LIBRARY IVC SYSTEM

Wear test of mechanical parts and vinyl floor of the 2x2GM160 Library system

HOUSING

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Instrumentation

- Testo 945 with contact temperature probe.
- Electrical motor Minimotor MC 160 P2 9 Nm, 36 rpm, 60 W.
- Electrical controller for motor and cycle counter.
- Analogical comparator.

Test descriptiopn

Wear analysis of mechanical parts and vinyl floor of a 2x2GM160 library system. The library was moved thanks to a lifting platform along the vinyl floor to reduce the pressure on the ground. A mechanical torque reducer was required to reduce the force needed to move the platform. To accelerate the wear process due to the use of the platform, the system was automated with an electric motor and control. The number of cycles was counted and material degradation was analyzed.

Materials and methods

Two 2GM160 racks and an Touch Slim Plus Air Handling Unit (AHU) were used to make up the library configuration. The weight of each single rack, with empty cages and bottles, is 435 kg. To simulate animal, bedding, food and water weight for 320 cages, a 130 kg load was applied on the racks. Racks were connected to the AHU and the system was lifted by the special platform *(picture 1)*. The total weight of the system library-load-platform was about 1450 kg. The test was carried out with an ambient temperature of approximately 24°C and relative humidity of around 50%. The vinyl floor temperature was approximately 23.5 °C. The library movement was carried out along a rail *(picture 2)*.

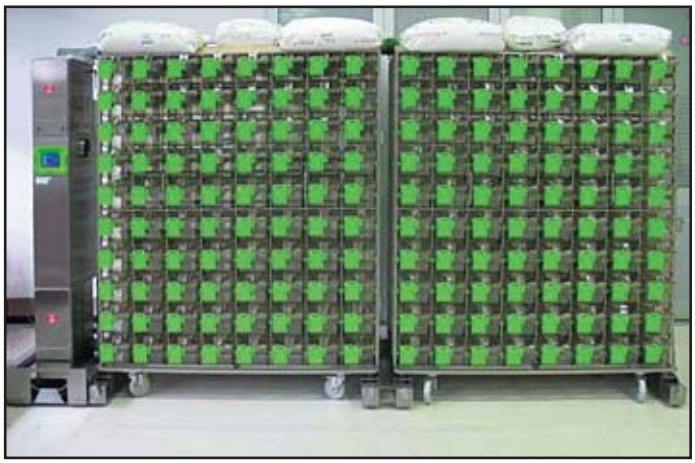
The automatic control system was equipped with two electro-mechanical interrupters *(picture 3)* to invert the rotation of the motor and thus the running direction of the library. The interrupter also triggered the cycle-counter. A cycle was defined as twice the distance between the two interrupter, equal to 1.568 m (61.7 in). The time of one movement in one direction was 1 minute and 1 second, with the platform moving at 25.7 mm/s (1.0 in/s). After an 11 second pause, the system changed direction. Each cycle lasted 2 minutes and 24 seconds.

Picture 4 shows the 9 Nm and low power motor (on the left) and the electrical control system. The test was interrupted periodically to check the state of wear of the materials. The system was stopped at times for some hours to check the imprints left on the vinyl floor.

Results

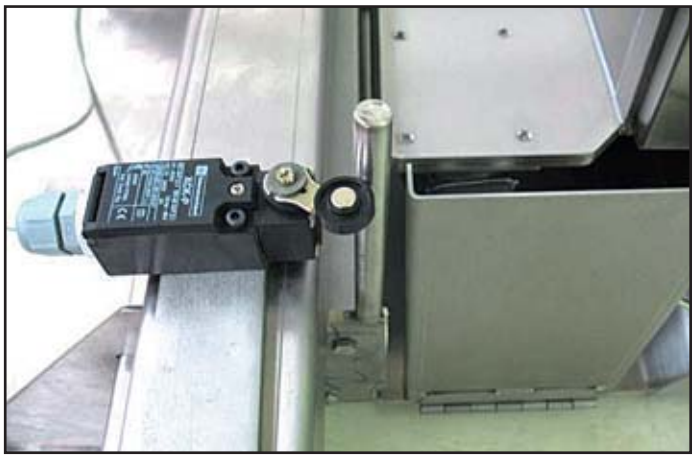
The whole system was tested along a 1.536 m (61.7 in) path over 3000 times forward and 3000 times backward. The system was therefore tested for a total distance of 9.408 km (5.85 miles) with 6000 changes of direction on the vinyl floor. The imprint depths left on the vinyl floor by the library movements were measured using an analogical comparator *(picture 5)*. *Picture 6* shows the measurement method: the imprint depth was calculated on the difference between the measurement outside (zero level) and inside the imprint.

The measured mean value of the imprint depth was 0.15 - 0.20 mm. No visible damage was detected on the vinyl floor. The 14 castors of the platform are shown in *picture 7*, where the red arrows show the 4 driving castors. Due to the shape, the size and the high number of castors, the platform load was discharged along a large surface, reducing the pressure on the floor. Under test conditions, the specific pressure discharge from the platform castors on the floor was about 18 kg/cm^2 (116 kg/sq. in). During the test, no hard imprints or damage to the vinyl floor was detected after leaving the system at standstill for some days. Any imprints disappeared in a matter hours thanks to the elasticity of the vinyl. No problems were detected with the mechanical parts in movement.



Picture 1: library configuration used in the test. It is composed of 2x2GM160 racks, an Air Handling Unit, the lifting platform and a load to simulate animals, bedding, food and water. The system moves along a vinyl floor.

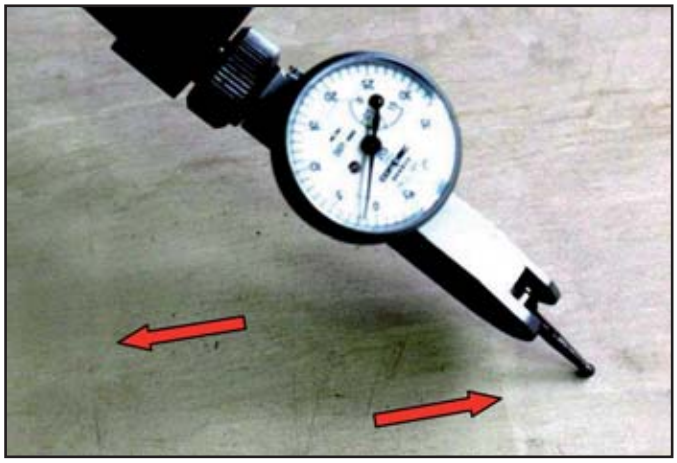
Picture 2: library runs along a rail to fix the direction of movement.

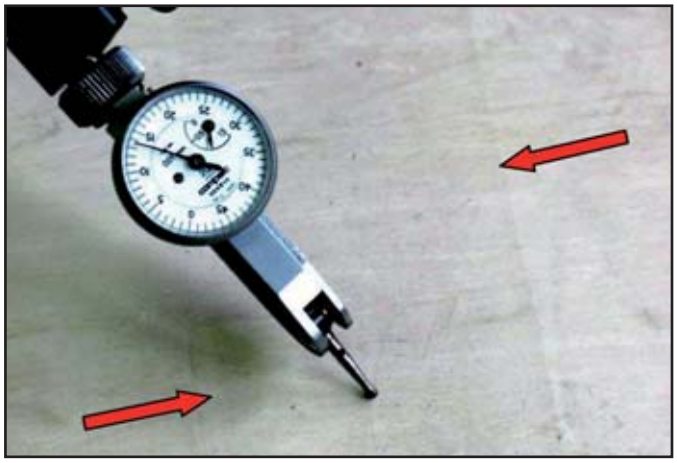


Picture 3: end run interrupter to invert direction and count cycles.

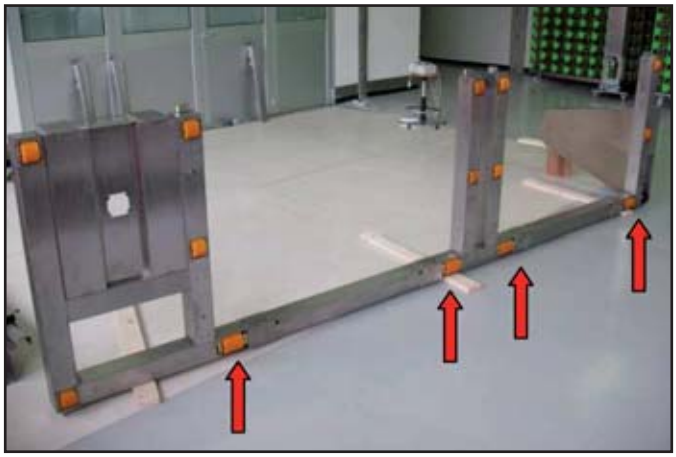
Picture 4: automation system. Motor (on the left) and control system with cycle counter (on the right).

Picture 5: analogical comparator used to measure deformations in the vinyl floor due to platform movements. The red arrow shows an imprint left by the castors.





Picture 6: measurement method to detect the depth of the imprint, bounded by red arrows in the figure.
Zero level was measured outside the imprint (on the left) and the depth was measured inside the imprint (on the right).



Picture 7: bottom view of the platform, where the 14 castors are shown. Red arrows show the 4 driving castors

Conclusions:

The test was carried out in critical conditions for the system. The vinyl floor was not glued to the lab concrete floor, and the latter did not show an extreme regularity. In addition, cycles were made with the maximum load possible, and very close in time, to prevent the vinyl floor from working in an elastic manner but instead always under compression. The points where the direction was changed were always in the same position on the floor. No significant damage or deep imprints were detected on the floor. The mechanical behaviour of the lifting platform proved to be efficient.

As a result of the test we can estimate a minimum life of 5 years for the lifting platform of the 2x2GM160 library system and the same for the vinyl floor.

With a soft floor, such as vinyl, it is required to reduce the pressure on the ground to prevent the floor from being damaged.
In this library configuration the weight of a rack and of its platform is discharged on the ground by 6 castors. This way, the load is released to the floor by a larger surface and the pressure is lower, reducing the risk of damage and increasing the vinyl floor lifetime.

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