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Bowling *for Safety?*

UL performs
field evaluation
on 50-year-old
bowling alley
pinsetter
machines

More than 100 million people in approximately 90 countries worldwide enjoy the sport of bowling. Bowling has a long and intriguing history tracing its ancestry back to the Egyptians around 3200 BC. In the early 1950s, one of the first automatic pinsetter machines was introduced into bowling alleys. Fifty years ago, this machine was a mechanical marvel, easy to operate, quick to repair, and built to last. Maybe it was built to last too long.



This problem was faced by the authority having jurisdiction (AHJ) in Plano, Texas. A brand-new, multi-million-dollar, 34-lane bowling alley was being built—using year-old pinsetter machines. These machines originally came from a U.S. military base in Korea, and later stored in a warehouse for an unknown period. During the initial building inspection, it was found that the pinsetter machines were UL Listed. The original round UL label was found on two of the 34 machines on site; the rest of the UL labels were either missing or covered over by layers of paint. Find a UL label and the inspection is over, right? Well, maybe not so fast. The immediate cause for concern was the safety issue of this old equipment being installed in a brand-new facility. The question lingered; had these machines reached their end of life?



Photo 1. 50-year-old UL label

The grand opening for this facility was only weeks away and the AHJ had red-tagged the pinsetters. The general contractor contacted Underwriters Laboratories (UL) to request a field evaluation for these pinsetter machines. UL's Dallas Local Engineering Services (LES)

office visited the facility the next day to conduct a preliminary evaluation with the AHJ. A quote for services was provided to the contractor, and the field evaluation was initiated two days later by UL's Dallas LES office. In a surprising twist of fate, the UL staff member had previously worked at a bowling alley 35 years ago, while serving in the military, and maintained the same model of pinsetter and he indicated, "It was like walking back in time, sort of déjà vu."

As part of UL's Field Evaluation Service, experienced technical staff members conduct on-site safety evaluations. If the product complies with UL's safety requirements, a Field Evaluated Product (FEP) Mark is applied. The FEP Mark is applied to products or equipment that can be completely evaluated on-site using non-destructive testing techniques. The FEP Marks are tamper-resistant, numbered serially, dated, and include the model designation of the product. The serial number of the FEP Mark is included in the report that is provided to the customer and the AHJ. In many cases, UL's field evaluation process is completed in one day.

During UL's initial field evaluation, the AHJ chose five pinsetter machines at random to be evaluated. It was agreed that if any problems were found on these five machines, changes would be required on the re-



Photo 2. Front view of multiple bowling lanes.

maining 29 machines since the original pinsetters were UL Listed for compliance with the Standard for Safety for Motor-Operated Appliances, UL 73. The maintenance personnel provided installation, repair, and maintenance manuals for the machines. When the construction review was initiated, it was discovered that none of the five machines were identical in construction, and several factory authorized, and unauthorized, modifications had been introduced over the past 50 years. The maintenance personnel intended to convert all 34 pinsetters to the identical configuration, but first UL needed to establish a common platform. Several of the pinsetters had been previously upgraded resulting in both mechanical and electrical modifications; others were more recent models. Over the years, the original scoring and pin detect circuitry had been removed to allow the upgrade to different external scoring systems, all of which had unique field wiring.

A basic platform was established that incorporated the latest factory authorized upgrades and the new computerized scoring system that was installed at this facility. This basic platform was the basis for UL's field evaluation of the pinsetters. In general, UL's field evaluation is not based on equipment functionality. However, in this situation, UL staff was relying on an operational product sample to determine the overall compliance of 34 machines. The field evaluation required two days to complete. During the first day, the basic platform was established and the first machine was thoroughly evaluated. During the second day, the testing was completed on the other four machines. As the field evaluation continued, the maintenance personnel upgraded the remaining 29 pinsetters to the requirements of the defined basic platform.

How does an automatic pinsetter actually work? Few bowlers have ever seen a pinsetter in action; it is hidden from view behind a wall over 75 feet away from the bowler. It is truly a mechanical marvel.

The pinsetter contains three electric motors; a 1-HP motor operates the basic pinsetter. The ball return mechanism is shared between two adjoining lanes, and uses a ½-HP ball accelerator motor located near the pinsetter and another ½-HP power lift motor that is located at the bowler's approach area. Each motor was found to be thermally protected. The main motor is connected to a transmission gearbox via belts and pulleys. The gearbox powers a rotating pin elevator and each pin is positioned into a bin on top of the moveable pin deck. At the correct time, all the pins are loaded, the pin deck is lowered, and 10 new pins are positioned on the alley. To speed up this process, each machine holds up to 20 pins, two full sets, so that when one rack is down, another rack is ready to take its place in case all of the pins are knocked down. The entire function of the pinsetter is controlled via limit switches, relays, and trigger mechanisms; a very simplistic controller.

A thorough visual evaluation of the control panel was conducted. No vacuum tubes were found under the panel's lid, but the system still used a selenium rectifier. The other components consisted of connectors, fuses, barrier strips, relays, switches, motor contactors, and an updated transistorized timing circuit. The internal wiring was inspected for cracked or degraded insulation. The relay contacts were checked for abnormal wear and signs of arcing. The AC field wiring to the pinsetter was installed in accordance with the original manufacturer recommendations and the current *NEC* requirements. Input voltage and current

tests were performed to validate the manufacturer's original operating specifications. To check for shock hazards, the AC power transformer was tested using a dielectric tester to determine any effects of insulation aging and breakdown. The control panels were found to be in remarkable condition considering their age. All the electrical cables were checked for aging and normal wear and tear.

Several electrical problems were found and corrected; improper safety fusing, previous scoring interface wiring modifications, and a lack of safety covers on several electrical cable trays. The control panel requires a unique 3.2 amp fine thread screw-in fuse that according to maintenance personnel is often replaced with a different fuse holder. Over the years, the wrong sized fuse could have been installed that may have stripped the original threads. Therefore, the damaged fuseholders were replaced. On several machines, an extra transformer had been added, a left-over from a previous scoring system. Although these extra transformers did not pose a safety problem, they were removed to maintain consistency between all of the pinsetter machines.

A dielectric test of the AC power transformers was performed on the remaining 29 pinsetter machines. As a result, two power transformers were replaced due to insulation breakdown. Mechanically, the system had been well maintained.

It was determined that the pinsetter machines continued to comply with the requirements in the Standard for Motor Operated Appliances, UL 73 and UL's Field Evaluated Product (FEP) Marks were applied to the five machines. Per the agreement with the AHJ, the remaining 29 pinsetters were upgraded to the same construction level. It was determined that no additional FEP Marks were required. It was clear that the end-of-life of these machines had not been reached. All of the machines were found to be properly maintained by factory trained personnel.

The question remains. Why do bowling alleys still



Photo 3. Front view of automatic pinsetter
Photo 4. Rear view of automatic pinsetter

use these 50-year-old machines? Years ago, the U.S. military installed this model of pinsetter in all of their bases throughout the world. Recent military base closures have created a surplus market for these machines. These machines are simple to troubleshoot, easy to repair, and replacement parts are still available. In many cases, having a few extra machines solely for spare parts has been found to be cost effective. That was the case at this new facility; two extra automatic pinsetters were on hand during the equipment installation phase and later disassembled for spare parts. According to maintenance personnel, the worse that can happen during a machine jam is for the main drive belt to simply slip off the motor pulley and stop the machine. From a safety aspect, the mechanical pin deck that sets the pins is rather lightweight and will not crush an operator; it weighs about 35 pounds.

In contrast, newer automatic pinsetters are built with computerized controls, and contain plastic components. During a machine jam, the plastic parts may break and computerized

controls are more difficult to troubleshoot.

The next time you perform safety inspections, merely searching for a third-party safety certification label may not be enough. Previously certified equipment that has been significantly modified or end-of-life issues may be of concern. Be aware of 50-year-old machines being disguised to the public as modern computerized automatic bowling equipment. You want your equipment to operate safely in its new surroundings. ✎



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