Vibration measurements of treadmill bearings

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Customer	Product Management
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1. Definition of tasks

The aim of vibration measurements at the ceiling was the examination of vibration reducing effects of the different treadmill bearings types g-fit Gear T300.

2. Description of the samples and testing process

The tests were executed with two different treadmills. For the insertion loss measurements in the specific set-up constellations, the vibrations occurring at the bottom side of the loaded ceiling were measured and compared with and without elastic treadmill bearings in different load situations (hard heel running and soft, normal running).

Test situation:
Treadmill type Precor 946i, mounted at load-bearing walls
Treadmill type Intensa 550Te, approx. 2m minimum distance to load-bearing wall
Pace 9.7 km/h

Treadmill bearings:
g-fit Gear T300 with Sylomer SR11 and Sylodamp (thickness 25mm) inserts
g-fit Gear T300 with Sylomer SR18 and Sylodamp (thickness 25mm) inserts
without additional elastic bearings

Picture 1: Measurement situation Precor 946i with g-fit Gear T300 (version with SR18)

The ceiling vibration was recorded at the bottom of the loaded ceiling with an acceleration sensor (PCB 393B05) and a MEDA blue stack (Company Wölfel).

Location of measurements:
The treadmills have been installed in the Fitpark Nenzing on the ground floor on a laminate floor. The acceleration sensor was mounted at the bottom side of the historical brick arch ceiling.

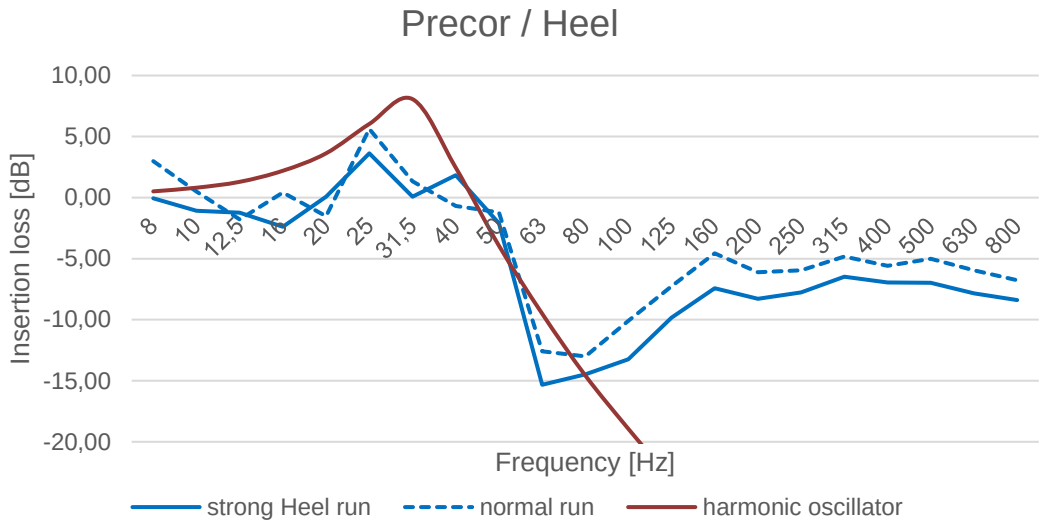
Picture 2: building of measurements

Picture 3: positioning of the acceleration sensor on the plasterwork of the brick arch

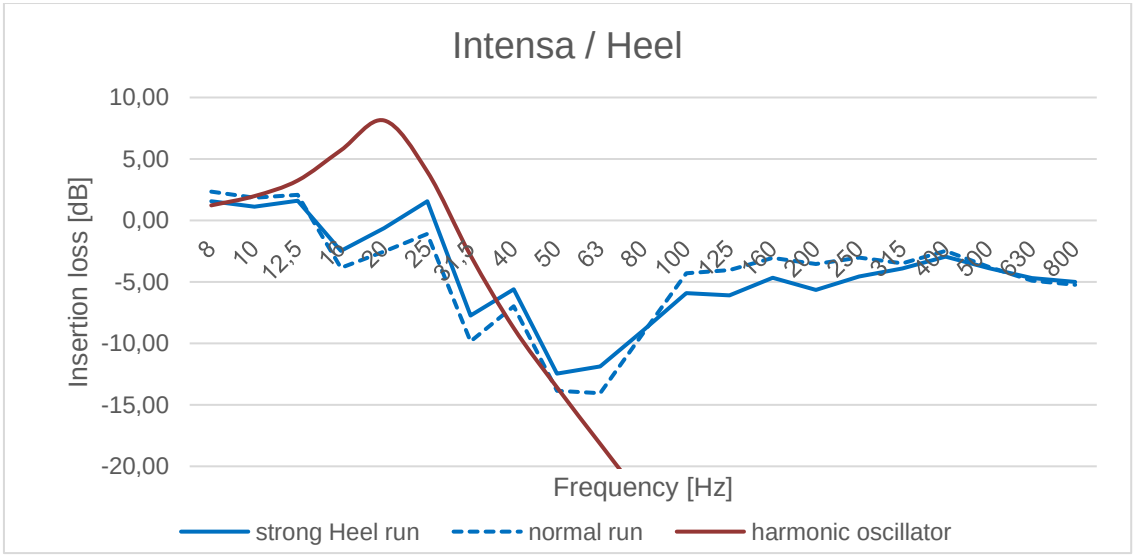
The acceleration is converted into oscillation velocities. Due to the more or less consistent loading (consideration not as a single event as the impact of the shoes but as permanent load) the effective value (energetic average value) with previous FAST-evaluation was used for the calculation of the third velocity range. All calculations were done with MEDA software.

3. Results

The following insertion loss, have been calculated as the ratio oscillation velocity with and without elastic bearing. The graphs show the insertion loss of the different elastic bearings for the two treadmill types.



Picture 4: Treadmill type Precor, version with SR18, reference value single-mass-oscillator with f0 = 32 Hz, relative viscous attenuation 20 %



Picture 5: treadmill type Intensa, version with SR18, reference value single-mass-oscillator with f_0 = 21 Hz, relative viscous attenuation 20 %

To make a comparison the insertion loss performance of a single-mass-oscillator (with force excitation at the mass point) has been illustrated with the according zero crossing. This proves that the attenuation performance of the products cannot be illustrated by a simple EMS-model, as additionally to the complex oscillation system arises a strong super elevation in the range of the natural frequency. Moreover the attenuation performance is much lower at higher frequencies than this would be the case in an EMS-model.

4. Summary

Regarding the insertion loss there is hardly any difference perceivable between the SR11 and SR18 bearings of both treadmills. As expected, the values of the insertion loss are more or less independent from hard-heel running or from normal running. Regarding the absolute values of the excitations the levels of hard heel running achieve a range between 20 to 40Hz and are 10dB higher, which is very similar for the other frequency ranges.

In the lower frequency range < 50 Hz only in single third spectra increases of maximal 5 dB are perceivable. Attenuation performances between 10 to 13 dB have been measured with the type Precor in a range from 63 to 100 Hz, with the type Intensa in a range from 50 to 80 Hz. In the higher frequency ranges an attenuation performance of approximately 5 to 8 dB has been consistently achieved. If the ceiling constructions were stiffer, a higher insertion loss would be expectable for this frequency range.

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