TESTING IN A PRESS THE FRANGIBLE SIGNAL LIGHT HOLDER FOR AIRPORTS

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ABSTRACT: By "beaconing", we understand the totality of optical, acoustical or radio apparatuses which permanently indicate the limits of an airfield, the landing place, the points where certain maneuverings must be made, dangerous obstacles and places etc. The signal light is an optical sign for marking the margins of an airfield or of the landing runways. In the area of an airport, any body with lights that is situated above the level of the runway must have a breaking section that would give in the case of a collision with a plane or any other vehicle. This breaking section of the holder is ensured by a frangible coupling, which is a replaceable part of the holder. In this paper, we present the checking of an aluminum frangible coupling. The frangible coupling was made by the firm ElectroMax Petroșani and was tested in the Laboratory for the Streng of materials from the University of Petroșani.

KEY WORDS: frangible holder, signal light, airport, testing.

1. INTRODUCTION

For the safety of flights and aeronautical activities, on the civil aeronautics fields and in their vicinity the demands, conditions and restrictions imposed by national and/or international civil aeronautical reglementations must be instituted and complied to.
Civil aeronautical servitudes are established and instituted by direct correlation with the particularities of the civil aeronautical terrain (cathegory, physical characteristics, infrastruc -ture and equipments exploitation/operating conditions), with the published procedures of instrumental flight and with the characteristics of the CNS and meteorological means involved (type, technical characteristics, operational performances).
Depedning on their nature, civil aeronautical servitudes can be classified in:
a) Liberation servitudes;
b) Signal lighting servitudes;
c) Radio (electromagnetic) servitudes;
d) Other servitudes (diverse)
Aeronautical signal lighting servitudes reffer to the signaling of the presence of obstacles which constitute a potential collision risk for planes and to the airfield areas which have use restrictions. The signaling of obstacles is done by:
- Marking (specific painting) or beacons (flags, specific bodies) during the day when there is good visibility.
- Specific lights (light beaconing) during the night or during the day when there is reduced visibility..

2. THE CONSTRUCTIVE SOLUTION FOR THE FRANGIBLE HOLDER

Every signal light must have a breaking point in the proximity of the spot or of the position in which the lamp is attached to the base platen or to the fitting slug. The breaking point must not be higher than 38 mm above

the soil surface and must break before any part of the device is deteriorated. The breaking point must resist a bending moment of 204 J with no failure, but must easily separate from the fitting system before the bending moment reaches 678 J.

figure 1, we show the 3D model of the constructive solution for the frangible holder for signal lights, which is composed of: 1 – signal light APP AL 008 02 WH; 2 – bracelet; 3 – M6X25 screw; 4 – aluminium pipe Φ40X5; 5 – frangible coupling G2"; 6 – M6X16 screw; 7 – square base of 140X140.

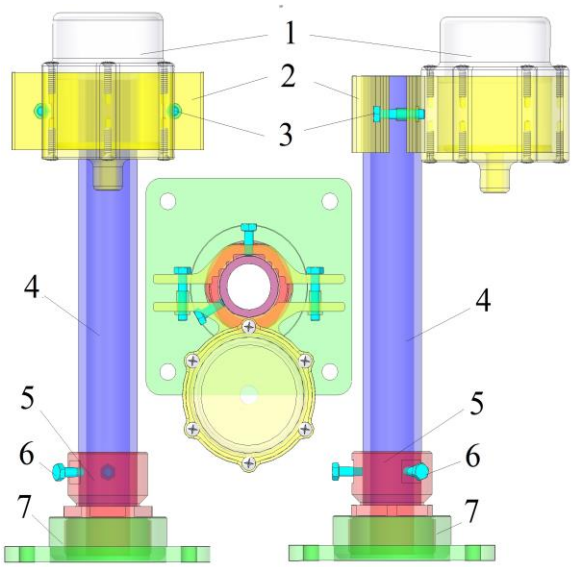

Figure 1. The constructive solution for the signal light holder of the beacon APP AL 008 02 WH

The frangibility is made for the holders of the signal lights by reducing the exterior diameter of the transversal section or by operating holes or other elements that reduce the effective resistance of the coupling at the height of 38 mm above the attachment foundation of the signal light. Also, the height of the signal light must not be over 360 mm because it has to be short enough to ensure the safety distance for the propellers or the gondolas of the reaction engines.

In figure 2, we show the constructive solution of the frangible coupling, which must ensure the frangibility of the signal light holder. The holder was designed as a changeable part and has the following parts: 1 –filleted surface G2"; 2 – hexagonal surface with an opening of 55 mm; 3 –the breaking surface; 4 – bore for fitting the pipe.Φ40X5 mm; 5 – filleted bore M6 for attaching the pipe.

For completing the frangible holder of the signal light and for checking the requirements of the frangible coupling the proposed constructive solution of the base was the one shown in figure 3, which is made up of: 1 – base platen 140X140X10 mm; 2 – filleted nut G2; 3 – seam weld.

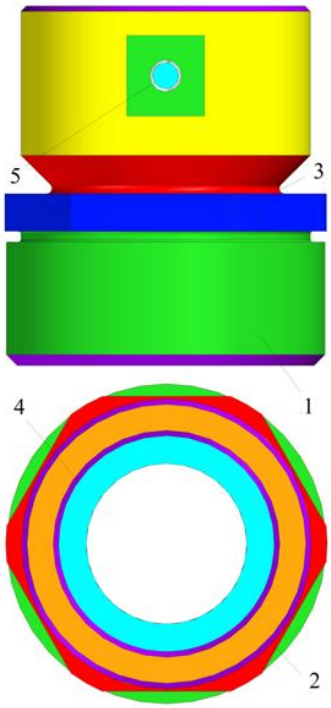

Figure 2. The constructive solution of the frangible coupling.

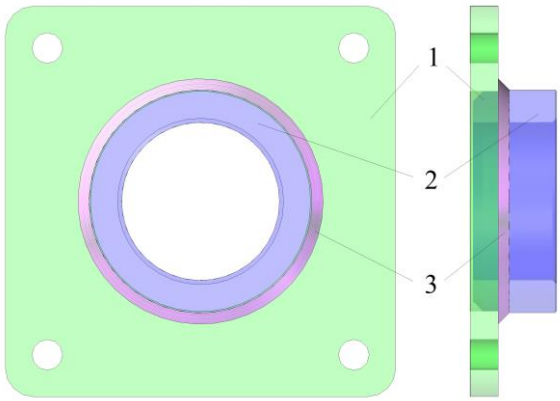

Figure 3. The constructive solution of the foot of the frangible coupling

The structure of the frangible holder of the signal light can be made of metallic or non-metallic materials, which are not affected negatively by the weather conditions in the outdoors. The materials selected in order to fulfill the requirements of frangibility must be

strong, light, and have a reduced module of hardness. The minimum weight is important in order to ensure that we consume the lowest quantity of energy necessary to accelerate the mass of the signal light at the speed of the plane that hits it. (Reference of the designing manual of the airfield ICAO, part 6, section 4.7.1.).

3. THE DEVICE FOR TESING THE SIGNAL LIGHT HOLDER IN THE PRESS

In figure 4 we show the constructive solution for the device necessary for the checking of the signal light holder in the press of the Laboratory for the Streng of materials from the University of Petroșani. This testing is necessary for detemining the value of the bending moment at which the frangible coupling breaks. The coupling was designed according to the mass and the work space of the press which will be used for the testing. The device for checking the signal light holder is made up of: 1 – base platen; 2 – attachment platen; 3 – large fin; 4 – small fin. In figure 5, we show the dimensions and the geometric characteristics of the critical sections D-D and C-C of the device for testing the frangible support of the signal light. For a steel sheet of 10 mm OL37/STAS 500/2-80, with a yield strength of 210 N/mm^2, a safety coefficient of 3,7 resulted.

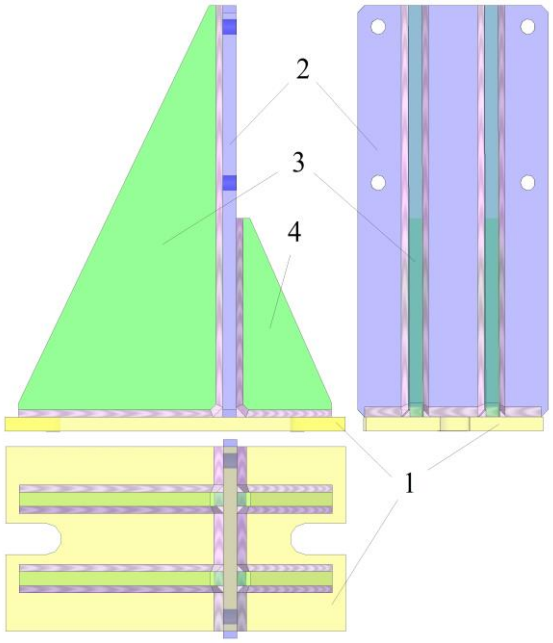

Figure 4. The constructive solution for the device for testing the frangible holder of the signal light.

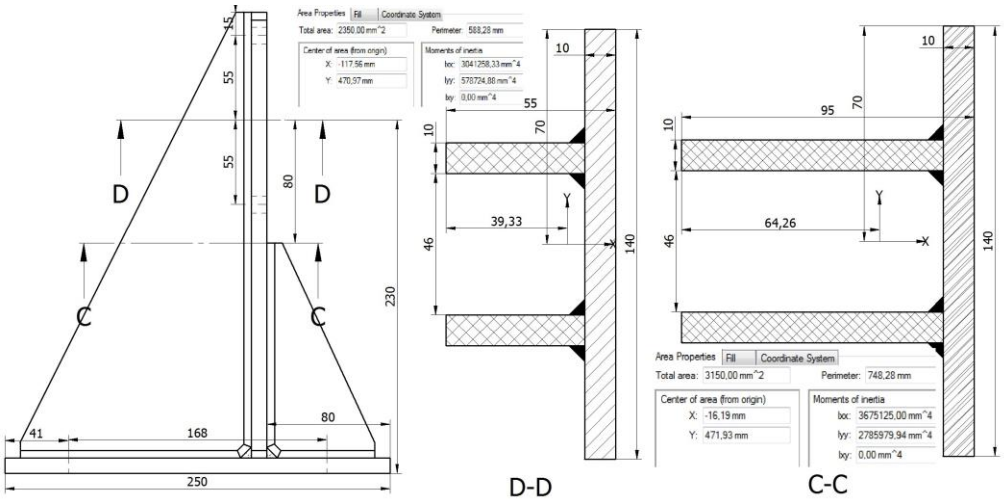

Figure 5. The dimensions of the device and the geometric characteristics of sections C-C and D-D.

4. TESTING THE FRANGIBLE HOLDER OF THE SIGNAL LIGHT

In figure 6, we show the frangible holder of the signal light fitted in the press from the laboratory of materials' resistance of the University of Petroșani with the purpose of trying to break by bending the frangible coupling, and in figure 7 we show the broken frangible coupling. At the first try, for applying in force arm at the distance of 190 mm, the breaking occured at a force of 560 daN and a bending moment of 1064 J, which is higher than the superior limit of 678 J (N m). As a result of the measuring of the

exterior diameter of the breaking section the resulting value was 45 mm, which confirmed the high value of the bending moment for the aluminum alloy EN WA 6082/SR EN 755-2. A new frangible coupling was made, with an exterior diameter of the breaking zone of 42,5 mm and, under the same test conditions, a breaking force at bending of 240 daN resulted, and a moment of 456 J (Nm), which is situated between the two admissible limits of 204 and 678 J (Nm).

With the help of modern software of CAD designing we could obtain a frangible holder for good quality signal lights, which corresponds to the requirements of the Manual for designing airfields (ICAO Doc. 9157), Part 6, and can be added to the products portfolio of the firm ElectroMax Petroșani

Figure 6. The testing of the frangible support of the signal light on the press

Figure 7. The breaking modality of the frangible support.

5. CONCLUSION

Based on the aeronautical regulations, we established the constructive solutions and the dimensions of the frangible coupling, the support foot and the pipe that holds up the signal light. In the holder's construction, the frangible coupling is a changeable part, spo that the signal light can be reassembled after it was hit/destroyed by the airship.

The frangible holder of the signal light was tested by bending in a press from the laboratory of materials' resistance from the University of Petroșani, at the first test we got a bending moment higher (1064 Nm) than the maximum value (678 Nm) due to the exterior diameter of the area, which is of 45 mm as opposed to 42,5 mm as it was written in the documentation.

We also tested the constructive solution of the device for testing in the press the frangible coupling of the signal light.

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