pallet stability, in accordance with ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe. There is a choice of Signode or Cordstrap. With both types of straps, the Drumclip is DIN EN 12195-1, ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe certified. The complete test reports can be found in Chapter 4.7 Test report ISTA | DRUMCLIP DC19B GREEN and Chapter 4.8 Test report EUMOS | DRUMCLIP DC19B GREEN.

ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe	Signode	(Figure 22a)
Item	Description	Specifications
Pallet type	CP-g	Chemicals Pallet, 1140x1140x156mm.
Drums	Open head UN200	4 Pieces
Straps	Signode Tenax 2220 Strapping	Polyester width 19mm, thickness: 0.89mm 1x horizontal, 1x vertical (2 in total)
Machine setting	Signode BXT3-19	2500 N
Type of Drumclip	DC19B	2 pieces

ISTA 3 E Palletstabiliteit en EUMOS 40509 Transportveilig	Cordstrap	(Figuur 22b)
Item	Description	Specifications
Pallet type	CP-g	Chemical Pallet, 1140x1140x156mm.
Drums	Open head UN200	4 Pieces
Straps	Cordstrap CC65	Polyester width: 19mm, thickness: 0.97mm 1x horizontal, 1x vertical (2 in total)
Buckle	CB6S	Galvanised steel (2 pieces)
Machine setting	CT25	see specifications Cordstrap Figure 24
Type of Drumclip	DC19B	2 pieces



Figure 22a



Figure 22b

4. Open head UN200 litre drum

4.4 Requirements DRUMCLIP DC19B GREEN

The certification DIN EN 12195-1 Load securing, ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe of the DRUMCLIP DC19B GREEN was obtained in combination with both Signode and Cordstrap supplies. See also Chapter 2 Applications.

4.4.1 Signode

Signode's requirements for meeting the above certifications are:

- Signode Tenax T2220 Polyester straps (Figure 23a)
- Signode BXT3 – 19 strapping machine (Figure 23b)




				
Tenax 2220 (19*0,89)				
PRODUCT DATA SHEET				
<p>This is to certify that the product supplied by us is manufactured according to quality procedures in compliance with ISO 9001, ISO14001, EN 13891 and EN 13394. Made of 100% of recycled PET</p> <p>Produced in Netherlands</p>				
Product description	Product designation:	Tenax 2220 (19*0,89)		
	Item code:	670273		
	Material type:	Polyester		
	Production technology:	Strand		
	Surface:	Flat		
	Colour:	Green		
Strap properties		Minimum	Nominal	Maximum
	Width (mm):	18.4	19	19.6
	Thickness (mm):	0.84	0.89	0.94
	Elongation (%):	10		15
	Break Strength (daN):	675	750	
Coils details	Coil Type:	standard		
	Coil Inside Diameter (mm):	408		
	Coil Outside Diameter (mm):	610		
	Coil Width (mm):	153		
	Net Coil Weight (kg):	24.684		
	Meters per coil:	1100		
Pallet details	Package Dimensions (LxWxH):	1200 x 1200 x 1100		
	Number of Coils per Pallet:	24		
	Approx. Gross Weight per Pallet (kg):	646		
Date of issue: 19/02/2020				

Figure 23a

4. Open head UN200 litre drum



Technical Data Sheet BXT3-19



Strapping tool		BXT3-19
Operation mode		auto / semi / manual
Tension force range	Standard	1300 – 4500N (290 – 1000 lbf)
	Soft	400 – 1600 (90 – 340 lbf)
Variable tension speed range		0 – 120 mm/s (4,7 in/s)
Weight (incl. battery)		4,3 kg (9,5 lb)
Dimensions (L x W x H)		370 x 143 x 135 mm
		15.5" x 5.6" x 5.3"
Working temperature		-10°C to +40°C (14-104 °F)
Relative humidity		up to 90%
Battery / Charger		
Charger type		Bosch
Battery charger voltage		100 or 110 or 230 V
Charging time		25-35 min.
Battery type		Bosch Li-ion 18V, 4.0 Ah
Cycles per battery charge		
- Low tension		800
- Medium tension		500
- High tension		300
Strap		
Strap		PET (Polyester) PP (Polypropylene)
Width		15-16, 18-19 mm (5/8", 3/4")
Thickness		0,8-1,3 mm (.031"-0.51")
Features		
Real time indication of applied tension force		✓
Variable tension speed		✓
Favorite strapping function		✓
Display color indication for tool status information		✓
Strap alignment indication		✓
Strap dust blow out vent		✓
Battery protection		✓
0-Tension welding		✓



Figure 23b

4. Open head UN200 litre drum

4.4.2 Cordstrap

The Cordstrap supplies required to meet the above certifications are:

- Cordstrap CC65 & CB6S (Figure 24)





Specifications Cordstrap Composite Strapping Solution: CC65 & CB6

Performance Specifications	
Performance System (strap & buckle) System Breaking Strength*	900 daN / 2025 lbf
Performance Strap Linear Breaking Strength*	625 daN / 1405 lbf
Elongation	<7%
Elongation at Break	11% - 17%
Certification	German Lloyd

Strap Specifications	
Dimensions Width*	19mm / 3/4"
Thickness*	0,97 mm / 1/32"
Material	High tenacity polyester filament yarn and Homopolymer Polypropylene
Coil Length per Coil**	500 m / 1640 ft
Core Diameter	200 mm / 8"
Packaging Carton Box Dimensions*	2 coils per box 390 x 390 x 354 mm / 15.3/8" x 15.3/8" x 14"
Box Weight*	20 kg / 44 lbs
Product Code	7266000
Pallet Box Dimensions*	30 coils per box 1181 x 781 x 890 mm / 46.9" x 31.1" x 35"
Box Weight*	296 kg / 653 lbs
Product Code	7266900

Buckle Specifications	
Dimensions Width*	19 mm / 3/4"
Material	Galvanized steel wire
Packaging Carton Box** Dimensions*	500 pieces per box 266 x 166 x 272 mm / 10.1/2" x 6.5/8" x 8.5/8"
Box Weight*	9 kg / 20 lbs
Product Code	7354500



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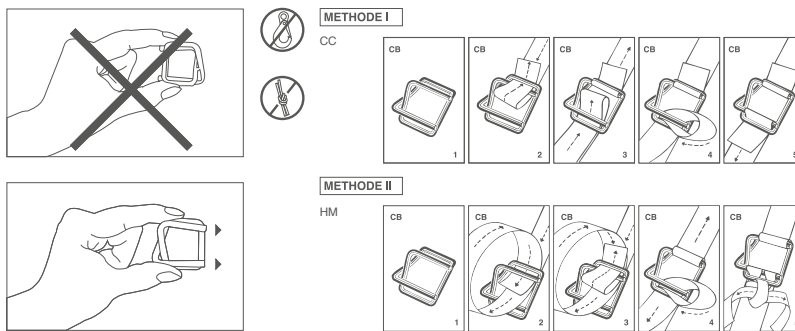
Continued product development



Training at Cordstrap Training Centers

Quality assurance

Figure 24 - page 1

4. Open head UN200 litre drum







Recommended Tensioner(s)	
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,3 kg / 2.9 lbs 7514000
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CTT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,4 kg / 3.1 lbs 7514600
Accessories	
Coil Dispenser with Buckle Tray Product Code Portable Version Product Code Static Version	7538000 7544000
Edge Protection	Different types and sizes available. Your Cordstrap cargo securing specialist can advise you about the best Edge Protection for your application.
Pallet Needle Product Code	7551000

*Tolerance of +/- 10%
**Tolerance of +/- 2%

We recommend storing all Cordstrap Products in a cool dry environment out of direct sunlight and between 5°C and 25°C / 41°F and 77°F

All information provided is based on accuracy at time of creation



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Continued product development

Training at Cordstrap Training Centers

Quality assurance

Figure 24 - page 2

4. Open head UN200 litre drum

4.5 Operating Instructions DRUMCLIP DC19B GREEN

Main steps to be taken before using the Drumclip.

- Check the Drumclip for any damages.
- Check the production date on the upper side of the Drumclip. The Drumclip must not be used for more than 2 years after the production date.
- The Drumclip may be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks with a gross weight of 3,500 kg or more.
- Drumclips must be stored in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.
- The maximum temperature at which the Drumclip can be used is -10C Degrees Celsius + 50 Degrees Celsius.

There are 2 operating instructions DRUMCLIP DC19B GREEN including a step-by-step plan.

- Figure 25a is the operating instruction in combination with Signode Tenax T2220
- Figure 25b is the operating instruction in combination with Cordstrap CC65 &CB6S

The operation instructions must always be followed.

4. Open head UN200 litre drum



Operating Instructions DC19B GREEN for open head drums in combination with Signode

Operating Instructions DRUMCLIP DC19B GREEN

In combination with two Signode Tennax T2220 (19x0.89mm) straps.

The DRUMCLIP DC19B GREEN is an innovative tool that makes it **safer** and **easier** to secure 200-litre open head drums to a pallet and/or trailer, without the use of additional pallets or other equipment. The DC19B has been tested with a 0.8g brake delay in combination with a strap (Signode Tenax 2220). This solution is DIN EN 12195-1, ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe certified. This combination can be used for transport and pallet stabilisation of UN 200 litre open head drums on pallets.

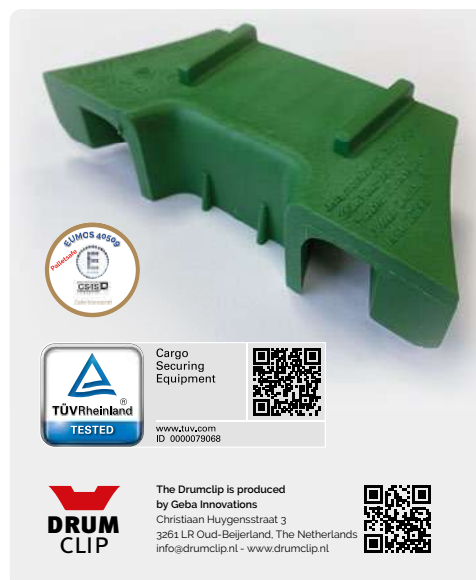
Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks of 3.500 kg or more.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1

Place four drums on a wooden pallet.

Place two Drumclips opposite each other between two drums with the wide side facing outwards. Use two Signode Tenax T2220 straps. One strap is stretched horizontally in the middle of the drums. The other strap is stretched vertically across the two Drumclips and under the pallet. Both straps should be tensioned with a force of 2500 N. Do this with each pallet of drums to be transported.



4. Open head UN200 litre drum



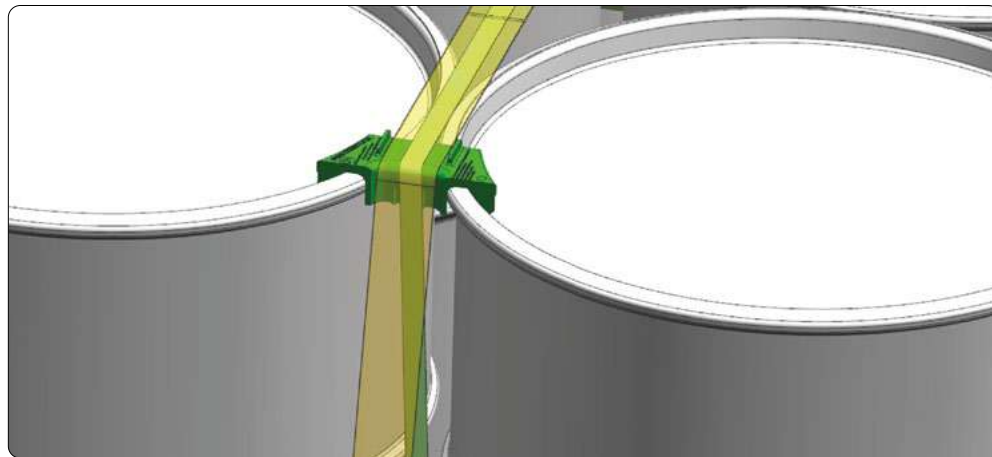
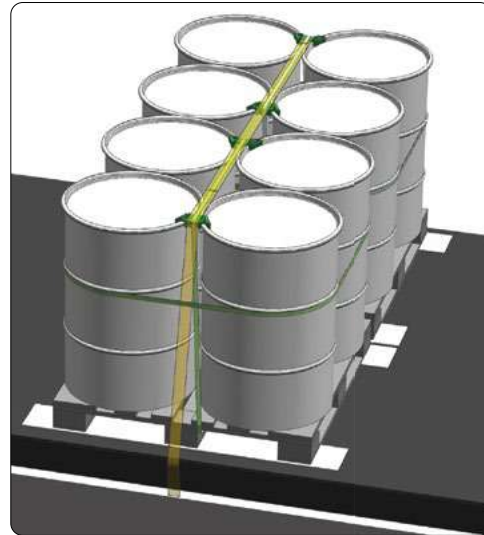
Operating Instructions DC19B GREEN for open head drums in combination with Signode

Step 2

Place the pallets of drums (with a forklift truck) on the trailer (in single or double rows) in such a way that the Drumclips are visible at the side of the trailer (the tension strap will be put on these later). Place the pallets on anti-slip mats that have a minimum friction resistance of 0.6u.

Step 3

Use a lashing strap with a minimum StF value of 350 DaN for a double row of drums. In this way, drums can be secured as shown in the illustration. Consult the guidelines for the lashing strap here. Place the strap across the drums and the Drumclips, so that the strap is between the strap guides of the Drumclips. Make sure the strap is not twisted. The strap should be placed on both sides of the vehicle under the horizontal strap that goes around the drums.



Step 4

Then attach the strap hooks to the anchor points on the vehicle. Use an ergo ratchet and a strap (50mm LC=2,500 daN) to secure the drum pallets to the vehicle. Lead the strap into the ergo ratchet and hand-tension with a force of SHF daN (50 kilograms). The strap should be at a 90-degree angle to the direction of travel and attached to the vehicle in line with the Drumclips.

4. Open head UN200 litre drum



Operating Instructions DC19B GREEN for open head drums in combination with Cordstrap

Equipment

For DIN EN 121295-1 load securing, four DRUMCLIP DC19B GREEN, three Cordstrap CC65 Composite Strapping (19mm; ¾") and three CB 6S Buckle (19mm; ¾") are required.

For ISTA 3E Pallet Stability, two DRUMCLIP DC19B GREEN, two Cordstrap CC65 Composite Strapping (19mm; ¾") and two CB 6S Buckle (19mm; ¾") are required.

The DRUMCLIP DC19B GREEN is an innovative tool that makes it **safer** and **easier** to secure 200-litre open head drums on a pallet and/or trailer, without the use of additional pallets or other equipment. The DC19B has been tested with a 0.8g brake delay in combination with straps (Cordstrap CC65 Composite Strapping + CB 6S Buckle). This solution is certified DIN EN 12195-1, ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe. This combination can be used for transport and pallet stabilisation of UN 200 litre open head drums on pallets.

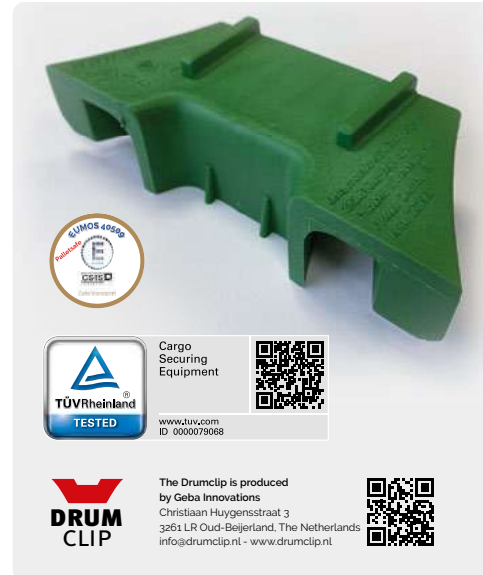
Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks of 3.500 kg or more.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1 (ISTA 3 E Pallet Stability and EUMOS 40509)

Place four 200-litre open head drums on a wooden pallet.

Place two Drumclips opposite each other on the outside of the drums with the wide side facing outwards. Each Drumclip is positioned between two drums. Use two Cordstrap CC 65 Composite Strapping and two CB 6S Buckles. One strap is stretched horizontally around



the drums. The other strap is stretched vertically across the Drumclips and under the pallet. The Buckle is used to connect the straps. Make sure that the position of the Buckle is not on the outside of the trailer or on top of the drums. For the correct positioning of the Buckle and the tension of the straps we recommend consulting Cordstrap's strapping instructions. Now the pallet is certified according to ISTA 3E Pallet Stability and EUMOS 40509. The above step should be carried out for each pallet with drums.



4. Open head UN200 litre drum



Operating Instructions DC19B GREEN for open head drums in combination with Cordstrap

Step 2

Add two Drumclips crosswise of the ones placed in Step 1 and tighten the Cordstrap strap and buckle vertically over the Drumclips and under the pallet as described in Step 1.

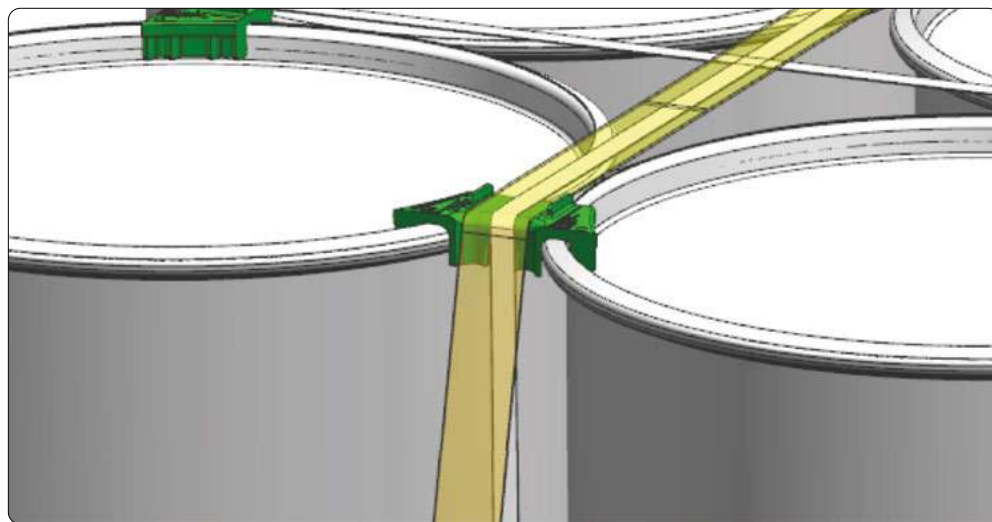
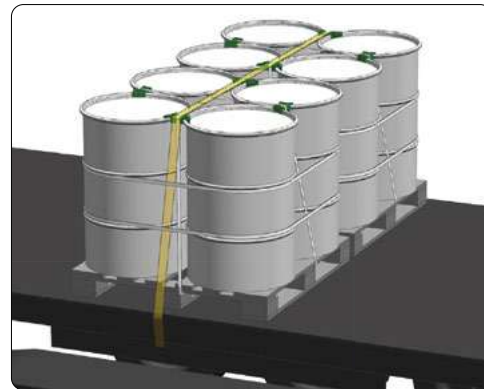
Step 3

Place the pallets with drums (with the forklift truck) in the trailer (in single or double rows). Place the pallets on anti-slip mats with a minimum friction of 0.6 Mu.

Step 4

Use a lashing strap with a minimum StF value 350 DaN for a double row of drums. In this way, drums can be secured as shown in the illustration. Please refer to the guidelines of the securing strap. Place the strap across the drums and the Drumclips, so that the strap is between the strap guides of the Drumclip. Make sure the strap is not twisted. The strap

should be placed on both sides of the vehicle under the horizontal strap that goes around the drums.



Step 5

Then attach the strap hooks to the anchor points on the vehicle. Use an ergo ratchet and a strap (50mm LC=2,500 daN) to secure the drum pallets to the vehicle.

Feed the strap into the ergo ratchet and hand-tension with a force of SHF daN (50 kilograms).

The strap should be at a 90-degree angle to the direction of travel and attached to the vehicle in line with the Drumclips. Now the pallet load is certified according to DIN EN 12195-1 load securing.

4. Open head UN200 litre drum

4.6 Test Report TÜV Rheinland | DRUMCLIP DC19B GREEN

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Technischer Bericht: 205XS0164-00
/ Technical Report

**„Beurteilung der Eignung eines Ladungssicherungskonzepts
für den Transport von Stahlfässern – fahrdynamische Untersuchungen“**
*/ Assessment of the suitability of a load securing concept
for the transport of steel drums - vehicle dynamics investigations*

September / September 2020

Auftraggeber / Client:
Fa. InVaGo BVBA,
NL-3261 PB Oud Beijerland

Bearbeitung / Handling:
TÜV Rheinland Kraftfahrt GmbH
Technologiezentrum
Verkehrssicherheit (TVS)
Typprüfstelle Fahrzeuge/Fahrzeugteile
Am Grauen Stein
51105 Köln

Dieser Technische Bericht dient ausschließlich der Dokumentation von Prüfergebnissen
/ This technical report is intended exclusively for the documentation of test results.

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ *Technical Report*



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

1. **Allgemeine Angaben / General information**

- 1.1. Technischer Bericht / *Technical report* : 205XS0164-00
- 1.2. Bauteil / *Component* : Drumclip
- 1.3. Typ / *Type* : DC19B GREEN
- 1.4. Prüfgrundlage / *Test basis* : in Anlehnung an DIN EN 12195-1 (Stand: 11/2010)
Beurteilung der Eignung eines Beladungssicherungskonzepts für den Transport von Stahlfässern –
fahr-dynamische Untersuchung / *following DIN EN 12195-1 (2010-11) Assessment of the suitability of a load securing concept for the transport of steel drums - a vehicle dynamics study*
- 1.5. Auftraggeber / *Client* : InVaGo BV
Poortlaan 6
NL-3261 PB Oud Beijerland
- 1.6. Prüflabor / *Testing laboratory* : TÜV Rheinland Krafftahrt GmbH
Technologiezentrum Verkehrssicherheit
Typprüfstelle Fahrzeuge/Fahrzeugteile
Am Grauen Stein
D - 51105 Köln
- 1.7. Antrag vom / *Application from* : Juni 2020
- 1.8. Prüfmuster eingegangen am / *Test sample received on* : entfällt / *not applicable*
- 1.9. Art der Prüfmuster / *Type of test sample* : Drumclip, Typ DC19B GREEN
- 1.10. Kennzeichnung / *Marking* : www.drumclip.nl
- 1.11. Prüfdatum / *Test date* : 13. Juni 2020, Rotterdam
- 1.12. Prüfort / *Test location* : C. Steinweg-Handelsveem BV
Theemsweg 26
NL-3197 KM Botlek Rotterdam
Haven 5111

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

2. Prüfungen / Tests

2.1. Allgemeines / General information

Auf Wunsch des Auftraggebers wurde eine weitere Ausführung der Fasssicherung Drumclip des Typs DC19B GREEN im Fahrversuch auf ihre Eignung als Hilfsmittel zur Ladungssicherung untersucht. Folgend ist ein Drumclip des Typs DC19B GREEN dargestellt /

At the customer's request a further type of drum securing device Drumclip type DC19B GREEN was tested in a driving test to determine its suitability as a load securing aid. In the following a Drumclip type DC19B GREEN is shown.



Drumclip DC19B GREEN (verschiedene Ansichten) / Drumclip DC19B GREEN (different views)

2.1.1. Anforderungen an die einzusetzenden Ladungssicherungsmittel / Requirements for the load securing equipment to be used

Für die Prüfungen wurden Spundfässer mit der UN Zulassung 1A1/X1.6/250 mit einem Fassungsvermögen von ca. 216 l und Stahl-Deckelfässer mit den UN Zulassungen 1A2/Y1.5/150 für Flüssigstoffe sowie 1A2/X420/S für Feststoffe mit einem Fassungsvermögen von ca. 212 l verwendet. Jeweils vier gleiche Fässer wurden auf einer Holzpalette 1.200 x 1.200 mm² abgestellt. Die Fässer wurden entweder maschinell mit Straps (Spannkraft jeweils 2.500 N) oder händisch mit Cordstrap® (Spannkraft jeweils 2.000 N) umspannt. Die Umspannung erfolgte horizontal und vertikal. Durch die vertikale Umspannung wurden Ladeeinheiten aus Fässern und Palette gebildet. Die Fässer der Ladeeinheit wurden mit Drumclips des Typs DC19B GREEN verbunden, um die vertikalen Umspannungen zu ermöglichen. Die Spezifikation des Straps sowie des Umreifungsgerätes sind Anlage 1 und die Spezifikationen des Cordstrap®, des Cordstrap-Verschlusses und des Spanngeräts sind Anlage 2 zu entnehmen. Folgend ist eine Ladeeinheit aus Fässern und Palette mit Drumclips auf den äußeren Fässern für die vertikale Umspannung dargestellt / *For the tests, bung drums with UN approval 1A1/X1.6/250 with a capacity of approx. 216 l and steel lid drums with UN approvals 1A2/Y1.5/150 for liquids and 1A2/X420/S for solids with a capacity of approx. 212 l were used. Four identical drums each were placed on a wooden pallet 1,200 x 1,200 mm². The drums were either mechanically strapped with straps (tension force 2,500 N each) or manually with Cordstrap® (tension force 2,000 N each). The strapping was applied horizontally and vertically. The vertical strapping formed load units of drums and pallet. The drums of the load unit were connected with Drumclips type DC19B GREEN to enable the vertical strapping to be applied. The specification the specifications of strap and strapping tool can be found in Annex 1 and the specifications of the Cordstrap®, the cordstrap fastener and the tensioner in Annex 2. In the following a load unit of drums and pallet with Drumclips on the outermost drums for the vertical strapping is shown.*

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Ladeeinheit mit Drumclips außen auf den Fässern /
Load unit with Drumclips on the outer side of the drums

Die Fässer waren gleichmäßig mit Wasser befüllt. Das Gesamtgewicht je Ladeeinheit mit Spundfässern betrug 800 kg und je Ladeeinheit mit Stahl-Deckelfässer 624 kg. Zwischen Trailerboden und Palette wurde Antirutschmaterial ($\mu \geq 0,6$) eingesetzt. Zwei nebeneinander positionierte Ladeeinheiten mit denselben Fässern wurden mit einer Ratsche (STF = 500 daN) und einem Spanngurt (LC = 2.500 daN) niedergezurrt. Der Spanngurt verlief mittig über die äußeren beiden Drumclips der Ladereihe, senkrecht nach unten und unterhalb der horizontalen Straps oder Cordstrap® / The drums were evenly filled with water. The total weight per loading unit with bung drums was 800 kg and per loading unit with open head drums 624 kg. Anti-slip material ($\mu \geq 0.6$) was used between the trailer floor and the pallet. Two load units positioned next to each other with the same drums were lashed down with a ratchet (STF = 500 daN) and a tension belt (LC = 2,500 daN). The lashing belt ran centrally over the outer Drumclips of the loading row and vertically downwards behind the horizontal straps or Cordstrap®.

2.1.2. Beladungen / Loads

Insgesamt wurden 3 verschiedene Sicherungsvarianten untersucht, die nachfolgend beschrieben sind / A total of 3 different securing variants were tested, which are described in the following.

Variante 1 / Variant 1:

- 4 Spundfässer, maschinell mit einem horizontalen und einem vertikalen Strap umspannt (Spannkraft jeweils 2.500 N), auf einer Palette. Durch den vertikalen Strap bilden die Fässer und die Palette eine Ladeeinheit / 4 bung drums, mechanically strapped with a horizontal and a vertical strap (tension force 2,500 N each), on a pallet. Due to the vertical strap, the drums and the pallet form one load unit.
- die jeweils äußeren beiden Fässer einer Ladeeinheit sind durch einen Drumclip verbunden (zwei Drumclips pro Ladeeinheit - diese sind notwendig, um den vertikalen Strap um die Ladeeinheit zu spannen) / The two outermost drums of each load unit are connected by a Drumclip (two drum clips per load unit - these are necessary to tighten the vertical strap around the load unit).
- 2 Ladeeinheiten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 load units with anti-slip material beneath ($\mu \geq 0.6$) side by side.
- die Fassreihe wurde mit einer Ratsche (STF = 500 daN) und einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und hinter

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

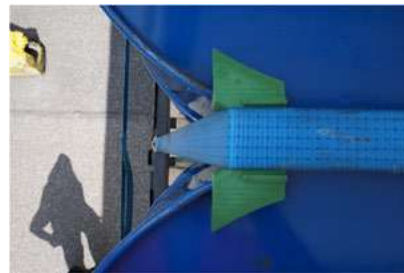


Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

dem horizontalen Strap (kontaktlos) vertikal nach unten / *The row of drums was lashed down with a ratchet (STF = 500 daN) and a lashing belt (Lc = 2,500 daN), the belt ran centrally over the outer Drumclips and vertically downwards behind the horizontal strap (contactless).*



Horizontaler und vertikaler Strap,
Spanngurt hinter dem horizontalen Strap /
*Horizontal and vertical strap,
lashing belt behind the horizontal strap*



Spanngurt mittig auf äußeren Drumclip,
Spanngurt hinter dem horizontalen Strap /
*Lashing belt centered on outer drum clip,
lashing belt behind the horizontal strap*



Zwei Drumclips pro Ladeinheit /
Two Drumclips per load unit



Detailansicht zwei Drumclips pro Ladeinheit /
Detailed view of two Drumclips per load unit

Variante 2 / Variant 2:

- 4 Stahl-Deckelfässer, maschinell mit einem horizontalen und einem vertikalen Strap umspannt (Spannkraft jeweils 2.500 N), auf einer Palette. Durch den vertikalen Strap bilden die Fässer und die Palette eine Ladeinheit / *4 open head drums, mechanically strapped with a horizontal and a vertical strap (tension force 2,500 N each), on a pallet. Due to the vertical strap, the drums and the pallet form one load unit.*
- die jeweils äußeren beiden Fässer einer Ladeinheit sind durch einen Drumclip verbunden (zwei Drumclips pro Ladeinheit - diese sind notwendig, um den vertikalen Strap um die Ladeinheit zu spannen) / *The two outermost drums of each load unit are connected by a Drumclip (two drum clips per load unit - these are necessary to tighten the vertical strap around the load unit).*
- 2 Ladeinheiten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / *2 load units with anti-slip material beneath ($\mu \geq 0.6$) side by side.*
- die Fassreihe wurde mit einer Ratsche (STF = 500 daN) und einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und hinter dem horizontalen Strap (kontaktlos) vertikal nach unten / *The row of drums was lashed down with a ratchet (STF = 500 daN) and a lashing belt (Lc = 2,500 daN), the belt ran centrally over the outer Drumclips and vertically downwards behind the horizontal strap (contactless).*

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Horizontaler und vertikaler Strap,
Spanngurt hinter dem horizontalen Strap /
Horizontal and vertical strap,
lashing belt behind the horizontal strap



Zwei Drumclips pro Ladeinheit /
Two Drumclips per load unit

Variante 3 / Variant 3:

- 4 Stahl-Deckelfässer, händisch mit einem horizontalen und zwei vertikalen Cordstrap® umspannt (Spannkraft jeweils 2.000 N), auf einer Palette. Durch die vertikalen Cordstrap® bilden die Fässer und die Palette eine Ladeinheit / 4 open head drums, manually strapped with a horizontal and two vertical Cordstrap® (tension force 2,000 N each), on a pallet. Due to the vertical cordsstraps, the drums and the pallet form one load unit.
- die jeweils äußeren beiden Fässer einer Ladeinheit sind durch einen Drumclip verbunden (vier Drumclips pro Ladeinheit - diese sind notwendig, um die beiden vertikalen Cordstrap® um die Ladeinheit zu spannen) / The two outermost drums of each load unit are connected by a Drumclip (four drum clips per load unit - these are necessary to tighten the two vertical Cordstrap® around the load unit).
- Der Cordstrap-Verschluss darf die anderen Cordstrap®, den Spanngurt und die Fässer nicht berühren und muss dementsprechend positioniert werden (um Beschädigungen zu vermeiden) / The cordstrap fastener is not to contact the other Cordstrap®, the lashing belt and the drums and must be positioned accordingly (to prevent damage).
- 2 Ladeinheiten mit unterlegtem Antirutschmaterial ($\mu \geq 0,6$) nebeneinander / 2 load units with anti-slip material beneath ($\mu \geq 0.6$) side by side.
- die Fassreihe wurde mit einer Ratsche (STF = 500 daN) und einem Spanngurt (LC = 2.500 daN) niedergezurrt, der Gurt verlief mittig über die äußeren Drumclips und hinter dem horizontalen Cordstrap® (kontaktlos) vertikal nach unten / The row of drums was lashed down with a ratchet (STF = 500 daN) and a lashing belt (Lc = 2,500 daN), the belt ran centrally over the outer Drumclips and vertically downwards behind the horizontal Cordstrap® (contactless).

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Horizontaler und vertikaler Cordstrap®,
Spanngurt hinter dem horizontalen
Cordstrap® / Horizontal and vertical
Cordstrap®, lashing belt behind the
horizontal Cordstrap®



Vier Drumclips pro Ladeeinheit /
Four Drumclips per load unit



Cordstrap-Verschlüsse kontaktlos positioniert /
Cordstrap fasteners positioned without contact

2.1.3. Prüfkräfte / Test forces

Als Prüfgrundlage wurde die DIN EN 12195-1 „Berechnung von Sicherungskräften“ herangezogen. In Kapitel 4.2 der Norm sind als Beschleunigungsbeiwerte für nicht kippfährdete Transportmittel für Fahrzeuge ab 3.500 kg die folgenden Werte zu finden / *DIN EN 12195-1 "Calculation of securing forces" was used as the test basis. In Chapter 4.2 of the standard, the following values can be found as acceleration coefficients for non-tilt-endangered means of transport for vehicles from 3,500 kg upwards:*

Sichern in <i>Securing for</i>	Beschleunigungsbeiwerte / <i>Acceleration coefficients</i>			
	a_x		a_y	a_z
	Nach vorne <i>To the front</i>	Nach hinten <i>To the rear</i>	Nur Rutschen <i>Sliding only</i>	Nach unten <i>Downwards</i>
Längsrichtung <i>Longitudinal direction</i>	0,8	0,5	./.	./.
Querrichtung <i>Transverse direction</i>	./.	./.	0,5	./.
Vertikal	./.	./.	./.	1,0

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report



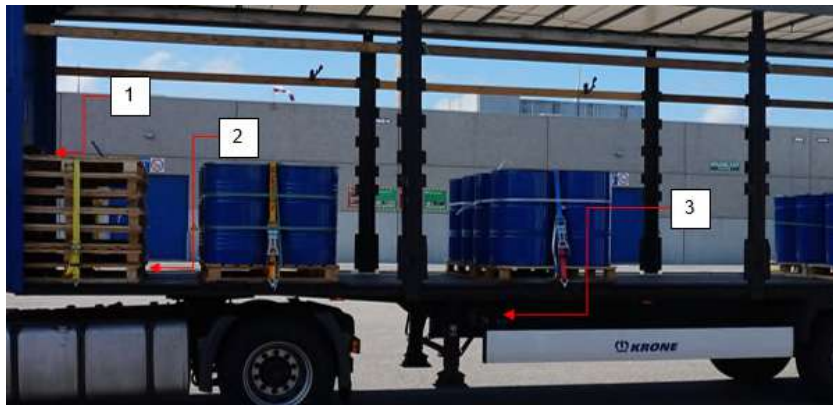
Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

Übersicht zu den Beschleunigungsbeiwerten / Overview of the acceleration coefficients

Diese europäische Norm gilt nicht für Fahrzeuge mit einem Gesamtgewicht bis einschließlich 3.500 kg, da bei diesen höhere Beschleunigungen auftreten können /
This European standard does not apply to vehicles with a total weight of up to and including 3,500 kg, as these vehicles may have higher accelerations.

2.1.4. Messinstrumente / Measuring instruments

Die Beschleunigungs- und die Verzögerungswerte wurden unabhängig voneinander durch zwei verschiedenen Messeinrichtungen des TÜV Rheinland Kraftfahrt GmbH (TRK) gemessen. Die eine Messeinrichtung umfasst zwei Beschleunigungssensoren, einen Universalverstärker und die Software Catman. Die andere Messeinrichtung umfasst eine VBOX 3i mit einem dazugehörigen Beschleunigungssensor. Folgend sind die Positionen der Beschleunigungssensoren dargestellt / *The acceleration and deceleration values were measured independantly by two different measuring devices of TÜV Rheinland Kraftfahrt GmbH (TRK). The one measuring device comprises two acceleration sensors, a universal amplifier and the Catman software. The other measuring device comprises a VBOX 3i with an associated acceleration sensor. In the following the positions of the accelerometers are shown*



Positionen der Beschleunigungssensoren / *Positions of the acceleration sensors:*

2.2. Prüfergebnisse / Test results

Im Folgenden sind die einzelnen Ergebnisse und Auffälligkeiten der Versuche dargestellt. Weitere Bilder sowie Filme zu den einzelnen Versuchen sind in Anlage 4 (USB-Datenträger) zu finden / *The individual results and peculiarities of the tests are presented below. Further pictures and films of the individual tests can be found in Appendix 4 (USB-stick).*

2.2.1. Fahrversuch Bremsen / Driving test braking

Versuch 1 / Test 1:

Das Fahrzeug war mit Variante 3 (Stahl-Deckelfässer) und 1 (Spundfässer) beladen. Es war geplant, das Fahrzeug aus einer Geschwindigkeit von ca. 40 km/h mit maximaler Verzögerung bis zum Stillstand abzubremsen. Es konnte keine Längsverzögerung von $\geq 0,8g$ über eine Zeitspanne von ≥ 80 ms erreicht werden.

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

Deshalb war eine Beurteilung anhand des Versuches nicht möglich /
The vehicle was loaded with variant 3 (open head drums) and 1 (bung drums). It was planned to brake the vehicle from a speed of approx. 40 km/h with maximum deceleration to a standstill. No longitudinal deceleration of $\geq 0.8 g$ over a period of $\geq 80 ms$ could be achieved. Therefore, an assessment based on the test was not possible.

Versuch 2 / Test 2:

Das Fahrzeug war mit Variante 2, 3 (jeweils Stahl-Deckelfässer) und 1 (Spundfässer) beladen. Es konnte eine Längsverzögerung von $\geq 0,8 g$ über eine Zeitspanne von $\geq 80 ms$ erreicht werden. Es wurde keine Verschiebung der Beladung festgestellt. Die Positionen der Drumclips, Straps, Cordstrap® und der Spanngurte wiesen keine Veränderung auf /
The vehicle was loaded with variant 2, 3 (each open head drums) and 1 (bung drums). A longitudinal deceleration of $\geq 0.8 g$ over a period of $\geq 80 ms$ was achieved. No shift of the load was detected. The positions of the Drumclips, straps, Cordstrap® and the lashing belt were not changed.

Versuch 3 / Test 3:

Das Fahrzeug war mit Variante 2, 3 (jeweils Stahl-Deckelfässer) und 1 (Spundfässer) beladen. Es konnte eine Längsverzögerung von $\geq 0,8 g$ über eine Zeitspanne von $\geq 80 ms$ erreicht werden. Es wurde keine Verschiebung der Beladung festgestellt. Die Positionen der Drumclips, Straps, Cordstrap® und der Spanngurte wiesen keine Veränderung auf /
The vehicle was loaded with variant 2, 3 (each open head drums) and 1 (bung drums). A longitudinal deceleration of $\geq 0.8 g$ over a period of $\geq 80 ms$ was achieved. No shift of the load was detected. The positions of the Drumclips, straps, Cordstrap® and the lashing belt were not changed.

Versuch 4 / Test 4:

Das Fahrzeug war mit Variante 2, 3 (jeweils Stahl-Deckelfässer) und 1 (Spundfässer) beladen. Es konnte eine Längsverzögerung von $\geq 0,8 g$ über eine Zeitspanne von $\geq 80 ms$ erreicht werden. Es wurde keine Verschiebung der Beladung festgestellt. Die Positionen der Drumclips, Straps, Cordstrap® und der Spanngurte wiesen keine Veränderung auf /
The vehicle was loaded with variant 2, 3 (each open head drums) and 1 (bung drums). A longitudinal deceleration of $\geq 0.8 g$ over a period of $\geq 80 ms$ was achieved. No shift of the load was detected. The positions of the Drumclips, straps, Cordstrap® and the lashing belt were not changed.

2.2.2. Fahrversuch Kreisfahrt / Driving test circular drive

Bei Kreisfahrten sind die Belastungen auf den Drumclip vergleichbar mit denen des Drumclips DC18A RED (siehe Bericht 195XS0017-03). Die Beladung verhielt sich bei den Kreisfahrten des Drumclips DC18A RED vollkommen neutral. Deshalb konnte von weiteren Kreisfahrten abgesehen werden / *In circular driving tests the loads on the Drumclip are comparable to those on the DC18A RED Drumclip (see report 195XS0017-03). The load on the Drumclip DC18A RED was completely neutral during the circular driving test of the Drumclip DC18A RED. Therefore it was possible to do without further circular driving test.*

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

Nachfolgend sind die im Fahrversuch gemessenen Werte zusammengefasst dargestellt:

Fahrmanöver	Sicherungsvarianten	$v \geq 40$ km/h	$t_{a \geq 0,8g} \geq 80$ ms [Ja / Nein] (TÜV)	Ergebnis	Bemerkung
Versuch 1 Bremsung	1 3	erfüllt	nicht erfüllt	keine Wertung	$t_{a \geq 0,8g}$ zu kurz
Versuch 2 Bremsung	1 2 3	erfüllt	erfüllt	positiv	./.
Versuch 3 Bremsung	1 2 3	erfüllt	erfüllt	positiv	Ein Peak unterhalb 0,8 g
Versuch 4 Bremsung	1 2 3	erfüllt	erfüllt	positiv	Ein Peak unterhalb 0,8 g

Übersicht der Fahrdynamischen Anforderungen und Ergebnisse

The values measured in the driving test are summarized below.

Driving manoeuvres	Variants of securing	$v \geq 40$ km/h	$t_{a \geq 0,8g} \geq 80$ ms [Yes / No] (TÜV)	Result	Remark
Test 1 Breaking	1 3	pass	not passed	No assessment	$t_{a \geq 0,8g}$ too short
Test 2 Breaking	1 2 3	pass	passed	positiv	./.
Test 3 Breaking	1 2 3	pass	passed	positiv	One peak below 0.8 g
Test 4 Breaking	1 2 3	pass	passed	positiv	One peak below 0.8 g

Overview of the driving dynamics requirements and results

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



3. Anlagen / annexes

- Anlage / annex 0: Änderungen, 1 Seite
Alterations, 1 page
- Anlage / annex 1: Spezifikation: Strap und Umreifungsmaschine, 2 Seiten /
Specification: Strap and strapping machin, 2 pages
- Anlage / annex 2: Spezifikation: Cordstrap®, Cordstrap-Verschluss und Spanngerät, 2 Seiten
Specifikation: Cordstrap®, cordstrap fastener and tensioner, 2 pages
- Anlage / annex 3: Technische Zeichnung (Drumclip, Typ DC19B GREEN), 2 Seiten
Technical drawing (Drumclip, type DC19B GREEN), 2 pages
- Anlage / annex 4: USB-Stick (Fotos, Filme, Messwerte, Technischer Bericht), 1 Seite /
USB-stick (photos, films, measurements, Technical Report), 1 page

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

4. Zusammenfassung / Summary

Auf Wunsch des Auftraggebers wurde eine neue Ausführung DC19B GREEN der Fasssicherung „Drumclip“ in verschiedenen Versuchsreihen auf ihre Eignung zur Ladungssicherung untersucht.

Diese Art der Sicherung erforderte für **Spundfässer** das Vorhandensein von:

- stabilen Ladeeinheiten
 - durch maschinelles Umspannen der Spundfässer mit einem horizontalen und einem vertikalen Strap (Spannkraft jeweils 2.500 N), um eine Einbeziehung der Palette in die Ladeeinheit zu gewährleisten, die Spezifikationen des Straps und des Umreifungsgerätes sind Anlage 1 zu entnehmen,
Hinweis: wegen des vertikalen Straps sind zwei Fasssicherungen pro Ladeeinheit zu verwenden!
- einer Verladung unter Verwendung von Antirutschmatten ($\mu \geq 0,6$),
- jeweils eine Ratsche mit einer normalen Handkraft von 500 daN und einem Spanngurt mit einer Belastbarkeit von 2.500 daN,
- eine Abspannung des Gurtes nach unten unter 90° zur Fahrtrichtung.
Hinweis: ein Spanngurtverlauf mit Kontakt zum horizontalen Strap ist unzulässig!

Diese Art der Sicherung erforderte für **Stahl-Deckelfässer** das Vorhandensein von:

- stabilen Ladeeinheiten
 - durch maschinelles Umspannen der Stahl-Deckelfässer mit einem horizontalen und einem vertikalen Strap (Spannkraft jeweils 2.500 N), um eine Einbeziehung der Palette in die Ladeeinheit zu gewährleisten, die Spezifikationen des Straps und des Umreifungsgerätes sind Anlage 1 zu entnehmen,
Hinweis: wegen des vertikalen Straps sind zwei Fasssicherungen pro Ladeeinheit zu verwenden!
 - durch händisches Umspannen der Stahl-Deckelfässer mit einem horizontalen und zwei überkreuzte vertikale Cordstrap® (Spannkraft jeweilige 2.000 N), um eine Einbeziehung der Palette in die Ladeeinheit zu gewährleisten, die Spezifikationen des Cordstrap®, des Cordstars-Verschlusses und des Spanngerätes sind Anlage 2 zu entnehmen,
Hinweis: wegen der zwei vertikalen Cordstrap® sind vier Fasssicherungen pro Ladeeinheit zu verwenden! Der Cordstrap-Verschluss darf die anderen Cordstrap®, den Spanngurt und die Fässer nicht berühren und muss dementsprechend positioniert werden (um Beschädigungen zu vermeiden)!
- einer Verladung unter Verwendung von Antirutschmatten ($\mu \geq 0,6$),
- jeweils einem Spanngurt mit einer Belastbarkeit von 2.500 daN und einer Ratsche mit einer normalen Handkraft von 500 daN,
- eine Abspannung des Gurtes nach unten unter 90° zur Fahrtrichtung.
Hinweis: ein Spanngurtverlauf mit Kontakt zum horizontalen Strap oder Cordstrap® ist unzulässig!

Bei Erfüllung dieser Anforderungen ist ein sicherer Einsatz des Drumclips des Typs DC19B GREEN möglich /

*At the customer's request further type of drum securing device Drumclip type DC19B GREEN was tested in various test series to determine its suitability for load securing. This type of securing required by **bung drums** the presence of:*

- *stable load units*

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

- *by mechanically strapping the bung drums with a horizontal and a vertical strap (tension force 2,500 N each) to ensure that the pallet is included in the loading unit, the specifications of the strap and the strapping device can be found in Annex 1,
Note: Because of the vertical strap, two drum securing devices must be used per loading unit!*
- *using anti-slip mats for loading ($\mu \geq 0.6$),*
- *one lashing belt each with a load capacity of 2,500 daN and a ratchet with a normal hand force of 500 daN,*
- *a belt tensioning downwards at 90° to the direction of travel.
Note: It is not permissible for the lashing belt to run in contact with the horizontal strap!*

*This type of securing required by **open head drums** the presence of:*

- *stable load units*
 - *by mechanically strapping the open head drums with a horizontal and a vertical strap (tension force 2,500 N each) to ensure that the pallet is included in the loading unit, the specifications of the strap and the strapping device can be found in Annex 1,
Note: Because of the vertical strap, two drum securing devices must be used per loading unit!*
 - *by manually strapping the open head drums with one horizontal and two crossed vertical Cordstrap® (tension force 2,000 N each) to ensure that the pallet is included in the loading unit, the specifications of the Cordstrap®, the cordstrap fastener and the tensioner can be found in Annex 2,
Note: Because of the two vertical Cordstrap®, four drum securing devices must be used per loading unit! The cordstrap fastener is not to contact the other Cordstrap®, the lashing belt and the drums and must be positioned accordingly (to prevent damage)!*
- *using anti-slip mats for loading ($\mu \geq 0.6$),*
- *one lashing belt each with a load capacity of 2,500 daN and a ratchet with a normal hand force of 500 daN,*
- *a belt tensioning downwards at 90° to the direction of travel.
Note: It is not permissible for the lashing belt to run in contact with the horizontal strap or Cordstrap®!*

If these requirements are met, Drumclip type DC19B GREEN could be used safely.

Die im Bericht enthaltenen Fotos stellen nur eine Auswahl dar. Die weiteren zu den Versuchen vorhandenen Fotos, Filme und Diagramme wurden dem Kunden elektronisch zur Verfügung gestellt / The photos contained in the report are only a selection. The other photos, films and diagrams available for the tests were made available to the customer electronically.

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ *Technical Report*



Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA

Das geprüfte Ladungssicherungskonzept erfüllt für die dokumentierte Sicherungssituation die Anforderungen der DIN EN 12195-1. Diese europäische Norm gilt nicht für Fahrzeuge mit einem zulässigen Gesamtgewicht bis einschließlich 3.500 kg, da bei diesen durchaus höhere Beschleunigungen auftreten können /

The tested load securing concept fulfils the requirements of DIN EN 12195-1 for the documented securing situation. This European standard does not apply to vehicles with a permissible gross weight of up to and including 3,500 kg, as higher accelerations can occur in these vehicles.

Der Technische Bericht umfasst 14 Seiten sowie die Anlagen 0 bis 4 und darf ohne schriftliche Genehmigung des Prüflaboratoriums nicht auszugsweise vervielfältigt werden. Er verliert seine Gültigkeit, wenn sich die unter Punkt 1.3. genannte Prüfgrundlage ändert /

The Technical Report comprises 14 pages and Annexes 0 to 4 and may not be reproduced in whole or in part without the written permission of the testing laboratory. It loses its validity if the test basis mentioned under point 1.3. changes.

Köln, den 28.09.2020 /
Cologne, 28th of September 2020
hsm

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im Technologiezentrum Verkehrssicherheit
der TÜV Rheinland Kraftfahrt GmbH



Dipl.-Ing. Th. Husemann

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 0

0. Änderungen / Alterations

- 0.1. Es wird berichtigt / *Is corrected* : ---
- 0.2. Es wird geändert / *Is changed* : ---
- 0.3. Es wird hinzugefügt / *Is added* : ---
- 0.4. Es entfällt / *Is not applicable* : ---

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report


Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



TÜVRheinland®
Anlage / Annex 1

Umreifungsgerät / strapping machine

Signode Akku Umreifungsgerät BXT 3-19

				
		BXT3-13 light	BXT3-16 Universal	BXT3-19 Heavy
Strap type		PET + PP	PET + PP	PET + PP
Strap width		9 - 13 mm	13 - 16 mm	16 - 19 mm
Strap thickness		PEI: 0.4 - 0.8 mm; PP: 0.5 - 0.8 mm	0.5 - 1.0 mm	0.8 - 1.3 mm
Weight		3.6 kg	3.8 kg	4.3 kg
Tension force		150 - 1200 N	400 - 2500 N	400 - 4500 N
Variable Tension Speed		0 - 290 mm/s	0 - 220 mm/s	0 - 120 mm/s
Cycles / Charge		up to 800	up to 800	up to 800
Battery		Bosch Li-Ion 18V, 2.0Ah	Bosch Li-Ion 18V, 2.0Ah	Bosch Li-Ion 18V, 4.0Ah
Charging time battery		15 - 30 min	15 - 30 min	25 - 35 min
Motor technology		Single motor technology, brushless	Single motor technology, brushless	Single motor technology, brushless
Dimension (L x W x H)		370 x 141 x 135 mm	370 x 141 x 135 mm	370 x 143 x 135 mm

Quelle / Source: <https://www.signode-bxt.com/en/product/tools/>

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 1

Strap

Strapart / Strap type: Signode Tenax 2220

Material / Material: Polyester

Breite / Width: 19 mm

Dicke / Thickness: 0,89 mm / 0.89 mm

Vorspannung / Pre-tension: 2.500 N / 2,500 N

Verschweißlevel / Welding time level: 4



TENAX®

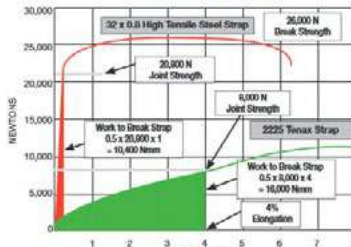
High performance polyester strapping

Technical specification and applications

		Type	Size (mm) Width x Thickness	Strength N	Standard m/coil	Jumbo m/coil	Super Jumbo m/coil
General Duty	1616	8.9 x 0.52	2,000	4,050			
	1716	10.5 x 0.52	2,220	3,350			
	1716	10.5 x 0.61	2,670	2,743			
	1816	11.9 x 0.44	2,220	3,200			
	1818	11.9 x 0.52	2,670	2,743			
	1822	11.9 x 0.71	3,560	1,981			
Heavy Duty	2030	15.62 x 0.76	4,900	1,600	4,400		
	2040	15.62 x 0.89	6,300	1,300	3,800	6,250	
	2080	15.62 x 1.02	7,100	1,200	3,300		
	2220	19.05 x 0.89	7,500	1,100	3,100	5,100	
	2225	19.05 x 1.27	11,100	800	2,200	3,600	
	2480	25 x 1.02	11,500	750	2,100		
	2680	32 x 1.00	14,700	600		2,700	
	2625	32 x 1.27	18,850	450		2,100	

Tenax® strapping load and elongation curves

HIGH TENSILE



Tenax® strapping range head and tool compatibility

	STD/DY	AST	AMT	AMPPT	VFX	VT	EXT	EXT2	EXT2	EXT2-32	MH	AK300/Z.20	Z.32
Operation	M	M	P	P	P	P	B	B	B	B	E	E	E
Seal	50Y	50AD	AMT	50AD	AMT	friction weld							

Tenax® coil specification

Coil	Weight	Coils / Pallet
Standard	25kg	12 or 24
Jumbo	70kg	6
Super Jumbo	115kg	4

4. Open head UN200 litre drum

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Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 2

Cordstrap®, Cordstrap-Verschluss und Spanngerät / Cordstrap®, cordstrap fastener and tensioner

Specifications Cordstrap Composite Strapping Solution: CC65 & CB6

Performance Specifications	
Performance System (strap & buckle) System Breaking Strength*	900 daN / 2025 lbf
Performance Strap Linear Breaking Strength*	625 daN / 1405 lbf
Elongation	<7%
Elongation at Break	11% - 17%
Certification	German Lloyd
Strap Specifications	
Dimensions Width*	19mm / 3/4"
Thickness*	0,97 mm / 1/32"
Material	High tenacity polyester filament yarn and Homopolymer Polypropylene
Coil Length per Coil** Core Diameter	500 m / 1640 ft 200 mm / 8"
Packaging Carton Box Dimensions* Box Weight* Product Code	2 coils per box 390 x 390 x 354 mm / 15.3/8" x 15.3/8" x 14" 20 kg / 44 lbs 7266000
Pallet Box Dimensions* Box Weight* Product Code	30 coils per box 1181 x 781 x 890 mm / 46.9" x 31.1" x 35" 296 kg / 653 lbs 7266900
Buckle Specifications	
Dimensions Width*	19 mm / 3/4"
Material	Galvanized steel wire
Packaging Carton Box** Dimensions* Box Weight* Product Code	500 pieces per box 266 x 166 x 272 mm / 10.1/2" x 6.5/8" x 8.5/8" 9 kg / 20 lbs 7354500

4. Open head UN200 litre drum

TÜV Rheinland Group

Technischer Bericht: 205XS0164-00
/ Technical Report

Bauteil / Component : Drumclip DC19B GREEN
Auftraggeber / Client : InVaGo BVBA



Anlage / Annex 2

Recommended Tensioner(s)	
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32"- 3/64" 1,3 kg / 2.9 lbs 7514000
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CTT25 50 – 550 daN / 110 – 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32"- 3/64" 1,4 kg / 3.1 lbs 7514600
Accessories	
Coil Dispenser with Buckle Tray Product Code Portable Version Product Code Static Version	7538000 7544000
Edge Protection	Different types and sizes available. Your Cordstrap cargo securing specialist can advise you about the best Edge Protection for your application.
Pallet Needle Product Code	7551000
*Tolerance of +/- 10% **Tolerance of +/- 2%	
We recommend storing all Cordstrap Products in a cool dry environment out of direct sunlight and between 5°C and 25°C / 41°F and 77°F	

Spanngerät CT25 / tensioner CT25

Für die Prüfungen wurde das Spanngerät CT25 verwendet. Das Verhältnis der Hebellänge zum Bolzendurchmesser beträgt 10:1, sodass eine Handkraft von 200 N auf den Hebel eine Spannkraft der Cordstrap® von 2.000 N erzeugt. Folgend sind die Längenverhältnisse des Spanngeräts dargestellt / *The tensioner CT25 was used for the tests. The ratio of the lever length to the bolt diameter is 10:1, so a manual force of 200 N on the lever produces a tension force of 2,000 N on the Cordstrap®. In the following the length ratios of the tensioner are shown.*



Bolzendurchmesser / Bolt diameter



Hebellänge / Lever length

4. Open head UN200 litre drum

4.7 Test Report ISTA | DRUMCLIP DC19B GREEN

4.7.1 With Signode

Test Report

IPS 7898-81

ISTA 3E PERFORMANCE TEST

DRUMCLIP DC19B GREEN

with

OPEN HEAD BARREL DRUMS

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IPS Technology is an independent packaging and tooling design agency. Aside from designing IPS also performs research, delivers advice on packaging issues and performs packaging test in its own test facility.

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CHERISHING INDUSTRIAL PRODUCTS 

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Packaging Tooling Testing



4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 2/21

Reference : IPS 7898 - 81
Description : Test Report ISTA 3E Drumclip DC19B Green with Open Head Barrel Drums
Date : August 19. 2019
Author(s) : Marten Ries

Client : Geba Innovations B.V.
Chr. Huygensstraat 3
3261 LR Oud-Beijerland
The Netherlands

Contacts : Wouter Geldhof

Test performed by : Marten Ries
Test Date(s) : August 16. 2019
Test Facility : IPS Technology, Eindhoven The Netherlands
ISTA Certified Testing Laboratory, Member ID: 9778 (Appendix A)

Table of Contents

1. Scope of test.....	3
2. Product Damage Tolerance and Package Degradation Allowance.....	5
3. Test plan.....	6
3.1 Atmospheric Conditioning.....	6
3.2 Shock; horizontal impact 1,2ms.....	7
3.3 Shock; 1st Rotational Edge Drop.....	8
3.4 Compression Test; Machine Apply and Release.....	9
3.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	10
3.6 Shock; 2nd Rotational Edge Drop.....	12
4. Test Results.....	13
4.1 Atmospheric Conditioning.....	13
4.2 Shock; Horizontal Impact.....	13
4.3 Shock; 1 Rotational Edge Drop.....	13
4.4 Compression; Machine Apply and Release.....	13
4.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	13
4.6 Shock; 2nd Rotational Edge Drop.....	14
5. Inspection after test.....	14
6. Conclusions.....	15
Appendix A. ISTA Certified Testing Laboratory.....	16
Appendix B. Test Equipment: Impact Tester.....	17
Appendix C. Test Equipment: Shaker.....	18
Appendix D. Impact speed.....	19
Appendix E. Compression test graph.....	20
Appendix F. Power Spectral Densities Profile.....	21

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4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 3/21

1. Scope of test

The goal of this transport simulation test, performed according to the ISTA 3E-2017 Standard for Unitized Loads, is to validate the capability of the Drumclip system for sufficient load stability subjected to rough mechanical handling; forklift truck handling and warehousing stacking.

Four Standard Open Head Barrel Drums 200L are placed on a pallet and secured with two Drumclips and secured with two polyester lashings.

Securing of the pallets during Full Truckload (FTL) will be done with help of strapping belts and is not in scope of this test.



Figure 1. Test configuration

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4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 4/21

Details of tested configuration:

The tested configuration is built up with components listed below:

Item	Remark
Standard Open Head Barrel Drums 200L. Quantity: 4	Drums fully filled with water. Used condition.
Pallet type: CP-9	Chemie Pallet, 1140x1140x156mm, used condition.
Lashing: Signode Tenax 2040 Strapping. Quantity: 2	Polyester Strapping 16mm, thickness 0,89mm Location of the strapping shown in Figure 1.
Drumclip type: DC19B Green	Quantity used: 2x

Lashing is assembled with Plastic Strapping Handtool: Strapex STB75.

Pre-tension on strapping: 2100N, Weldingtime level: 4

Parameter	Value
Total mass DUT:	853 kg
Dimensions:	Approx. 1170x1170x1030mm (LxWxH).
Sample Numbers to be tested:	1

Remark:

The drums are exceeding the base dimensions of the pallet.

The Tenax strapping will be applied just before the execution of the test program.

Identification of sides (according to ISTA 3E) see Figure 2.



Figure 2. Faces of DUT identified.

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Packaging Tooling Testing



4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 5/21

2. Product Damage Tolerance and Package Degradation Allowance

The product will be tested in the prepared configuration. Replacement of components of DUT is not allowed.

Product Damage Allowance:

During horizontal impact tests the drums will impact the ridged wall of the Horizontal Impact Tester.

The drums are exceeding the dimensions of the pallet base.

It will be expected that damage to the drums cannot be avoided during the execution of these tests.

Damage to the drums caused by these impacts is within the allowance criteria.

Package Degradation Allowance:

During and after the test the integrity of the DUT must be guaranteed.

- All drums are placed on the pallet bottom during and after the execution of the test.
- The forklift truck can interface the pallet during and after the execution of the test.
- The Drumclip is not broken-heavily damaged (validation by Geba Innovations)

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 6/21

3. Test plan

The test plan is based on the ISTA 3E -2017 procedure.

According ISTA 3E the test sequence will be executed as stated in the table below.

<i>Performance Test Schedule</i>	<i>Description</i>	<i>Note</i>
1 st	Atmospheric preconditioning	Ambient level
2 nd	Shock; horizontal impact	1,2 m/s
3 rd	Shock: rotational edge drop	Drop height 150mm
4 th	Compression	Apply and release method
5 th	Vibration: random	Overall Grms= 0.54
6 th	Shock: rotational edge drop	Drop height 150mm

3.1 Atmospheric Conditioning

The sample will be conditioned to ambient laboratory level.

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 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81

Page : 7/21

3.2 Shock; horizontal impact 1,2ms

The DUT will be exposed to horizontal impacts in order and under the conditions as stated in the table below.

Sequence No.	Specific Face	Impact Speed
1	Face 6	1,2 m/s
2	Face 5	1,2 m/s
3	Face 2	1,2 m/s
4	Face 4	1,2 m/s

Horizontal impact testing will be performed with the IPS Technology horizontal impact tester.

Specifications of the horizontal impact tester can be found in Appendix B.



Figure 3. DUT on horizontal impact tester.

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 8/21

3.3 Shock; 1st Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 4. Set-up Rotational Edge Drop Test

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 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81

Page : 9/21

3.4 Compression Test; Machine Apply and Release

The DUT will be exposed to a; 'Machine Apply and Release' compression test according to the ISTA 3E test protocol. For the calculation for compression (Apply and Release method) the formula $AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) (L-1)\} \times 1,4 \times 9,8$ is applicable.

Wt	Total weight of packaged product (Kilograms)	853 Kg	
S	Total number of <u>potential</u> unitized loads in a warehouse stack or a vehicle stack	4	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	35.145 N	= 3.582,6 Kg

The test will be performed with an additional (empty) pallet on top of the DUT. This will be done in order to simulate the reality of stacking load. Figure is showing the compression test setup.



Figure 5. Test set-up Compression Test

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 10/21

3.5 Vibration; ISTA Steel Spring Truck Random Vibration

The DUT will be exposed to a vibration test without compressive load, to simulate transport vibrations. The test is performed under 'loose load' conditions. For the test setup see Figure .

The during of 60minutes will be equivalent to a transport of 480km.

Orientation	Vibration Profile acc.	Duration
Face 3 down (bottom face)	ISTA Steel Spring Truck	60 minutes

Specifications of the vibration test equipment can be found in Appendix C.

The Power Spectral Densities ISTA Steel Spring Truck profile is given in the figure below.

Frequency (Hz)	PSD Level, g ² /Hz
1.0	0.00072
3.0	0.018
4.0	0.018
6.0	0.00072
12.0	0.00072
16.0	0.0036
25.0	0.0036
30.0	0.00072
40.0	0.0036
60.0	0.0036
100.0	0.00036
200.0	0.000018

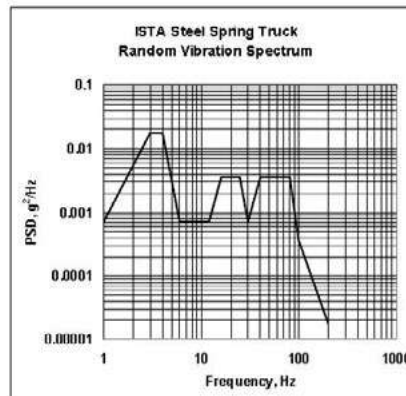


Figure 2. Power Spectral Densities – Steel Spring Truck Random Vibration

4. Open head UN200 litre drum

Reference : IPS 7898 - 81

Page : 11/21



Figure 6. Test setup for vibration test

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 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 12/21

3.6 Shock; 2nd Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 7. Set-up Rotational Edge Drop Test

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 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 13/21

4. Test Results

The tests are executed according to test plan. In the following chapters the test results can be found per test.

4.1 Atmospheric Conditioning

The DUT has been conditioned to ambient laboratory level.



4.2 Shock; Horizontal Impact

The horizontal impact test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. The impact speed is measured at 1,2 m/s. See for the speed graph Appendix D.

4.3 Shock; 1 Rotational Edge Drop

The Rotational Edge Drop Sequence is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence.

4.4 Compression; Machine Apply and Release

The compression test is executed with a higher load, 172kg higher then defined in the test plan. No remarkable event occurred before, during or after the Test Sequence. A screenshot of the compression test is shown in a graph in Appendix E.

4.5 Vibration; ISTA Steel Spring Truck Random Vibration

The vibration test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. A screenshot of the PSD during the test is shown in Appendix F.

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 14/21

4.6 Shock; 2nd Rotational Edge Drop

The Rotational Edge Drop Sequence is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence.

5. Inspection after test

After execution of the complete test cycle no remarkable – unexpected damages to the DUT and its components could be found. The expected damage to the drums could be found only on face 4. The condition of the CP-9 pallet was still in useable condition.



Figure 8. Damage to drum ring; only face 4.

Examination of the condition by personnel of Geba Innovations B.V. of the Drumclips after the test showed no visible damage or wear.

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 15/21

6. Conclusions

The test has been executed according to the test plan.
No remarkable-unexpected events and/or damage has occurred before, during or after the test to the DUT.

The Drumclip system in combination with the defined lashing configuration is fully capable to ensure safe individual pallet mechanical pallet handling and warehouse stacking.

Eindhoven, August 20, 2019

Checked and approved by:



Marten Ries
Sr. Project Engineer



Marijn Sijbers
Test Engineer

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 16/21

Appendix A. ISTA Certified Testing Laboratory




This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778 Valid through: February 1, 2020

Location: Eindhoven, Netherlands

IPS Technology


A.J. Gruber
ISTA President



Eric Hiser
ISTA Vice President - Technical

Figure 9. IPS Technology ISTA Laboratory Certification

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 17/21

Appendix B. Test Equipment: Impact Tester

**Fabrikant**

IPS Technology

Oppervlakte

245x250 cm

Max. productmassa

1300 kg

Opspanning

Horizontaal

Botssnelheden

2-10 km/h

Datalogging

Snelheidsmeetsysteem registreert de snelheid bij botsing

Optioneel

Versnellingsmetingen aan het product met een drie-assige versnellingsopnemer

Normen (o.a.):

ASTM D 5487
ISO 2244

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 18/21

Appendix C. Test Equipment: Shaker



- Manufacturer : Lansmont model 10000 TTV II
- Max. specimen size : 152 x 152 cm
- Max. specimen weight : 2200 kg
- Max. amplitude (peak to peak) : 6,4 cm
- Frequency-range : 3 - 300 Hz
- Frequency-rang at max. load : 3 - 200 Hz
- Acceleration range : 0 - 8 g
- Max. acceleration at max. load : 2 g
- Automatic displacement or acceleration control
- Automatic sweep generator and random vibration facilities (Lansmont TouchTest Vibration system)
- Accelerometer

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 **IPS Technology**
Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 19/21

Appendix D. Impact speed

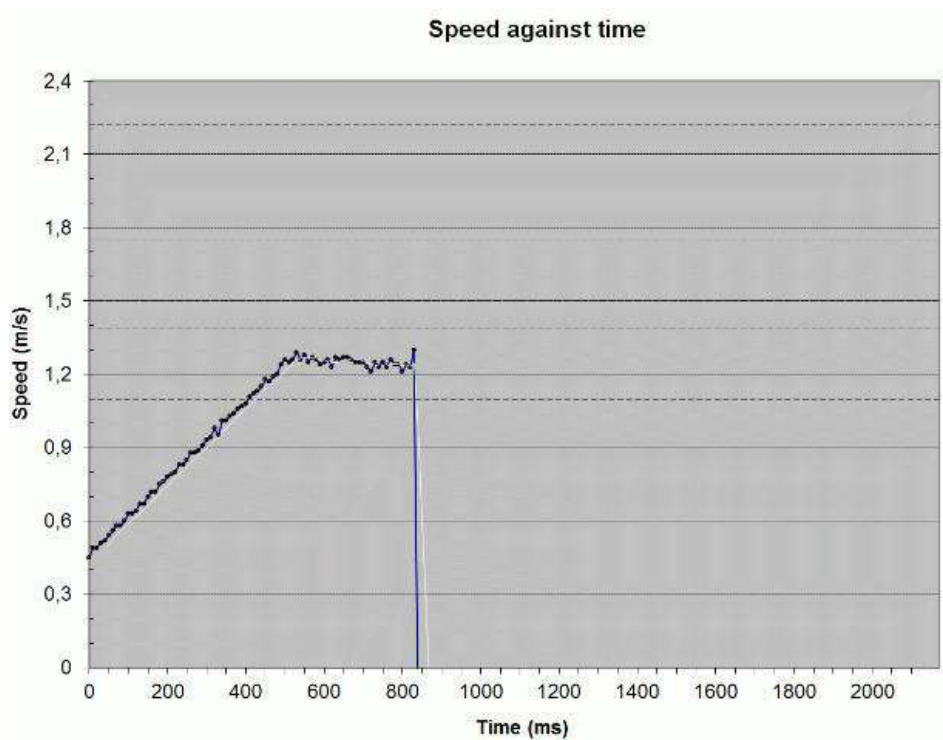


Figure 10. Impact speed >1,2m/s

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 20/21

Appendix E. Compression test graph

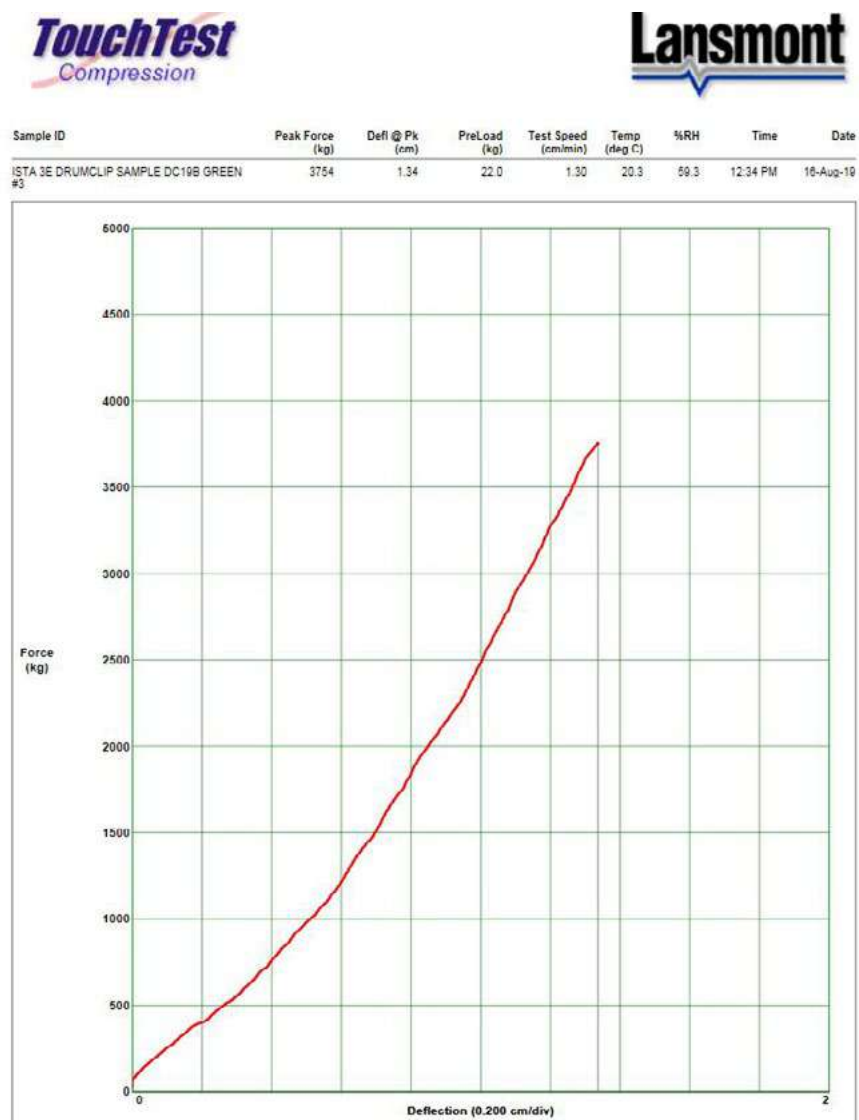


Figure 11. Compression test graph – Apply and release compression test

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Packaging Tooling Testing

4. Open head UN200 litre drum

Reference : IPS 7898 - 81
Page : 21/21

Appendix F. Power Spectral Densities Profile

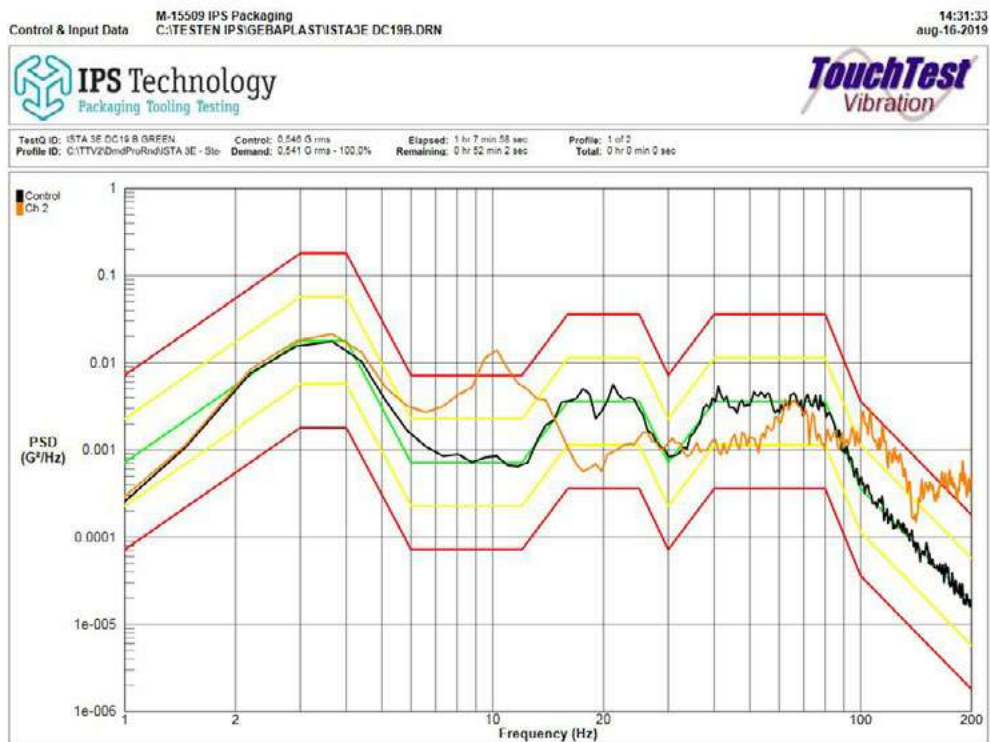


Figure 12. Power Spectral Densities - ISTA Steel Spring Truck Random Vibration; 1 hr 8 min.

Remark: Location accelerometer place on top of Drumclip Ch2. for response monitoring (examination only)

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IPS Technology
Packaging Tooling Testing

4. Open head UN200 litre drum

4.7.2 With Cordstrap



Transport simulation on Metal drums – Cordstrap CC65, CB6S - Drumclip DC19B GREEN

Test Report IPS8858-80 | ISTA-3E₂₀₁₇



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The IPS-report may be released for viewing to relevant parties.

IPS Technology is an independent packaging and tooling design agency. Aside from designing IPS also performs research, delivers advice on packaging issues and performs packaging test in its own test facility.



Test conducted on 24 February 2022

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4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

CUSTOMER INFORMATION

Client: Geba Innovations **ATTN:** Wouter Geldhof
Project name: Transport simulation on metal drums - Cordstrap CC65 and CB65 -
2x Drumclip DC19B GREEN

LAB INFORMATION

Testing Lab: IPS-Technology
Location: Boschdijk 760, 5624 CL Eindhoven, The Netherlands
ISTA Member: ST-9778
Date of Test: 24 February 2022
Test performed by: Otto van den Berg



This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778

Valid through: February 1, 2024

Location: Eindhoven, NB, Netherlands

IPS Technology


A.J. Gruber
ISTA President


Eric Hiser
ISTA Vice President - Technical

4. Open head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRODUCT & PACKAGING INFORMATION

Packed product(s) and packaging description	4 metal drums on a wooden pallet, strapped with Cordstrap CC65 and CB6S and 2x Drumclip DC19B GREEN.
Packed pallet dimension	120 x 120 x 102 [mm]
Packed pallet weight	767 [kg]
Packed pallet degradation allowance	If no conditions are provided by the customer, IPS will adopt a "PPDA" as follows: The packed pallet may show damaging marks, but still needs to bundle, protect and support the content in a functional way.
Product Damage Tolerance	Individual packages and products contained are not within the scope of this test, and are not opened or checked.

CONCLUSIONS

Testing is done according to plan and no incidents occurred during testing.

Pallet is functional, strapping and Drumclips are in place. Drums are bundled, protected and supported as stated in the "PPDA" above.

The package therefore **PASSES** the test.

Eindhoven, 28 February 2022

Test Engineer:
Otto van den Berg

Checked by:
Johan Bruins




4. Open head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

TEST RESULTS

Overview Recommendations

Testing is performed according to plan and without incidents.

Packaging Condition

Packaging is functional after all tests.

Product Condition (if inspected)

Drumclips are undamaged and in the correct position.
Cordstraps are undamaged.

OBSERVATIONS

Items in Grey are not performed. Items in red are not completed.

Test	Value	OBSERVATIONS
BLOCK 1 Temp and Humidity		23°C and 50% Humidity
BLOCK 2 Shock: Horizontal Impact	1.2m/s	
BLOCK 3 Shock: Rotational edge drop	150 mm	
BLOCK 4 Compression: Apply and release	6442 kg	
BLOCK 5 Vibration: Random	1 hours	
BLOCK 6 Shock: Rotational edge drop	150 mm	



Package after testing



Extra

4. Open head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRE-TEST INSPECTION

Product Condition

Drums have some dents. Pallet is undamaged. Drumclips and Cordstraps are new and installed after arrival at IPS testlab.

Packaging Condition before testing

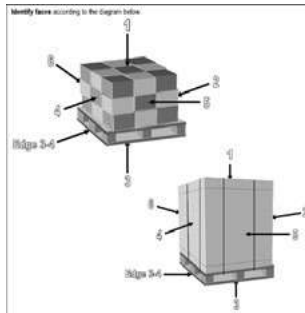
NEW re-packaged with new materials before testing.

Additional Notes

Re-strapping is done by Geba employee with appropriate tools, conform packaging guidelines of Geba.



Package as received



Identification of sides



Pallet re-strapped

4. Open head UN200 litre drum



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

TEST SUMMARY

Described in this test report is a transport simulation test. The goal of this test, performed according the ISTA 3E version 2017 standard for Unitized Loads, is to validate how the packed pallet, and the Cordstrap and Drumclip in particular, handle shocks and vibrations during transport. An engineer of Geba Innovations is present during testing. Before testing, the pallet is re-straped using new Drumclips and new Cordstraps, with the proper tools according the packaging guidelines of Geba. All testing is done without the transport belt over the pallet as prescribed by the Geba packaging guidelines. After the test the pallet, Cordstraps and Drumclips are inspected by engineers of IPS Technology.

Further inspection (done by the customer) is not within the scope of this test report.

The following tests are conducted in sequence:

Items in grey are not performed as agreed by the customer.

Sequence Number	Test category	Test Type	Test Level	For ISTA Certification
1	Atmospheric Preconditioning TEST BLOCK 1	Temperature and Humidity	Ambient	Required
*	Atmospheric Conditioning TEST BLOCK 1	Controlled Temperature and Humidity	Temperature and Humidity chosen from chart	Optional
2	Shock (alternative methods allowed) TEST BLOCK 2	Inclined Impact	1.2 m/s	Required
		Horizontal impact	1.2 m/s	
3	Shock TEST BLOCKS 3	Rotational edge drop	150 mm	Required
4	Compression (alternative methods allowed) TEST BLOCK 4	Apply and release	Truck or Truck & Air dependent	Required
		Apply and hold		
		Weight and load spreader		
5	Vibration BLOCK 5	Random	Overall Grms levels of 0.54	Required
6	Shock TEST BLOCK 6	Rotational edge drop	150 mm	Required

4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ATMOSPHERIC PRECONDITIONING

The package is preconditioned to laboratory ambient temperature and humidity (23°C, 50% RH) for at least 12 hours prior to testing.

SHOCK: HORIZONTAL IMPACT

Rolling floor | water tank counter weight | steel wall

The packed pallet is exposed to horizontal impacts to all four sides. Impact velocity is 1.2 m/s.



Test observations

Drum top edges are overlapping/stacked after tests. Lids or sealing rings are not affected by this.

4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

SHOCK: FIRST ROTATIONAL EDGE DROP

Wooden beam | Wooden block | Rope

Based on the mass of the packed pallet, 767 kg, the drop height is set at 150 mm. During the drop test, the side opposite to the drop side is supported by a timber with a height of 100 mm. Two long edges and a short edge are tested.



Test setup

Test observations

No remarkable events occurred during testing.

4. Open head UN200 litre drum



Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ISTA 3E version 2017

COMPRESSION: APPLY AND RELEASE

Compression tester: Lansmont Corp | Type: 152-50K | Last calibrated/valid until: 20-11-2017/20-11-2020

The packed pallet is exposed to a 'Apply and Release' compression test according to the ISTA 3E test protocol and calculation.

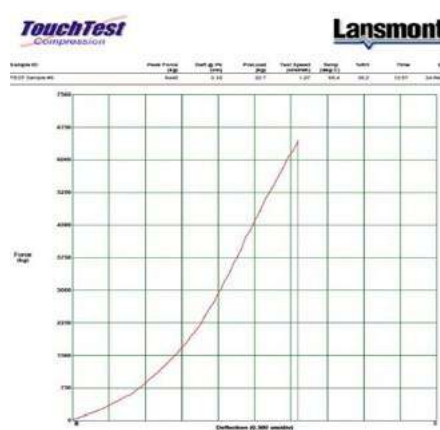
$$AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) \times (L-1)\} \times 1,4 \times 9,8$$

$$AR = \{[767 \times (3-1) + (767/1) \times (1-1)] \times 3 - (767/ 1) \times (1-1)\} \times 1,4 \times 9,8$$

Wt	Total weight of packaged product (Kilograms)	767 Kg	
S	Total number of <u>potential</u> unitized loads in a vehicle stack	3	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	63139 N	= 6442 Kg



Test setup



Test observations

The test is performed with a pallet on top of the packet pallet. This is done in order to simulate a stacking load "footprint" of similar packed pallets.

The package withstood the compression test without problems.

4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

RANDOM VIBRATION: STEEL TRUCK PROFILE

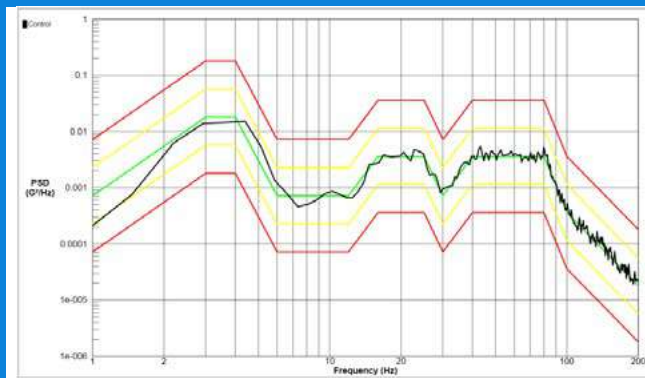
Vibration table: Lansmont Corp. | Type: 10000 TTV | Last calibrated/valid until: 24-11-2020 / 24-11-2023

The packed pallet is placed on the vibration table and is handled as 'loose load' shipment, not attached to the table. This is not in compliance with the Geba packaging guidelines. The duration of 60 minutes is specified by the customer and is equivalent to 480 km truck transport.

Test profile and settings

Frequency (Hz)	PSD Level (g^2/Hz)
1.0	0.00072
3.0	0.018
4.0	0.018
6.0	0.00072
12.0	0.00072
16.0	0.0036
25.0	0.0036
30.0	0.00072
40.0	0.0036
80.0	0.0036
100.0	0.00036
200.0	0.000018

Typical graph of ISTA 3E Steel spring truck Spectrum



Test setup

Test observations

No remarkable events occurred during testing.

4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

SHOCK: SECOND ROTATIONAL EDGE DROP

Wooden beam | wooden block | rope

Test setup similar to first drop test.



Test observations

No remarkable events occurred during testing.

4. Open head UN200 litre drum



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

POST TEST PICTURES

After the test the packaging and the product is photographed to show how the packaging and product endured the testing.



Post test observations

After execution of the complete test cycle no remarkable / unexpected damages to the packed pallet or its components are found. Drums are contained, secured and stable on the pallet.



Recommendations

END OF REPORT

4. Open head UN200 litre drum

4.8 Test Report EUMOS | DRUMCLIP DC19B GREEN

4.8.1 With Signode


Standard EUMOS 40509 - TEST REPORT			
	Customer	Date	
	DRUMCLIP	10-5-2022	
	Project	Reference	Revision
	Drumclip	OH DC 19 B 2 S2	01
			

1. Load unit descriptive data

- *Dimensions (mm):* 1000 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H 600 x L575 x W575
- *Nature of the Products:* Metal drums open head
- *Description of Primary Pack:* 4 metal open head drums SIGNODE 2 Straps 2 drumclips DC 19 B Green
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

EUMOS 40509 - 4 Open head DC19B Signode - page 1

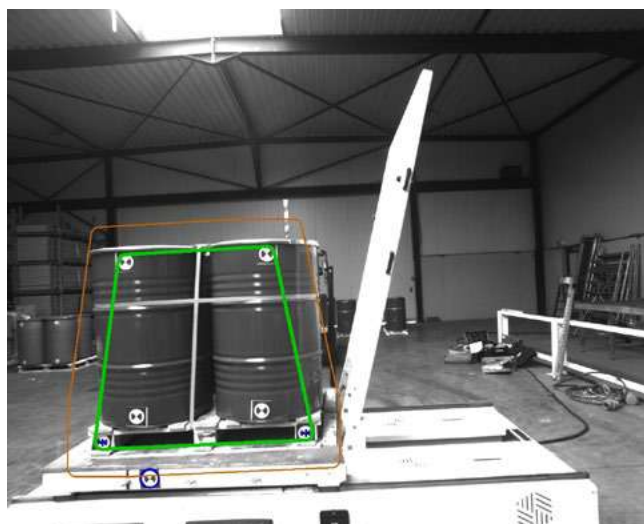
4. Open head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip	Reference OH DC 19 B 2 S2	Revision 01

2. Test related data


2.1. Orientation of the test: Length

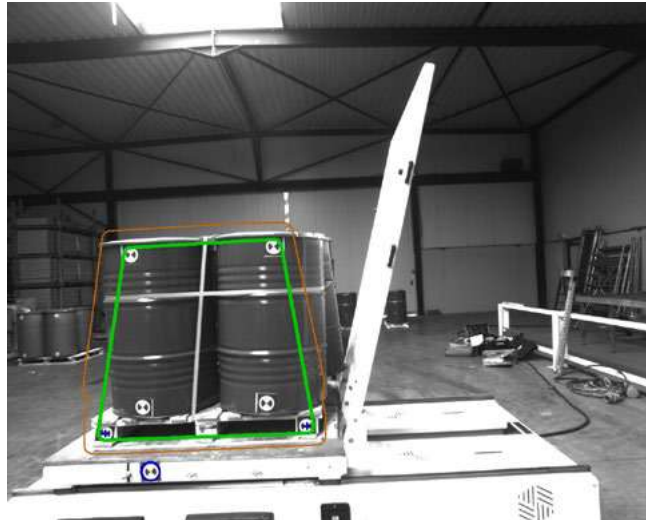
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.70G
- *Testing History:* non



Load Before Test

4. Open head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip	Reference OH DC 19 B 2 S2	Revision 01





Permanent Deformation



Max Elastic Deformation

4. Open head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing • testing • services Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip	Reference OH DC 19 B 2 S2	Revision 01
			 EUMOS 40 509


3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*



4. Open head UN200 litre drum


4.8.2 With Cordstrap

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP		Date 10-5-2022
	Project Drumclip test	Reference oh dc19b green 0.6	Revision 01

1. Load unit descriptive data

- *Dimensions (mm):* 1000 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H 590 x L575 x W575
- *Nature of the Products:* Openhead drums
- *Description of Primary Pack:* 4 metal openhead drums Strap CB 65 cordstrap
2 drumclips DC 19 B Green
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

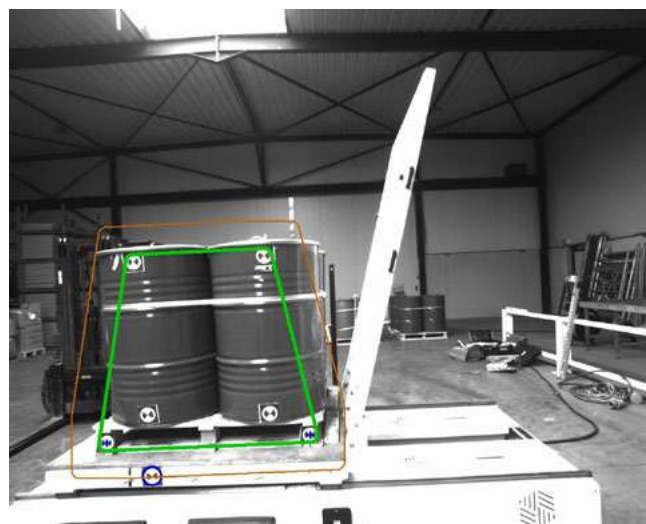
4. Open head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference oh dc19b green 0.6	Revision 01

2. Test related data



2.1. Orientation of the test: Length

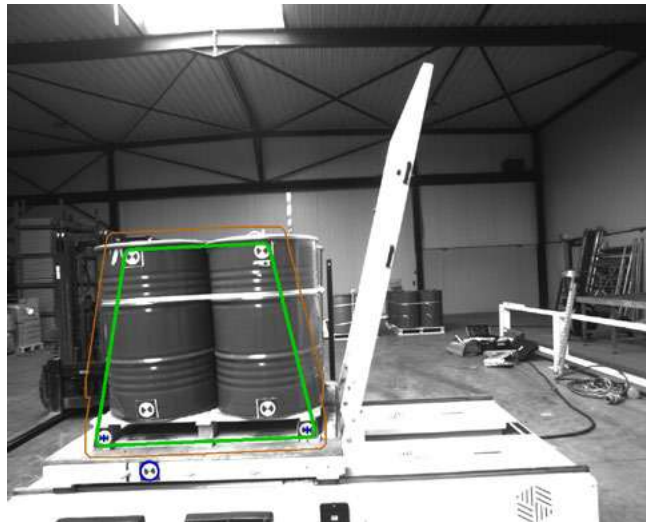
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.60G
- *Testing History:* non



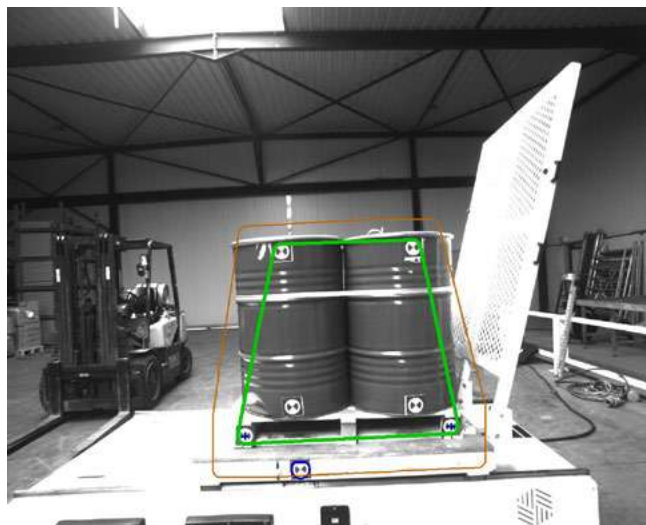
Load Before Test

4. Open head UN200 litre drum

Standard EUMOS 40509 - TEST REPORT			
	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference oh dc19b green 0.6	Revision 01
			





Permanent Deformation



Max Elastic Deformation

4. Open head UN200 litre drum

Standard EUMOS 40509 – TEST REPORT			
 CS-TS LOGISTIC LAB Cargo-Measuring / Weighing / Seals Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference oh dc19b green 0.6	Revision 01
			 EUMOS 40 509

3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*



5. Plastic drums

Plastic drums can be recognised by their closed top with two lockable openings (See Figure 26). DRUMCLIP DC19B GREEN can be used to create pallet stability for these drums. DRUMCLIP DC19B GREEN can be used for pallet stability and transport safety.



Figure 26: Plastic drum

5.1 DRUMCLIP DC19B GREEN

The DRUMCLIP DC19B GREEN is a plastic tool that can be used to secure plastic drums to the pallet. This Drumclip is primarily designed for Openhead UN 200 litre drums (see Chapter 4). The DRUMCLIP DC19B GREEN in combination with plastic drums, is ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe certified. Figure 27, 28 and 29 below show the application of DRUMCLIP DC19B GREEN on a plastic drum.



Figure 27: DRUMCLIP DC19B GREEN secured with Signode Tenax T2220 Polyester strap

5. Plastic drums



Figure 28: DRUMCLIP DC19B GREEN secured with Cordstrap CC65 &CB6S strap



Figure 29: DRUMCLIP DC19B GREEN secured with Cordstrap CC65 &CB6S strap

5. Plastic drums

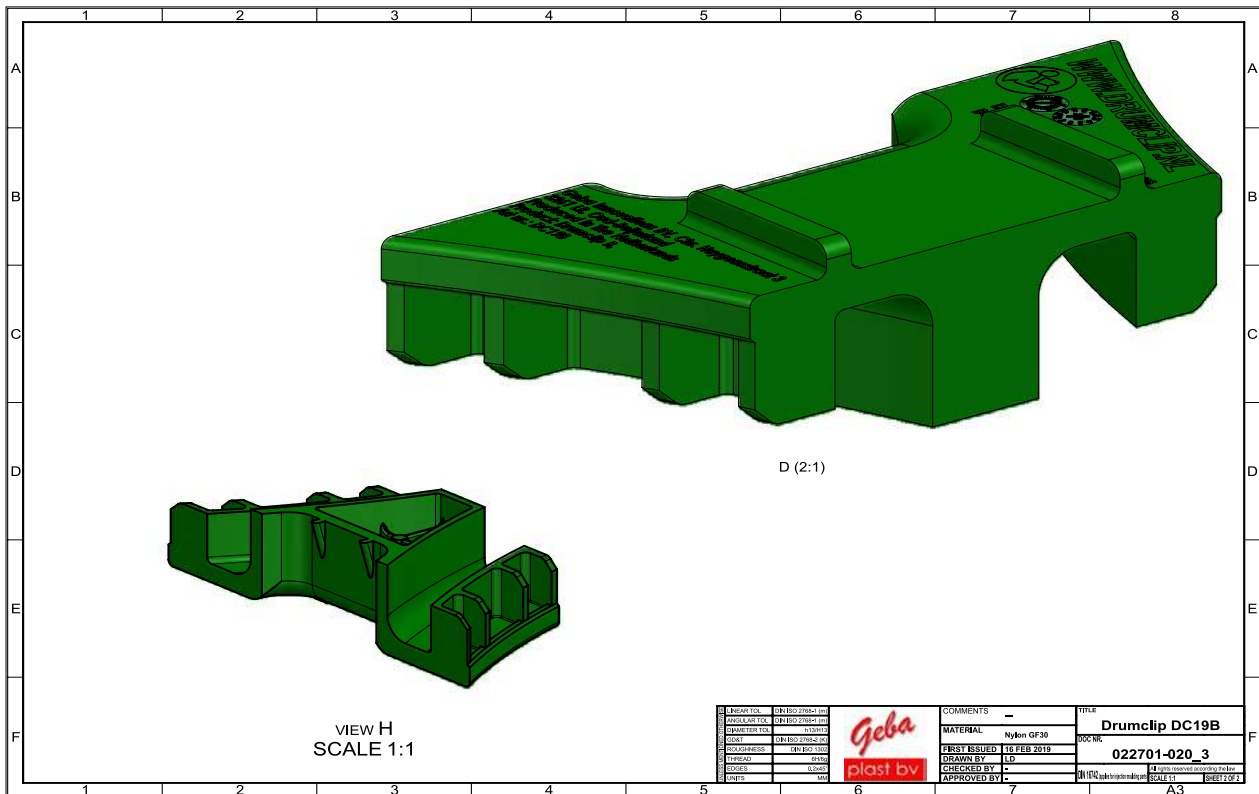


Figure 30b: Isometric view DRUMCLIP DC19B GREEN



Figure 31: Stamp production date DC19B GREEN

5. Plastic drums

5.3 Certification DRUMCLIP DC19B GREEN

The Drumclip is certified for pallet stability according to ISTA 3 E and EUMOS 40509 Transport safe. There is a choice of Signode or Cordstrap. The Drumclip is certified with both types of straps ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe. The complete test reports can be found in Chapter 5.6 Test report ISTA | DRUMCLIP DC19B GREEN and Chapter 5.7 Test report EUMOS | DRUMCLIP DC19B GREEN.

ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe	Signode	(Figure 32a)
Item	Description	Specifications
Pallet type	CP-9	Chemicals Pallet,1140x1140x156mm.
Drums	Plastic	4 Plastic Drums
Straps	Signode Tenax 2220	Polyester width: 19mm, thickness: 0.89mm 1x horizontal, 1x vertical (2 in total)
Machine setting	Signode BXT3-19	2500 N
Type of Drumclip	DC19B	4 Pieces
Anti-slip mats	3 pieces	Minimum resistance value of 0,6μ

ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe	Cordstrap	(Figure 32b)
Item	Description	Specifications
Pallet type	CP-9	Chemicals Pallet,1140x1140x156mm.
Drums	Plastic	4 Plastic Drums
Straps	Cordstrap CC65	Polyester width: 19mm, thickness: 0.97mm 1x horizontal, 1x vertical (2 in total)
Buckle	CB6S	Galvanised steel (2 pieces)
Machine setting	CT25	See specifications Cordstrap Figure 34
Type of Drumclip	DC19B	4 Pieces
Anti-slip mats	3 pieces	Minimum resistance value of 0,6μ



Figure 32a



Figure 32b

5. Plastic drums

5.4 Requirements DRUMCLIP DC19B GREEN

The certifying ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe of the DRUMCLIP DC19B GREEN was obtained in combination with supplies from both Signode and Cordstrap. See also Chapter 2.

5.4.1 Signode

Signode's requirements for compliance with ISTA 3 E pallet stability certification are:

- Signode Tenax T2220 Polyester straps (Figure 33a)
- Signode BXT3 – 19 strapping machine (Figure 33b)




				
Tenax 2220 (19*0,89)				
PRODUCT DATA SHEET				
<p>This is to certify that the product supplied by us is manufactured according to quality procedures in compliance with ISO 9001, ISO14001, EN 13891 and EN 13394. Made of 100% of recycled PET</p> <p>Produced in Netherlands</p>				
Product description	Product designation:	Tenax 2220 (19*0,89)		
	Item code:	670273		
	Material type:	Polyester		
	Production technology:	Strand		
	Surface:	Flat		
	Colour:	Green		
Strap properties		Minimum	Nominal	Maximum
	Width (mm):	18.4	19	19.6
	Thickness (mm):	0.84	0.89	0.94
	Elongation (%):	10		15
	Break Strength (daN):	675	750	
Coils details	Coil Type:	standard		
	Coil Inside Diameter (mm):	408		
	Coil Outside Diameter (mm):	610		
	Coil Width (mm):	153		
	Net Coil Weight (kg):	24.684		
	Meters per coil:	1100		
Pallet details	Package Dimensions (LxWxH):	1200 x 1200 x 1100		
	Number of Coils per Pallet:	24		
	Approx. Gross Weight per Pallet (kg):	646		
Date of issue: 19/02/2020				

Figure 33a

5. Plastic drums



Technical Data Sheet BXT3-19



Strapping tool		BXT3-19
Operation mode		auto / semi / manual
Tension force range	Standard	1300 – 4500N (290 – 1000 lbf)
	Soft	400 – 1600 (90 – 340 lbf)
Variable tension speed range		0 – 120 mm/s (4,7 in/s)
Weight (incl. battery)		4,3 kg (9,5 lb)
Dimensions (L x W x H)		370 x 143 x 135 mm 15.5" x 5.6" x 5.3"
Working temperature		-10°C to +40°C (14-104 °F)
Relative humidity		up to 90%
Battery / Charger		
Charger type		Bosch
Battery charger voltage		100 or 110 or 230 V
Charging time		25-35 min.
Battery type		Bosch Li-ion 18V, 4.0 Ah
Cycles per battery charge		
-	Low tension	800
-	Medium tension	500
-	High tension	300
Strap		
Strap		PET (Polyester) PP (Polypropylene)
Width		15-16, 18-19 mm (5/8", 3/4")
Thickness		0,8-1,3 mm (.031"-0.51")
Features		
Real time indication of applied tension force		✓
Variable tension speed		✓
Favorite strapping function		✓
Display color indication for tool status information		✓
Strap alignment indication		✓
Strap dust blow out vent		✓
Battery protection		✓
0-Tension welding		✓



Figure 33b

5. Plastic drums

5.4.2 Cordstrap

Cordstrap's requirements for meeting the above certifications are:

- Cordstrap CC65 & CB6S (see Figure 34)





Specifications Cordstrap Composite Strapping Solution: CC65 & CB6

Performance Specifications	
Performance System (strap & buckle) System Breaking Strength*	900 daN / 2025 lbf
Performance Strap Linear Breaking Strength* Elongation Elongation at Break	625 daN / 1405 lbf <7% 11% - 17%
Certification	German Lloyd

Strap Specifications	
Dimensions Width* Thickness*	19mm / 3/4" 0,97 mm / 1/32"
Material	High tenacity polyester filament yarn and Homopolymer Polypropylene
Coil Length per Coil** Core Diameter	500 m / 1640 ft 200 mm / 8"
Packaging Carton Box Dimensions* Box Weight* Product Code	2 coils per box 390 x 390 x 354 mm / 15.3/8" x 15.3/8" x 14" 20 kg / 44 lbs 7266000
Pallet Box Dimensions* Box Weight* Product Code	30 coils per box 1181 x 781 x 890 mm / 46.9" x 31.1" x 35" 296 kg / 653 lbs 7266900

Buckle Specifications	
Dimensions Width*	19 mm / 3/4"
Material	Galvanized steel wire
Packaging Carton Box** Dimensions* Box Weight* Product Code	500 pieces per box 266 x 166 x 272 mm / 10.1/2" x 6.5/8" x 8.5/8" 9 kg / 20 lbs 7354500



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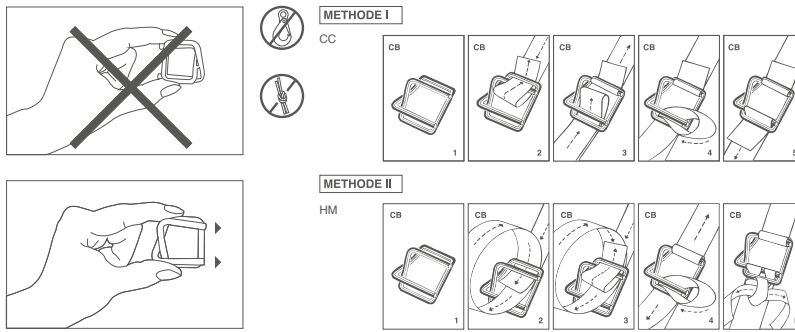
Continued product development



Training at Cordstrap Training Centers

Quality assurance

Figure 34 - Page 1

5. Plastic drums







Recommended Tensioner(s)	
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CT25 50 - 550 daN / 110 - 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,3 kg / 2.9 lbs 7514000
Manual Tensioner Applied Pre-tension Suitable for strap widths Suitable for strap thicknesses Weight* Product Code	CTT25 50 - 550 daN / 110 - 1235 lbf 13 mm - 25 mm / 1/2" - 1" 0,8 - 1,2 mm / 1/32" - 3/64" 1,4 kg / 3.1 lbs 7514600
Accessories	
Coil Dispenser with Buckle Tray Product Code Portable Version Product Code Static Version	7538000 7544000
Edge Protection	Different types and sizes available. Your Cordstrap cargo securing specialist can advise you about the best Edge Protection for your application.
Pallet Needle Product Code	7551000

*Tolerance of +/- 10%
**Tolerance of +/- 2%

We recommend storing all Cordstrap Products in a cool dry environment out of direct sunlight and between 5°C and 25°C / 41°F and 77°F

All information provided is based on accuracy at time of creation



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Figure 34 - Page 2

5. Plastic drums

5.5 Operating instructions DRUMCLIP DC19B GREEN

Main steps to be taken before using the Drumclip.

- Check the Drumclip for any damages.
- Check the production date on the upper side of the Drumclip. The Drumclip must not be used for more than 2 years after the production date.
- The Drumclip may be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- The Drumclip may only be used on trucks with a gross weight of 3,500 kg or more.
- Drumclips must be stored in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.
- The maximum temperature at which the Drumclip can be used is -10C Degrees Celsius + 50 Degrees Celsius.

There are 2 operating instructions DRUMCLIP DC19B GREEN including a step-by-step plan.

- Figure 35a is the operating instruction in combination with Signode Tenax T2220
- Figure 35b is the operating instruction in combination with Cordstrap CC65 &CB6S

The operation instructions must always be followed.

5. Plastic drums



Operating Instructions DC19B GREEN for plastic drums in combination with Signode

Operating Instructions DRUMCLIP DC19B GREEN

In combination with two Signode Tennax T2220 (19x0.89mm) straps.

DRUMCLIP DC19B GREEN is an innovative tool that makes it **safer** and **easier** to secure plastic drums to a pallet, without the use of additional pallets or other equipment. This solution is ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe certified. This combination is useful for pallet stabilisation of 200 litre plastic drums on pallets.

Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1

Place four plastic drums on a wooden pallet.

Step 2

Place two Drumclips opposite each other between two drums with the wide side facing outwards. Use two Signode Tenax T2220 straps. One strap is stretched horizontally at the centre of the drums. The other strap is stretched vertically over the two Drumclips and under the pallet. Both straps are tensioned with a force of 2500 N. Now the pallet is safely certified according to ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe. The above step should be performed for each pallet with drums.



5. Plastic drums



Operating Instructions DC19B GREEN for plastic drums in combination with Cordstrap

Operating Instructions DRUMCLIP DC19B GREEN

In combination with three Cordstrap CC 65 Composite Strapping (19mm; ¾"), and three CB 6S Buckle (19mm, ¾").

The DRUMCLIP DC19B GREEN is an innovative tool that makes it **safer** and **easier** to secure 200-litre plastic drums to a pallet, without the use of additional pallets or other equipment. This solution is ISTA 3 E Pallet Stability and EUMOS 40509 Transport Safe certified. This combination can be used for pallet stabilisation of 200 litre plastic drums on pallets.

Important information

- Check the Drumclip before use. A damaged Drumclip may not be used again.
- Check the production date on the upperside of the Drumclip. The Drumclip must not be used for longer than 2 years after the production date.
- The Drumclip can be cleaned with water and soap.
- If the Drumclip has been in contact with chemicals, it may no longer be used.
- Drumclips must be kept in dry, moderately heated conditions and protected from sunlight and mechanical damage.
- The Drumclip may not be dried or stored near fire or in places with elevated temperatures.

Step 1

Place four plastic drums on a wooden pallet.

Step 2

Place four Drumclips on the outside of the drums with the wide side facing out. Each Drumclip lies between two drums. Use three Cordstrap CC 65 Composite Strapping and two CB 6S Buckles. One strap is stretched horizontally around the drums. The second strap is stretched vertically over two Drumclips that are opposite each other and under the pallet. The third strap is used to do the same with the other two Drumclips. The Buckle is used to connect the straps. Make sure that the position of the Buckle is not on the outside of the trailer or on top of the drums. For the correct positioning of the Buckle and the tension of the straps we recommend consulting Cordstrap's strapping instructions. Now the pallet is safely certified



according to ISTA 3E Pallet Stability and EUMOS 40509 Transport Safe. The above step should be performed for each pallet with drums.



5. Plastic drums

5.6 Test Report ISTA | DRUMCLIP DC19B GREEN

5.6.1 With Signode

Test Report

IPS 7898-82

ISTA 3E PERFORMANCE TEST

DRUMCLIP DC19B GREEN

with

PLASTIC DRUMS

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IPS Technology is an independent packaging and tooling design agency. Aside from designing IPS also performs research, delivers advice on packaging issues and performs packaging test in its own test facility.

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KvK: 17136987

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IPS Technology
Packaging Tooling Testing



5. Plastic drums

Reference : IPS 7898 - 82
Page : 2/22

Reference : IPS 7898 - 82
Description : Test Report ISTA 3E Drumclip DC19B GREEN with Plastic Drums
Date : August 19. 2019
Author(s) : Marten Ries

Client : Geba Innovations B.V.
Chr. Huygensstraat 3
3261 LR Oud-Beijerland
The Netherlands

Contacts : Wouter Geldhof

Test performed by : Marten Ries
Test Date(s) : August 16. 2019
Test Facility : IPS Technology, Eindhoven The Netherlands
ISTA Certified Testing Laboratory, Member ID: 9778 (Appendix A)

Table of Contents

1. Scope of test.....	3
2. Product Damage Tolerance and Package Degradation Allowance.....	5
3. Test plan.....	6
3.1 Atmospheric Conditioning.....	6
3.2 Shock; horizontal impact 1,2ms.....	7
3.3 Shock; 1st Rotational Edge Drop	8
3.4 Compression Test; Machine Apply and Release	9
3.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	10
3.6 Shock; 2nd Rotational Edge Drop	12
4. Test Results.....	13
4.1 Atmospheric Conditioning.....	13
4.2 Shock; Horizontal Impact.....	13
4.3 Shock; 1 Rotational Edge Drop	13
4.4 Compression; Machine Apply and Release.....	13
4.5 Vibration; ISTA Steel Spring Truck Random Vibration.....	14
4.6 Shock; 2nd Rotational Edge Drop	14
5. Inspection after test	15
6. Conclusions.....	16
Appendix A. ISTA Certified Testing Laboratory	17
Appendix B. Test Equipment: Impact Tester.....	18
Appendix C. Test Equipment: Shaker	19
Appendix D. Impact speed	20
Appendix E. Compression test graph.....	21
Appendix F. Power Spectral Densities Profile	22

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5. Plastic drums

Reference : IPS 7898 - 82
Page : 3/22

1. Scope of test

The goal of this transport simulation test, performed according to the ISTA 3E-2017 Standard for Unitized Loads, is to validate the capability of the Drumclip system for sufficient load stability subjected to rough mechanical handling; forklift truck handling and warehousing stacking.

Four Standard Plastic Drums 200L are placed on a pallet and secured with four Drumclips and secured with three polyester lashings.

Securing of the pallets during Full Truckload (FTL) will be done with help of strapping belts and is not in scope of this test.



Figure 1. Test configuration

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5. Plastic drums

Reference : IPS 7898 - 82

Page : 4/22

Details of tested configuration:

The tested configuration is built up with components listed below:

Item	Remark
Standard Plastic Drums 200L. Quantity: 4	Drums fully filled with water. Used condition.
Pallet type: CP-9	Chemie Pallet, 1140x1140x156mm, used condition.
Lashing: Signode Tenax 2040 Strapping. Quantity: 3	Polyester Strapping 16mm, thickness 0,89mm Location of the strapping shown in Figure 1.
Drumclip type: DC19B GREEN	Quantity used: 4x

Lashing is assembled with Plastic Strapping Handtool: Strapex STB75.

Pre-tension on strapping: 2100N, Weldingtime level: 4

Parameter	Value
Total mass DUT:	892 kg
Dimensions:	1170x1170x1030mm (LxWxH).
Sample Numbers to be tested:	1

Remark:

The drums are exceeding the base dimensions of the pallet.

The Tenax strapping will be applied just before the execution of the test program.

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5. Plastic drums

Reference : IPS 7898 - 82

Page : 5/22

2. Product Damage Tolerance and Package Degradation Allowance

The product will be tested in the prepared configuration. Replacement of components of DUT is not allowed.

Product Damage Allowance:

During horizontal impact tests the drums will impact the ridged wall of the Horizontal Impact Tester.

The drums are exceeding the dimensions of the pallet base.

It will be expected that damage to the drums cannot be avoided during the execution of these tests.

Damage to the drums caused by these impacts is within the allowance criteria.

Package Degradation Allowance:

During and after the test the integrity of the DUT must be guaranteed.

- All drums are placed on the pallet bottom during and after the execution of the test.
- The forklift truck can interface the pallet during and after the execution of the test.
- The Drumclip is not broken-heavily damaged (validation by Geba Innovations B.V.)

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5. Plastic drums

Reference : IPS 7898 - 82

Page : 6/22

3. Test plan

The test plan is based on the ISTA 3E -2017 procedure.

According ISTA 3E the test sequence will be executed as stated in the table below.

<i>Performance Test Schedule</i>	<i>Description</i>	<i>Note</i>
1 st	Atmospheric preconditioning	Ambient level
2 nd	Shock; horizontal impact	1,2 m/s
3 rd	Shock: rotational edge drop	Drop height 150mm
4 th	Compression	Apply and release method
5 th	Vibration: random	Overall Grms= 0.54
6 th	Shock: rotational edge drop	Drop height 150mm

3.1 Atmospheric Conditioning

The sample will be conditioned to ambient laboratory level.

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82

Page : 7/22

3.2 Shock; horizontal impact 1,2ms

The DUT will be exposed to horizontal impacts in order and under the conditions as stated in the table below.

Sequence No.	Specific Face	Impact Speed
1	Face 6	1,2 m/s
2	Face 5	1,2 m/s
3	Face 2	1,2 m/s
4	Face 4	1,2 m/s

Horizontal impact testing will be performed with the IPS Technology horizontal impact tester.

Specifications of the horizontal impact tester can be found in Appendix B.



Figure 3.DUT on horizontal impact tester.

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 8/22

3.3 Shock; 1st Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 4. Set-up Rotational Edge Drop Test

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5. Plastic drums

Reference : IPS 7898 - 82

Page : 9/22

3.4 Compression Test; Machine Apply and Release

The DUT will be exposed to a 'Machine Apply and Release' compression test according to the ISTA 3E test protocol. For the calculation for compression (Apply and Release method) the formula $AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) \times (L-1)\} \times 1,4 \times 9,8$ is applicable.

Wt	Total weight of packaged product (Kilograms)	921 Kg	
S	Total number of <u>potential</u> unitized loads in a warehouse stack or a vehicle stack	3	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	25.339N	= 2.583 Kg

The test will be performed with an additional (empty) pallet on top of the DUT. This will be done in order to simulate the reality of stacking load.



Figure 5. Set-up compression test

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 10/22

3.5 Vibration; ISTA Steel Spring Truck Random Vibration

The DUT will be exposed to a vibration test without compressive load, to simulate transport vibrations. The test is performed under 'loose load' conditions. For the test setup see Figure .
The during of 60minutes will be equivalent to a transport of 480km.

<i>Orientation</i>	<i>Vibration Profile acc.</i>	<i>Duration</i>
Face 3 down (bottom face)	ISTA Steel Spring Truck	60 minutes

Specifications of the vibration test equipment can be found in Appendix C.

The Power Spectral Densities ISTA Steel Spring Truck profile is given in the figure below.

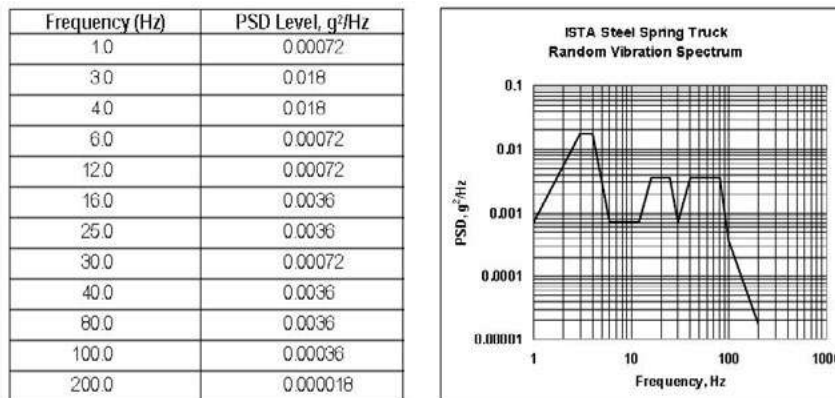


Figure 2. Power Spectral Densities – Steel Spring Truck Random Vibration

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5. Plastic drums

Reference : IPS 7898 - 82

Page : 11/22



Figure 6. Test setup for vibration test

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5. Plastic drums

Reference : IPS 7898 - 82
Page : 12/22

3.6 Shock; 2nd Rotational Edge Drop

Based on the mass of the DUT >230kg the drop height is set on 150mm.
During the drop test, the side opposite to the drop side is supported by a timber with a height of 90mm.
The DUT is exposed to rotational edge drops in order and under the conditions according to the table below.

Sequence No.	Specific edge	Drop height
1	Edge 3-6	150mm
2	Edge 3-2	150 mm
3	Edge 3-5	150 mm



Figure 7. Set-up Rotational Edge Drop Test

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 13/22

4. Test Results

The tests are executed according to test plan. In the following chapters the test results can be found per test.

4.1 Atmospheric Conditioning

The DUT has been conditioned to ambient laboratory level.



4.2 Shock; Horizontal Impact

The horizontal impact test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. The impact speed is measured at 1,2 m/s. See for the speed graph Appendix D.

4.3 Shock; 1 Rotational Edge Drop

The Rotational Edge Drop Sequence is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence.

4.4 Compression; Machine Apply and Release

The compression test is executed according test plan. At a load of approx. 1600 kg wooden bars parts of the top part of the pallet base cracked.

A screenshot of the compression test and the crack is shown in a graph in Appendix E.

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 14/22

4.5 Vibration; ISTA Steel Spring Truck Random Vibration

The vibration test is executed according test plan. No remarkable event occurred before, during or after performance of this Test Sequence. A screenshot of the PSD during the test is shown in Appendix F.

4.6 Shock; 2nd Rotational Edge Drop

The Rotational Edge Drop Sequence is executed according test plan.
During execution of the test bending of the pallet bottom could be seen.



Figure 8. Bended pallet bottom

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 15/22

5. Inspection after test

After execution of the complete test cycle no remarkable – unexpected damages to the DUT and its components could be found. The expected damage to the drums was not found.

The condition of the CP-9 pallet was still in useable condition. However several cracks in the wooden carriage were found. It has to be remarked that the pallet quality was poor.

During and after execution of the test the position of the Drumclip were not levelled to the top surface of the plastic drums. Also in this position the Drumclips interfaced mechanically with the edge of the plastic drums.



Figure 8. Position of drum clips during drop testing.

Examination of the condition by personnel of Geba Innovations B.V. of the Drumclips after the test showed no visible damage or wear.

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Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 16/22

6. Conclusions

The test has been executed according to the test plan.

With exception of the damage occurred during the compression test no remarkable-unexpected events and/or damage has occurred before, during or after the test to the DUT.

Despite the poor pallet quality the tested configuration maintained the position of the plastic drums on the pallet bottom.

The Drumclip system in combination with the defined lashing configuration is fully capable to ensure safe individual mechanical pallet handling and warehouse stacking.

Eindhoven, August 20, 2019

Checked and approved by:



Marten Ries
Sr. Project Engineer

Marijn Sibbers
Test Engineer

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 17/22

Appendix A. ISTA Certified Testing Laboratory



This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778 Valid through: February 1, 2020
Location: Eindhoven, Netherlands

IPS Technology


A.J. Gruber
ISTA President


Eric Hiser
ISTA Vice President - Technical

Figure 9. IPS Technology ISTA Laboratory Certification

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CHERISHING INDUSTRIAL PRODUCTS 

 **IPS Technology**
Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 18/22

Appendix B. Test Equipment: Impact Tester

**Fabrikant**

IPS Technology

Oppervlakte

245x250 cm

Max. productmassa

1300 kg

Opspanning

Horizontaal

Botssnelheden

2-10 km/h

Datalogging

Snelheidsmeetsysteem registreert de snelheid bij botsing

Optioneel

Versnellingsmetingen aan het product met een drie-assige versnellingsopnemer

Normen (o.a.):

ASTM D 5487
ISO 2244

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CHERISHING INDUSTRIAL PRODUCTS



 **IPS Technology**
Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82
Page : 19/22

Appendix C. Test Equipment: Shaker



- Manufacturer : Lansmont model 10000 TTV II
- Max. specimen size : 152 x 152 cm
- Max. specimen weight : 2200 kg
- Max. amplitude (peak to peak) : 6,4 cm
- Frequency-range : 3 - 300 Hz
- Frequency-rang at max. load : 3 - 200 Hz
- Acceleration range : 0 - 8 g
- Max. acceleration at max. load : 2 g
- Automatic displacement or acceleration control
- Automatic sweep generator and random vibration facilities (Lansmont TouchTest Vibration system)
- Accelerometer

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 **IPS Technology**
Packaging Tooling Testing

5. Plastic drums

Reference : IPS 7898 - 82

Page : 20/22

Appendix D. Impact speed

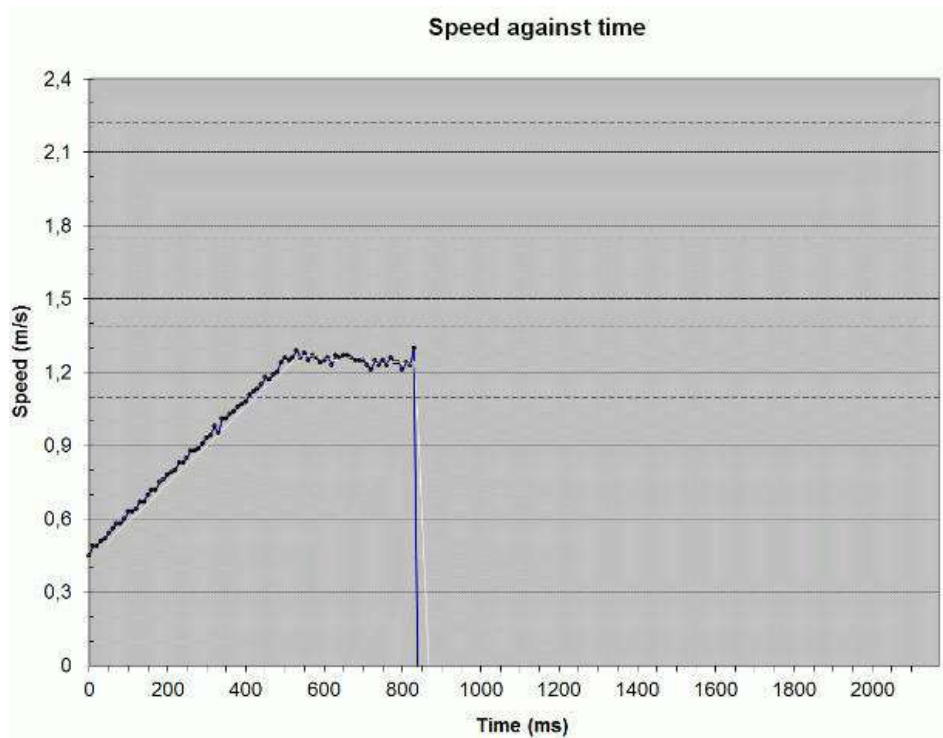


Figure 10. Impact speed >1,2m/s

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5. Plastic drums

Reference : IPS 7898 - 82
Page : 21/22

Appendix E. Compression test graph

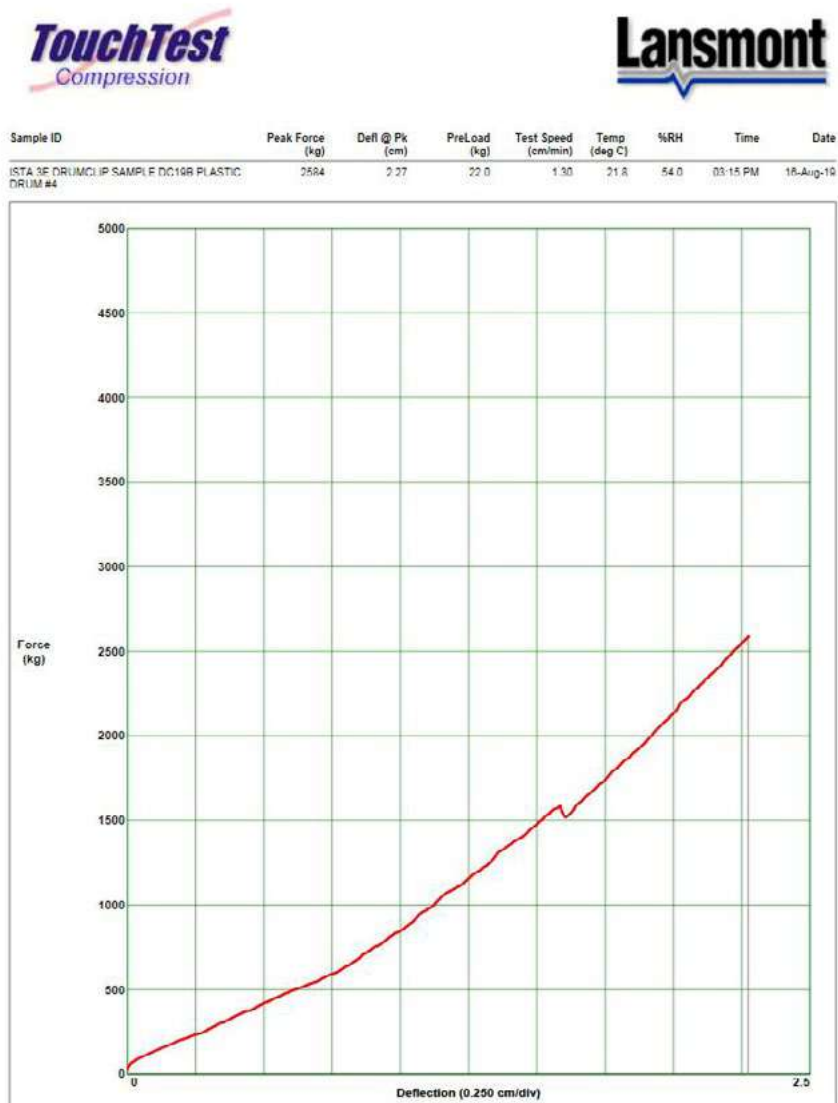


Figure 11. Compression test graph – Apply and release compression test

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5. Plastic drums

Reference : IPS 7898 - 82
 Page : 22/22

Appendix F. Power Spectral Densities Profile

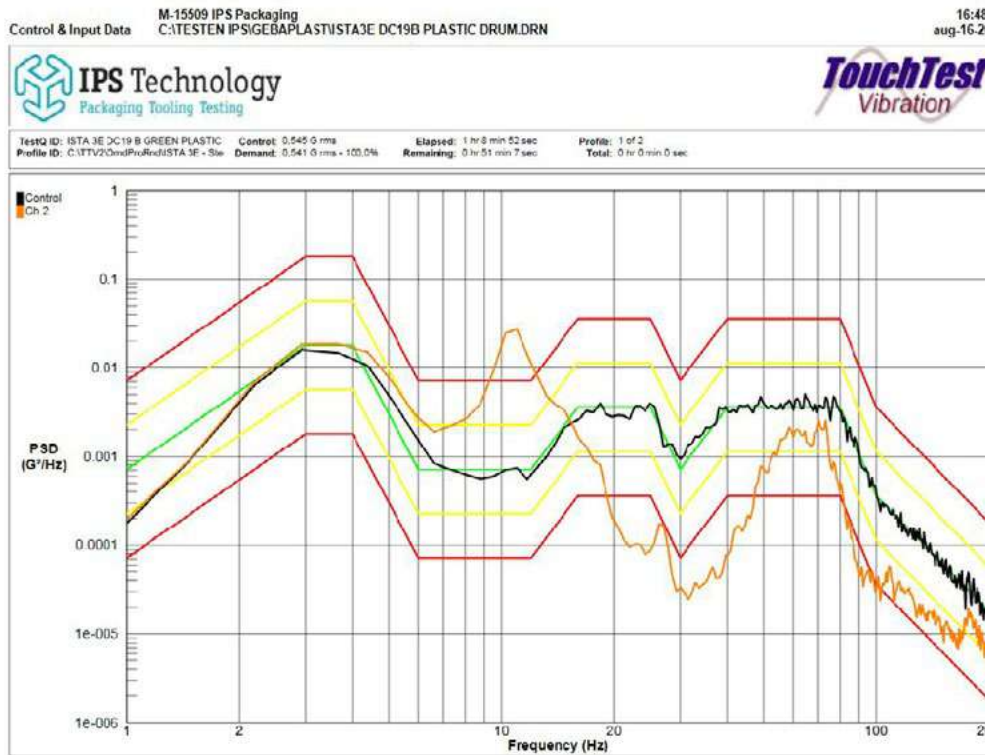


Figure 12. Power Spectral Densities - ISTA Steel Spring Truck Random Vibration; 1 hr 9min.

Remark; accelerometer Ch2 placed on top of the Drumclip for response monitoring (examination only).

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5. Plastic drums

5.6.2 With Cordstrap



Transport simulation on Plastic drums – Cordstrap CC65 and CB6S - Drumclip DC19B GREEN

Test Report IPS8858-80 | ISTA-3E₂₀₁₇



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The IPS-report may be released for viewing to relevant parties.

IPS Technology is an independent packaging and tooling design agency. Aside from designing IPS also performs research, delivers advice on packaging issues and performs packaging test in its own test facility.



Test conducted on 24 February 2022

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5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

CUSTOMER INFORMATION

Client: Geba Innovations **ATTN:** Wouter Geldhof
Project name: Transport simulation on metal drums - Cordstrap CC65 and CB65 -
4x Drumclip DC19B GREEN

LAB INFORMATION

Testing Lab: IPS-Technology
Location: Boschdijk 760, 5624 CL Eindhoven, The Netherlands
ISTA Member: ST-9778
Date of Test: 24 February 2022
Test performed by: Otto van den Berg



This recognizes that the company listed below is a **Certified Testing Laboratory** member of the International Safe Transit Association (ISTA).

Member ID: 9778

Valid through: February 1, 2024

Location: Eindhoven, NB, Netherlands

IPS Technology


A.J. Gruber
ISTA President


Eric Hiser
ISTA Vice President - Technical

5. Plastic drums



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRODUCT & PACKAGING INFORMATION

Packed product(s) and packaging description	4 plastic drums on a wooden pallet, strapped Cordstrap CC65 and CB6S and 4x Drumclip DC19B GREEN.
Packed pallet dimension	116 x 116 x 108 [mm]
Packed pallet weight	916 [kg]
Packed pallet degradation allowance	If no conditions are provided by the customer, IPS will adopt a "PPDA" as follows: The packed pallet may show damaging marks, but still needs to bundle, protect and support the content in a functional way.
Product Damage Tolerance	Individual packages and products contained are not within the scope of this test, and are not opened or checked.

CONCLUSIONS

Testing is done according to plan and no incidents occurred during testing.

Pallet is functional, strapping and Drumclips are in place. Drums are bundled, protected and supported as stated in the "PPDA" above.

The package therefore **PASSES** the test.

Eindhoven, 28 February 2022

Test Engineer:
Otto van den Berg

Checked by:
Johan Bruins

5. Plastic drums



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

TEST RESULTS

Overview Recommendations	Testing is performed according to plan and without incidents.
Packaging Condition	Packaging is functional after all tests.
Product Condition (if inspected)	Drumclips are undamaged and in the correct position. Cordstraps are undamaged.

		OBSERVATIONS	
		Items in Grey are not performed. Items in red are not completed.	
	Test	Value	
BLOCK 1	Temp and Humidity		23°C and 50% Humidity
BLOCK 2	Shock: Horizontal Impact	1.2 m/s	
BLOCK 3	Shock: Rotational edge drop	150 mm	
BLOCK 4	Compression: Apply and release	3847 kg	
BLOCK 5	Vibration: Random	1 hour	
BLOCK 6	Shock: Rotational edge drop	150 mm	



Package after testing



Product after testing

5. Plastic drums



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

PRE-TEST INSPECTION

Product Condition

Drums have some dents. Pallet is undamaged. Drumclips and Cordstraps are new and installed after arrival at IPS testlab.

Packaging Condition before testing

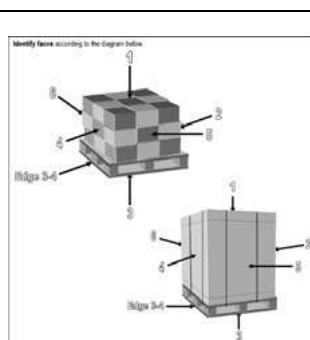
NEW re-packaged with new materials before testing.

Additional Notes

Re-strapping is done by Geba employee with appropriate tools, conform packaging guidelines of Geba.



Package as received



Identification of sides



Pallet re-strapped

5. Plastic drums



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

TEST SUMMARY

Described in this test report is a transport simulation test. The goal of this test, performed according to the ISTA 3E version 2017 standard for Unitized Loads, is to validate how the packed pallet, and the Cordstrap and Drumclip in particular, handle shocks and vibrations during transport. An engineer of Geba Innovations is present during testing. Before testing, the pallet is re-straped using new Drumclips and new Cordstraps, with the proper tools according to the packaging guidelines of Geba. All testing is done without the transport belt over the pallet as prescribed by the Geba packaging guidelines. After the test the pallet, Cordstraps and Drumclips are inspected by engineers of IPS Technology.

Further inspection (done by the customer) is not within the scope of this test report.

The following tests are conducted in sequence:

Items in grey are not performed as agreed by the customer.

Sequence Number	Test category	Test Type	Test Level	For ISTA Certification
1	Atmospheric Preconditioning TEST BLOCK 1	Temperature and Humidity	Ambient	Required
*	Atmospheric Conditioning TEST BLOCK 1	Controlled Temperature and Humidity	Temperature and Humidity chosen from chart	Optional
2	Shock (alternative methods allowed) TEST BLOCK 2	Inclined Impact	1.2 m/s	Required
		Horizontal impact	1.2 m/s	
3	Shock TEST BLOCKS 3	Rotational edge drop	150 mm	Required
4	Compression (alternative methods allowed) TEST BLOCK 4	Apply and release	Truck or Truck & Air dependent	Required
		Apply and hold		
		Weight and load spreader		
5	Vibration BLOCK 5	Random	Overall Grms levels of 0.54	Required
6	Shock TEST BLOCK 6	Rotational Edge Drop	150 mm	Required

5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

ATMOSPHERIC PRECONDITIONING

The package is preconditioned to laboratory ambient temperature and humidity (23°C, 50% RH) for at least 12 hours prior to testing.

SHOCK: HORIZONTAL IMPACT

Rolling floor | water tank counter weight | steel wall

The packed pallet is exposed to horizontal impacts to all four sides. Impact velocity is 1.2 m/s.



Test observations

No remarkable events occurred during testing.

5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

SHOCK: FIRST ROTATIONAL EDGE DROP

Wooden beam | Wooden block | Rope

Based on the mass of the packed pallet, 916 kg, the drop height is set at 150 mm. During the drop test, the side opposite to the drop side is supported by a timber with a height of 100 mm. Two long edges and a short edge are tested.



Test setup

Test observations

No remarkable events occurred during testing.

5. Plastic drums



Internal Doc ID#: IPS8858-80

ISTA 3E version 2017

Date of report: 25 February 2022

COMPRESSION: APPLY AND RELEASE

Compression tester: Lansmont Corp | Type: 152-50K | Last calibrated/valid until: 20-11-2017/20-11-2020

The packed pallet is exposed to a 'Apply and Release' compression test according to the ISTA 3E test protocol and calculation.

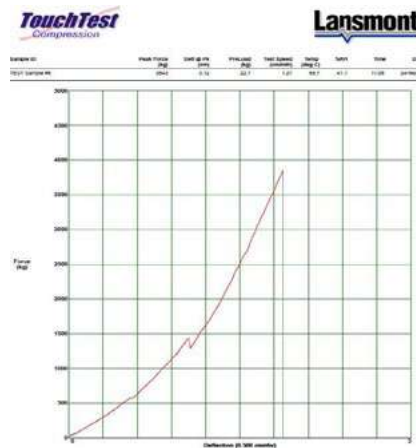
$$AR = \{[Wt \times (S-1) + (Wt/L) \times (L-1)] \times F - (Wt / L) \times (L-1)\} \times 1,4 \times 9,8$$

$$AR = \{[916 \times (2-1) + (916/1) \times (1-1)] \times 3 - (916/ 1) \times (1-1)\} \times 1,4 \times 9,8$$

Wt	Total weight of packaged product (Kilograms)	916 Kg	
S	Total number of <u>potential</u> unitized loads in a vehicle stack	2	Including the bottom unitized load
L	Total number of layers in the unitized load	1	
F	Compensating factor	3	Typical compensating factor
9,8	Metric conversion factor	9,8	
1,4	Factor to account for time of compression	1,4	
AR	Result of calculation: Test Load for Apply and Release (Newton)	37700 N	= 3847 Kg



Test setup



Test observations

The test is performed with a pallet on top of the packet pallet. This is done in order to simulate a stacking load "footprint" of similar packed pallets.

The package withstood the compression test without problems.

5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

RANDOM VIBRATION: STEEL TRUCK PROFILE

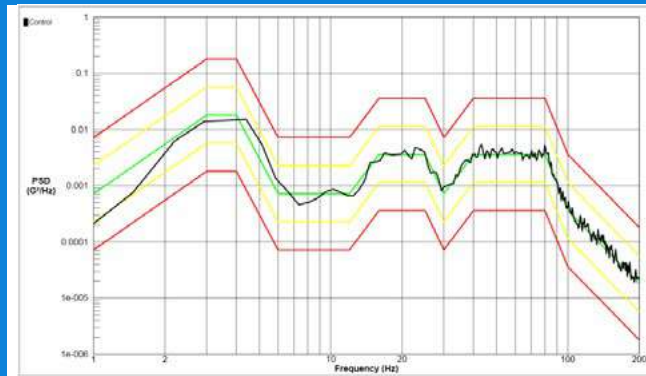
Vibration table: Lansmont Corp. | Type: 10000 TTV | Last calibrated/valid until: 24-11-2020 / 24-11-2023

The packed pallet is placed on the vibration table and is handled as 'loose load' shipment, not attached to the table. This is not in compliance with the Geba packaging guidelines. The duration of 60 minutes is specified by the customer and is equivalent to 480 km truck transport.

Test profile and settings

Frequency (Hz)	PSD Level (g^2/Hz)
1.0	0.00072
3.0	0.018
4.0	0.018
6.0	0.00072
12.0	0.00072
16.0	0.0036
25.0	0.0036
30.0	0.00072
40.0	0.0036
80.0	0.0036
100.0	0.00036
200.0	0.000018

Typical graph of ISTA 3E Steel spring truck Spectrum



Test setup

Test observations

No remarkable events occurred during testing.

5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80
Date of report: 25 February 2022

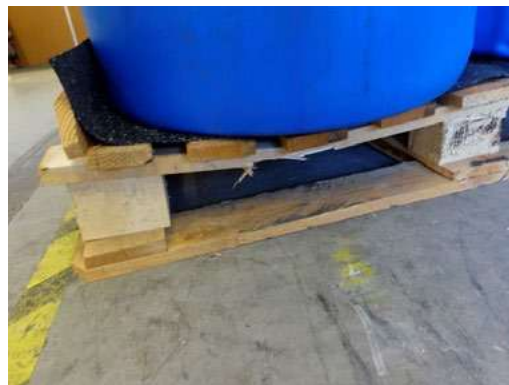
SHOCK: SECOND ROTATIONAL EDGE DROP

Wooden beam | wooden block | rope

Test setup similar to first drop test.



Test setup



After test

Test observations

Pallet cracked but still functional.

5. Plastic drums



ISTA 3E version 2017

Internal Doc ID#: IPS8858-80

Date of report: 25 February 2022

POST TEST PICTURES

After the test the packaging and the product is photographed to show how the packaging and product endured the testing.



Post test observations

After execution of the complete test cycle no remarkable/unexpected damages to the packed pallet or its components are found. Drums are contained, secured and stable on the pallet.



Recommendations

END OF REPORT

5. Plastic drums

5.7 Test Report EUMOS | DRUMCLIP DC19B GREEN



5.7.1 With Signode

Standard EUMOS 40509 - TEST REPORT			
	Customer	Date	
	DRUMCLIP	10-5-2022	
	Project	Reference	Revision
	Drumclip test	PE DC 19 B 4 S4	01
			

1. Load unit descriptive data

- *Dimensions (mm):* 1000 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H 600 x L575 x W575
- *Nature of the Products:* Plastic drums
- *Description of Primary Pack:* 4 plastic drums SIGNODE 4 Straps 4 drumclips
DC 19 B Green
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

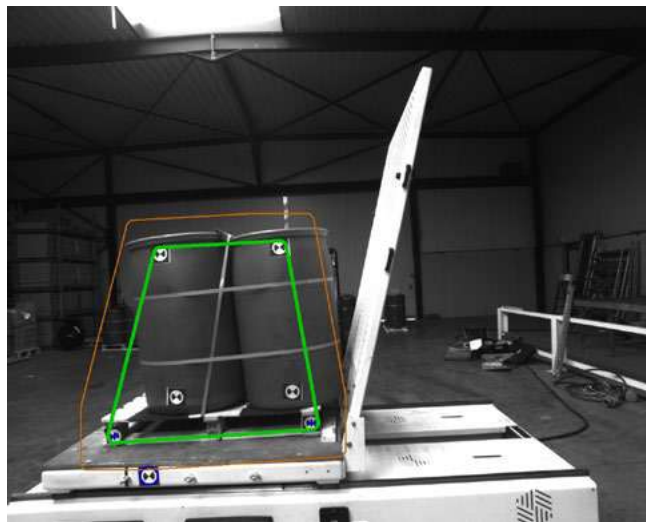
5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing • testing • services Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference PE DC 19 B 4 S4	Revision 01
			 EUMOS 40 509

2. Test related data



2.1. Orientation of the test: Length

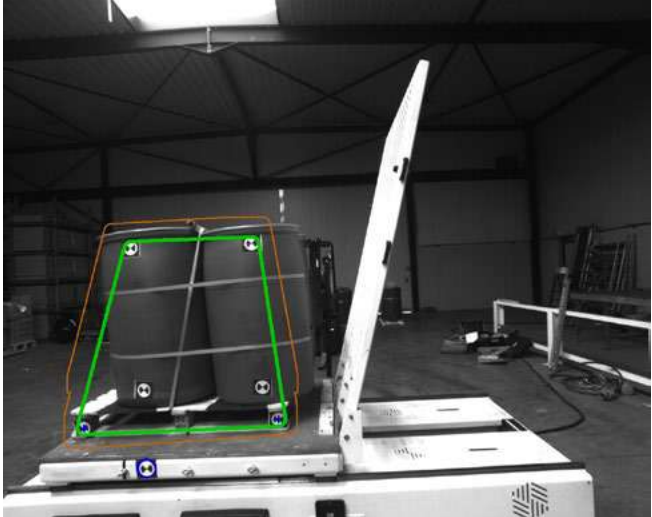
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.80G
- *Testing History:* non




Load Before Test

5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB <small>Cargo securing training services</small> Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference PE DC 19 B 4 S4	Revision 01
			 EUMOS 40 509





Permanent Deformation



Max Elastic Deformation

5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing • testing • services Safe transport	Customer DRUMCLIP	Date 10-5-2022	
	Project Drumclip test	Reference PE DC 19 B 4 S4	Revision 01
			 EUMOS 40 509


3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*



5. Plastic drums



5.7.2 With Cordstrap

Standard EUMOS 40509 - TEST REPORT			
	Customer dRUMCLIP		Date 10-5-2022
	Project Drumclip TEST	Reference PE dc19 4 C 4 0.5	Revision 01

1. Load unit descriptive data

- *Dimensions (mm):* 1070 X 1150 X 1150
- *Weight (kg):* 850
- *Center of Gravity (mm):* H600 x L575 x W575
- *Nature of the Products:* PE drums
- *Description of Primary Pack:* CB 65 strap Corstrap 4 drumclips DC 19 B Green
- *Layer Stacking pattern:* 1 layer of 4 drums
- *Type of Pallet:* CP 9
- *Responsible of the description:* Dhr. Wouter Geldhof

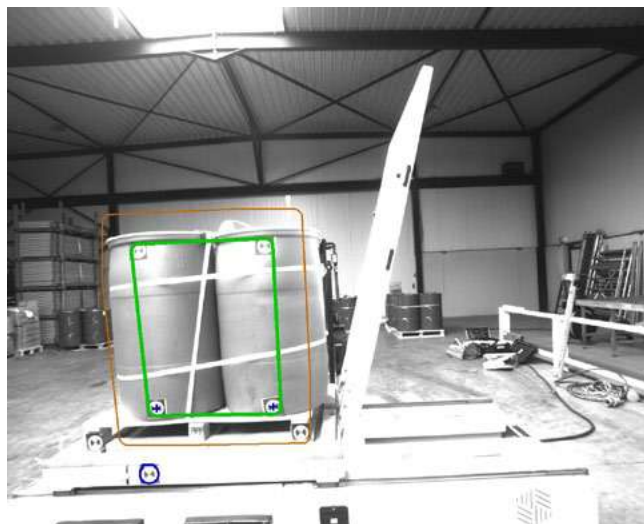
5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
	Customer dRUMCLIP	Date 10-5-2022	
	Project Drumclip TEST	Reference PE dc19 4 C 4 0,5	Revision 01
			

2. Test related data



2.1. Orientation of the test: Length

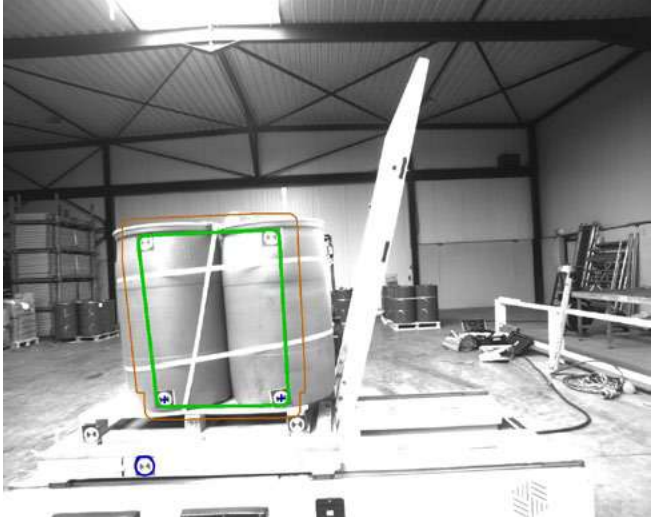
- *Date of Test:* 10/5/2022
- *Place:* Brugge
- *Rigidity (g):* 0.50G
- *Testing History:* non



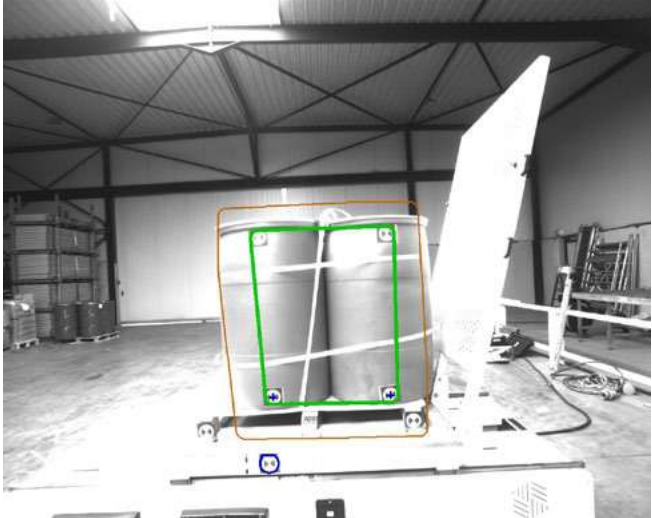
Load Before Test

5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB <small>Cargo securing training services</small> Safe transport	Customer dRUMCLIP	Date 10-5-2022	
	Project Drumclip TEST	Reference PE dc19 4 C 4 0,5	Revision 01
			 EUMOS 40 509





Permanent Deformation



Max Elastic Deformation

5. Plastic drums

Standard EUMOS 40509 - TEST REPORT			
 CS-TS CS-TS LOGISTIC LAB Cargo securing / lashing services Safe transport	Customer dRUMCLIP	Date 10-5-2022	 EUMOS 40 509
	Project Drumclip TEST	Reference PE dc19 4 C 4 0,5	

3. Test Validation

- *Temperature of the test area:* 22°
- *Humidity of the test area:* 65%
- *Responsible of Report:* Dhr. Geert Frans
- *Sign:*

