

Information on evaluation criteria

The federal guideline for ballistic and blast protection TR-SB and VPAM ERV version 3 have introduced a new method for testing occupant protection and new evaluation criteria compared to ERV version 2. The major changes include the introduction of the biofidel dummy and an evaluation matrix based on the DGU (German Trauma Society) shock room criteria.

The biofidel dummy is similar in mass distribution, flexibility and fracture behaviour to the skeletal structure of an average adult (50% male, 175 cm, 78 kg). This method provides a reproducible evaluation of blast test results. Successful blast tests are categorized by one to three stars (depending on dummy damage), making the evaluation more transparent and comparable. In addition, acceleration sensors can be fitted to the dummy on request. These acceleration data are not used for the test evaluation, but may provide additional information.

Certification according to the federal guideline for ballistic and blast protection TR-SB for the testing of civilian armoured vehicles can only be done by approved testing facilities. PTI administrates a list of these testing facilities.

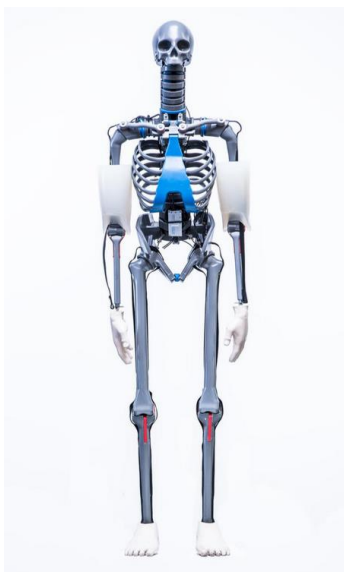


Abb. 1: Biofidel dummy (source: CTS dummy-solution GmbH & Co. KG)

BASICS OF DUMMY ASSESSMENT

The assessment of the dummy after blast testing examines different criteria depending on the test scenario. A certificate and a test report will be issued for each successful blast test. The skin of the dummy is considered as an indicator for fragments. Penetration of the skin is classified as a test failure.

The three different blast testing scenarios are listed below:

1 ROOF BLAST TEST

A roof blast test is not passed if one or more of the following requirements according to the evaluation scheme are not met:

- the armouring elements
- the fragment indicator
- the surface of the vehicle interior
- the head contact sensor

A successful test, where these minimum requirements are met, is categorised by:

- **3 stars** if all requirements are met without limitations
- **2 stars** if the contact sensor has scored according to the rating scheme and the fragment indicator is not broken
- **1 star** if an opening in the armour elements is detected

2 FLOOR BLAST TEST

A floor blast test is not passed if one or more of the following requirements according to the evaluation scheme are not met:

- the armouring elements
- the fragment indicator
- the surface of the vehicle interior
- the biofidel dummy

If the above minimum requirements are met, a successful test is categorised on the basis of the dummy evaluation matrix as follows (for example see Figure 2.):

- **3 stars** if the dummy is not damaged in any way
- **2 stars** are awarded if the dummy is slightly damaged
- **1 star** is awarded if the dummy is damaged

A reusable dummy is used for the floor blast test. Only the legs of the dummy are replaced for each blast test.

| Testbeurteilung Unterbodenansprengung | | | | | | |
|---|---------------------------|---|---|----------------------|---|-----------|
| Test vom | | Fahrzeug | | | | |
| Dummy-Typ | | Dummy SN | Bein SN links | Bein SN rechts | | |
| Primus Light unbreakable mit Beinen breakable | | | | | | |
| Nr. Schadenbild | | | | | | ERGEBNIS |
| Kriterium Verletzung | | Kriterium Handlungsfähigkeit | Kommentierung | Feststellungen | | Kontrolle |
| 1 | Knochenbruch Oberschenkel | Es ist kein Bruch des Oberschenkelknochens zulässig | Es ist kein Bruch des Oberschenkelknochens zulässig | Linker Oberschenkel | OHNE Befund <input type="checkbox"/> L_OS_O8 gebrochen <input type="checkbox"/> L_OS_B Knochenriss <input type="checkbox"/> L_OS_R Abplatzung <input type="checkbox"/> L_OS_Ab | |
| | | | | Rechter Oberschenkel | OHNE Befund <input type="checkbox"/> R_OS_O8 gebrochen <input type="checkbox"/> R_OS_B Knochenriss <input type="checkbox"/> R_OS_R Abplatzung <input type="checkbox"/> R_OS_Ab | |

Fig. 2: Example from the evaluation matrix for floor blast tests, a total of five types of damage to the Biofidel dummy are assessed.

3 SIDE BLAST TEST

A side blast test is not passed if one or more of the following requirements according to the evaluation scheme are not met:

- the armouring elements
- the surface of the vehicle interior
- the Biofidel dummy
- the blast pressure levels

If the above minimum requirements are met, a successful test is categorised on the basis of the evaluation matrix as follows (for example see Fig. 3 and Fig. 4):

- **3 stars** if the dummy is not damaged in any way
- **2 stars** are awarded if the dummy is slightly damaged
- **1 star** is awarded if the dummy is damaged

A side blast test requires **two dummies (non-reusable)** to evaluate.

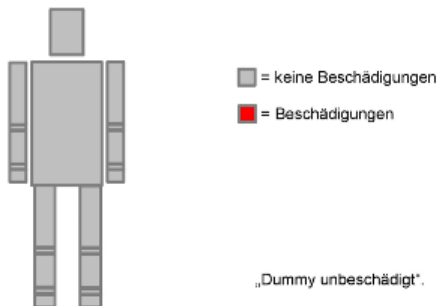
Side blasts can be tested with at of two or four metres to the charge. These test levels cannot directly be compared with each other. A successful side blast test at a distance of two metres is always considered as a higher level of protection than compared to testing at four metres.

| Testbeurteilung Seitenansprengung | | | | | | |
|-----------------------------------|----------------------|---|--|----------------|---|-----------|
| Test vom | | Fahrzeug | | | | |
| Dummy-Typ | | PRIMUS breakable | | | | |
| | | Dummy SN | | | | |
| | | | | | | ERGEBNIS |
| Nr. Schadenbild | Kriterium Verletzung | Kriterium Handlungsfähigkeit | Kommentierung | Feststellungen | | |
| 1 | Knochenbruch Oberarm | Ein Bruch der Oberarmknochen ist zulässig | Es ist kein Bruch des Oberarmknochens zulässig | | Linker Oberarm OHNE Befund <input type="checkbox"/> L_OA_OB gebrochen <input type="checkbox"/> L_OA_B Knochenriss <input type="checkbox"/> L_OA_R Abplatzung <input type="checkbox"/> L_OA_Ab Rechter Oberarm OHNE Befund <input type="checkbox"/> R_OA_OB gebrochen <input type="checkbox"/> R_OA_B Knochenriss <input type="checkbox"/> R_OA_R Abplatzung <input type="checkbox"/> R_OA_Ab | Kontrolle |

Fig. 3: Example from the evaluation matrix for side blast testing, a total of 19 types of damage to the biofidel dummy are evaluated.

Bewertung der Dummies:

Teilergebnis zum Biofidel Dummy an der vorderen, linken Sitzposition.



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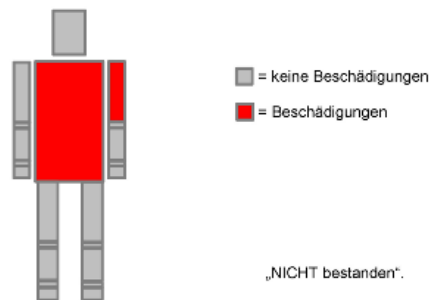


Fig. 4: The graph summarizes the damage of two dummies after a side blast test.

4 ADDITIONAL TESTING

Additional tests may be necessary to test potential vulnerabilities in the construction or additional seats, these shall be included in the assessment of the respective test scenario. The additional tests shall be documented in the test report only. No additional dummy is needed to perform this vulnerability check.