



SafeDirection
CRASH BARRIER SOLUTIONS

HERCULES

MASH TL-3 Crash Cushion

Installation and Repair Manual



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1. GENERAL

1.1. Foreword.

The following document represents the Installation and Repair Manual for HERCULES crash cushion tested according to American Standard MASH TL-3.

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1.2. HERCULES crash cushion: Components.

The Crash Cushion is formed by the following components

- | | |
|---|--|
| 1. Collapsible beam split into 10 modular bays; | 6. Steel basement; |
| 2. Backstop with sliding rail; | 7. Frontal sliding trolley; |
| 3. 4-beam side panels; | 8. Retaining panel; |
| 4. Sliding elements; | 9. Frontal Plate for reflective sticker. |
| 5. Collapsible beam support; | |

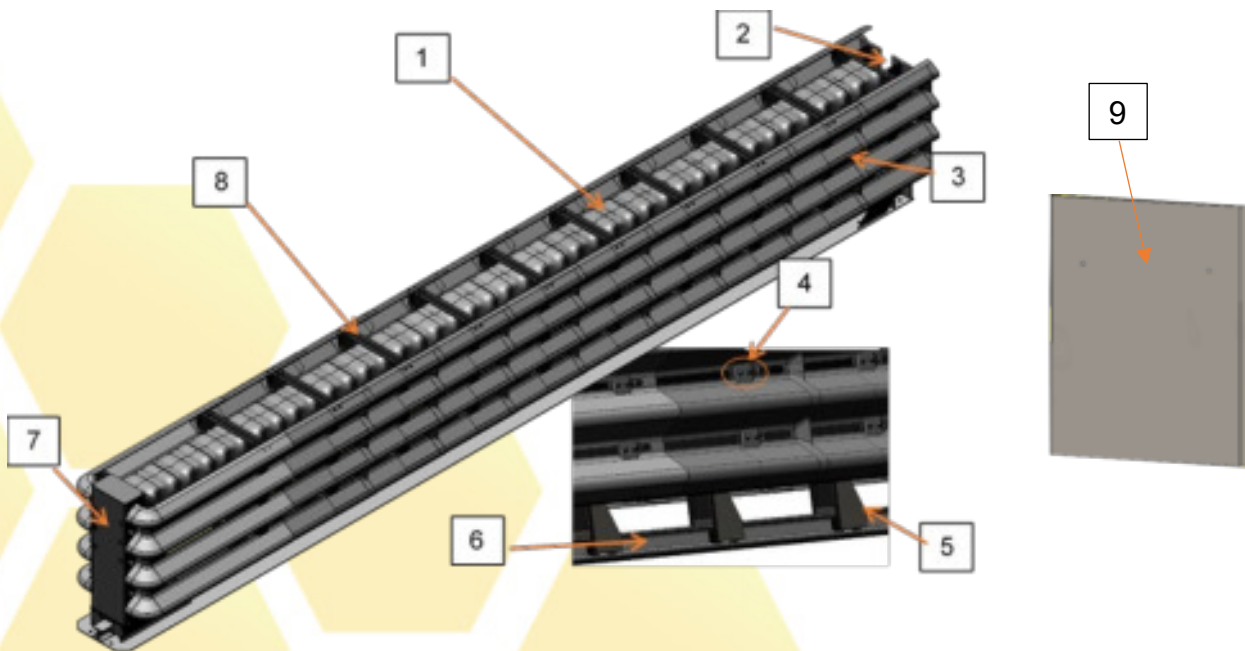


Fig. 1.: HERCULES Crash Cushion

1.3. HERCULES crash cushion: Model and size.

HERCULES is a fully redirective, non-gating crash cushion tested to MASH TL-3 criteria (62 mph - 100 km/h).

The size of the device is shown in Table 1.

Table 1: Available models.

Model	TL-3-P		TL-3-PL	
Length	19.4 ft	5922 mm	19,4 ft	5922 mm
Width	23.2 in	588 mm	31.9 in	810 mm
Height	34.0 in	867 mm	34.0 in	867 mm

1.4. Customer service.

Industry A.M.S. s.r.l. is committed to provide customer service at the highest level. The Company welcomes comments concerning the quality and the manufacturing of its products, the installation procedure and the supporting documentation. Customers are invited to contact the Company in the following ways:

email: info@smaroadsafety.com

phone: +39 0823 821560

2. INSTALLATION PROCEDURE

2.1. Foreword.

The HERCULES crash cushion is supplied pre-assembled. Therefore, only anchoring of the device to the concrete pad will be necessary.

The use of safety equipment is mandatory. Installers shall wear personal safety equipment (e.g. gloves, safety glasses, safety vest and other equipment as required by the road authority).

Tools for the installation.

1. Equipment for the crash cushion lifting (crane, ropes, forklift for a mass of 1051 kg)
2. Dynamometric wrench with 36mm clamping sleeve.
3. Chemical anchors for concrete consisting of resin **FISCHER V 300T** + sleeves **RG M16I**, or equivalent (supplied on request).

2.2. Installation Details.

The HERCULES crash cushion should be installed on a concrete base type **RCK 25** with chemical anchors.

The concrete base size and reinforcement is shown in Table 2 and picture Fig. 2 and Fig. 3

Table 2: concrete base dimensions.

	SMA TL-3
Concrete base	L= 6134 mm W= 1067 mm H= 152 mm
Welded Wire Fabric	L= 6096 mm W= 914 mm H= 190 mm

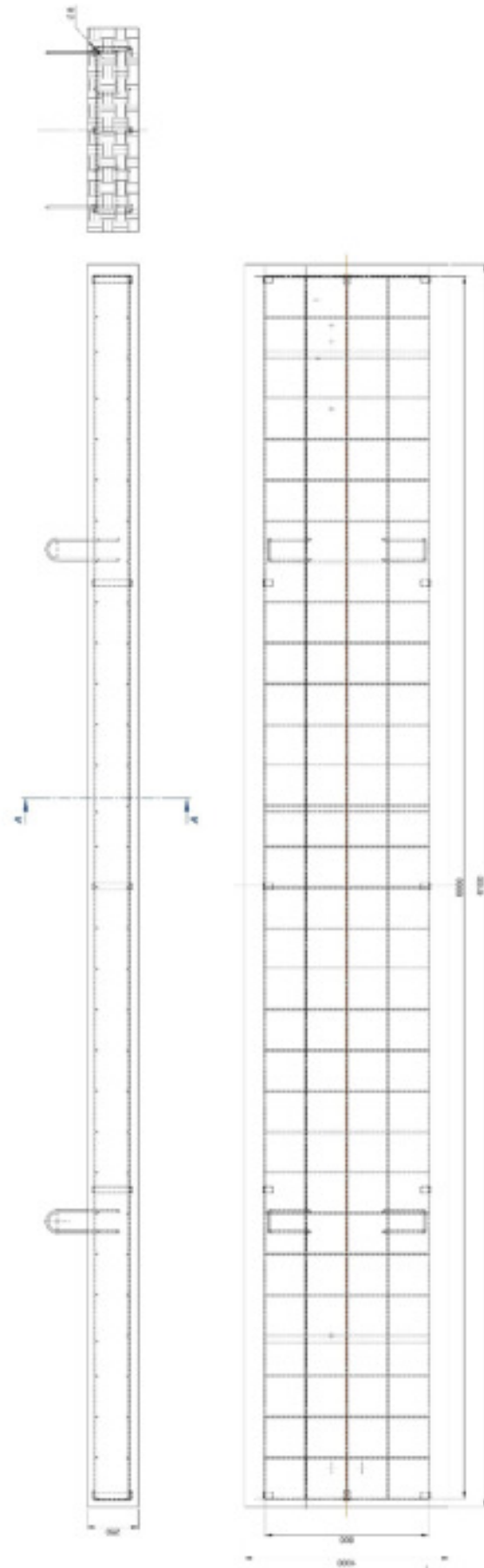


Fig. 2: Concrete pad with welded wire fabric for HERCULES

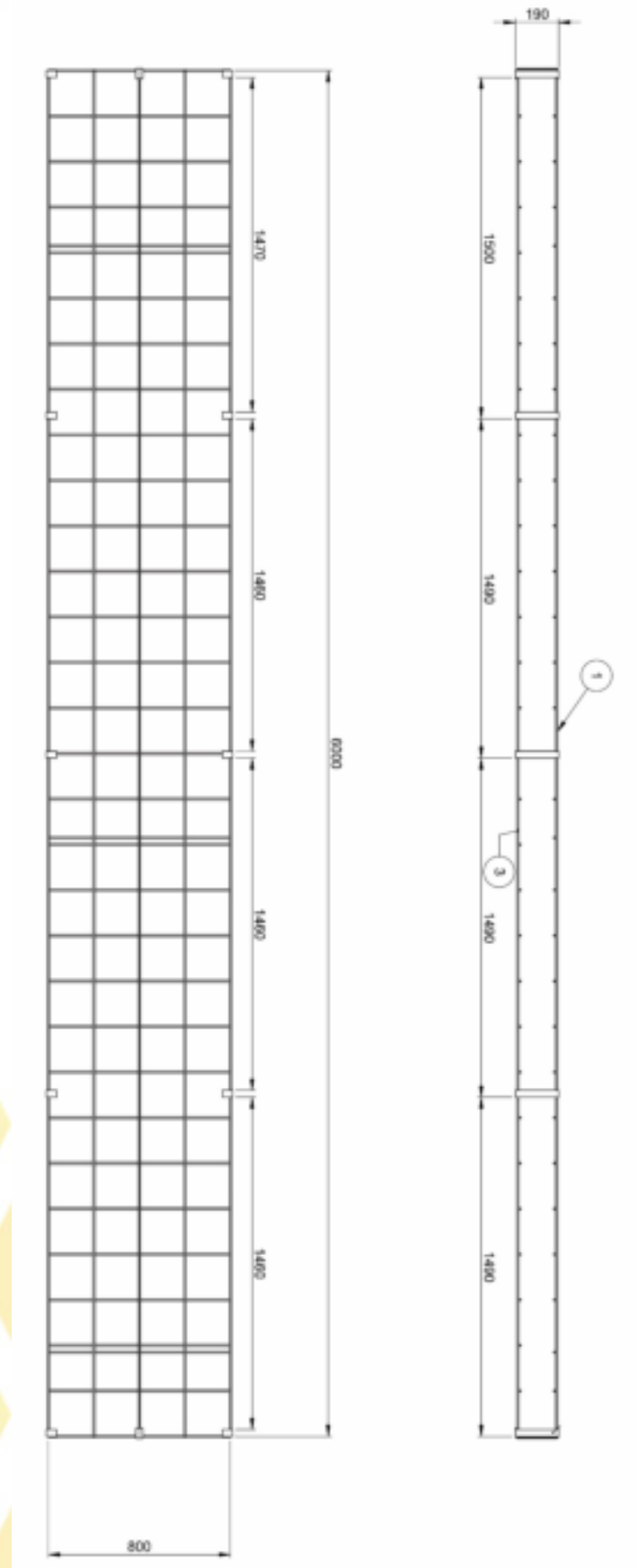


Fig. 3: Welded Wire Fabric (SL82) for HERCULES

Procedure - Installation with FISCHER chemical anchors.

Details of the kit

For installation on concrete it is mandatory to use the specific kit which includes:

- Resin type Fischer V 300T (Fig. 4)
- Internally threaded sleeve type RG 22 X 160 M16I (Fig. 5)
- Threaded bolts with button head type $\frac{3}{4}$ UNC (M16 x 30 mm) (Fig 7)
- Washers

Equipment for the installation (not included with the kit)

- Drilling template manufactured and supplied by Industry A.M.S.
- Drilling machine
- Cartridge gun for Fischer resin
- Equipment for removing the debris from the holes

Procedure

1. Place the drilling template on the ground by allowing at least 457 mm clearance to the obstacle.
2. Drill the holes with a diameter 24 mm and depth 165 mm (see Table 3) with drilling machine.
⚠ The holes must be drilled to obtain a conic form (Fig. 6). The hole diameter must be approximately 4 mm greater than the threaded sleeve at the bottom of the hole.
3. Clean debris from the holes by blowing with air.
4. Insert the resin V 300T in the hole with the cartridge gun.
5. Insert the sleeve RG 22 x 160 M16 I in the hole. Excess resin will come out of the hole.
6. Clean the excess resin from around hole.
7. Allow resin to cure based on times shown in Table 4.
8. Place the Crash Cushion on the ground without disturbing the holes.
9. Place the washers and install the M16x30 bolts for a minimum depth of 24 mm.

Table 3: Quantity and depth for specific holes for FISCHER

Item	
Quantity of holes	40
Quantity of washers	40
Holes on the ground: Ø in (mm)	24
Holes on the ground: depth in (mm)	165
Type of bolt A354 Grade BC (Class: 8.8)	(M 16)

Table 4 : External temperature and Cure Time for FISCHER Resin

Cartridge temperature	Time for processability	External temperature	Time for loading application
		- 5°C — ± 0°C	24 hrs.
		± 0°C — + 5°C	3 hrs.
+ 5°C — + 10°C	9 min.	+ 5°C — + 10°C	90 min.
+ 10°C — + 20°C	5 min.	+ 10°C — + 20°C	60 min.
+ 20°C — + 30°C	4 min.	+ 20°C — + 30°C	45 min.
+ 30°C — + 40°C	2 min.	+ 30°C — + 40°C	30 min.

The times shown are applied starting from the contact between the resin and the hardener in the mixer.
For the installation the cartridge temperature must be at least +5°C. For a longer installation time, e. g. in case of work interruption, the mixer must be replaced.



Fig. 4: Resin type Fischer V 300T



Fig. 5: Sleeve type Fischer RG 22 x 160 M16I



Fig. 6: Conic drill

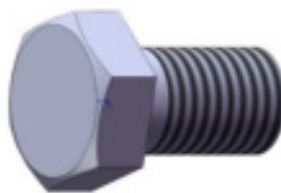


Fig. 7: Screw M16x30

2.3. Positioning in front of the obstacle

The Crash Cushion must be placed in front of the obstacle, by respecting a minimum distance of 457 mm between the edge of the last side panel and the obstacle.



Fig.8: Side view positioning with respect to the obstacle.



Fig.9: Top view positioning with respect to the obstacle.

The lateral maximum acceptable slope for Hercules is $\pm 5^\circ$ (8%).

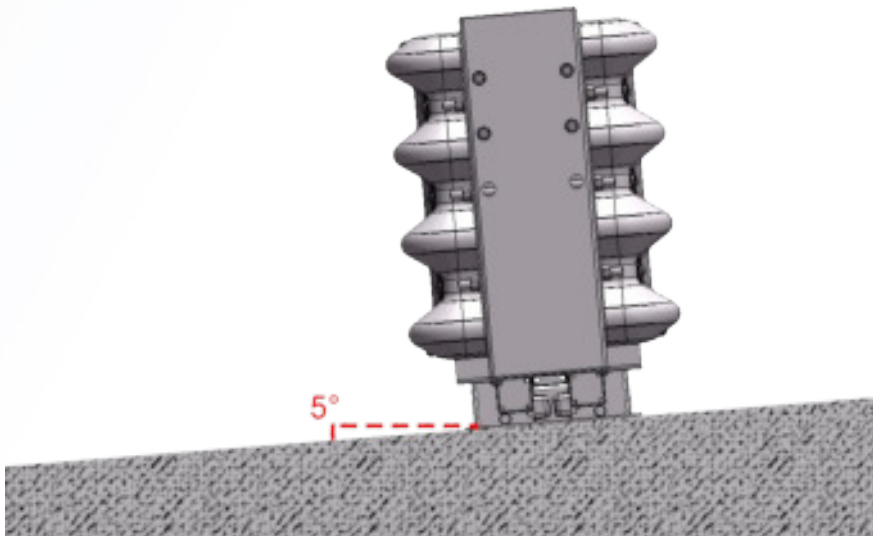


Fig. 10: Lateral Slope

2.4. Connection of the crash cushion to other Barriers.

HERCULES can be connected to many different types of barrier as approved by the local road authority.

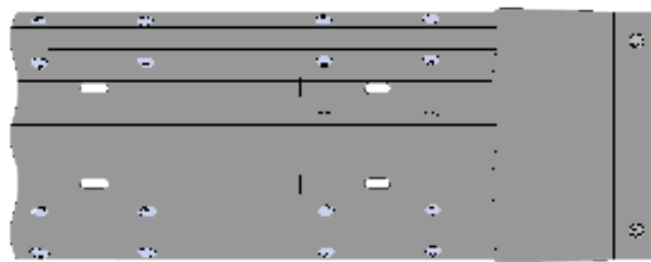


Fig. 11a: Example of thrie beam connection to New Jersey barrier

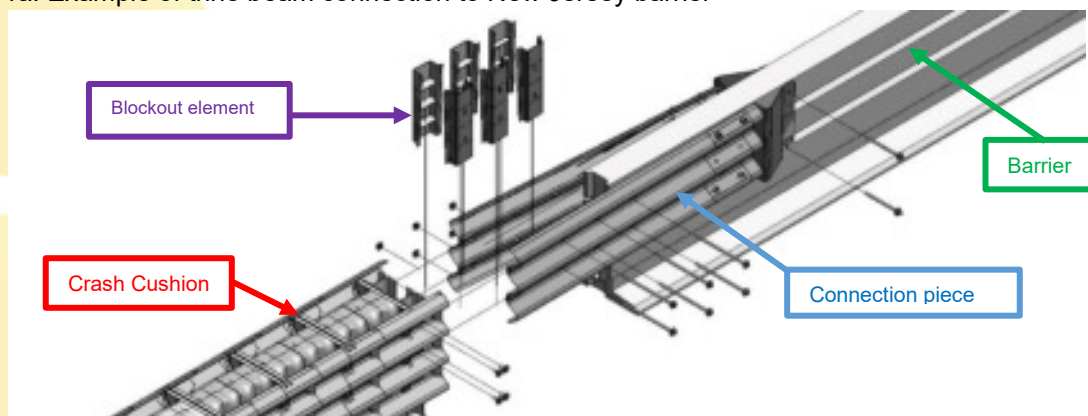


Fig. 11b: Exploding view of the crash cushion connected with the barrier

Industry A.M.S. can design and supply specific connection pieces according to the customers' requests, and acceptance by the local road authority.

2.5. SMA App with NFC Technology

HERCULES is equipped with the NFC Tag which permits to access to the Product information and installation procedures through a smartphone equipped with NFC reader and Android System.

The NFC Tag is located on the back face of the Crash Cushion backstop, as shown in the picture Fig. 12.



Fig. 12: NFC Tag screwed on the Crash Cushion

The SMA App is available for Android smartphone and can be downloaded by the customer through a link supplied by SMA Road Safety.

For further details, please contact the following email address: info@smaroadsafety.com

The SMA app permits to have information on the specific product by touching the NFC Tag with the smartphone.

As soon as the user is logged in, he can have access to the following details:

- Product information: Serial Number, Model Name.
- Installation Procedure shown step by step with text and pictures.
- Exploding view of the device with the opportunity to select the Spare Parts.
- Repair Procedure step by step with text and pictures.

3. REPAIR PROCEDURE

3.1. Foreword

The HERCULES crash cushion should not require maintenance under standard conditions of use and is designed such that after an impact only the damaged components need to be replaced.

After a typical frontal impact to the HERCULES that is within MASH TL-3 criteria, usually replacement of the damaged collapsible beam module is all that is required.

After a typical side impact to the HERCULES that is within MASH TL-3 criteria, usually replacement of the damaged side panels is all that is required.

In case of a vehicle impact outside of the MASH TL-3 criteria, usually replacement of components will vary and be based on the impact scenario.

3.2. Component replacement

Below you can find the list of components for HERCULES crash cushion.

All the components (Figure 13 and Table 6) other than the steel base can be easily unscrewed and replaced.

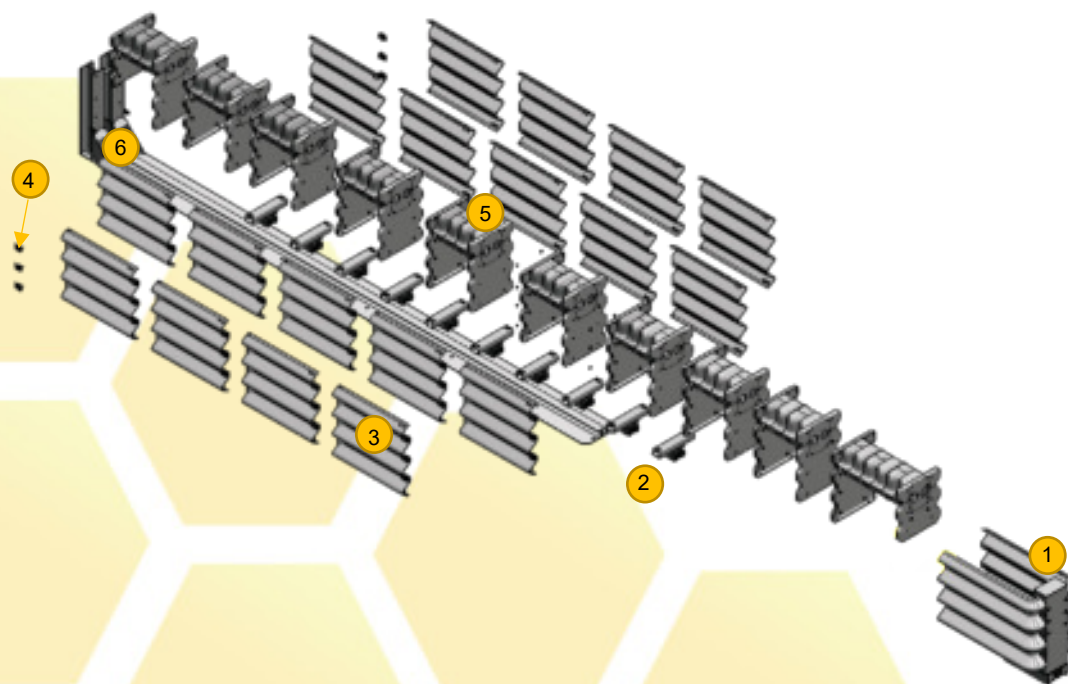


Fig. 13: Exploding view of HERCULES crash cushion.

Table 6: Components of the HERCULES crash cushion TL-3

Item n.	Component	Quantity
1	Frontal Trolley with side panels	1
2	Collapsible beam support (module 1-10)	10
3	4-beam side panel	18
4	Sliding element	60
5	Collapsible beam module	10
6	Steel Base with welded sliding rail and backstop	1

3.3. Repair procedure

Below you can find the specific procedure to remove and replace the damaged components after an impact.

The Repair procedure is also available on the SMA App (See par. 2.5).

3.3.1 Frontal plate

The frontal plate allows to attach the reflective sticker.

1. Unscrew the two pins which connect the trolley with the plate.
2. Replace with the new plate.
3. Attach the reflective sticker.

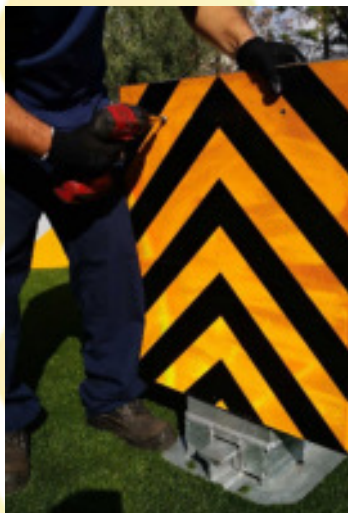
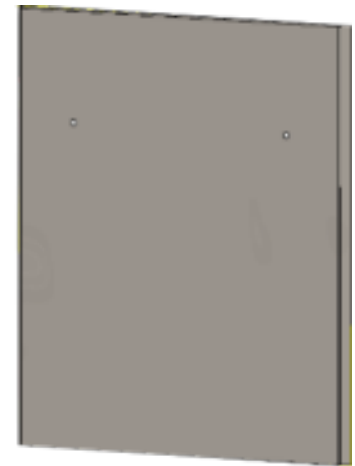


Fig.14: Removal of the frontal plate.

3.3.2 Frontal Trolley with side panels

The Frontal trolley is formed by the trolley and the two 4-beam side panels connected to the trolley box through the angular shape element.

1. Unscrew the nuts and remove the central threaded bar which passes through the frontal trolley to connect the frontal side panels each other (see Fig. 15)
2. Loosen the four nuts of the upper and lower threaded bar on the two sides of the frontal trolley
3. Unscrew two button head screws on each sliding element that connect both side panels of the frontal trolley with the collapsible beam. (Fig. 16)
4. Use a screwdriver extension tool (Fig. 17) to unscrew six hexagonal head screws from the frontal face of the trolley and remove the trolley from the collapsible beam. (Fig. 18)
5. Fix a rope around the trolley on one side and to the handling machine on the other side. (Fig. 19)
6. Slide the trolley forward along the rail with the help of a handling machine.
7. Place the new frontal trolley to be in contact with the collapsible beam. (Fig. 20)
8. Screw six hexagonal head screws back on the frontal face of the trolley.
9. Insert the central threaded bar and tighten the nuts.
10. Fix the sliding elements back on the side panels by screwing two button head screws on each piece.

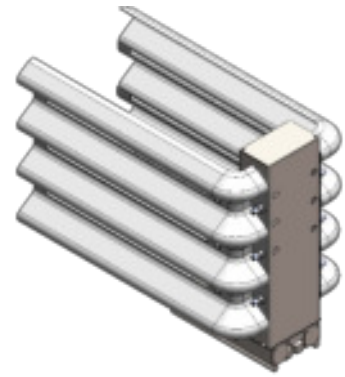


Fig.15: Removal of the threaded bar



Fig. 16: Removal of the sliding element



Fig.17: extension element for screwdriver



Fig. 18: Unscrewing of the trolley



Fig. 19: Pulling out of the trolley



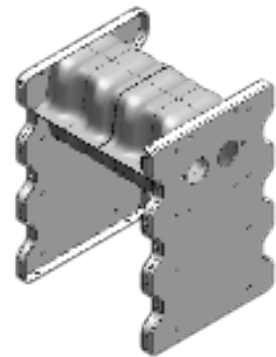
Fig. 20: Positioning of the new trolley

3.3.3 Collapsible beam module

The module of the Collapsible beam (Fig. 20) consists of a piece of the beam included between two vertical panels.

1. Unscrew and slide forward the Frontal Trolley (see paragraph 3.3.1).
2. Remove the three sliding elements each side (Fig. 15) and the button screws on the top (two each side) to remove the 4-beam side panels (Fig. 21).
3. Unscrew eight hexagonal head screws from the panel of the beam to separate the beam modules (Fig. 23).
4. Remove the collapsible beam support by unscrewing four button head screws (Fig 24).
5. Move the component out and replace it with the new one (Fig. 25).

 The modules of the collapsible beam differ from each other by shape and features. Therefore, it is important to place the right component according to the original design of the system. (see table of the components in Chapter 4.)



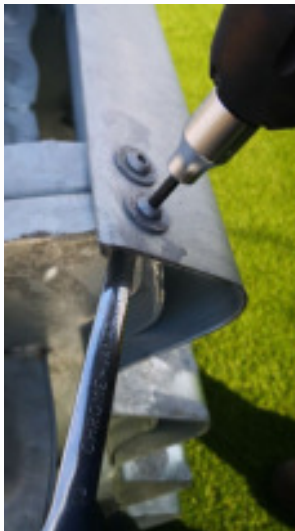


Fig. 21: Screws on the top of the side panel

F
R
O
N
T



B
A
C
K

Fig. 22: Side panel description. The holes are located on the front side.



Fig.23: Collapsible beam



Fig.24: Unscrewing of the modules



Fig.25: Unscrewing of the support



Fig. 26: Replacement of the collapsible beam

3.3.4 Collapsible beam support

The collapsible beam support for modules consists of a tubular element and a welded skid and permits the longitudinal sliding of the elements along the rail.

1. Slide the collapsible beam module (par. 3.3.2) forward along the rail and move it out.
2. Unscrew four button head screws that connect two vertical panels of the module with the tubular element of the support (Fig. 24).
3. Replace the support with the new part and attach it back to the vertical panel of the collapsible beam module (Fig. 27).
4. Slide the collapsible beam module back along the rail.



3.3.5. 4-beam Side panel

The 4-beam side panel absorbs the lateral impact of the vehicle and is fixed to the vertical panel of the collapsible beam by means of the sliding elements and some screws on the top.

1. Remove the sliding elements (Fig. 15).
2. Unscrew the button screws on the top (Fig. 20)
3. Replace the damaged panel with the new one (Fig. 21).
4. Screw the sliding element back in place.

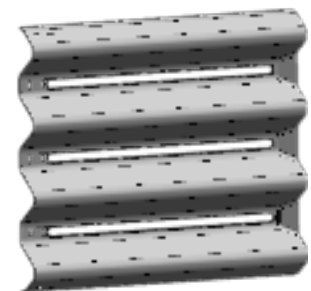


Fig.27: Sliding of the collapsible beam support (module 2-10)

3.4 Marking of tightened screws

During the replacement of the damaged components, it is advisable to mark the screws with a marker pen each time they have been tightened as shown in Fig. 28 to be sure that the whole repair procedure has been carried out in the correct way.



Fig. 28: Marking of the tightened screws

4. APPENDIX

Attachment A – Chemical anchors for concrete base.

LOADS

Injection system FIS V: Injection mortar FIS V with Internal threaded anchor RG M I
zinc plated steel / stainless steel

Permissible loads of a single anchor in non-cracked normal concrete (concrete compression zone) of strength class C20/25 (=B25) ⁽¹⁾⁽²⁾										Minimum spacings while reducing the load	
Type	Screw material resp. screw surface	Min. member thickness	Effective anchorage depth	Maximum torque moment	Permissible tensile load	Permissible shear load	Required edge distance (with one edge) for		Required spacing for	Min. spacing	Min. edge distance
		h_{min} [mm]	h_{ef} [mm]	T_{max} [Nm]	$N_{perm}^{(3)}$ [kN]	$V_{perm}^{(4)}$ [kN]	Max. tension load c [mm]	Max. shear load c [mm]	Max. Load s_{gr} [mm]	$s_{min}^{(5)}$ [mm]	$c_{min}^{(6)}$ [mm]
RG M 8 I	5.8	120	90	10	9,0	5,3	70	65	270	55	55
	8.8				13,8	8,3	130	95			
	A4-70				9,9	5,9	80	70			
RG M 10 I	5.8	130	90	20	13,8	8,3	105	90	270	65	65
	8.8				19,0	13,3	175	155			
	A4-70				15,7	9,3	130	100			
RG M 12 I	5.8	170	125	40	20,5	12,1	155	110	375	75	75
	8.8				23,8	19,3	190	190			
	A4-70				22,5	13,5	175	125			
RG M 16 I	5.8	210	160	80	35,7	22,4	240	180	480	95	95
	8.8				35,8	35,8		320			
	A4-70				25,1	25,1		205			
RG M 20 I	5.8	270	200	120	54,8	35,4	335	245	600	125	125
	8.8					42,9		315			
	A4-70					39,4		285			

For the design the complete assessment ETA-02/0024 has to be considered. ⁽⁷⁾

⁽¹⁾ The partial safety factors for material resistance as regulated in the ETA-02/0024 as well as a partial safety factor for load actions of $\gamma_L = 1,4$ are considered. As an single anchor counts e.g. an anchor with a spacing $s > 3 \cdot h_{ef}$ and an edge distance $c > 1,5 \cdot h_{ef}$. Accurate data see ETA-02/0024.

⁽²⁾ For higher concrete strength classes up to C50/60 higher permissible loads may be possible.

⁽³⁾ Drill method hammer drilling. For further allowable application conditions see ETA-02/0024.

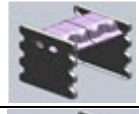
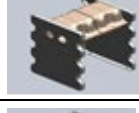
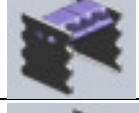
⁽⁴⁾ For combinations of tensile loads, shear loads, bending moments as well as reduced edge distances or spacings (anchor groups) see ETA-02/0024.

⁽⁵⁾ Minimum possible axial spacings resp. edge distance while reducing the permissible load.

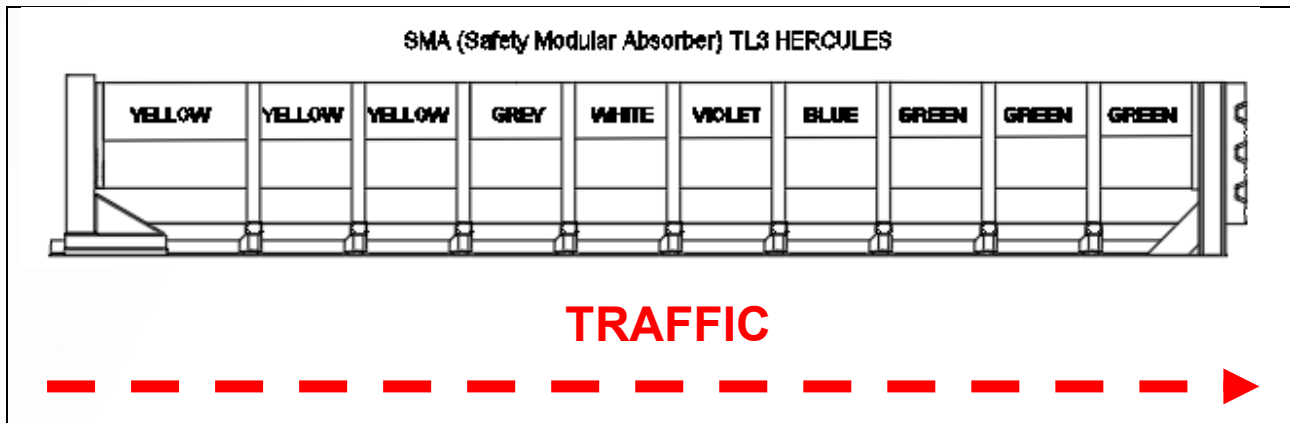
⁽⁶⁾ Minimum possible spacing resp. edge distance while reducing the permissible load for the required minimum member thickness. The combination of minimum edge distance and minimum spacing is not possible. One of both values has to be increased acc. ETA-02/0024.

⁽⁷⁾ The given loads refer to the European Technical Assessment ETA-02/0024, issue date 13/02/2017. Design of the loads according ETAG 001, Technical Report TR 025 (for static resp. quasi-static loads).

Attachment B – Table of spare parts for HERCULES crash cushion.

PART NUMBER	DESCRIPTION	LENGTH	WIDTH	HEIGHT	TAG COLOR	QTY	
D53522403	Frontal plate	16 mm	638 mm	714		1	
D53531500	Frontal trolley with side panels	1093 mm	589 mm	867 mm		1	
D53532300	Collapsible beam - Module 1	766 mm	479 mm	685 mm	YELLOW	1	
D53531900	Collapsible beam - Module 2; 3	519 mm	479 mm	685 mm	YELLOW	2	
D53532100	Collapsible beam - Module 4	519 mm	479 mm	685 mm	GREY	1	
D53531800	Collapsible beam - Module 5	519 mm	479 mm	685 mm	WHITE	1	
D53532000	Collapsible beam – Module 6	519 mm	479 mm	685 mm	VIOLET	1	
D53531700	Collapsible beam - Module 7	519 mm	479 mm	685 mm	BLUE	1	
D53531600	Collapsible beam - Module 8; 9	519 mm	479 mm	685 mm	GREEN	2	
D53532200	Collapsible beam - Module 10	519 mm	479 mm	685 mm	GREEN	1	
D53530603	4-beam side panel with bolts	800 mm	82 mm	700 mm		18	
D49110500	Sliding elements with bolts	44 mm	80 mm	55 mm		60	
D53530100	Collapsible beam support with bolts Module 1-10	109 mm	400 mm	152 mm		10	

Scheme of the collapsible beam with the sequence of the modules. Side view



SafeDirection

CRASH BARRIER SOLUTIONS

Safe Direction is SMA's exclusive Australian distributor of the Hercules Crash Cushion

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