



EXPERT OPINION

Handrail Coating

Report-No. 03_008



Order placed by: ESCALATOR HANDRAIL GmbH
Peter-Deybe-Strasse 1
52499 Baesweiler

TÜV customer No.: 287579

Type of product: Coating of handrails of escalators and passenger conveyors

Site: C & A store, Koblenz

Period of monitoring: Beginning: 5 December 2002 End: 5 March 2003
Running time: 750 hours

Order placed with: TÜV Anlagentechnik GmbH
TÜV Rheinland Berlin Brandenburg Group

Responsible: Regionalbereich Köln (Cologne Area Division)
Bereich Fördertechnik (Conveyor Technology Division)

Inspections made on: 16 January, 7 February, 5 March 2003

Expert: Dipl.-Ing. Reichelt

Present at inspections: Olaf Müller, EHC

Report prepared on: 9 May 2003

Sheets: 14



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1. Assignment

A field test was to be carried out to monitor and document the durability of a new type of handrail coating. Possible new hazards to escalator users were to be identified by means of a hazard analysis. During the visits to the site, close inspections were made of the handrails, including the coatings, with the escalator in use.

2. Basis of Testing

EC Directive on Machinery 98/37/EC

DIN EN 115

3. Description of Product and Site

3.1 Coating:

Manufacturer: ESCALATOR Handrail GmbH

Trade name: A D Rail

Material: PUR film

3.2 Site/ambient conditions:

Clothing store No atmospheric effects

Heated and dry room No exposure to UV radiation

Type of drive: Linear drive with low surface pressure

Handrail speed: 0.5 m/s

3.3 Handrail:

Manufacturer: ESCALATOR Handrail GmbH
 Trade name: NT 2000
 Material: PUR

3.4 Escalator:

Manufacturer:	OTIS	Serial No.	47 NK 3212
Year of construction:	1997	Type:	506 NCE
Rise:	4.4 m	Angle of inclination:	35°
Step width:	808 mm	Speed:	0.5 m/s

4. Result (visual assessment during continuous operation)

The escalator (Fig. 1) is in excellent condition and maintained at regular intervals by a specialised firm. With all elements of the handrail drive being in a proper state and satisfying the requirements placed by the escalator manufacturer, they have no adverse effect on the handrail (Figs. 2, 3).

When the coating is applied to the handrail, small air bubbles may form beneath the film and roughen the surface (Fig. 4). All through the long-duration test, such "imperfections" did not lead to damage or an incipient separation of the coating.

Even the dull spots appearing on the coating after a longer period of standstill, e.g. over night, which are due to the handrail supporting on the guide rollers, are not critical. These marks are merely optical phenomena and go away soon after the escalator has been started again.

Special attention was given to those areas where the coating overlaps for separations were assumed to occur due to alternating bending load. After half the period of use, the right handrail began to show signs of minor separations (about 2-3 mm) that were the doing of escalator users. Someone must have tried in vain to strip off the film. This incident definitely verified the non-critical behaviour of the coating under conditions of casual vandalism. It was hardly possible to keep on stripping off the film since its adhesion was so great that the mere attempt of detaching a larger area resulted in the breaking off of the bit of film the "vandal" had grabbed at. The protruding parts of the coating were all soft and had no sharp edges or tips; there was no risk of injury. The damaged area could be worked neatly using cutters (Figs. 5, 6, 7).

In those areas of the handrails, for instance, the joints, where the surface conditions are less perfect, the behaviour of the coating gave no cause for complaint (Figs. 8, 9, 10, 11).

The handrail coatings did not show any signs of aging or wear.

5. Hazard Analysis

A hazard analysis was made to deal with all the hazards listed in Annex C, Table C1 of EN 115. The matrix shown below includes all the hazards relevant to the handrail. The other hazards mentioned in Annex C, Table C1 of EN 115 are not applicable here.

Item	Hazards EN 115 Table C 1	EN 115	Solution
1.1	Crushing hazard	7.3.1	No alteration to handrail geometry
		7.5	
1.5	Drawing-in or trapping hazard	7.5	No alteration to handrail geometry
1.6	Impact hazard	7.3.1	No alteration to handrail geometry
1.11	Loss of stability	7.8	Not applicable since the breaking strength of the handrail is not affected
1.12	Slip, trip and fall hazards	7.1	Hazards and separations of coating are unlikely to occur provided the handrail coating is used as described in this expert opinion
		7.2	
		7.4	
		7.6	
		7.7	
8.1	Hazards generated by neglecting ergonomic principles	7.3.2	No alteration to handrail geometry
		7.3.3	
		7.4	
10.5	Overturn, unexpected loss of stability	7.8	Not applicable since the breaking strength of the handrail is not affected
11.1	Hazards caused by failure of guards	7.5	No hazard, a separation of the film activates the handrail control and causes the escalator to stop
11.6	Energy supply disconnecting devices	7.8	Not applicable
11.7	Emergency devices	7.8	Not applicable

6. Conclusion

The hazard analysis and the field test on the handrail coating proved that there is no doubt about the safety of the product provided the above-mentioned requirements of use are fulfilled.

If the coating is applied to escalators with different handrail drive systems, it is necessary to see to it that the specific load is similar.

An advantage worth mentioning is that when touching the smooth coating, users of escalators and passenger conveyors feel it to be "clean". This might help people to break the wide-spread bad habit of not holding on to the handrail when using escalators or passenger conveyors.

Cologne, 9 May 2003

Expert

A handwritten signature in black ink, appearing to read 'Reichelt'.

Dipl.-Ing. Reichelt



Fig. 1

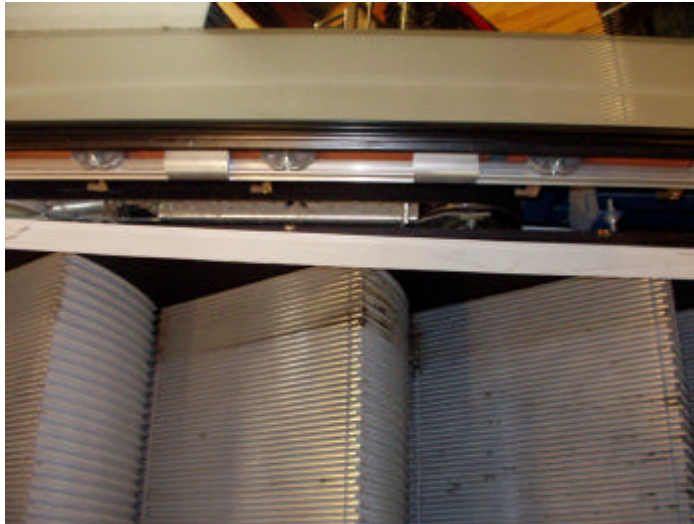


Fig. 2

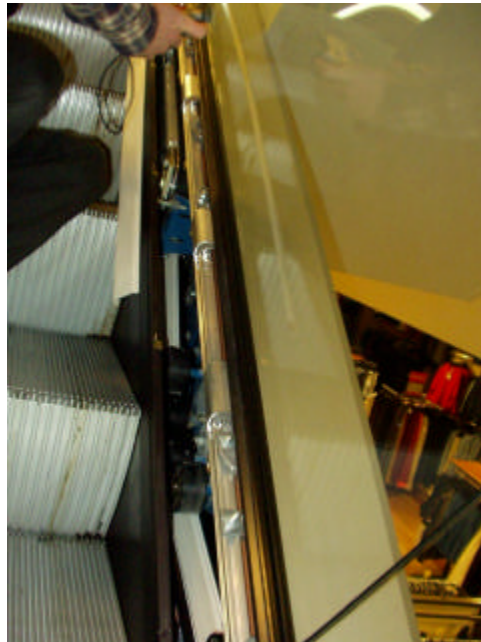


Fig. 3



Fig. 4



Fig. 5

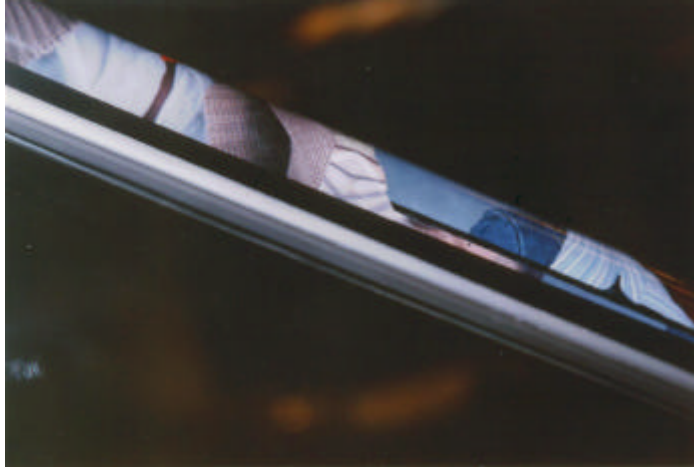


Fig. 6



Fig. 7



Fig. 8



Fig. 9

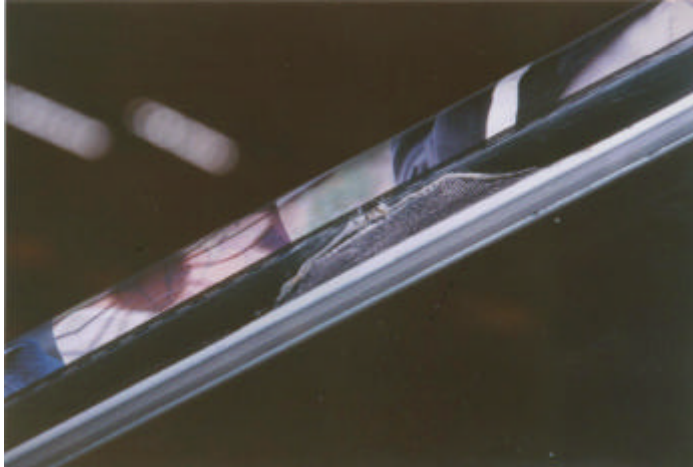


Fig. 10



Fig. 11