

## Technical Annex to Communication No. 2365

### SHORT TRACK SPEED SKATING PADDING MEASURES TO INCREASE SAFETY FOR SKATERS

#### A.1. General information

The International Skating Union (ISU) has commissioned the International Academy of Sports Sciences and Technology (AISTS) and the COMATEC Institute of the High School of Engineering and Management of the canton of Vaud (HEIG-VD), Switzerland to develop a standardized testing procedure to certify padding systems used in Short Track Speed Skating competitions. The objective of the tests is to verify that the mattresses (padding) have sufficient shock absorption capacities, in order to prevent athletes' injuries, increase the promotion of the sport, and give direction to manufacturers for production and possibly innovation.

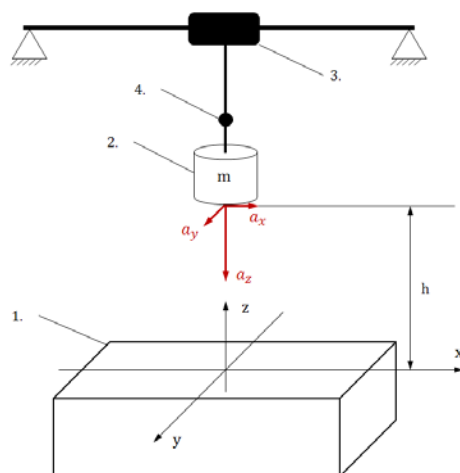
#### A.2. Description of the testing procedure

The following configuration (Figure 1) shows the vertical drop of a mass on a sample pad. The 32 kg mass has an accelerometer embedded in it. Three different heights ( $H$ ) are taken into account - 2, 3 and 4 m. Only the measurements recorded from the 4 meter height are used for the final results and analysis.

The 32 kgs instrumental mass used has a diameter of 200 mm, is made of S235 Steel and is of 124 mm in height. For each sample pad and at each height, the acceleration shock is measured three times.

The absorption is calculated by the maximum acceleration " $a_{max}$ " recorded during the first impact of the mass on the mattress.

The energy dissipation capacity corresponds to *how much energy is dissipated in the pad during impact*. This capacity is numerically given by the *restitution factor "e%"*, which is calculated by knowing the initial height " $H$ " of the mass, and then compared to the bouncing height " $H_b$ ".



**Figure 1** Vertical shock performs on a sample pad;  
1. Sample to test, 2. Instrumented mass (32 kg), 3. Winch, 4. Drop triggering device.

### **A.3. Testing procedure**

The testing procedure consists of:

- Installing the configuration (set-up) as seen above in Figure 1
- Mechanical drop test performed on the reference test pad (2x20 cm width) consisting of four different foam layers, with the following specifications to set the reference basis of the testing equipment and software:

- i) 12 cm of 22,40 kg/ m<sup>3</sup> density open cell foam (front layer);
- ii) 8 cm of 32,04 kg/m<sup>3</sup> density closed cell foam;
- iii) 12 cm of 22,40 kg/m<sup>3</sup> density open cell foam;
- iv) 8 cm of 32,04 kg/m<sup>3</sup> density closed cell foam.

- Mechanical drop test performed on the sample test pad.
- 3 tests per height, at 2, 3 and 4 m (9 shocks test per sample).
- Acceleration is measured for each test (9 measures per pad).

### **A.4. Acquisition and post-processing**

Accelerations shall be measured with a triaxial accelerometer which has the following characteristics:

- Minimum bandwidth: 0Hz-30Hz (it is important that the accelerometer captures the static component at 0Hz)
- Mounted eigen frequency: greater than 2KHz
- Noise in the 0-30Hz frequency band: less than 0.1g

In the case of digital sampling, an anti-aliasing filter should, if possible, be used. The sampling frequency shall be greater than 2,5 times the cut off frequency of the anti-aliasing filter at -3db.

If no anti-aliasing filter is available, it is requested that the sampling frequency is large enough to capture the significant spectral content of the signal. It is requested to check that the resonant frequency of the mounted accelerometer does not disturb the measurement. The rupture of a fix pencil tip (0.7 mm in diameter and 4 mm in length) supported in the immediate vicinity of the accelerometer (possibly on the accelerometer) shall not generate a measured vibration amplitude greater than 0,2g.

The final signal shall be filtered with a bandwidth from 0Hz to 30Hz.

### **A.5. Form of results**

For each height of fall, the measured results shall be compared with the results of the reference mattresses, however, the drop height of 4 meter is the decisive result for validation. The purpose of the testing is to compare the properties of the submitted mats with the reference mattress, so that suppliers/manufacturers get feedback for their further product development and "customers" (organizers of Short Track Events) can assess the basic quality of Paddings.