



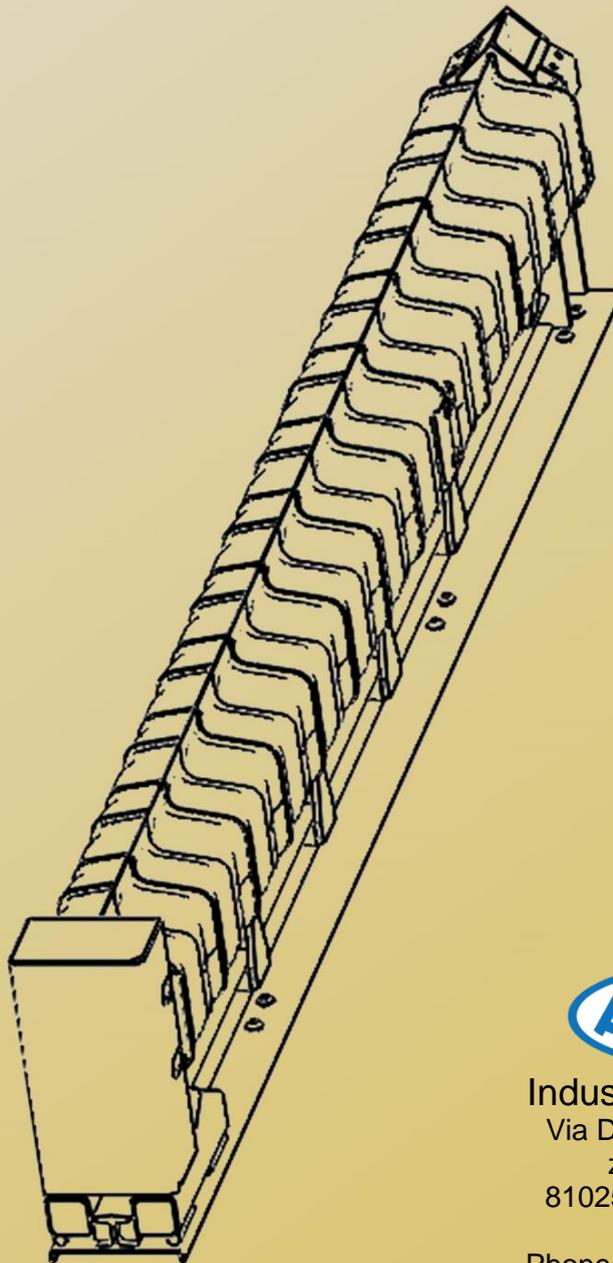
SMA[®]

safety modular absorber

End Terminals

Installation and restoring manual

SMAT2 – SMAT4



Industry A.M.S. s.r.l.

Via Dante Giacosa snc

zona ASI sud

81025 Marcianise (CE)

Italy

Phone: +39 0823 821 560

info@amssrl.com

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1. GENERAL

1.1 Foreword

The following document represents the SMA® (Safety Modular Absorber) Installation and Restoring Manual for the End Terminals, developed from the Company Industry A.M.S. srl, which has its seat in Marcianise (CE), ITALY. Copyright 2015, all rights reserved.

1.2 Crash Test

SMA® End Terminals have successfully passed the Crash tests according to the European standard ENV1317-4 and prEN 1317-7.

The crash tests have been performed by the Test Lab of **Certification Security Institute (CSI) S.p.A.**, with its site in Viale Lombardia 20, Bollate (MI), Italy.

Below (Tab. 1) they are indicated the test results.

Tab. 1: Summary of the test reports, as indicated by the Certification Security Institute.

Test report code	Test	ASI-1998	ASI-2010	THIV (km/h)	PHD (g)	Lateral Displ.	Exit Box	Standard
0136/ME/HRB/14	TT 1.3.110	1.4	1.4	41	20	Z1	D1	ENV 1317-4 / prEN 1317-7
0135/ME/HRB/14	TT 2.1.100	1.3	1.3	43	20	Z1	D1	ENV 1317-4 / prEN 1317-7
0134/ME/HRB/14	TT 4.3.110	1.1	1.1	32	14	Z1	D1	ENV 1317-4 / prEN 1317-7
0137/ME/HRB/14	TT 5.1.100	1.3	1.2	32	7	Z1	D1	ENV 1317-4 / prEN 1317-7
0155/ME/HRB/14	TT 6.3.110*	n.a.	1.3	30	n.a.	Z1	D1	prEN 1317-7
0157/ME/HRB/14	TT 3.3.110	n.a.	1.1	40	n.a.	Z1	D1	prEN 1317-7
0020/ME/HRB/16	TT 6.3.110	n.a.	0.9	20	n.a.	Z1	D1	prEN 1317-7
0154/ME/HRB/14	TT 2.1.80	1.1	1.1	40	18	Z2	D1	ENV 1317-4 / prEN 1317-7

* test on the Critical Impact Point

1.3 SMA End Terminals: Components

All the components below described are assembled with bolts with different sizes and typologies, in order to make easier the installation and/or the restoring procedure.

1	Collapsible beam formed by modular bays;
2	End terminal basement;
3	Tie rods welded to the collapsible beam;
4	Sliding trolley;
5	Lateral plates – for the fixing of the trolley and the bays;
6	Installation plates for the fixing of the End terminal to the ground;
7	Posts with welded plate

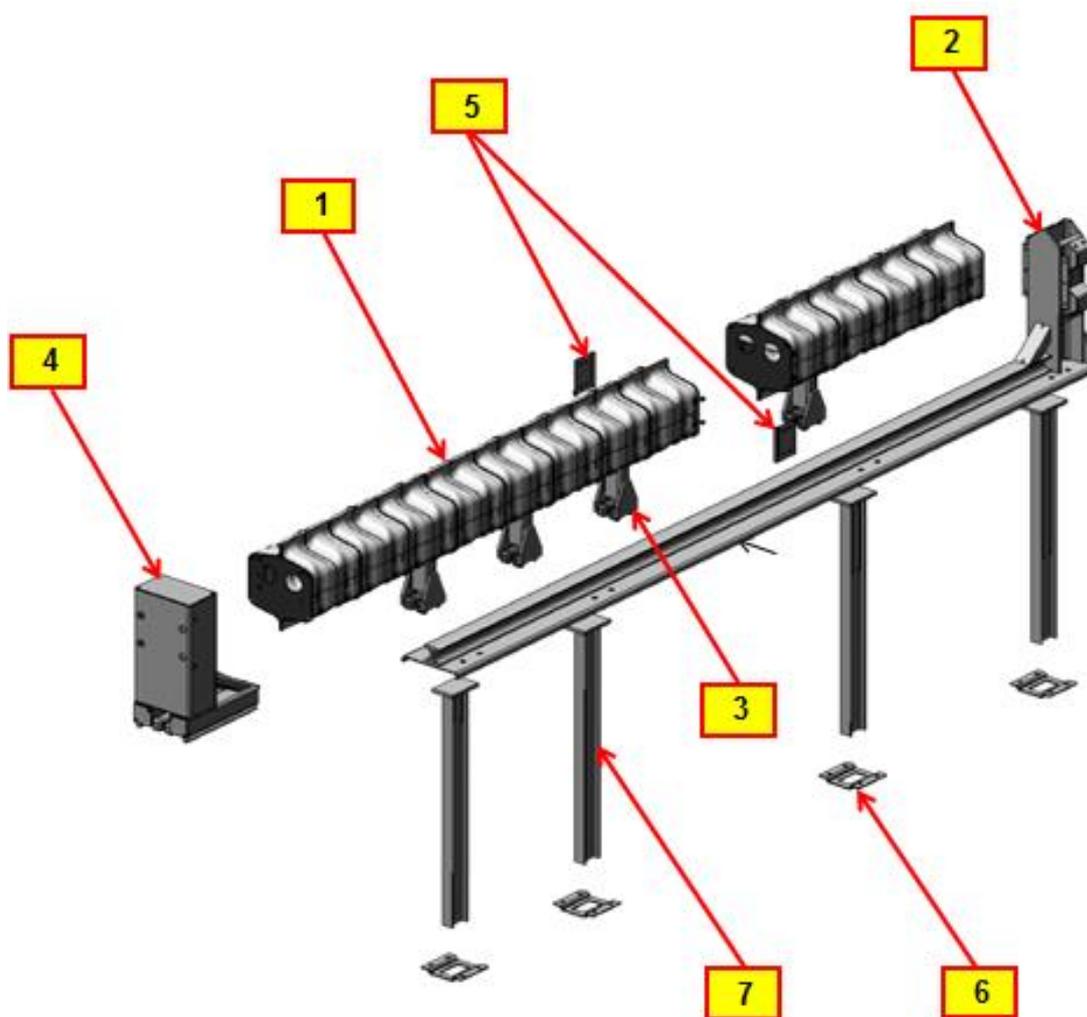


Fig. 1: Componenti del terminale di barriera SMA T2

1.4 SMA End Terminals: Family and Sizes

- **SMA T 2** for the speed class 80 km/h (also named “P2” according to the Standard ENV 1317-4 or “T 80” according to prEn 1317-7).
- **SMA T 4** for the speed class 110 km/h (also named “P4” according to the Standard ENV 1317-4 or “T 110” according to prEn 1317-7).

SMA T 2	Speed class: 80 Km/h		
Sizes	Lenght: 3470 mm	Height from the soil: 620 mm	Width: 280 mm

SMA T 4	Speed class: 110 Km/h		
Sizes	Lenght: 5840 mm	Height from the soil: 620 mm	Width: 280 mm

1.5 Transition

SMA End terminal has performed the crash tests with the following transition:

Type of barrier	Containment level	Working width
W Beam barrier	H2	W2 or W3

Industry A.M.S. has designed and manufactured the SMA Transition which permits the connection between the End Terminal and the different longitudinal barrier typologies.

It will be supplied together with the End Terminal (see also par. 2.6 for further details).

SMA Transition can be:

single sided: which is used for the connection to the side barriers;

double sided: which is used for the connection to the median barriers.

Furthermore the Company distributes the SMA Transitions for the connection to different types of end/begin of the barrier. For example:

Tab. 2: Transition typologies

TYPE 1	from double beam to double beam
TYPE 2	from double beam to triple beam
TYPE 3	connection to new jersey

1.6 NFC Technology

SMA[®] End Terminals are supplied with a tag behind the structure (Fig. 2) for the use of the NFC (Near Field Communication) technology compatible with tablet and smartphone provided with OS **Android**.

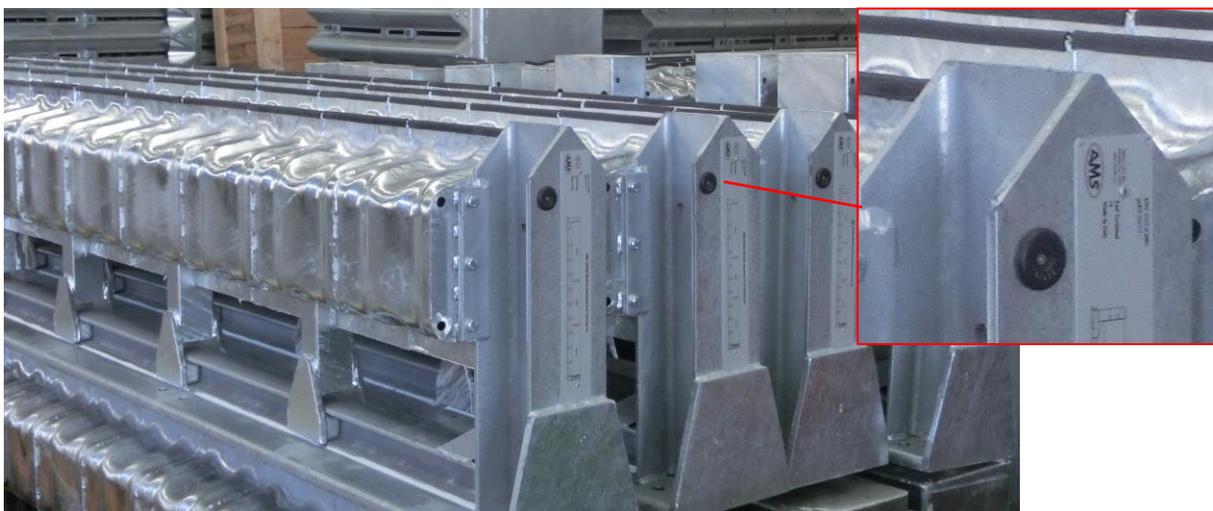


Fig. 2: Tag on the structure of the End Terminal.

By the contact of the device with the tag and following authorisation released by Industry A.M.S., it is possible to open **SMA Road Safety**, where it is possible to have access to the guided procedure for the installation and the restoring.

1.7 Customer service

Industry A.M.S. s.r.l. commits to supply the customer service at the highest level.

The Company welcomes the comments concerning the quality and the manufacturing of its products, the installation procedure and the supporting documentation.

The clients are invited to contact the Company in the following ways:

e-mail: info@amssrl.com

phone: +39 0823 821560

2. INSTALLATION PROCEDURE

2.1 Foreword

The End Terminal is provided already assembled in every part. For this reason, it will be necessary only the device fixing to the plates of the posts which are on the soil.

It is mandatory to observe the safety and hygienic norms. **Industry A.M.S. srl** refuses any responsibility in case of non-fulfillment of the local norms.

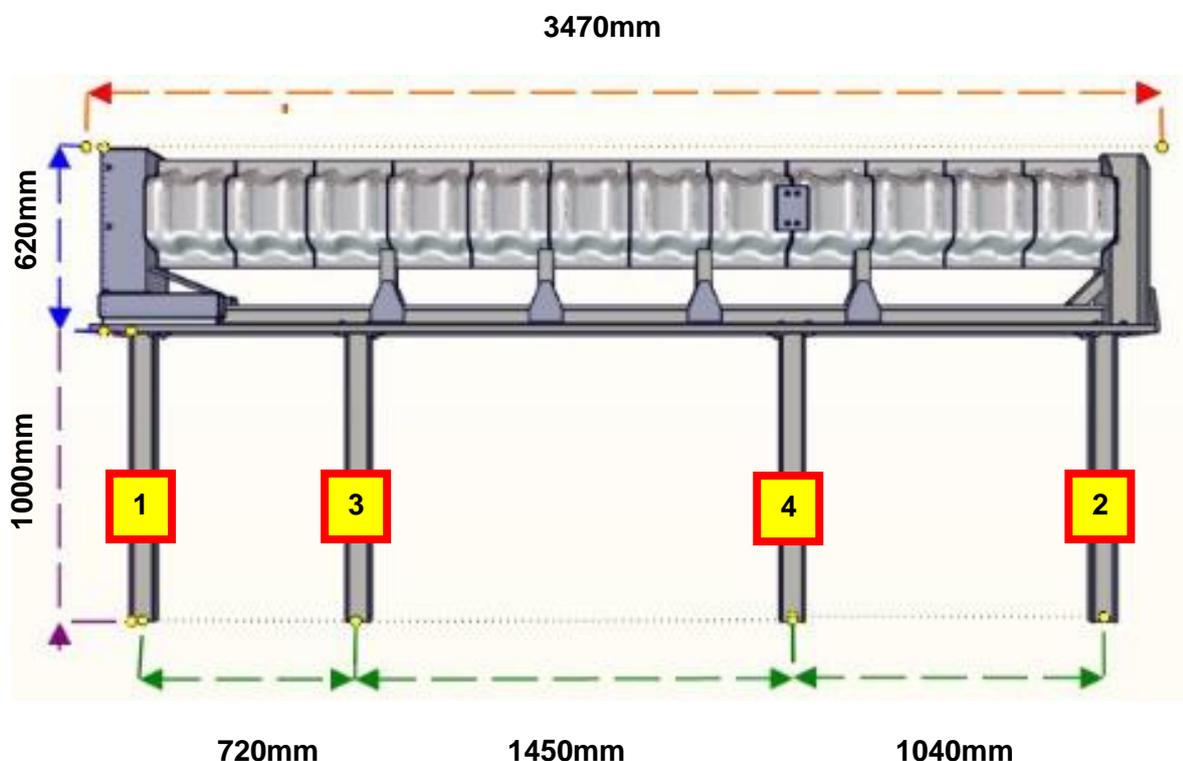


Fig. 3: Side view of the End Terminal SMA T2.

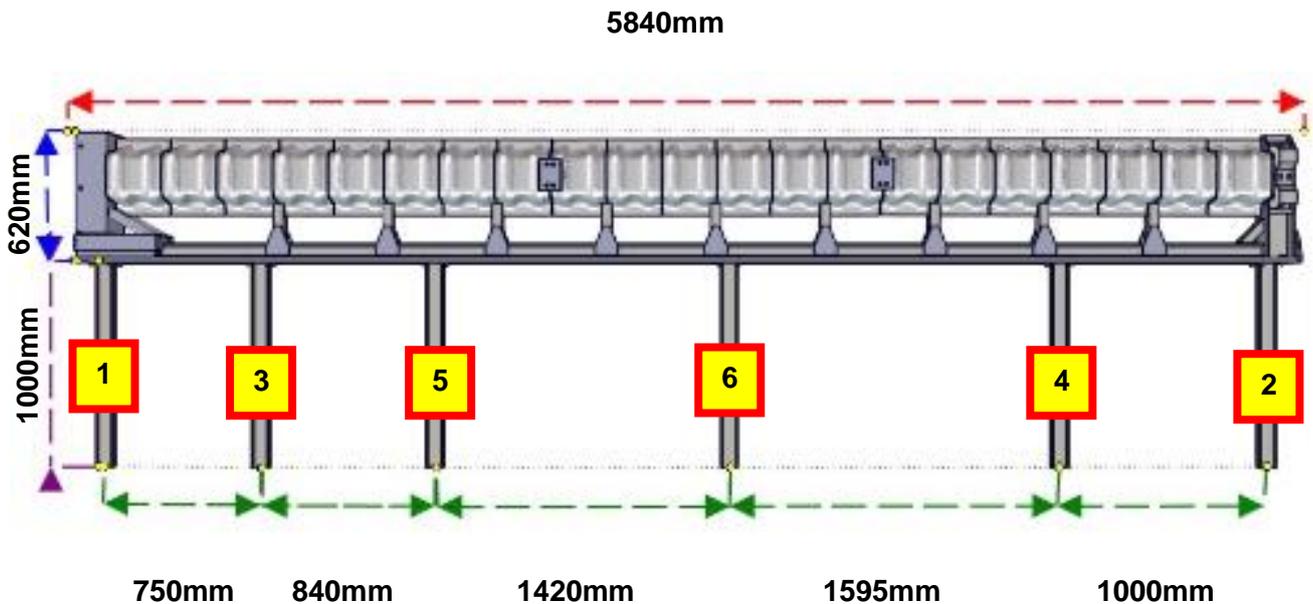


Fig. 4: Side view of the End Terminal SMA T4

2.2 Installation tools

- Drilling template for the positioning of the posts (supplied on request);
- Dynamometric wrench for bolts M16 – M10;
- Handling device;
- Pile driver;
- Tool for the post hammering.
- Down The Hole (DTH) hammers (only for harder grounds)

2.3 Positioning in front of the barrier

SMA® End terminal must be placed parallel to the barrier and perpendicular to the ground.

Moreover it must be anchored to the barrier with the **SMA®** transition.

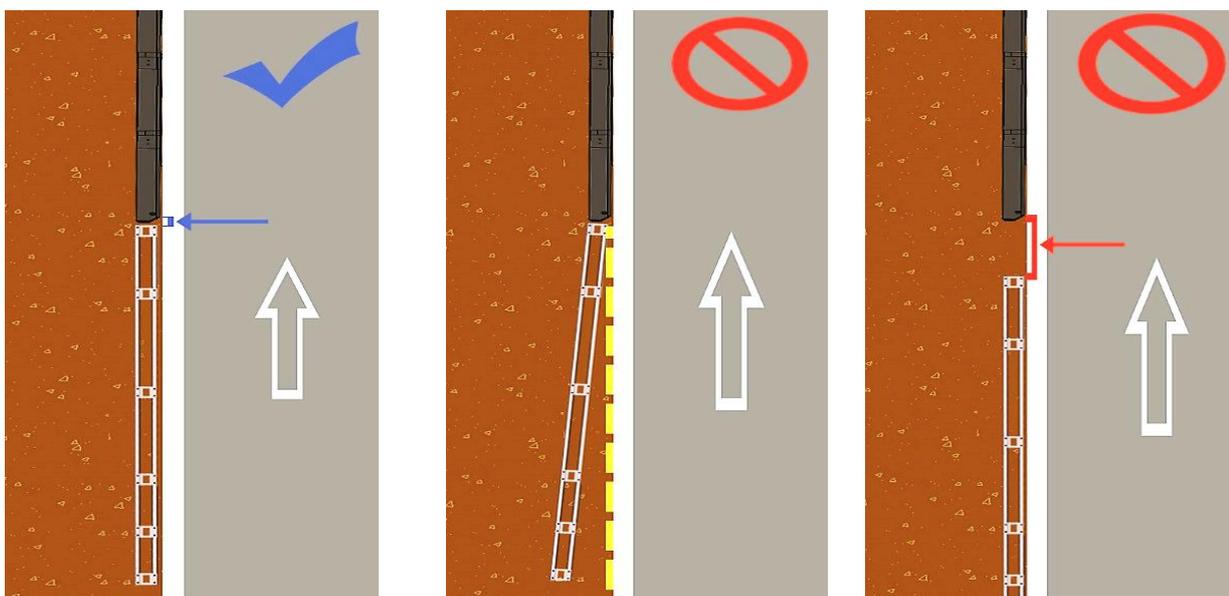


Fig. 5: Top view of the drilling template positioning compared with possible errors.

2.4 Installation procedure

SMA[®] End Terminals can be installed on soil and/or asphalt.

It is mandatory that the ground class is between **3** and **5** according to the classification **DIN 18300**.

Before starting the installation, it is mandatory:

- the adequate cleaning of the soil;
- the fence installation along the working zone;
- the safety equipment;
- the use of signalisation tools.

⚠ If rock is encountered in the subsoil during the works, **Industry A.M.S.** suggests to proceed as indicated at the paragraph 2.5.

Ramming of the posts

Please ram the posts in an orderly way as indicated in the pictures Fig. 2 -3 (optionally it is possible to follow the procedure come described at par. 2.5).

You can find a video of the installation procedure on our Youtube channel **SMA Road Safety** at the following link:

<https://www.youtube.com/watch?v=VwH0rY8skg&feature=youtu.be>

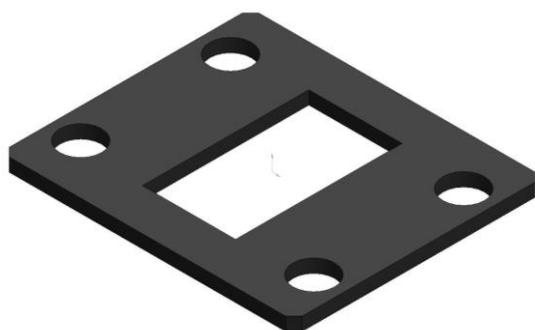


Fig. 6: Installation plate



Fig. 7: Preparation of the installation plates by using the drilling template for SMA T2-SMA T4

1. Place the installation plates on the soil in front of the barrier (Fig. 6 and 7).
2. Insert the post n.1 (Fig.9) into the ground, through the hole of the installation plate (Fig.8). Such procedur is performed by the use of a pile driver. To avoid the post damage it is recommended

the use of the tool for the post hammering, it is inserted into the pile driver and screwed on the plate of the post which will be rammed, this tool is supplied by **Industry AMS srl** (Fig. 9).



Fig. 8: Insertion of the post type IPE 80 with welded plate.



Fig. 9: Tool for the post hammering screwed on the post

⚠ It is mandatory the vertical position during the ramming (Fig. 10).



Fig. 10: Check through the spirit level

⚠ The post must be inserted into the soil as deep as the upper plate on the post is at the same level of the ground floor. (Fig. 11).



Fig. 11: Ramming complete

3. Proceed with the insertion of the posts numerically next to the n. 1 as in Fig. 3-4.
4. Unscrew the brackets from the installation plates.
5. Clean the plates from dusts and debris for the anchoring of **SMA**[®] End Terminal

Fixing of End Terminal and Transition

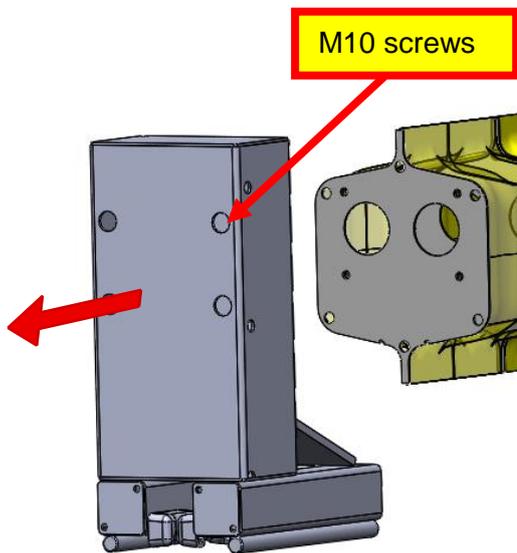


Fig. 12: The trolley is slid forward along the rail to permit the fixing on the installation plates.

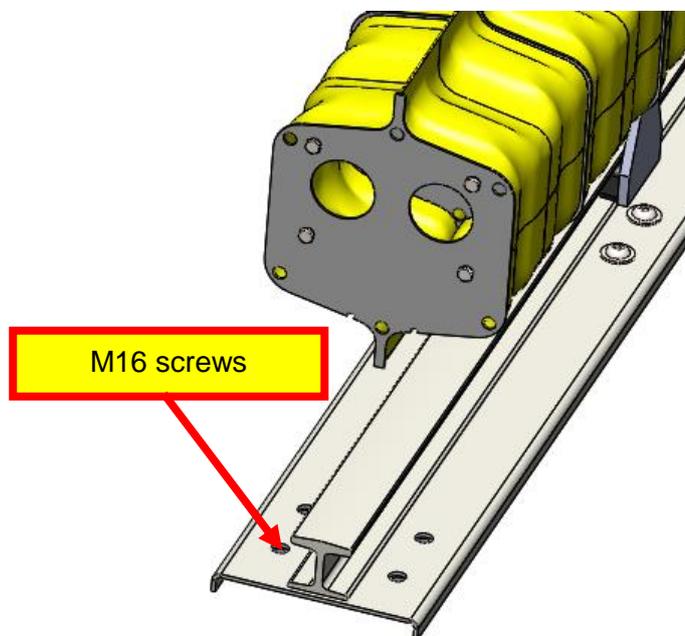


Fig. 13: Top view of the End terminal without trolley.

6. Unscrew the 4 bolts M16 of the trolley in the frontal holes, then remove it by sliding it along the rail with the support of a handling device (Fig. 12-13).

7. Fix the **SMA**[®] End Terminal on the post plates and screw the M16 screws to the plate with a tightening torque 210Nm (class 8.8).
8. Replace the frontal trolley and tighten the M10 screws.
9. Place the End terminal transition in order to connect the backstop with the barrier (see par. 2.7).
10. Fix the transition (see par. 2.7) through M16 screw with tightening torque 210Nm (class 8.8). In case of double sided transition, it must be performed the same procedure for both the sides.

2.5 Installation in case of harder grounds

If the ground is too hard to hammer the posts with the pile driver (ground classes **6** and **7**), it is necessary to use a different installation procedure. This procedure can also be used as optional to the standard procedure

1. Drill the ground through the DHT hammer, for the post insertion (depth **1 mt**; \varnothing **120 mm**)
2. Place the installation plates beside the holes.
3. Fill the holes with concrete $R_{ck} \geq 25$ Mpa.
4. Insert the post as deep as the plate is ground floor.
5. Wait for the cure time and eventually clean the plates.
6. Proceed as described at the paragraph 2.7.

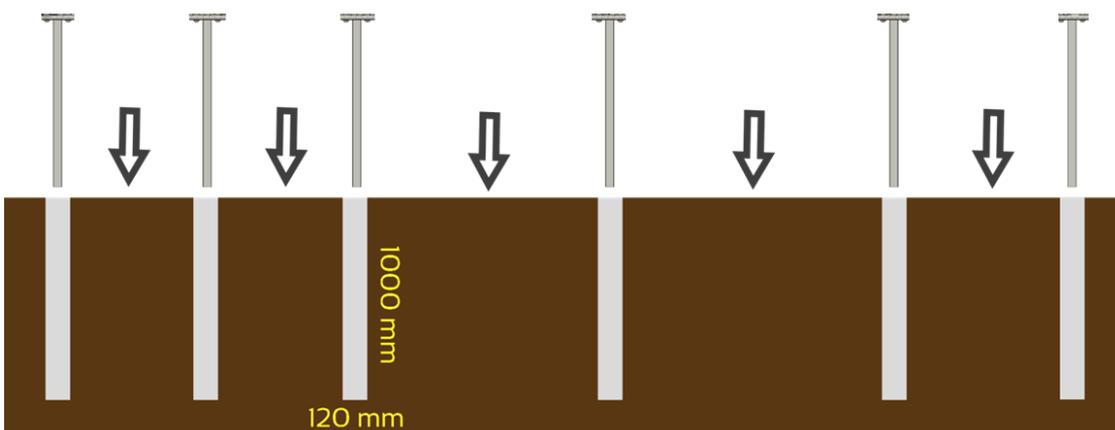


Fig. 13: The picture shows the post insertion of the SMA T 4 after the casting the concrete.

2.6 Solution for working zones

SMA[®] End Terminal can also be used as temporary re-directive solution for working zones (Fig. 14).

In this case, SMA device is fixed on a steel plate which permits the placement in front of the obstacle without drilling the ground.



Fig. 14: SMA temporary solution for working zones

The device is supplied already mounted on the steel plate, so the installation procedure is very simple and fast:

- 1) Place the End Terminal for working zones in front of the obstacle.
- 2) Fix the End Terminal to the obstacle with a suitable connection.

After the road works, it is possible to unscrew the connection and remove the SMA End Terminal by lifting it from the ground.

2.7 Installation of the Transition

The transition will be supplied according to the barrier specifications.

⚠ The customer has to send all the information below requested:

- Profile of the barrier;
- Height from the ground;
- Dynamic deflection;
- Interaxis distance of the holes on the profile;
- Side of anchoring to the barrier (Fig. 15)

Fixing procedure

1. Match the holes on the transition with the holes on the end/begin of the barrier
2. Screw the transition to the end/begin of the barrier by mean of M16 bolts, with a tightening torque 210 Nm (bolts class 8.8).

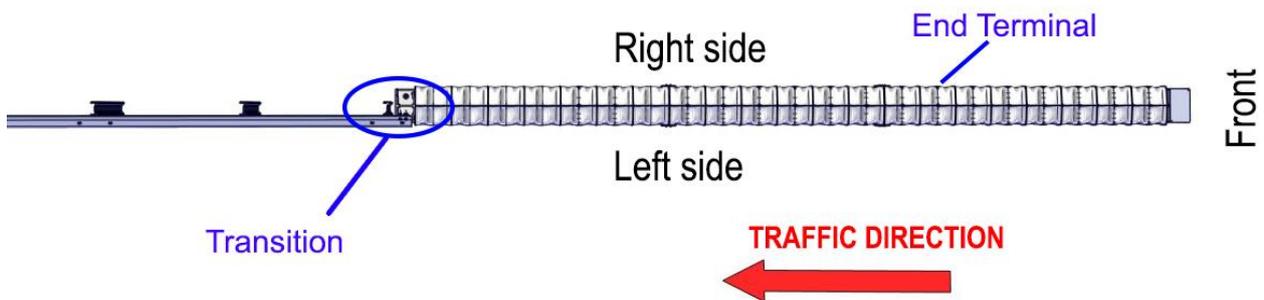


Fig. 2: Top view of the End Terminal connected to the barrier.

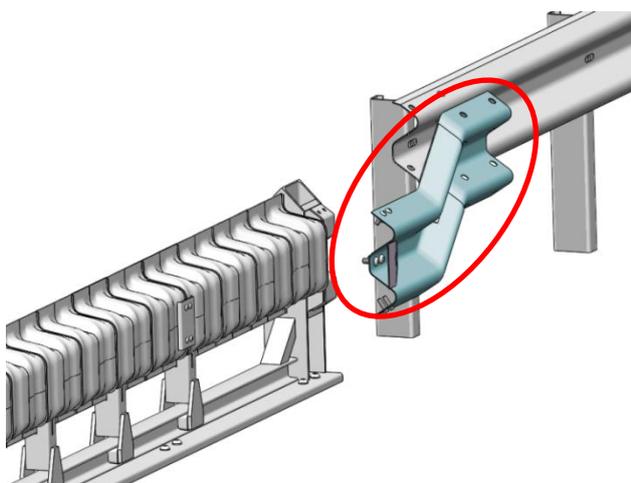


Fig. 16: Example of transition to double beam barrier

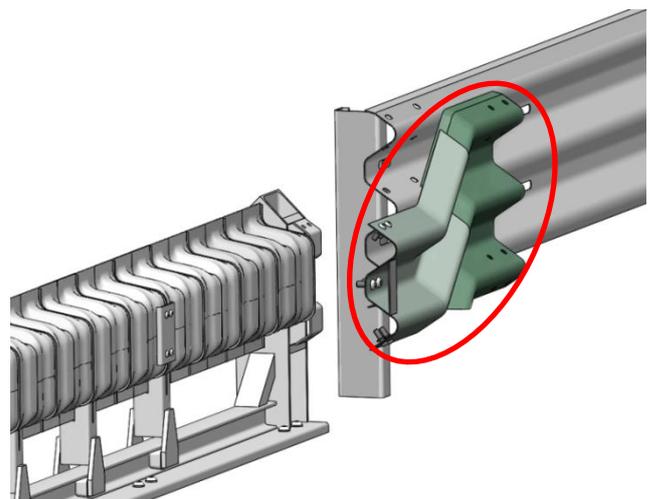
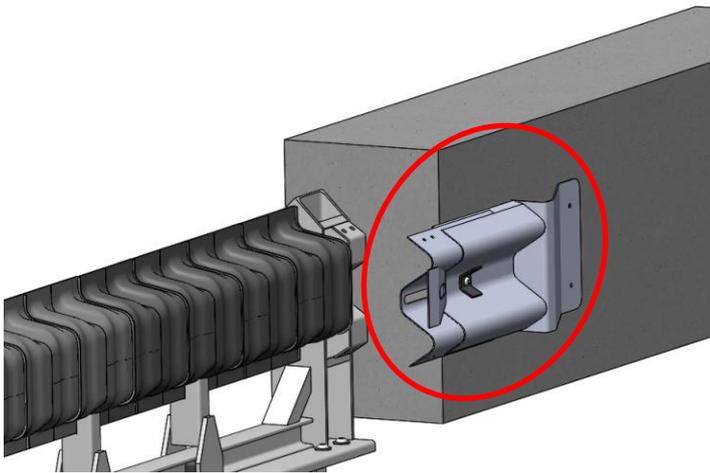


Fig. 3: Example of transition to thrie beam barrier



Connection to double beam profile

SMA End terminal has been tested with a special connection to a N2W2 barrier.

It is possible to fix SMA End Terminal to a double beam barrier with a different height (up to 800 mm from the ground), by changing the grade and the dynamic deflection of such barrier.

In the example below illustrated (Fig. 19-20-21) the dynamic deflection is gradually changed from W4 to W2 by adding some posts in specific sections of the beam.

The existing barrier in the picture (Fig. 19) has a post spacing of 2000 mm, it has to be changed in order to make the barrier a W2 type.

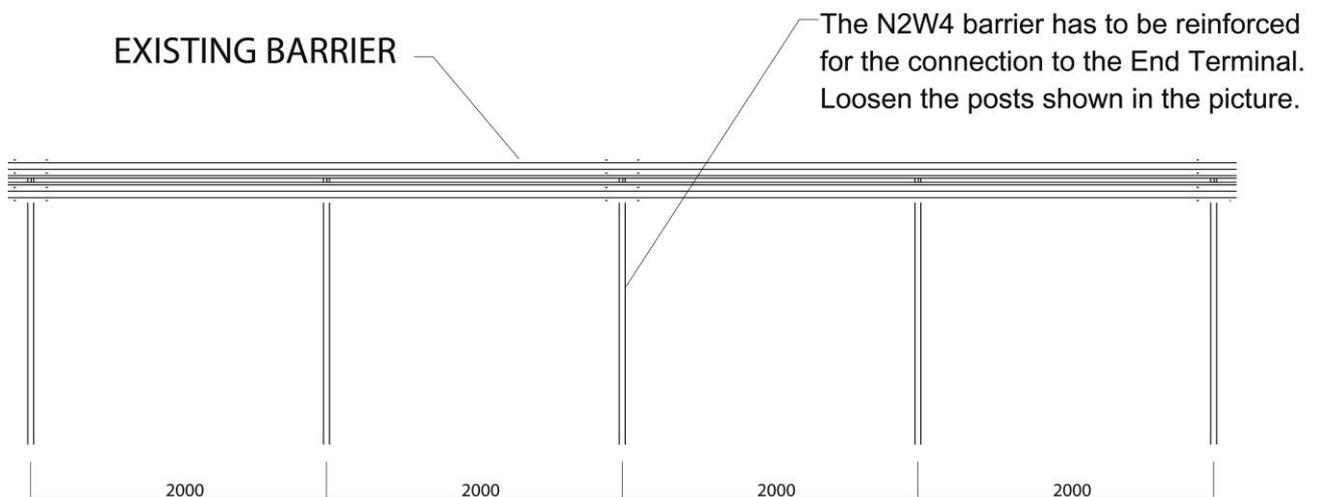


Fig. 19: Side view of the barrier before the installation of the End Terminal

In the following picture (Fig. 20) **2 posts** have been added to the barrier, so that the post spacing has been changed to 1000 mm. The section of the barrier has been tilted down to be connected to the backstop of the End Terminal by using a transition, as also shown in the exploding view.

Ram the posts with the pile driver in order to connect the barrier to the End Terminal.

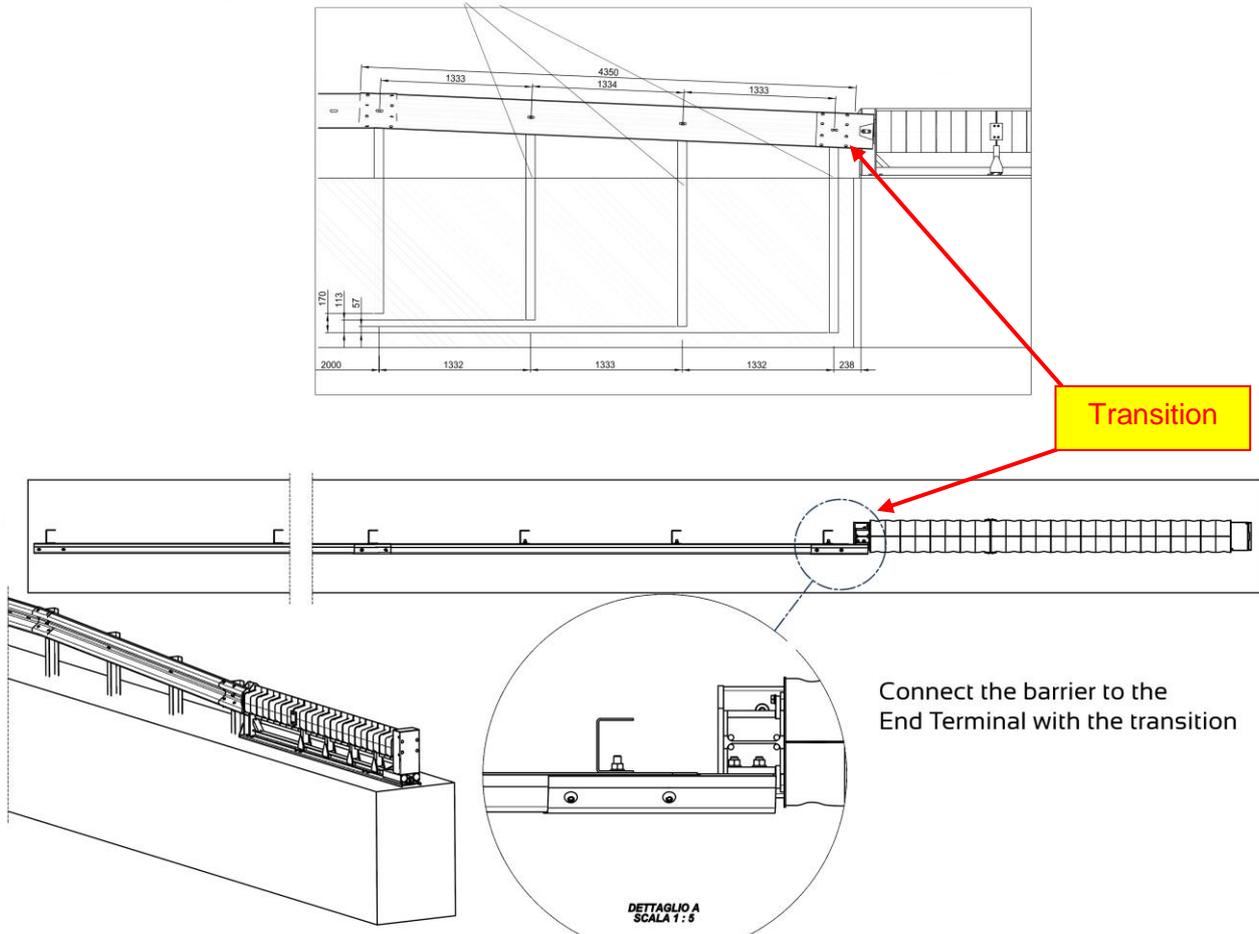


Fig. 20: Connection of the barrier to the End Terminal – top and side view.

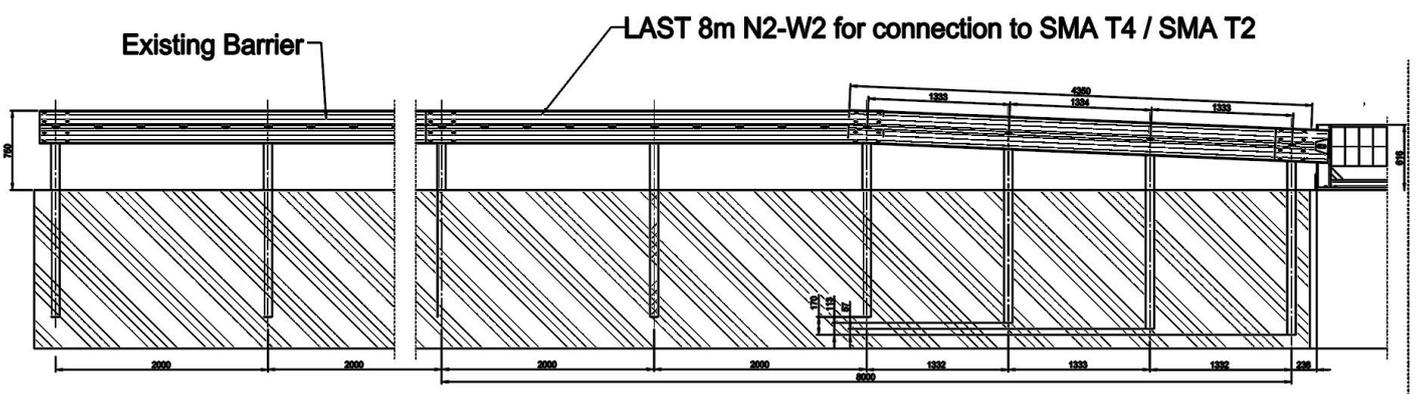


Fig. 21: Connection of the barrier to the End Terminal – complete view.

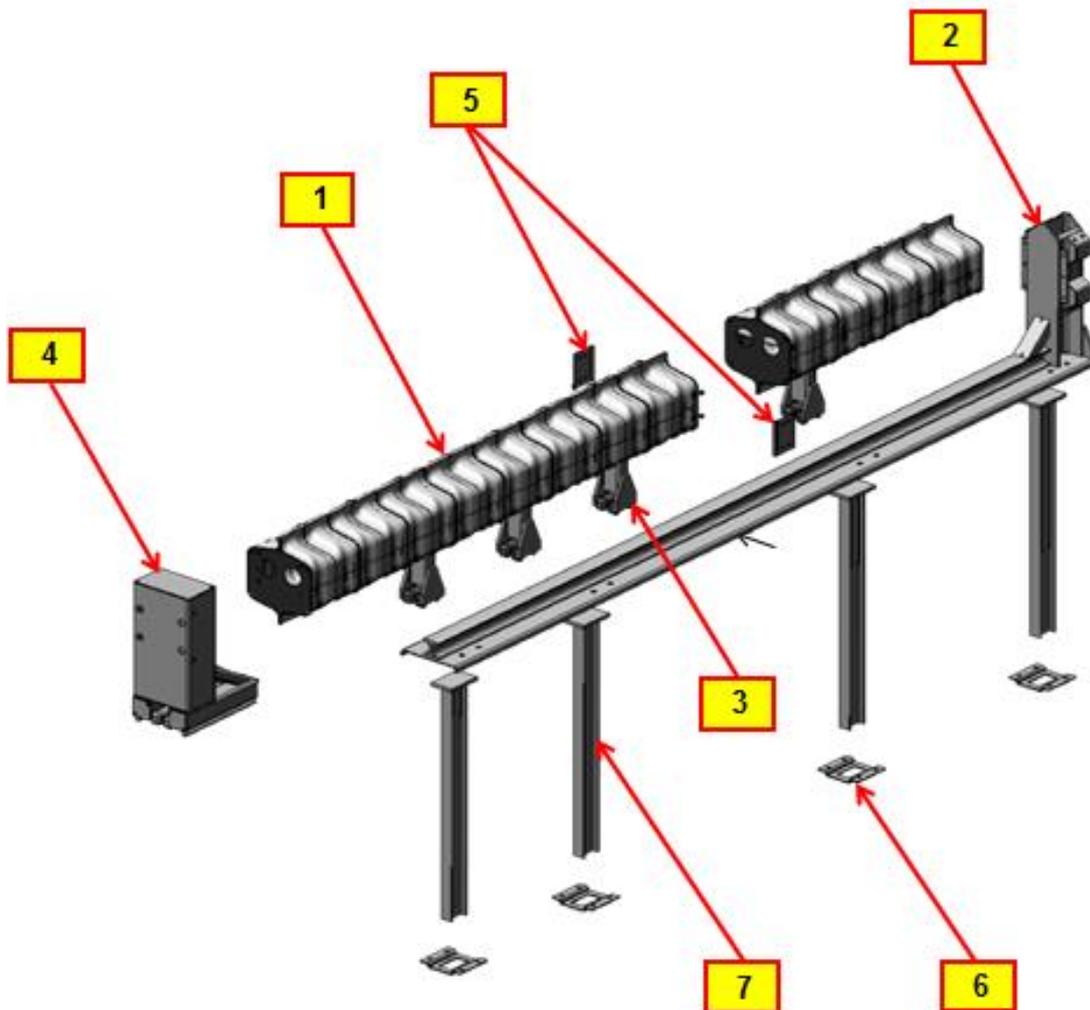
3. INSPECTION - RESTORING

3.1 Foreword

SMA End Terminals don't need maintenance under standard condition of use. If the vehicle impacts according to EN 1317 it can be restored by simply replacing the damaged components with the opportunity to totally recover the remaining part of the structure.

End Terminal components:

1	Collapsible beam formed by modular bays;
2	End terminal basement;
3	Tie rods welded to the collapsible beam;
4	Sliding trolley;
5	Lateral plates – for the fixing of the trolley and the bays;
6	Installation plates for the fixing of the End terminal to the ground;
7	Posts with welded plate



3.2 Component replacement

Each component has a Rif. code with the related drawing number.

They can be consulted in the sheets at the Chapter 5: SPARE PARTS

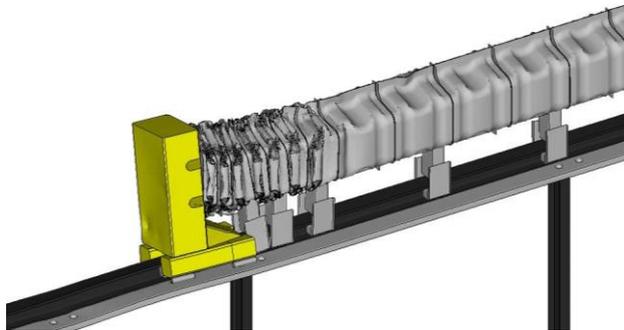


Fig. 22: SMA T 4 frontally impacted

Trolley (Rif. S)

1. Remove the reflective sticker (if present) and unscrew the 4 M10 screws which connect the trolley to the collapsible beam(Fig. 23).

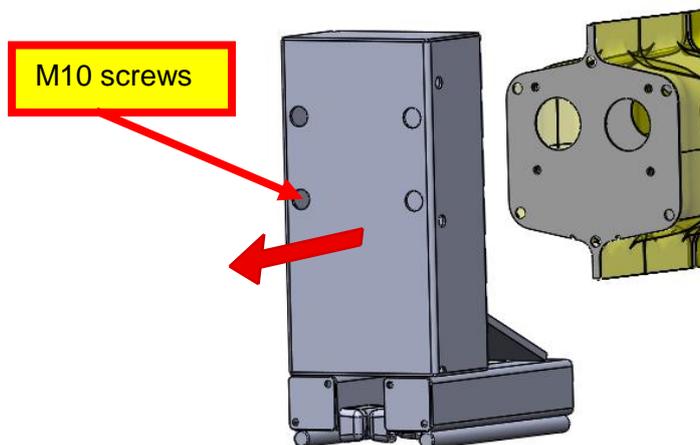


Fig. 23: Frontal trolley

2. Slide the Trolley forward along the rail through a handling device and pull the component out (Fig. 23).
3. Replace the damaged component with the new one, by taking care to insert the frontal Trolley into the rail, and slide the new Trolley along the rail in order that it comes into contact with the collapsible beam
4. Screw the M10 screws (50 Nm for bolts class 8.8).

Modular bay (Rif. M)

1. Remove the trolley (as in the previous explanation).
2. Remove the lateral plates which connect the different bays of the collapsible beam

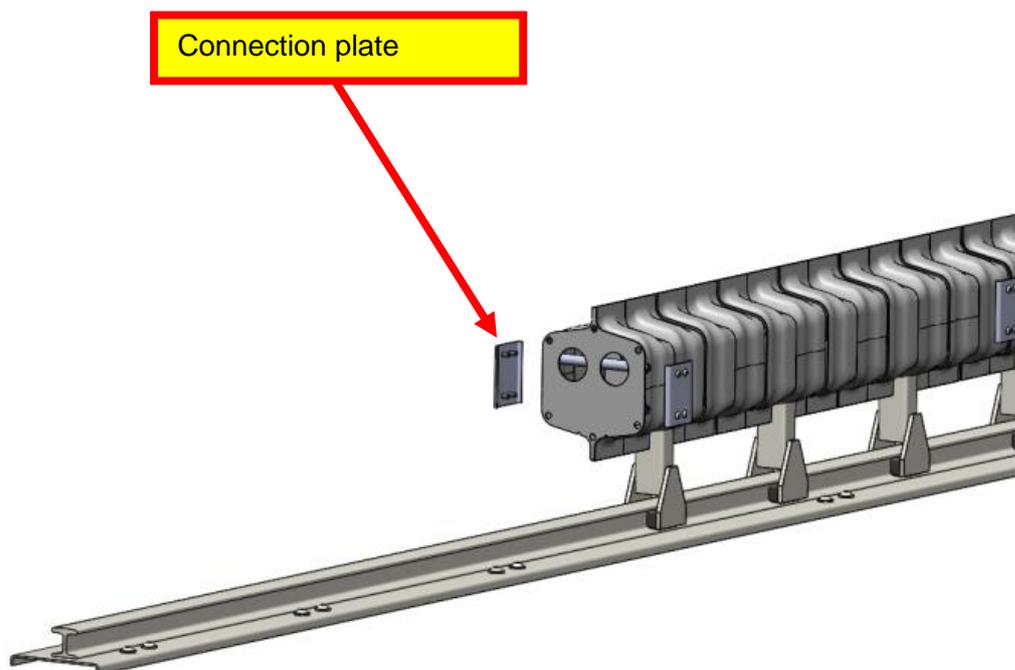


Fig. 24: Removing procedure of the modular bay

3. Slide the Trolley forward along the rail by using a handling machine.
4. Unscrew the 4 M10 bolts on the 2 lateral plates (Fig. 24) which connects the back part of the front modular bay with the front part of the next one.
5. Slide the modular bay forward along the rail with a handling machine and remove it.
6. Replace the damaged component with the new one, then slide it back until the contact with the next bay or with the backstop of the structure.(Fig 25)
7. Screw the 2 lateral plates with 4 M8 bolts, by applying a tightening torque 25,5 Nm. (bolts class 8.8).

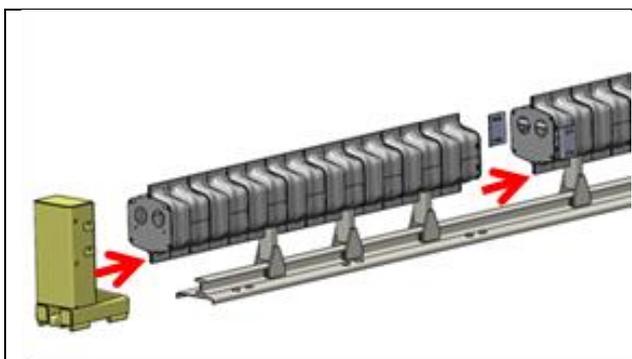


Fig. 25:Assembling of the new components

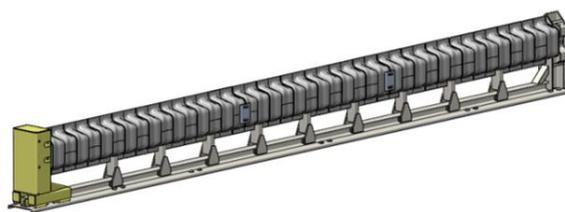
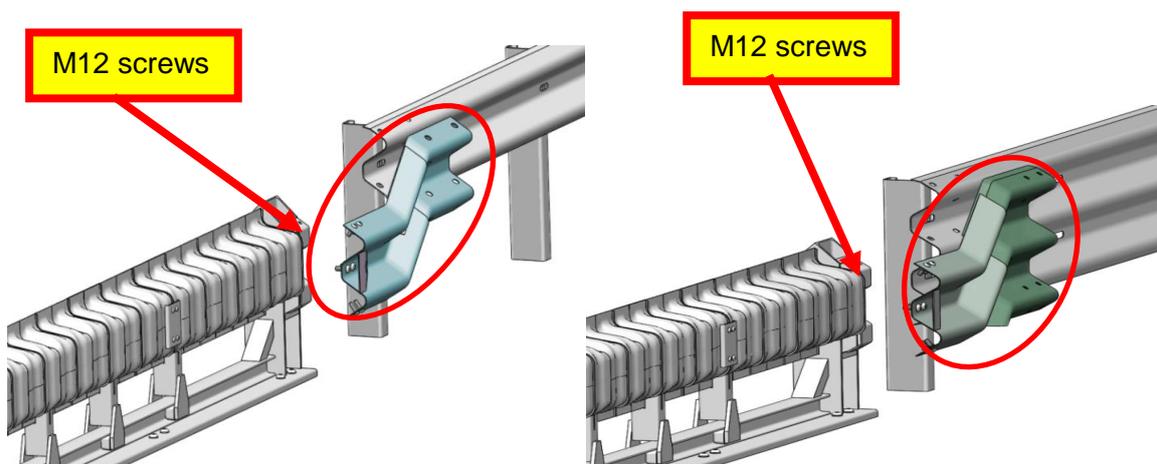


Fig. 26:Restored End Terminal

Transition (Rif. T)

1. Unscrew the M12 screws on the End Terminal junction;
2. Remove the damaged transition;
3. Place the new transition;
4. Screw the M12 bolts (tightening torque: 87 Nm for bolts class 8.8).



4. PLAN OF THE COLLAPSIBLE BEAM

SMA End Terminals are supplied with the collapsible beam split in modular bays.

The beam components, whether replaced, are mounted according to the plan of the tag on the back side of the structure.

During the assembling it is needed to take care of each type and dimension of the modular bay. Each bay is different from the others in terms of number and position of the tie rods in the lower part

4.1 Details of the modular bays

The positioning of the modular bays in each single device is shown below. The modular bays are connected through 4 bolts that fasten 2 joint-cover profiles in order to ensure the stability.

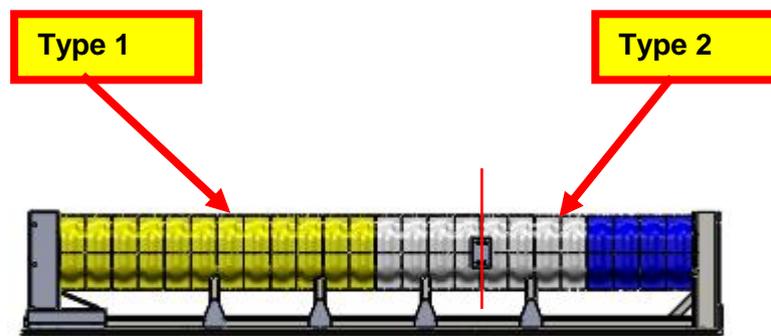


Fig. 27: Collapsible beam sections SMA T 2

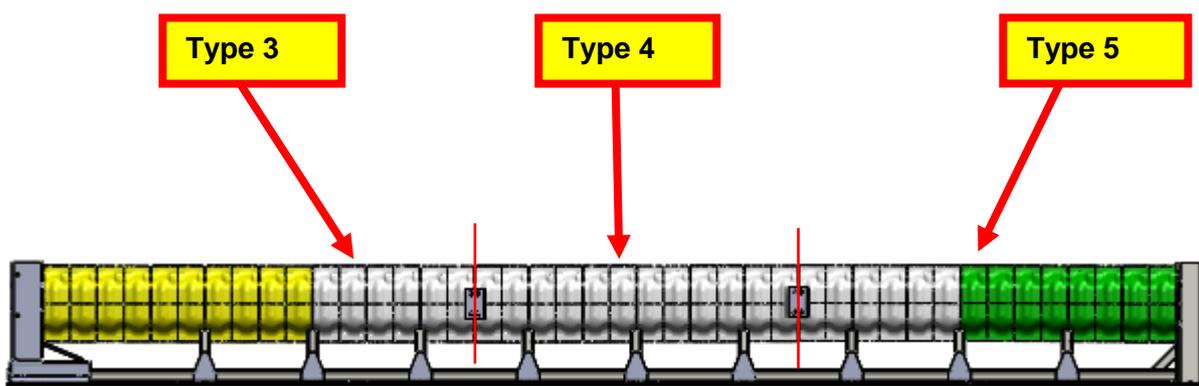


Fig. 28: Collapsible beam sections SMA T 4

5. SPARE PARTS

Rif.	Description	Q.ty	Drawing number
SMA T 2			
S	 Trolley	1	D43760002
M1	 Modular bay Type 1	1	D45470102
M2	 Modular bay Type 2	1	D45470101
p	 Post	4	D43760039
a	 Installation plate	4	D43760048
b	 Basement	1	D45470001
SMA T 4			
S	 Trolley	1	D43760002
M3	 Modular bay Type 3	1	D43760103
M4	 Modular bay Type 4	1	D43760102
M5	 Modular bay Type 5	1	D43760101
p	 Post	6	D43760039

a		Installation plate	6	D43760048
b		Basement	1	D43760001
TRANSITIONS				
		Transition to double beam barrier single / double sided	1 / 2	D41922606
		Transition to thrie beam barrier single / double sided	1 / 2	D41922811
		Transition to concrete barrier single / double sided	1 / 2	D41923303

6. DURABILITY

The structure and the main parts are treated with hot-dip galvanized process according to UNI 1461 and galvanized according to ISO 2081. The absorbing panels are treated with cataphoresis treatment under the law n ° FIAT 5.00604, 20/12/2001.

The SMA devices are guaranteed for 10 years against the corrosion.

7. STORAGE

To permit the placement in the containers, the Crash Cushion/End Terminals are disposed and loaded in groups of 3x3 or 3x4.

8. TECHNICAL REFERALS AND NORMATIVES

UNI EN 1317 /2010	End Terminals
UNI EN 22768: 1996	Tolerances
UNI 1461	Hot-dip galvanized process
Norma FIAT n°5.00604 del 20/12/2001	Cataphoresis
UNI 2081	Electrolytic galvanizing

9. LIMITATION AND WARNINGS

SMA End Terminals have been tested to meet the requirements and guidelines of the P2 and P4 performance classes using the EN criteria described in European Standard ENV1317-4 and prEN 1317-7 (Terminals and Transitions).

The required tests are not intended to represent the performance of products when impacted by every vehicle type or every impact condition.

Industry A.M.S. srl does not represent nor warrant that the results of these controlled tests show that vehicle impacts with the products in other conditions would necessarily avoid injury to person(s) or property. Impacts that exceed the tested specifications of the product may not result in acceptable crash performance as outlined in ENV 1317-4 and prEN 1317-7, relative to structural adequacy, occupant risk and vehicle trajectory.

Industry A.M.S. srl expressly disclaims any warrant or liability far injury or damage to persons or property resulting from any impact, collision , or harmful contact with products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled in consultation with Industry A.M.S. or by third parties.

SMA End Terminals may be connected directly to W-Beam barrier with a containment level of H2 and a working width of W2 or W3. For connections to barriers having different containment levels and/or different working widths, appropriate connections, per your local jurisdiction, should be used.

For further information, please contact our office.