



Interchangeable Body System,
specially developed by EMPL

Safety Tests on the EMPL troop carriers
equipped with special safety seats



www.empl.at

Empl Interchangeable Body System

Table of contents

- Task / Aim
- Tested Vehicle
- Procedure and results of the tests
 - Test 1: Tilting of the vehicle while driving over a ramp
 - Test 2: Tilting the vehicle from an elevated ramp (ECE R66)
 - Test 3: Rollover of vehicle on a steep hill
- Summary
- Tests with a Van Type Body



Fig. 1: Chassis with interchangeable body

Task / Aim

Technical inspection of the EMPL Troop Carrier regarding safety of the passengers to be transported!

- Tested Vehicle
 - Interchangeable Body, type "Troop Carrier", mounted on a Torsion free sub frame and equipped with specially developed Safety seats, as ordered in a huge quantity by the Austrian Armed Forces (Fig.1)

- Tests
 - Simulation of 3 possible, very realistic accident situations as
 - 1) Tilting of the Vehicle while driving over a ramp
(Tilting test while driving over a ramp, with approx. 20 km/h)
 - 2) Tilting of the Vehicle from a certain height
(Tilting Test similar to the European Bus Test "ECE R66" intended for checking the stability of the roof structure)
 - 3) Rollover of the Vehicle on a steep hill

Remark:

As far as the specially developed safety seats are concerned, we are not going into detail. Special crash test series took place in 2001 in Germany (see page 6).

- Main Points of inspection
 - Stability of the connection elements "torsion free sub frame & chassis" (Fig. 2)
 - Stability of the locking mechanism "subframe & interchangeable body" (Fig. 3)
 - Stabilität der Verankerungen der Sicherheits-Sitzmodule im Pritschen-Boden (Abb. 4)
 - Stability of the connection elements "safety seat module & body floor" (Fig. 4)
 - Overall stability of body (side wall, front wall, stanchion, tarpaulin frame), regardless if mounted fixed or interchangeable.

Empl Interchangeable Body System



Fig. 2: Vehicle with torsion free subframe



Fig. 3: Locking mechanism for interchangeable body



Fig. 4: Elements bracing the EMPL safety seat module on



Fig. 5: Defined survival space in the EMPL safety seat module

Empl Interchangeable Body System

Tested Vehicle

- Tested Chassis
DC UNIMOG Type 425 T including
D65 (Fig. 6)
- Conducted modifications
Enlargement of the wheelbase by
600 mm, corresponding to U4000
- Body
out of series production (order of Austrian Armed Forces)

Consisting of :
EMPL interchangeable Body (Troop Carrier)
EMPL Safety Seat Module (Fig. 7-11)
EMPL Torsion free subframe



Fig. 6: Test Vehicle UNIMOG 425

- EMPL Safety Seat Module

The safety seat module specially developed by EMPL was successfully tested in 2001 in the WTD 41, the testing facility of the German Army in Trier. (Frontal crash test when driving 50 km/h)



Fig. 7-11: Frontal Crash-Test in Trier

Empl Interchangeable Body System

Procedure and Results of the Test

Test 1: Tilting of the Vehicle while driving over a ramp

- Procedure

With the help of a winch, the UNIMOG (unfit to drive) is pulled with 20 km/h over a ramp until the vehicle tips over (Fig. 12 & 13)



Fig. 12 & 13: Test 1 – Front & rear View

- Results
The UNIMOG tipped over at a slope of approx. 39° (Fig. 14)

- The Platform was not damaged
- The connection elements between
 - Chassis & torsion free subframe
 - Subframe & interchangeable body
 - Floor of platform body & safety seat module were 100% stable
- The EMPL safety seat module
No damage of the survival space
- The assault rifles remained in the destined fittings
- The tarpaulin was damaged slightly

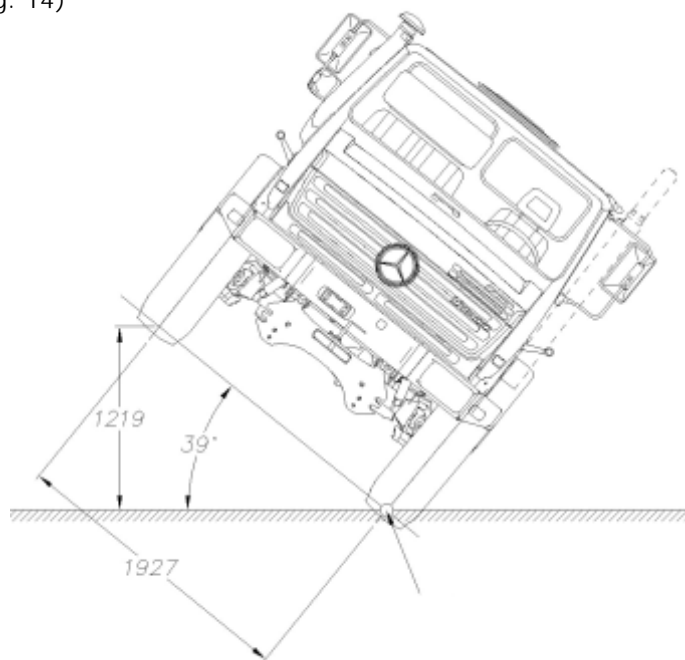


Fig. 14: Test 1 – Vehicle at pivotal point

Test 2: Tilting of the Vehicle from an elevated ramp (in accordance to the European Bus test „ECE R66“)

- Procedure
The Vehicle is positioned on a tilting ramp (with a height of 800mm) (Fig. 15) and is tilted side way on a horizontal hard surface (asphalt) (Fig. 16-21).

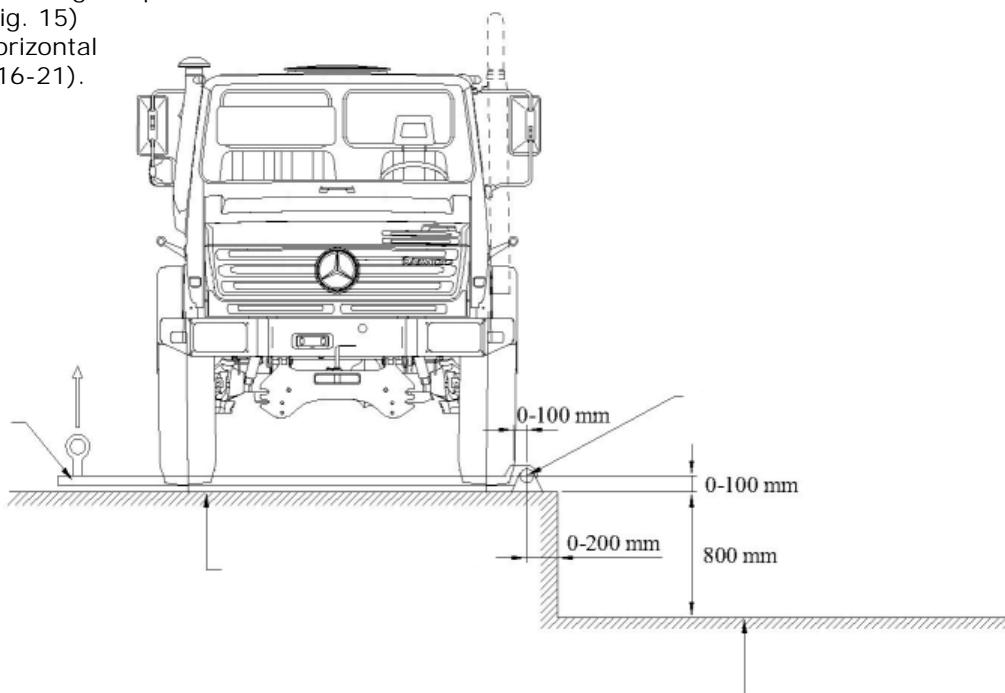


Fig. 15: Test 2 – Test Arrangement

Empl Interchangeable Body System

Procedure and Results of the Test



Fig. 16 - 21: Test 2 – Procedure

- Results

- The connection elements between
 - Chassis & torsion free subframe
 - Subframe & interchangeable body
 - Floor of platform body & Safety seat modulewere 100% stable
- The EMPL safety seat module
no damage
- The assault rifles
remained in the destined fittings (Fig. 22)
- Damages within expected bounds

Slight amendments for product improvement and further development were included into construction

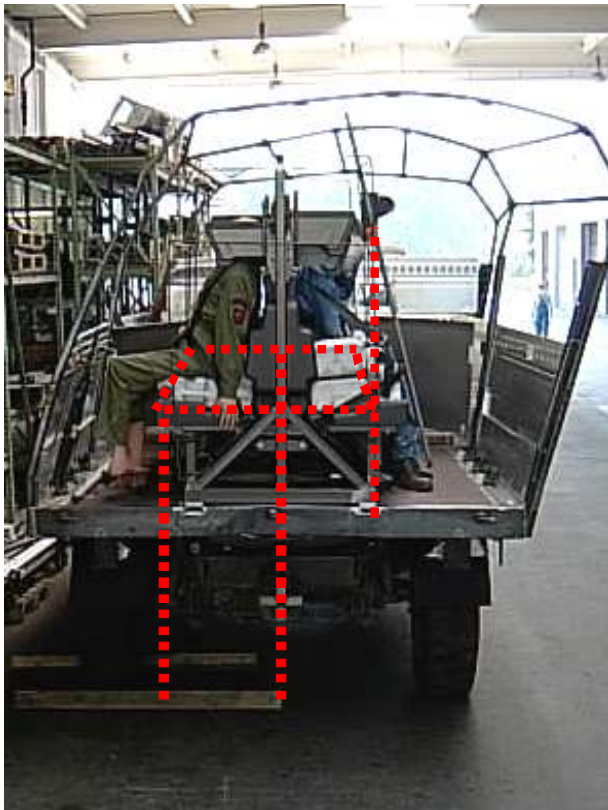


Fig. 22: Undamaged Survival Space



Fig. 23: Assault rifles remained in fittings

Empl Interchangeable Body System

Procedure and Results of the Test

Test 3: Rollover of vehicle on a steep hill

- Procedure

The fully laden UNIMOG (Fig. 24+25) is tilted side way (Fig. 26) and consequently starts rolling down a steep hill (Fig. 27-32).



Fig. 24+25: Test 3 - Fully laden Chassis and Platform Body



Fig. 26: Test 3 - Test Arrangement



Fig. 27+28: Vehicle after 1st rollover (phase 1)



Fig. 29+30: Vehicle after free fall crash (phase 2)



Fig. 31+32: Vehicle after crash on opposite hill (phase 3)

Empl Interchangeable Body System

Procedure and Results of the Test

- Results
 - The vehicle overturned 2,5 times before crashing into the opposite hill and came to a rest in the river.
 - The procedure of the test was as expected.
 - All 4 elements, connection the platform with the subframe, resisted major forces and were not damaged. Only slight deformation was detected. (Fig. 33)
 - Only the safety seat modules at the very front and the rear of the platform were deformed between 280 mm and 430 mm. The two modules in the middle remained intact. (Fig. 34)

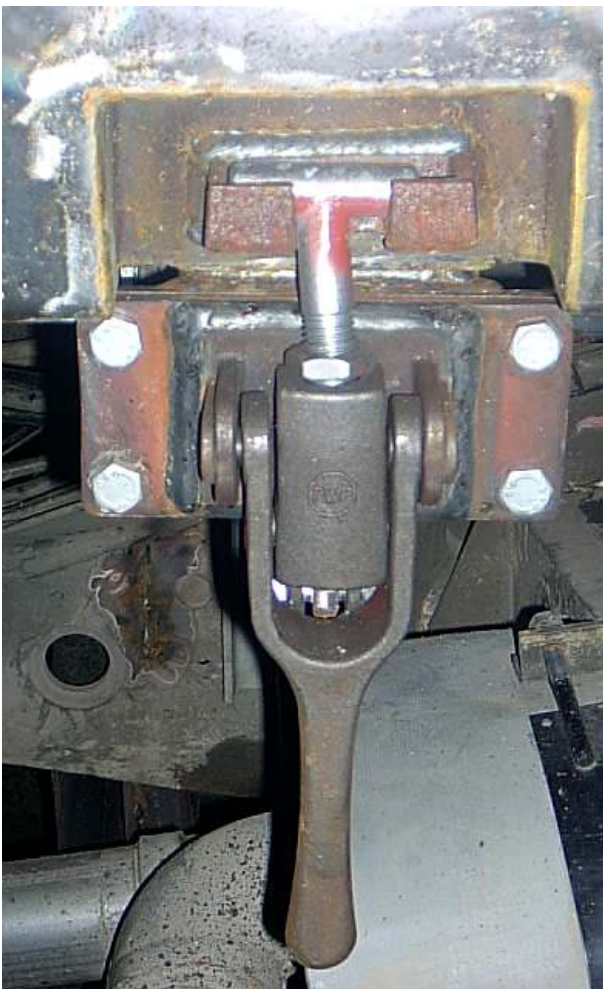


Fig. 33: Undamaged locking mechanism



Fig. 34: Safety seat module at the rear

Summary

The overall test (Test 1-3) shows that the EMPL safety system - consisting of the torsion free subframe, the interchangeable body and the crash-tested safety seat module - sets a completely new benchmark as far as transport safety is concerned!

This System, specially developed by EMPL, defines a new safety standard! Even in case of severe accidents, the risk of injury is immensely reduced and the chance of survival raises enormously!

- Test 1+2 - Ramp tilting test
These two tests (similar to ECE R66) showed no damage of the EMPL Safety Seat Modules. The survival space was not deformed and the dummy doll was not damaged at all.
- Test 3 - Rollover / Vehicle rolling downhill
After the vehicle tests on the ramp, constructive measures and improvements were implemented. Those measures have proven to be very effective.

The Rollover Test at the downhill terrain showed that, even after 2,5 overturns, the connection elements between "chassis and torsion free subframe", "subframe and interchangeable body" as well as "seat module and platform floor" remained fully operative and were not damaged!

- Phase 1 - after 1st rollover (Fig. 27+28)
No substantial damages after 1st rollover.
- Phase 2 - 2nd collision after free fall (Fig. 29+30)
After the vehicle crashed with the top ahead and in free fall on the nearly horizontal river bank, the driving cab deformed massively, whereas only some parts of the body deformed slightly. (as e.g. the seat module at the very front)
- Phase 3 - 3rd collision on the opposite hill (Fig. 31+32)
The following crash on the opposite hill caused all of the ballast weights, fastened in the driving cab, to be catapulted out as well as some of the ballast containers (à 25 kg), mounted on the seat modules. Moreover, the collision caused deformation of the seat module at the rear. (Fig. 34)

Empl Interchangeable Body System

Test Van Type Body



Fig. 35-42: Rollover a Van Type Body

