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STAND FOR TESTING ADD-ON ARMOUR

Abstract. The paper describes a stand designed by the OBRUM's Design Office for testing ballistic resistance of additional armour. Discussed are the basic features of the stand that enable testing compliance of armour modules with the requirements of STANAG AEP-55. Collapsible design of the stand makes it a portable piece of equipment that may be carried using the available means of transport. The design enables testing armour provided with an additional component – spall liner. Possible areas of application are presented.

Keywords: protection level, additional armour, composite armour, spall liner, ballistic resistance, ballistic resistance testing.

1. INTRODUCTION

One of the projects within the framework of the 4th Defence and Security Contest financed by the National Centre for Research and Development is *Additional modular armour for wheeled armoured personnel carriers and tracked platforms – codename MODPANC* [1]. The project is being executed by a Consortium of five institutions:

- Institute of Non Ferrous Metals, Light Metals Division in Skawina – Project Leader (research institution);
- Foundry Research Institute, Kraków – Consortium member (research institution);
- Motor Transport Institute, Warsaw – Consortium member (research institution);
- OBRUM sp. z o.o., Gliwice – Consortium member (industrial institution);
- LUBAWA S.A., Ostrów Wielkopolski - Consortium member (industrial institution).

The main goal of the project is to design and construct an additional modular system of additional armour for armoured personnel carriers and tracked platforms [1].

Additional ballistic protection of facilities/vehicles by modular armours is meant as protective arrangement (including the system of its mounting, primary armour/supporting structure of the protected facility and internal spall liner, which should provide attaining protection of the facilities in accordance with the requirements at an expected target level II, III, IV or higher (as a passive protection kit) as defined in STANAG 4569 Edition 2. [2].

2. RESEARCH ON AND TESTING OF ADDITIONAL ARMOUR MODELS

The work to be carried out by MODPANC Consortium members at the subsequent stages of design and development includes testing of ballistic resistance of the armour itself as well as of the complete test object consisting of: primary armour – additional armour (attached by means of a mounting system) – spall liner. The manner of conducting the tests is precisely

defined, and is described in NATO publication AEP-55 [3]. For this purpose OBRUM has drawn up a document with a detailed description of the mode and manner of conducting the tests [4].

2.1. Testing instrumentation

Introductory tests of additional armour models will be conducted by military institutes that run certified laboratories and are in possession of the required armament and ammunition and of the necessary tools and instruments.

These institutions include:

- Military Institute of Armament Technology, Zielonka near Warsaw;
- Military Institute of Armour and Vehicle Engineering, Sulejów.

Instruments used for testing are relatively simple.

An example of an armour test piece that underwent a shooting test is shown in Fig. 1.



Fig. 1. Sample piece of armour installed on the test stand

Paper [5] describes a test stand designed and fabricated at OBRUM for introductory testing of individual sample pieces of additional armour. These sample pieces may have the following dimensions:

- 250 x 250 mm;
- 250 x 500 mm;
- 500 x 500 mm.

Now a new armour testing stand has been designed and fabricated to verify the protection level of the modules made and to carry out ballistic tests in accordance with the AEP-55 standard. The basic input data for the stand design included the following:

- collapsible frame structure of the stand, making it portable by available means of transport;
- base of the stand enabling fixing it to the ground;
- objects for simultaneous shooting testing comprising two armour modules 500 x 500 mm mounted directly onto a piece of primary armour 600 x 1000 mm in size;
- structure of the test piece enabling attaching and dismantling a spall liner.

3. TEST STAND

Figure 2 represents an axonometric view of the stand for testing additional armour.

The stand consists of two basic units:

1. Support.
2. Test object.

The test object is detached from the support after unscrewing six fixing bolts (Fig 2 – item 3).

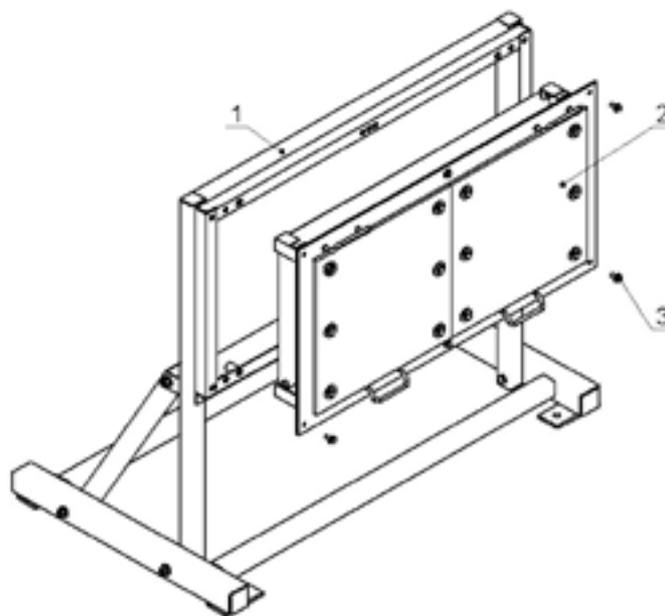


Fig. 2. Stand for testing additional armour

1 – support, 2 – test object, 3 – fixing bolt

Some details of the design are shown in Fig. 3. The design enables conducting shooting testing with an additional protective layer, the so-called spall liner (Fig. 3c, item 5) attached to the inner face of the primary armour (armour plate) by means of six butterfly bolts (Fig. 3c, item 4). For control purposes (evaluation of shooting results) an aluminium witness plate

(Fig 3c, item 6) is additionally mounted onto the primary armour. To prevent the stand from moving, before conducting shooting tests it must be anchored to the floor or ground by means of expansion bolts (concrete floor) or special steel pins (soil, e.g. grassy ground). Openings (Figs. 3b, 3d, detail C-C) for receiving the fixing elements are in the bottom part of the support in flat bars welded onto the support.

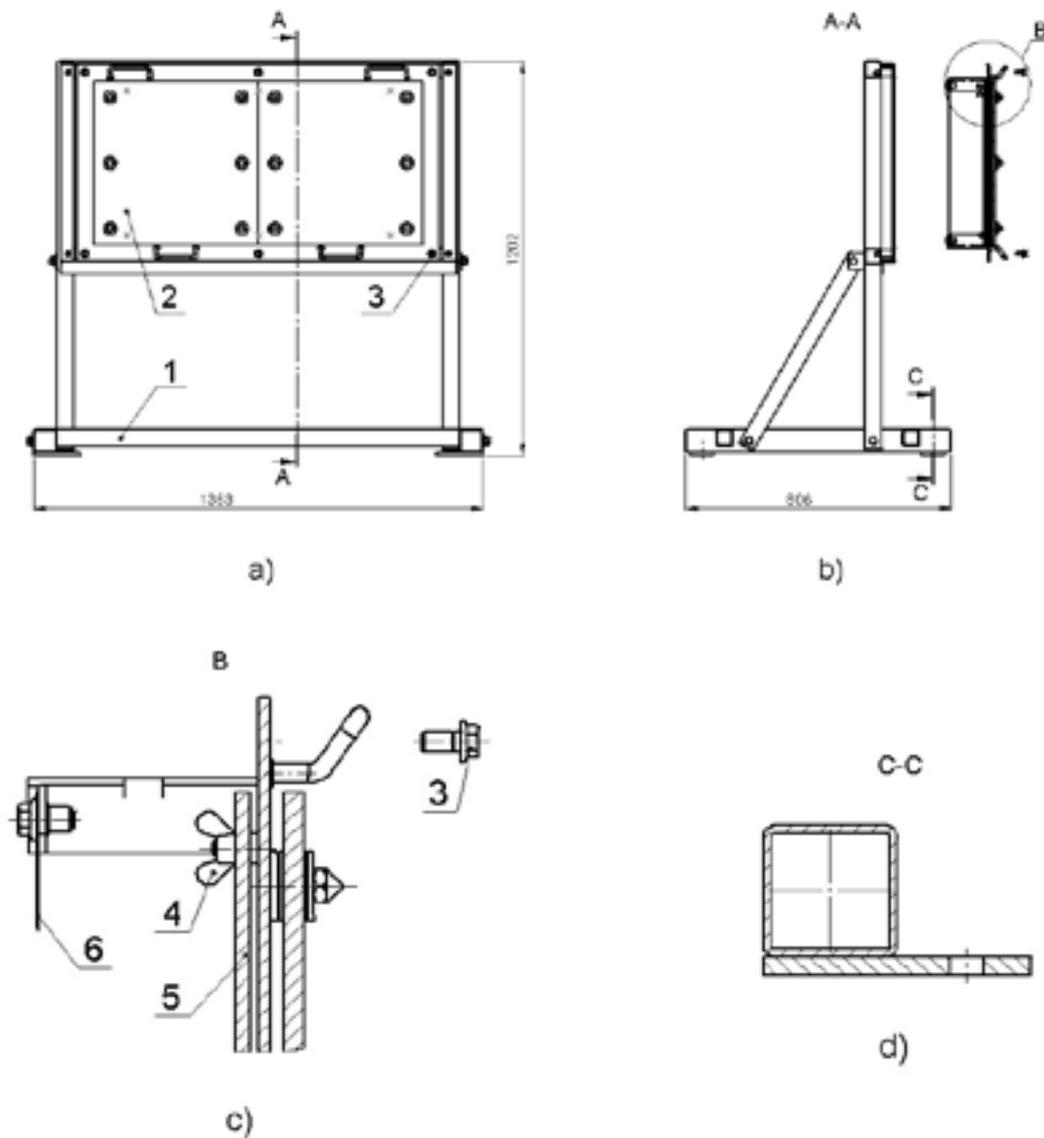


Fig. 3. Structural units of the stand

1 – support, 2 – test object, 3 – fixing bolt, 4 – bolt for fixing spall liner, 5 – spall liner, 6 – witness plate

3. SUMMARY

The developed stand is designed for conducting ballistic tests (shooting tests) of the test object which constitutes a complete element of additional armour.

Such tests will be conducted to verify compliance of the solutions applied in armour design with protection levels II, III and IV [6].

The design of the stand enables testing at an angle of impact of 90°. Tests at other impact angles will be carried out using another stand - object demonstrator that spatially reproduces the shape of a land vehicle.

Tests with the use of the described stand include hitting single points of the armour, multi-hit tests, hitting places of contact between two armour modules and hitting fixing points – ballistic bolts.

The stand for shooting tests will be fitted with two modules: one that has undergone environmental exposure tests, the other taken from the manufacturing line. The above testing mode will enable comparative assessment of the impact of environmental exposures on the parameters of the armour module.

4. REFERENCES

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