

**MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES**

SUBJECT: ASME A17 Committee Meeting
LOCATION: Holiday Inn, Calgary, Alberta, Canada
DATE: September 16 - 17, 1999
ENTRY DATE: September 22, 1999

CPSA 6 (b)(1) Cleared
[Signature]
No Mfrs/PrvtLbrs or
Products Identified
Excepted by _____
Firms Notified,
Comments Processed.

LOG ENTRY SOURCE: Patricia L. Hackett, Engineering Sciences

COMMISSION ATTENDEES: Patricia L. Hackett, Engineering Sciences
Ronald Medford, EXHR

[Signature]

NON-COMMISSION ATTENDEES: Can be found in ASME minutes

MEETING SUMMARY: The ASME A17 Main Committee met and listened to a presentation by Robert Farra, of ADL regarding the escalator skirt/step entrapment performance standard study. The presentation reviewed the purpose of the study and the results of the testing performed. In addition, Neil presented a proposed Technical Revision (TR) to the code, based on the results of the study. The ASME A17 main committee voted to submit the TR for balloting. A copy of the TR is attached. Following the A17 main committee meeting, the escalator and moving walkway sub-committee met. Questions regarding the ADL study and the TR were addressed. In addition, the other TR's and outstanding agenda items were addressed. A copy of the agenda and the minutes can be obtained through Geraldine Burdeshaw, ASME @ 212-591-8500.

[Handwritten mark]





National Elevator Industry, Inc.

ASSOCIATION HEADQUARTERS

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RESPOND TO: **Edward A. Donoghue Associates Inc.**
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Salem, NY 12865-0201
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September 16, 1999

Geraldine Burdeshaw, Secretary
ASME A17 Main Committee
American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990
United States of America

Subject: Request for Technical Revisions
Escalator Step/Skirt Performance Index

Dear Geraldine;

National Elevator Industry Inc. is requesting the following revisions be made to ASME A17.1, ASME A17.2.3 and ASME A17.3. NEII further request:

- The ASME A17 Escalator and Moving Walks Committee be assigned primary responsibility for processing this TR.
- An expedited ballot of the ASME A17 Main Committee be undertaken once the Escalator and Moving Walks Committee completes their review.
- The ASME A17 Existing Installations, Maintenance and Inspectors' Manual Committees be balloted concurrently with the Main Committee.
- The public review period be concurrent with the Main Committee balloting.
- The revisions to ASME A17.1-1996, including TR 96-10 (skirt deflectors), be published ~~immediately~~ upon approval with an effective date of 60 days after publication.
- The revisions to ASME A17.1-2000 be included in said edition if approved prior to publication. If not, then published prior to the effective date of ASME A17.1-2000 with the same effective date as ASME A17.1-2000.

ASME A17.1-1996, Addenda A17.1d-2000

Revise Rule 802.3e to read as follows:

802.3e Clearance Between Skirt and Step. ~~The clearance on each side of the steps (loaded gap) between the step tread and the adjacent skirt panel shall be not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel 3/16 in. (4.8 mm). The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over an area no less than 1940 mm² (3 in.²) and no more than 3870 mm² (6 in.²).~~

Revise Rule 802.3f to read as follows:

802.3f Skirt Panels

- (1) The height of the skirt above the tread nose line shall be at least 1 in. (25 mm) measured vertically.
- (2) Skirt panel shall be designed not to deflect more than 1/16 in. (1.6 mm) under a force of 150 lbf (667 N).
- (3) ~~The exposed surfaces of the skirt panels adjacent to the steps shall be smooth and made from a low friction material or treated with a friction reducing material.~~

Add a new Rule 802.3k to read as follows

802.3k Step/Skirt Performance Index.

(1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} = \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = -3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$e = 2.7183$

$y = -3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.4 when a skirt deflector device complying with the requirements of Rule 802.3j is provided.

Add a new Rule 1008.2s to read as follows:

1008.2s Step/Skirt Performance Index.

- (1) The escalator skirt shall not be cleaned, lubricated, or otherwise modified in preparation for testing. The escalator instantaneous step/skirt index measurements [Rule 802.3k(1)] shall be recorded from each sides of two distinct steps along the inclined portion of the escalator, where the steps are fully extended, at intervals no larger than 150 mm (6 in.). Test steps shall be separated by a minimum of 8 steps.
- (2) A load of 110 N (25 lbf) shall be laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm² (3 in.²) and no more than 3870 mm² (6 in.²).
- (3) No vertical load exceeding 220 N (50 lbf) shall be applied to the test step and adjacent steps.
- (4) The coefficient of friction shall be measured with the test specimen conforming to the requirement of 802.3k(2) sliding in the direction of the step motion under a 110 N (25 lbf) normal force at the operating speed of the escalator and shall be measured with devices having sensitivity better than ± 2.2 N (0.5 lbf). The direction of step motion shall be the direction of normal operation. If the escalator is operated in both directions, the down direction shall be used for the test.
- (5) For both the coefficient of friction measurement and the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1008.2s(4).

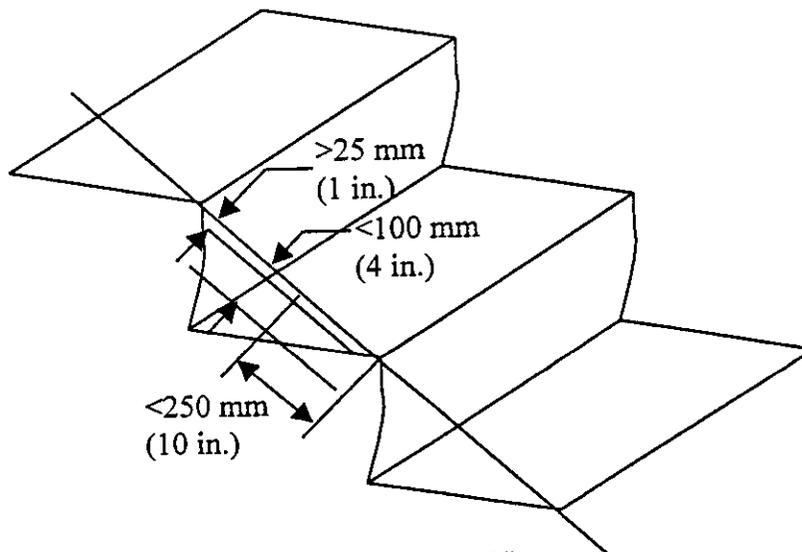


Fig. 1008.2s (4)

- (6) Verify that that the step/skirt performance index conforms to the requirements in Rules 802.3k and 1206.6c (Item 1.17.2).

Add a new Rule 1008.2t to read as follows:

1008.2t Clearance Between Step and Skirt (Loaded Gap).

Escalators installed under ASME A17.1d-2000 shall be tested as follows.

- (1) Loaded gap measurements shall be taken at intervals not exceeding 300 mm (12 in.) in the region adjacent to the flat steps (Rule 802.6e) and before the steps are fully extended. Loaded gap measurements shall be made on each skirt panel.
- (2) The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf) (Rule 802.3e). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) For the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1008.2s(4).

Add a new Rule 1206.6c to read as follows:

1206.6c Step/Skirt Performance Index.

- (1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm^2 and no more than 3870 mm^2 .

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.^2 and no more than 6 in.^2 .

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than $0.8 \mu\text{m}$ ($32 \mu\text{in.}$))	$2900 \pm 325 \text{ mm}^2$ ($4.5 \pm 0.5 \text{ in.}^2$) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.4 when a skirt deflector device is provided.

ASME A17.1-2000

Revise Rule 802.3e as follows:

802.3e Clearance Between Skirt and Step. ~~The clearance on either side of the steps between the step tread and the adjacent skirt panel shall be not more than 4 mm (0.16 in.), and the sum of the clearances on both sides shall be not more than 7 mm (0.28 in.).~~ The clearance (loaded gap) between the step tread and the adjacent skirt panel shall be not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over an area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).

Revise Section Rule 802.3f as follows:

802.3f Skirt Panels.

- (3) The height of the skirt above the tread nose line shall be at least 25 mm (1 in.) measured vertically.
- (4) Skirt panel shall be designed not to deflect more than 1/16 in. (1.6 mm) under a force of 150 lbf (667 N).
- ~~(1) The exposed surfaces of the skirt panels adjacent to the steps shall be smooth and made from a low friction material, or permanently treated with a friction-reducing material. Untreated surfaces, such as porcelain, enameled steel, bronze, or stainless steel, are not acceptable.~~

Add a new Rule 802.3g as follows:

802.3g Step/Skirt Performance Index.

- (1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} = \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.25 when a skirt deflector device complying with the requirements of Rule 802.3j is provided.

Add new Rules 1002.3a(17)(e) (acceptance test) and 1013.2t (category one periodic test) as follows:

10### Clearance Between Step and Skirt (Loaded Gap)

- (1) Loaded gap measurements shall be taken at intervals not exceeding 300 mm (12 in.) in the region adjacent to the flat steps (Rule 802.6e) and before the steps are fully extended. Loaded gap measurements shall be made on both skirt panels.
- (2) The applied load shall not deviate from 110 N (25 lbf) (Rule 802.3e) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) For the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1002.3a(21).

Add new Rule 1002.3a(21) (acceptance test) and 1013.2v (category one periodic test) to read as follows:

10### Step/Skirt Performance Index.

- (1) The escalator skirt shall not be cleaned, lubricated, or otherwise modified in preparation for testing. The escalator instantaneous step/skirt index measurements [Rule 802.3k(1)] shall be recorded from each sides of two distinct steps along the inclined portion of the escalator, where the steps are fully extended, at intervals no larger than 150 mm (6 in.). Test steps shall be separated by a minimum of 8 steps.
- (2) A load of 110 N (25 lbf) shall be laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) No vertical load exceeding 220 N (50 lbf) shall be applied to the test step and adjacent steps.
- (4) The coefficient of friction shall be measured with the test specimen conforming to the requirement of 802.3k(2) sliding in the direction of the step motion under a 110 N (25 lbf) normal force at the operating speed of the escalator and shall be measured with devices having sensitivity better than ± 2.2 N (0.5 lbf). The direction of step motion shall be the direction of

normal operation. If the escalator is operated in both directions, the down direction shall be used for the test.

- (5) For both the coefficient of friction measurement and the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1002.3a(21).

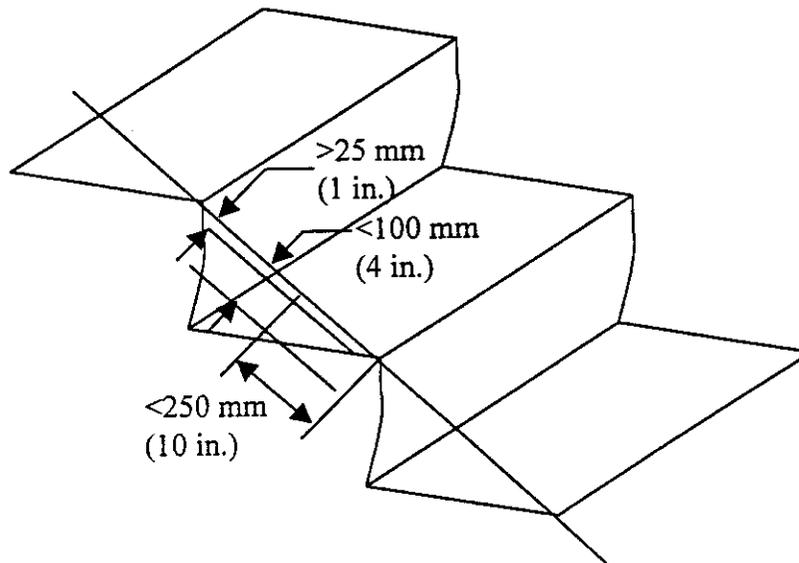


Fig. 1002.3a(21)

- (6) Verify that that the step/skirt performance index conforms to the requirements in Rules 802.3g and 2005.7 (Item 1.17.2).

Add a new Rule 2005.7 to read as follows:

2005.7 Step/Skirt Performance Index.

- (a) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} \frac{e^y}{e^y + 1}$$

where

(SI Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel. mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm^2 and no more than 3870 mm^2 .

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel. in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.^2 and no more than 6 in.^2 .

(b) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than $0.8 \mu\text{m}$ ($32 \mu\text{in.}$))	$2900 \pm 325 \text{ mm}^2$ ($4.5 \pm 0.5 \text{ in.}^2$) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(c) The escalator step/skirt performance index shall be:

(1) ≤ 0.15 ;

- (2) ≤ 0.25 for escalators installed under ASME A17.1-2000 and later editions and when a skirt deflector device complying with the requirements of Rule 802.3j is provided; or
- (3) ≤ 0.4 , for escalators installed under ASME A17.1d-2000 and earlier editions and a skirt deflector device is provided

ASME A17.2.3

Revise Item 1.17 to read as follows:

ITEM 1.17 STEP/SKIRT CLEARANCES, PANELS AND PERFORMANCE INDEX

1.17.1 Routine

Check the clearance between the skirt panel and the step using a thickness gauge or by laying a small rule on the edge of the step to read the distance. Several steps should be checked through their entire travel. The allowable clearances are as follows (see Fig. 1.17.1):

- (a) A17.1-1955 through A17.1d-1970: not more than 3/16 in. (4.8 mm) with a total of both sides not more than 1/4 in. (6.4 mm), except where skirt obstruction devices are installed at the lower entrance for escalators installed under the A17.1-1965 through A17.1(d)-1970.
- (b) A17.1-1971 through A17.1-1979 editions: not more than 3/8 in. (9.5 mm) on each side.
- (c) A17.1-1980 ~~and later editions~~ through A17.1c-1999 and A17.3: not more than 3/16 in. (4.8 mm) on each side.
- (d) A17.1d-2000 and later editions. not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel. Each side shall be independently tested.

For escalators installed under A17.1a-1982 through A17.1c-1999 and later editions, inspect the exposed surface of the skirt panel to check whether it is either made from a low friction material or treated with a friction reducing material. The skirt panels of escalators installed prior to A17.1a-1982 should also be treated with a friction reducing material. The panel should be tested at several places during the run and especially near the transition entrance and exit. If examination of the panels raises a question about the friction of the skirt panels, the manufacturer's recommendation should be requested and compared to the

treatment schedule if available. If skirts are treated, examine the steps to verify that friction-reducing treatment has not been applied on them.

1.17.2 Periodic

Visually inspect the condition of step/skirt panel gap while the escalator is stationary. Mark a step and operate the escalator to bring other steps into view as required until every step on the escalator has been examined. Document any outstanding conditions, such as step/skirt gaps, damaged steps, damaged step treads, damaged skirt panels, mismatched skirt panel joints, or sharp edges on the edge of the step or skirt panel. Pay particular attention to the gaps between the riser portion of the step and the skirt panel.

Run the escalator in its normal direction of travel for at least two cycles of steps. If the escalator is operated in both directions, run the escalator for at least 2 cycles of steps in both the up and down directions. Visually examine the step/skirt gaps along the entire length of the escalator. Pay particular attention to the gaps at the transitions. Note any abnormal operation of the escalator such as jumping steps, irregular step movement, step/skirt panel interference, or skirt panel misalignments.

(a) Step/Skirt Performance Index Test (Moving Step).

Select two steps to conduct this test. One step should be selected as a representative step. It should appear similar to the majority of the other steps on the escalator. A second step should be chosen to represent any unusual step or group of steps. Steps that appear to have been replaced, exhibit wear, show signs of damage, or move in irregular ways are candidates for the second test step. If all the steps appear similar, then the steps should be randomly selected. In any case the test steps should be separated by at least 8 steps.

If the escalator is a "down" escalator, or the escalator is operated in both directions, the test step should be moved to the top of the escalator before the curved skirt panels prior to each test run, and run down during the test. If the escalator is normally operated as an "up" escalator, then the test step should be moved to the bottom of the escalator just before the curved skirt panels prior to each test run, and run up during the test.

- (1) Install the test apparatus on the step to be tested. Install a polycarbonate test specimen on the test apparatus.
- (2) Orient a frictional force transducer to match the angle of the skirt panel as shown in Fig. 1.17.2 (b).

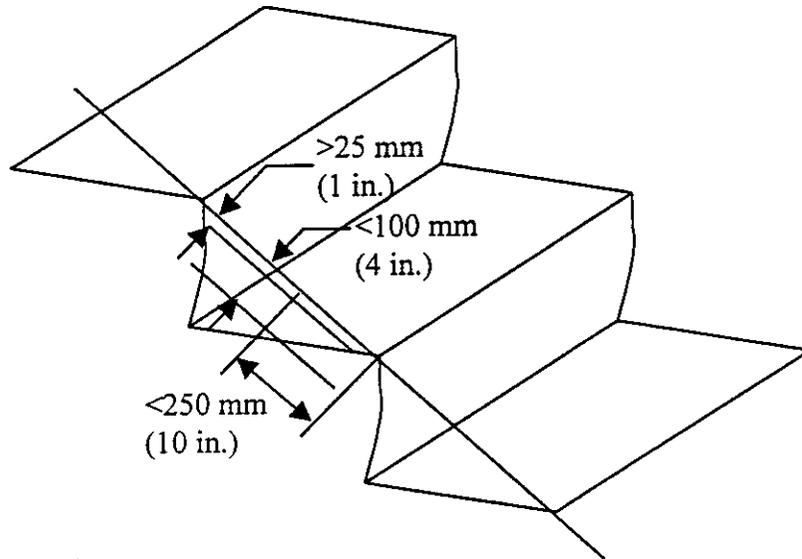


Fig. 1.17.2 (b)

- (3) Using the test apparatus apply a 110 N (25 lbf) load between the step and the skirt. The load should be maintained throughout the test.
- (4) Start a new test and begin acquiring data as soon as the escalator is operating at rated speed. Data obtained prior to the escalator operating at rated speed is to be discarded. A coefficient of friction and a loaded gap measurement should be recorded every 150 mm (6 in.) at a minimum.
- (5) Run the escalator continuously until the test step and apparatus reach the curved skirt panel at the opposite end of the escalator. Stop collecting data.
- (6) Process the collected data. Repeat steps 1 through 8 for both sides of both test steps. Use a new polycarbonate test specimen for each run. The index values obtained should not exceed the values specified by ASME A17.1 and/or ASME A17.3 Codes.

(b) Loaded Gap Test (Stationary Step).

This test will be conducted in the curved portions of the escalator where moving step testing was not conducted. The steps selected for this test can be the same as those used for the coefficient of friction and loaded gap, moving step tests. The escalator should be stationary while these measurements are taken.

- (1) Move the step to be tested to the flat portion of the escalator at the bottom of the escalator. The edge of the comb plate should be approximately 150 mm (6 in.) from the edge of the test step.

- (2) Install the test apparatus on the step to be tested. Install a polycarbonate test specimen on the portion of the apparatus, which touches the skirt panel.
- (3) Using the test apparatus apply a 110 N (25 lbf) load between the step and the skirt.
- (4) Measure and record the loaded gap.
- (5) Remove the 110 N (25 lbf) load and advance device or escalator so that the device moves approximately 300 mm (12 in.) further away from the comb plate.
- (6) Repeat steps 3-5 until the test apparatus has reached the point where the coefficient of friction and loaded gap moving step test begins.
- (7) Repeat steps 1 through 6 for the opposite skirt panel.
- (8) Repeat the previous 7 steps, but this time start at the top of the escalator and gradually move the escalator down until the apparatus has reached the area where moving step measurements were made.

The recorded loaded gap measurements should not exceed the values specified by ASME A17.1 and/or ASME A17.3.

1.17.3 Acceptance

Check that the skirt panels extend to a height of at least 1 in. (25 mm) vertically above the step tread nose line and that they meet Code deflection requirements.

1.17.4 References

A17.1 – Rules 802.3e, 802.3f, 802.3k, 1008.2s, 1008.2t, and 1206.6b and 1206.6c.

ASME A17.3

Add a new Section 5.1.10 to read as follows:

5.1.10 Step/Skirt Performance Index.

- (a) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} \frac{e^y}{e^y + 1}$$

where

(SI Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(b) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(c) The escalator step/skirt performance index shall be:

(1) ≤ 0.15 ; or

(2) ≤ 0.4 when a skirt deflector device is provided.

REASONS:

National Elevator Industry, Inc. (NEII) contracted with Arthur D. Little (ADL) to develop an Escalator Step/Skirt Performance Index. These recommended revisions are the result of this comprehensive study. The Index, valued from zero to one, represents the relative potential for entrapment of objects in the step to skirt gap. A lower Index represents a lower potential.

This proposal is based on the results of the ADL study and is summarized in the following table:

CODE	STEP/SKIRT PERFORMANCE INDEX	LUBRICATION ALLOWED	LOADED GAP REQUIRED
< A17.1d-2000 and A17.3	≤ 0.15 Skirt deflector not required > 0.15 to 0.4 Skirt deflector required > 0.4 Not in compliance	Yes	Indirectly
A17.1d-2000	≤ 0.15 Skirt deflector not required > 0.15 to 0.4 Skirt deflector required > 0.4 Not in compliance	No	Yes
A17.1-2000	≤ 0.15 Skirt deflector not required > 0.15 to 0.25 Skirt deflector required > 0.25 Not in compliance	No	Yes

Based on the ADL study, the Index value recommendations were established for existing/current escalators, and future escalators. The Index values were established from the following criteria:

- 1) The nominal estimated Index value of the current ASME A17 Code.
- 2) The desired Index value for a low entrapment potential for hands.
- 3) The desired Index value for a low entrapment potential for leg calf.

CURRENT A17 CODE INDEX

The Step/Skirt Index value is based on estimates of the two primary escalator parameters in the current and prior ASME A17.1 Code. The loaded gap parameter (the value of the step-to-skirt gap under a spreading force of 25 lbf) and skirt coefficient of friction parameters were estimated due to ambiguity or non-existent ASME A17.1 Code requirements. The current ASME A17.1 Code specification of 0.19 in. maximum step-to-skirt clearance does not address additional parameters of step stiffness and step dead band movement identified in the ADL study. These contribute to the loaded gap index parameter, and so were estimated. This additional gap value

is nominally 0.05 in. resulting in a gap of 0.24 in. An additional gap increase due to the ASME A17.1 Code specified skirt stiffness of 0.06 in. at 150 lbf or 0.01 in. at 25 lbf increases the gap to 0.25 in. loaded gap.

The current ASME A17.1 Code specifies that the skirt be "made from a low coefficient of friction material or treated with a friction reducing material". A conservative coefficient of friction of 0.4 between the skirt and polycarbonate (the friction test sample) is estimated based upon ADL tests in both the lab and field.

The estimated loaded gap of 0.25 in. and a polycarbonate coefficient of friction of 0.4 results in an Index of 0.4 for escalators that comply with current ASME A17.1 Code requirements. However, it is also possible that an existing escalator could have an Index as high as 0.7 and still comply with current ASME A17.1 Code requirements.

ADL STUDY INDEX VALUES

The ADL study included a series of highly stressed tests to try and introduce entrapments of artificial shoes and body parts (referred to as Sawbones parts). These tests indicate that an Index of 0.15 is needed for low entrapment potential of all objects studied, including the leg calf that had the highest incidents of entrapment. One method of complying with the proposed Rules is to provide escalators with an Index of 0.15 or below. However, this low Index cannot realistically be achieved and maintained on all existing and new escalator designs, thus additional design options are needed.

Skirt deflector devices installed in compliance with the proposed ASME A17.1, Rule 802.3j, should be effective in the prevention of leg calf entrapments and the proposal makes them mandatory for escalators with an Index above 0.15. However, skirt deflectors may not be as effective in the prevention of other entrapments such as those involving hands and shoes. Therefore, an Index value up to 0.4 is proposed, for escalators installed under ASME A17.1d-2000 and earlier editions, as an alternative, when used in conjunction with skirt deflector devices.

An Index of 0.2 is clearly a valid threshold based on Sawbones hand entrapment tests (see ADL report Figure 5-2 and Table 5-1). However, other factors show this Index value to be conservative. First, the Index was derived from severe test conditions with test sample placement into the gap and maximum expected entrapping force applied. Second, for the leg calf, entrapments at these low index values were sometimes actually pinches that were classified as entrapments. Third, the object coefficient of friction with stainless steel for the test sample Sawbones hand and calf at 0.8 is significantly higher than real skin at 0.5. This makes the entrapment of Sawbones hand samples significantly more likely than real hands at the same loaded gap.

Estimation can be made of the effect of Sawbones sample coefficient of friction as compared to real skin coefficient of friction on the Index. For Sawbones hand tests, the ADL study showed a low entrapment potential below an object Index of 0.4, with object coefficient of friction of 0.8 and loaded gap of 0.16 in. The index curves show that an object Index of 0.4 and a low entrapment potential are maintained when the coefficient of friction is decreased from 0.8 (Sawbones skin) to 0.5 (real skin) while the loaded gap is increased from 0.16 in. to 0.23 in. Thus, the loaded gap (0.23 in.) at which real hand entrapment potential diminishes is larger than the loaded gap (0.16 in.) associated with diminished Sawbones hand entrapment potential. The Index of an escalator will be measured with a polycarbonate test sample with an assumed coefficient of friction of 0.4. Using this test sample, a Sawbones hand Index of 0.4 with a loaded gap of 0.16 in. would be reduced to a measured Index of 0.2. In like manner, a real hand Index of 0.4 with a loaded gap of 0.23 in. would be reduced to a measured Index of 0.35. Therefore, an escalator with a loaded gap of 0.23 and an Index of 0.35 has a low real hand entrapment potential. A real hand would have the same low entrapment potential at an Index of 0.35 as the test Sawbones hand at an Index of 0.2.

Similar analysis can be made for the leg calf. Low entrapment potential exists for the Sawbones calf below object Index of 0.2, with object coefficient of friction of 0.8 and loaded gap of 0.06 in. Equivalently low entrapment potential exists for the real calf at object Index of 0.2 with object coefficient of friction decreased to 0.5 and loaded gap increased to 0.13 in. The equivalent measured Index is 0.1 for Sawbones and 0.16 for real calves. Entrapment potential is low for real calves at an Index of 0.16 or below.

The above assumptions provides the basis and support for the index recommendations:

- 1) The current ASME A17.1 Code reflects an Index of 0.4 nominal.
- 2) The ADL study indicates low entrapment potential with an Index of 0.2 for Sawbones hand that translates to an Index of 0.35 for a real hand.
- 3) The ADL study indicates low entrapment potential with an Index of 0.1 for Sawbones calf that translates to an Index of 0.16 for a real calf.
- 4) These are conservative numbers due to the severity of testing and the conservative classification of calf entrapments.

Because the nominal ASME A17.1 Code Index of 0.4 is reasonably close to the low hand entrapment potential, a maximum Index of 0.4 is proposed for escalators installed under ASME A17.1d-2000 and earlier editions. A lower entrapment potential is desired for the future. Therefore, a maximum Index of 0.25 is proposed beginning with ASME A17.1-2000. This should allow sufficient time for manufacturers to design for and achieve the desired Index. These Index thresholds, when used in conjunction with the required skirt deflector devices, will significantly reduce the entrapment potential on existing and new escalators. An Index of 0.15 or below will allow an escalator to be installed without skirt deflector devices.

Geraldine Burdeshaw, Secretary
ASME A17 Main Committee
American Society of Mechanical Engineers
September 16, 1999
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Even though the Index provides a comprehensive measure of entrapment potential, a requirement for a loaded gap in the new ASME A17.1 Code requirement is desirable. The loaded gap parameter provides an additional margin of control of escalators that rely heavily upon low coefficient of friction that can be difficult to maintain in the field. In addition, the loaded gap parameter provides a sound means of monitoring step band wear and need for correction. A loaded gap of 5 mm is proposed for escalators installed under ASME A17.1d-2000 and ASME A17.1-2000.

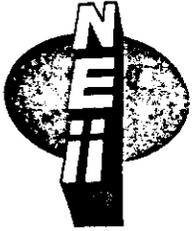
The current ASME A17.1 Code parameters of step-to-skirt gap and skirt treatment are redundant and replaced by the proposed new ASME A17.1 Code requirements. If these requirements were maintained they would be misleading, as compliance with the old requirements would not assure compliance with the new loaded gap and step/skirt performance index requirements.

Very truly yours



Edward A. Donoghue, CPCA
Code and Safety Consultant to NEII

cc: US Consumer Products Safety Commission
NEII Members ASME A17 Committee
NEII Central Code Committee
NEII Advisory Group on CPSC
NEII Technical Advisory Ad-Hoc Group on CPSC
CSA B44 Technical Committee
E. James Walker
ADL Inc.



National Elevator Industry, Inc.

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September 16, 1999

Geraldine Burdeshaw, Secretary
ASME A17 Main Committee
American Society of Mechanical Engineers
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United States of America

KPSA 6 (b)(1) Cleared
9/27/99
To: Mrs. Geraldine Burdeshaw
Product Identified
Accepted by
Notified
Processed

Subject: Request for Technical Revisions
Escalator Step/Skirt Performance Index

Dear Geraldine;

National Elevator Industry Inc. is requesting the following revisions be made to ASME A17.1, ASME A17.2.3 and ASME A17.3. NEII further request:

- The ASME A17 Escalator and Moving Walks Committee be assigned primary responsibility for processing this TR.
- An expedited ballot of the ASME A17 Main Committee be undertaken once the Escalator and Moving Walks Committee completes their review.
- The ASME A17 Existing Installations, Maintenance and Inspectors' Manual Committees be balloted concurrently with the Main Committee.
- The public review period be concurrent with the Main Committee balloting.
- The revisions to ASME A17.1-1996, including TR 96-10 (skirt deflectors), be published immediately upon approval with an effective date of 60 days after publication.
- The revisions to ASME A17.1-2000 be included in said edition if approved prior to publication. If not, then published prior to the effective date of ASME A17.1-2000 with the same effective date as ASME A17.1-2000.

ASME A17.1-1996, Addenda A17.1d-2000

Revise Rule 802.3e to read as follows:

802.3e Clearance Between Skirt and Step. ~~The clearance on each side of the steps (loaded gap) between the step tread and the adjacent skirt panel shall be not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel 3/16 in. (4.8 mm). The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over an area no less than 1940 mm² (3 in.²) and no more than 3870 mm² (6 in.²).~~

Revise Rule 802.3f to read as follows:

802.3f Skirt Panels

- (1) The height of the skirt above the tread nose line shall be at least 1 in. (25 mm) measured vertically.
- (2) Skirt panel shall be designed not to deflect more than 1/16 in. (1.6 mm) under a force of 150 lbf (667 N).
- (3) ~~The exposed surfaces of the skirt panels adjacent to the steps shall be smooth and made from a low friction material or treated with a friction reducing material.~~

Add a new Rule 802.3k to read as follows

802.3k Step/Skirt Performance Index.

- (1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} = \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = -3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.4 when a skirt deflector device complying with the requirements of Rule 802.3j is provided.

Add a new Rule 1008.2s to read as follows:

1008.2s Step/Skirt Performance Index.

- (1) The escalator skirt shall not be cleaned, lubricated, or otherwise modified in preparation for testing. The escalator instantaneous step/skirt index measurements [Rule 802.3k(1)] shall be recorded from each sides of two distinct steps along the inclined portion of the escalator, where the steps are fully extended, at intervals no larger than 150 mm (6 in.). Test steps shall be separated by a minimum of 8 steps.
- (2) A load of 110 N (25 lbf) shall be laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) No vertical load exceeding 220 N (50 lbf) shall be applied to the test step and adjacent steps.
- (4) The coefficient of friction shall be measured with the test specimen conforming to the requirement of 802.3k(2) sliding in the direction of the step motion under a 110 N (25 lbf) normal force at the operating speed of the escalator and shall be measured with devices having sensitivity better than ± 2.2 N (0.5 lbf). The direction of step motion shall be the direction of normal operation. If the escalator is operated in both directions, the down direction shall be used for the test.
- (5) For both the coefficient of friction measurement and the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1008.2s(4).

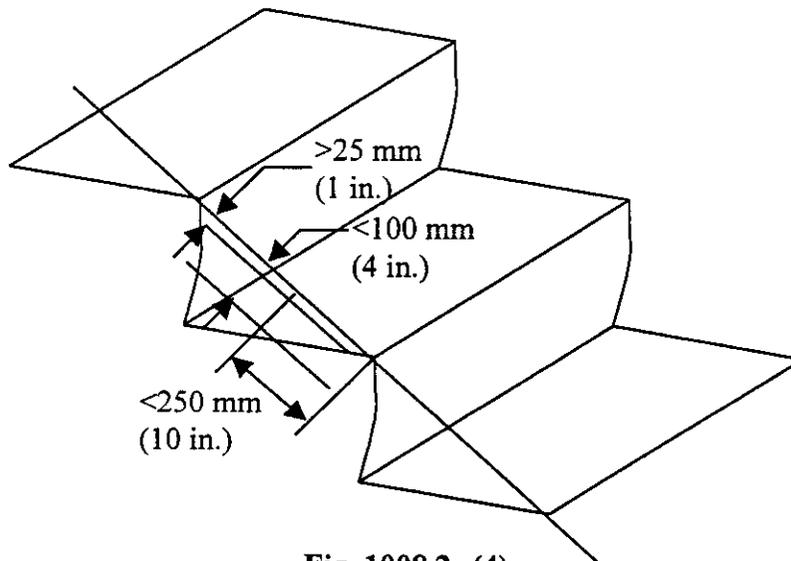


Fig. 1008.2s (4)

- (6) Verify that that the step/skirt performance index conforms to the requirements in Rules 802.3k and 1206.6c (Item 1.17.2).

Add a new Rule 1008.2t to read as follows:

1008.2t Clearance Between Step and Skirt (Loaded Gap).

Escalators installed under ASME A17.1d-2000 shall be tested as follows.

- (1) Loaded gap measurements shall be taken at intervals not exceeding 300 mm (12 in.) in the region adjacent to the flat steps (Rule 802.6e) and before the steps are fully extended. Loaded gap measurements shall be made on each skirt panel.
- (2) The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf) (Rule 802.3e). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) For the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1008.2s(4).

Add a new Rule 1206.6c to read as follows:

1206.6c Step/Skirt Performance Index.

- (1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$$e = 2.7183$$

$$y = -3.77 + 2.37(\mu) + 9.3(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.4 when a skirt deflector device is provided.

ASME A17.1-2000

Revise Rule 802.3e as follows:

802.3e Clearance Between Skirt and Step. ~~The clearance on either side of the steps between the step tread and the adjacent skirt panel shall be not more than 4 mm (0.16 in.), and the sum of the clearances on both sides shall be not more than 7 mm (0.28 in.).~~ The clearance (loaded gap) between the step tread and the adjacent skirt panel shall be not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over an area no less than 1940 mm^2 (3 in.^2) and no more than 3870 mm^2 (6 in.^2).

Revise Section Rule 802.3f as follows:

802.3f Skirt Panels.

- (3) The height of the skirt above the tread nose line shall be at least 25 mm (1 in.) measured vertically.
- (4) Skirt panel shall be designed not to deflect more than 1/16 in. (1.6 mm) under a force of 150 lbf (667 N).
- (1) ~~The exposed surfaces of the skirt panels adjacent to the steps shall be smooth and made from a low friction material, or permanently treated with a friction-reducing material. Untreated surfaces, such as porcelain, enameled steel, bronze, or stainless steel, are not acceptable.~~

Add a new Rule 802.3g as follows:

802.3g Step/Skirt Performance Index.

- (1) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} = \frac{e^y}{e^y + 1}$$

where

(SI Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$$e = 2.7183$$

$$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(2) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μ m (32 μ in.))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(3) The escalator step/skirt performance index shall be:

(a) ≤ 0.15 ; or

(b) ≤ 0.25 when a skirt deflector device complying with the requirements of Rule 802.3j is provided.

Add new Rules 1002.3a(17)(e) (acceptance test) and 1013.2t (category one periodic test) as follows:

10### Clearance Between Step and Skirt (Loaded Gap)

- (1) Loaded gap measurements shall be taken at intervals not exceeding 300 mm (12 in.) in the region adjacent to the flat steps (Rule 802.6e) and before the steps are fully extended. Loaded gap measurements shall be made on both skirt panels.
- (2) The applied load shall not deviate from 110 N (25 lbf) (Rule 802.3e) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) For the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1002.3a(21).

Add new Rule 1002.3a(21) (acceptance test) and 1013.2v (category one periodic test) to read as follows:

10### Step/Skirt Performance Index.

- (1) The escalator skirt shall not be cleaned, lubricated, or otherwise modified in preparation for testing. The escalator instantaneous step/skirt index measurements [Rule 802.3k(1)] shall be recorded from each sides of two distinct steps along the inclined portion of the escalator, where the steps are fully extended, at intervals no larger than 150 mm (6 in.). Test steps shall be separated by a minimum of 8 steps.
- (2) A load of 110 N (25 lbf) shall be laterally applied from the step to the adjacent skirt panel. The applied load shall not deviate from 110 N (25 lbf) by more than ± 11 N (2.5 lbf). The load shall be distributed over a round or square area no less than 1940 mm^2 (3 in.²) and no more than 3870 mm^2 (6 in.²).
- (3) No vertical load exceeding 220 N (50 lbf) shall be applied to the test step and adjacent steps.
- (4) The coefficient of friction shall be measured with the test specimen conforming to the requirement of 802.3k(2) sliding in the direction of the step motion under a 110 N (25 lbf) normal force at the operating speed of the escalator and shall be measured with devices having sensitivity better than ± 2.2 N (0.5 lbf). The direction of step motion shall be the direction of

normal operation. If the escalator is operated in both directions, the down direction shall be used for the test.

- (5) For both the coefficient of friction measurement and the loaded gap measurements, the center of the applied load shall be between 25 mm (1 in.) and 100 mm (4 in.) below the nose line of the steps. The center of the applied load shall be not more than 250 mm (10 in.) from the nose of the step. See Fig. 1002.3a(21).

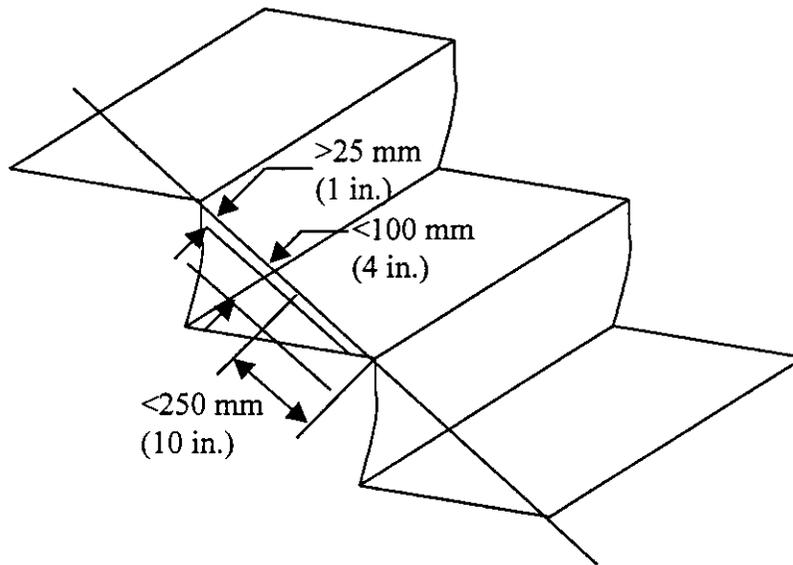


Fig. 1002.3a(21)

- (6) Verify that that the step/skirt performance index conforms to the requirements in Rules 802.3g and 2005.7 (Item 1.17.2).

Add a new Rule 2005.7 to read as follows:

2005.7 Step/Skirt Performance Index.

- (a) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} \frac{e^y}{e^y + 1}$$

where

(SI Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm² and no more than 3870 mm².

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.² and no more than 6 in.².

(b) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than 0.8 μm (32 $\mu\text{in.}$))	2900 \pm 325 mm ² (4.5 \pm 0.5 in. ²) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(c) The escalator step/skirt performance index shall be:

(1) ≤ 0.15 ;

- (2) ≤ 0.25 for escalators installed under ASME A17.1-2000 and later editions and when a skirt deflector device complying with the requirements of Rule 802.3j is provided; or
- (3) ≤ 0.4 , for escalators installed under ASME A17.1d-2000 and earlier editions and a skirt deflector device is provided

ASME A17.2.3

Revise Item 1.17 to read as follows:

ITEM 1.17 STEP/SKIRT CLEARANCES, PANELS AND PERFORMANCE INDEX

1.17.1 Routine

Check the clearance between the skirt panel and the step using a thickness gauge or by laying a small rule on the edge of the step to read the distance. Several steps should be checked through their entire travel. The allowable clearances are as follows (see Fig. 1.17.1):

- (a) A17.1-1955 through A17.1d-1970: not more than 3/16 in. (4.8 mm) with a total of both sides not more than 1/4 in. (6.4 mm), except where skirt obstruction devices are installed at the lower entrance for escalators installed under the A17.1-1965 through A17.1(d)-1970.
- (b) A17.1-1971 through A17.1-1979 editions: not more than 3/8 in. (9.5 mm) on each side.
- (c) A17.1-1980 ~~and later editions~~ through A17.1c-1999 and A17.3: not more than 3/16 in. (4.8 mm) on each side.
- (d) A17.1d-2000 and later editions, not more than 5 mm (0.2 in.) when 110 N (25 lbf) is laterally applied from the step to the adjacent skirt panel. Each side shall be independently tested.

For escalators installed under A17.1a-1982 through A17.1c-1999 ~~and later editions~~, inspect the exposed surface of the skirt panel to check whether it is either made from a low friction material or treated with a friction reducing material. The skirt panels of escalators installed prior to A17.1a-1982 should also be treated with a friction reducing material. The panel should be tested at several places during the run and especially near the transition entrance and exit. If examination of the panels raises a question about the friction of the skirt panels, the manufacturer's recommendation should be requested and compared to the

treatment schedule if available. If skirts are treated, examine the steps to verify that friction-reducing treatment has not been applied on them.

1.17.2 Periodic

Visually inspect the condition of step/skirt panel gap while the escalator is stationary. Mark a step and operate the escalator to bring other steps into view as required until every step on the escalator has been examined. Document any outstanding conditions, such as step/skirt gaps, damaged steps, damaged step treads, damaged skirt panels, mismatched skirt panel joints, or sharp edges on the edge of the step or skirt panel. Pay particular attention to the gaps between the riser portion of the step and the skirt panel.

Run the escalator in its normal direction of travel for at least two cycles of steps. If the escalator is operated in both directions, run the escalator for at least 2 cycles of steps in both the up and down directions. Visually examine the step/skirt gaps along the entire length of the escalator. Pay particular attention to the gaps at the transitions. Note any abnormal operation of the escalator such as jumping steps, irregular step movement, step/skirt panel interference, or skirt panel misalignments.

(a) Step/Skirt Performance Index Test (Moving Step).

Select two steps to conduct this test. One step should be selected as a representative step. It should appear similar to the majority of the other steps on the escalator. A second step should be chosen to represent any unusual step or group of steps. Steps that appear to have been replaced, exhibit wear, show signs of damage, or move in irregular ways are candidates for the second test step. If all the steps appear similar, then the steps should be randomly selected. In any case the test steps should be separated by at least 8 steps.

If the escalator is a "down" escalator, or the escalator is operated in both directions, the test step should be moved to the top of the escalator before the curved skirt panels prior to each test run, and run down during the test. If the escalator is normally operated as an "up" escalator, then the test step should be moved to the bottom of the escalator just before the curved skirt panels prior to each test run, and run up during the test.

(1) Install the test apparatus on the step to be tested. Install a polycarbonate test specimen on the test apparatus.

(2) Orient a frictional force transducer to match the angle of the skirt panel as shown in Fig. 1.17.2 (b).

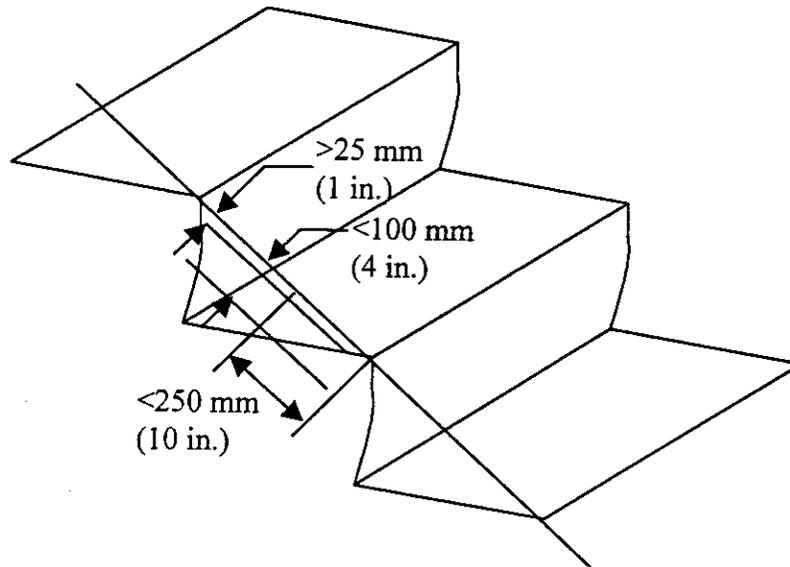


Fig. 1.17.2 (b)

- (3) Using the test apparatus apply a 110 N (25 lbf) load between the step and the skirt. The load should be maintained throughout the test.
- (4) Start a new test and begin acquiring data as soon as the escalator is operating at rated speed. Data obtained prior to the escalator operating at rated speed is to be discarded. A coefficient of friction and a loaded gap measurement should be recorded every 150 mm (6 in.) at a minimum.
- (5) Run the escalator continuously until the test step and apparatus reach the curved skirt panel at the opposite end of the escalator. Stop collecting data.
- (6) Process the collected data. Repeat steps 1 through 8 for both sides of both test steps. Use a new polycarbonate test specimen for each run. The index values obtained should not exceed the values specified by ASME A17.1 and/or ASME A17.3 Codes.

(b) Loaded Gap Test (Stationary Step).

This test will be conducted in the curved portions of the escalator where moving step testing was not conducted. The steps selected for this test can be the same as those used for the coefficient of friction and loaded gap, moving step tests. The escalator should be stationary while these measurements are taken.

- (1) Move the step to be tested to the flat portion of the escalator at the bottom of the escalator. The edge of the comb plate should be approximately 150 mm (6 in.) from the edge of the test step.

- (2) Install the test apparatus on the step to be tested. Install a polycarbonate test specimen on the portion of the apparatus, which touches the skirt panel.
- (3) Using the test apparatus apply a 110 N (25 lbf) load between the step and the skirt.
- (4) Measure and record the loaded gap.
- (5) Remove the 110 N (25 lbf) load and advance device or escalator so that the device moves approximately 300 mm (12 in.) further away from the comb plate.
- (6) Repeat steps 3-5 until the test apparatus has reached the point where the coefficient of friction and loaded gap moving step test begins.
- (7) Repeat steps 1 through 6 for the opposite skirt panel.
- (8) Repeat the previous 7 steps, but this time start at the top of the escalator and gradually move the escalator down until the apparatus has reached the area where moving step measurements were made.

The recorded loaded gap measurements should not exceed the values specified by ASME A17.1 and/or ASME A17.3.

1.17.3 Acceptance

Check that the skirt panels extend to a height of at least 1 in. (25 mm) vertically above the step tread nose line and that they meet Code deflection requirements.

1.17.4 References

A17.1 – Rules 802.3e, 802.3f, 802.3k, 1008.2s, 1008.2t, ~~and~~ 1206.6b and 1206.6c.

ASME A17.3

Add a new Section 5.1.10 to read as follows:

5.1.10 Step/Skirt Performance Index.

- (a) The step/skirt performance index, when subjected to the test specified in Rule 1008.2s, shall be the maximum value of the recorded instantaneous step/skirt

$$\text{index} = \frac{e^y}{e^y + 1}$$

where

(SI Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 0.37(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 110 N normal load. The coefficient of friction shall be measured without addition of any field applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 110 N is applied from the step to skirt panel, mm.

The applied load shall not deviate from 110 N by more than ± 11 N. The load shall be distributed over a round or square area no less than 1940 mm^2 and no more than 3870 mm^2 .

(Customary Units)

$e = 2.7183$

$y = - 3.77 + 2.37(\mu) + 9.3(L_g)$

μ = The sliding coefficient of friction of a polycarbonate test specimen on the skirt panel at the measurement point calculated when subjected to a 25 lbf normal load. The coefficient of friction shall be measured without addition of any field-applied lubricant.

L_g = The clearance between the step and the adjacent skirt panel when 25 lbf is applied from the step to skirt panel, in.

The applied load shall not deviate from 25 lbf by more than ± 2.5 lbf. The load shall be distributed over a round or square area no less than 3 in.^2 and no more than 6 in.^2 .

(b) The step/skirt performance index polycarbonate test specimen shall conform to the following specifications:

Material	Color	Finish	Area in contact with skirt panel	Specification
Polycarbonate w/o fillers	Natural no Pigments	Glossy (roughness less than $0.8 \mu\text{m}$ ($32 \mu\text{in.}$))	$2900 \pm 325 \text{ mm}^2$ ($4.5 \pm 0.5 \text{ in.}^2$) and at least 0.8 mm (0.03 in.) thick	GE Lexan 100 series or equivalent polycarbonate

(c) The escalator step/skirt performance index shall be:

- (1) ≤ 0.15 ; or
- (2) ≤ 0.4 when a skirt deflector device is provided.

REASONS:

National Elevator Industry, Inc. (NEII) contracted with Arthur D. Little (ADL) to develop an Escalator Step/Skirt Performance Index. These recommended revisions are the result of this comprehensive study. The Index, valued from zero to one, represents the relative potential for entrapment of objects in the step to skirt gap. A lower Index represents a lower potential.

This proposal is based on the results of the ADL study and is summarized in the following table:

CODE	STEP/SKIRT PERFORMANCE INDEX	LUBRICATION ALLOWED	LOADED GAP REQUIRED
< A17.1d-2000 and A17.3	≤ 0.15 Skirt deflector not required > 0.15 to 0.4 Skirt deflector required > 0.4 Not in compliance	Yes	Indirectly
A17.1d-2000	≤ 0.15 Skirt deflector not required > 0.15 to 0.4 Skirt deflector required > 0.4 Not in compliance	No	Yes
A17.1-2000	≤ 0.15 Skirt deflector not required > 0.15 to 0.25 Skirt deflector required > 0.25 Not in compliance	No	Yes

Based on the ADL study, the Index value recommendations were established for existing/current escalators, and future escalators. The Index values were established from the following criteria:

- 1) The nominal estimated Index value of the current ASME A17 Code.
- 2) The desired Index value for a low entrapment potential for hands.
- 3) The desired Index value for a low entrapment potential for leg calf.

CURRENT A17 CODE INDEX

The Step/Skirt Index value is based on estimates of the two primary escalator parameters in the current and prior ASME A17.1 Code. The loaded gap parameter (the value of the step-to-skirt gap under a spreading force of 25 lbf) and skirt coefficient of friction parameters were estimated due to ambiguity or non-existent ASME A17.1 Code requirements. The current ASME A17.1 Code specification of 0.19 in. maximum step-to-skirt clearance does not address additional parameters of step stiffness and step dead band movement identified in the ADL study. These contribute to the loaded gap index parameter, and so were estimated. This additional gap value

is nominally 0.05 in. resulting in a gap of 0.24 in. An additional gap increase due to the ASME A17.1 Code specified skirt stiffness of 0.06 in. at 150 lbf or 0.01 in. at 25 lbf increases the gap to 0.25 in. loaded gap.

The current ASME A17.1 Code specifies that the skirt be "made from a low coefficient of friction material or treated with a friction reducing material". A conservative coefficient of friction of 0.4 between the skirt and polycarbonate (the friction test sample) is estimated based upon ADL tests in both the lab and field.

The estimated loaded gap of 0.25 in. and a polycarbonate coefficient of friction of 0.4 results in an Index of 0.4 for escalators that comply with current ASME A17.1 Code requirements. However, it is also possible that an existing escalator could have an Index as high as 0.7 and still comply with current ASME A17.1 Code requirements.

ADL STUDY INDEX VALUES

The ADL study included a series of highly stressed tests to try and introduce entrapments of artificial shoes and body parts (referred to as Sawbones parts). These tests indicate that an Index of 0.15 is needed for low entrapment potential of all objects studied, including the leg calf that had the highest incidents of entrapment. One method of complying with the proposed Rules is to provide escalators with an Index of 0.15 or below. However, this low Index cannot realistically be achieved and maintained on all existing and new escalator designs, thus additional design options are needed.

Skirt deflector devices installed in compliance with the proposed ASME A17.1, Rule 802.3j, should be effective in the prevention of leg calf entrapments and the proposal makes them mandatory for escalators with an Index above 0.15. However, skirt deflectors may not be as effective in the prevention of other entrapments such as those involving hands and shoes. Therefore, an Index value up to 0.4 is proposed, for escalators installed under ASME A17.1d-2000 and earlier editions, as an alternative, when used in conjunction with skirt deflector devices.

An Index of 0.2 is clearly a valid threshold based on Sawbones hand entrapment tests (see ADL report Figure 5-2 and Table 5-1). However, other factors show this Index value to be conservative. First, the Index was derived from severe test conditions with test sample placement into the gap and maximum expected entrapping force applied. Second, for the leg calf, entrapments at these low index values were sometimes actually pinches that were classified as entrapments. Third, the object coefficient of friction with stainless steel for the test sample Sawbones hand and calf at 0.8 is significantly higher than real skin at 0.5. This makes the entrapment of Sawbones hand samples significantly more likely than real hands at the same loaded gap.

Estimation can be made of the effect of Sawbones sample coefficient of friction as compared to real skin coefficient of friction on the Index. For Sawbones hand tests, the ADL study showed a low entrapment potential below an object Index of 0.4, with object coefficient of friction of 0.8 and loaded gap of 0.16 in. The index curves show that an object Index of 0.4 and a low entrapment potential are maintained when the coefficient of friction is decreased from 0.8 (Sawbones skin) to 0.5 (real skin) while the loaded gap is increased from 0.16 in. to 0.23 in. Thus, the loaded gap (0.23 in.) at which real hand entrapment potential diminishes is larger than the loaded gap (0.16 in.) associated with diminished Sawbones hand entrapment potential. The Index of an escalator will be measured with a polycarbonate test sample with an assumed coefficient of friction of 0.4. Using this test sample, a Sawbones hand Index of 0.4 with a loaded gap of 0.16 in. would be reduced to a measured Index of 0.2. In like manner, a real hand Index of 0.4 with a loaded gap of 0.23 in. would be reduced to a measured Index of 0.35. Therefore, an escalator with a loaded gap of 0.23 and an Index of 0.35 has a low real hand entrapment potential. A real hand would have the same low entrapment potential at an Index of 0.35 as the test Sawbones hand at an Index of 0.2.

Similar analysis can be made for the leg calf. Low entrapment potential exists for the Sawbones calf below object Index of 0.2, with object coefficient of friction of 0.8 and loaded gap of 0.06 in. Equivalently low entrapment potential exists for the real calf at object Index of 0.2 with object coefficient of friction decreased to 0.5 and loaded gap increased to 0.13 in. The equivalent measured Index is 0.1 for Sawbones and 0.16 for real calves. Entrapment potential is low for real calves at an Index of 0.16 or below.

The above assumptions provides the basis and support for the index recommendations:

- 1) The current ASME A17.1 Code reflects an Index of 0.4 nominal.
- 2) The ADL study indicates low entrapment potential with an Index of 0.2 for Sawbones hand that translates to an Index of 0.35 for a real hand.
- 3) The ADL study indicates low entrapment potential with an Index of 0.1 for Sawbones calf that translates to an Index of 0.16 for a real calf.
- 4) These are conservative numbers due to the severity of testing and the conservative classification of calf entrapments.

Because the nominal ASME A17.1 Code Index of 0.4 is reasonably close to the low hand entrapment potential, a maximum Index of 0.4 is proposed for escalators installed under ASME A17.1d-2000 and earlier editions. A lower entrapment potential is desired for the future. Therefore, a maximum Index of 0.25 is proposed beginning with ASME A17.1-2000. This should allow sufficient time for manufacturers to design for and achieve the desired Index. These Index thresholds, when used in conjunction with the required skirt deflector devices, will significantly reduce the entrapment potential on existing and new escalators. An Index of 0.15 or below will allow an escalator to be installed without skirt deflector devices.

Geraldine Burdeshaw, Secretary
ASME A17 Main Committee
American Society of Mechanical Engineers
September 16, 1999
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Even though the Index provides a comprehensive measure of entrapment potential, a requirement for a loaded gap in the new ASME A17.1 Code requirement is desirable. The loaded gap parameter provides an additional margin of control of escalators that rely heavily upon low coefficient of friction that can be difficult to maintain in the field. In addition, the loaded gap parameter provides a sound means of monitoring step band wear and need for correction. A loaded gap of 5 mm is proposed for escalators installed under ASME A17.1d-2000 and ASME A17.1-2000.

The current ASME A17.1 Code parameters of step-to-skirt gap and skirt treatment are redundant and replaced by the proposed new ASME A17.1 Code requirements. If these requirements were maintained they would be misleading, as compliance with the old requirements would not assure compliance with the new loaded gap and step/skirt performance index requirements.

Very truly yours



Edward A. Donoghue, CPCA
Code and Safety Consultant to NEII

cc: US Consumer Products Safety Commission
NEII Members ASME A17 Committee
NEII Central Code Committee
NEII Advisory Group on CPSC
NEII Technical Advisory Ad-Hoc Group on CPSC
CSA B44 Technical Committee
E. James Walker
ADL Inc.

TR 96-10 - Reconsideration

1) Deflector Device Proposed Rules for New Escalators

Proposed A17.1 Definition:

Deflector Device. A device which provides a means of deflecting the feet of riders away from the step/skirt panel interface

802.3f - no changes

802.3j - new rule

802.3j Skirt Deflector Devices. Deflector devices shall be permitted. Where provided, deflector devices shall extend from skirt panels parallel to the escalator path of travel. Means to secure such deflector devices are permitted to be on the exposed surface of the skirt. Any exposed fastener heads shall be of the tamper resistant type and flush to within 1mm (0.04 in).

Rationale:

(i) Deflector systems are an uncomplicated method of deflecting the feet of riders away from the step/skirt panel interface and can be secured in various manners depending on the design.

(ii) To prevent the use of common flat or phillips head screws the same terminology as in A17.1 rule 802.3i is used.

(1) Rigid elements shall be in conformance with the following conditions:

- (a) Horizontal protrusions extending above the step shall be 18 mm (0.75 in) maximum. Corners or changes in profile shall be rounded or beveled. The exposed surfaces of such elements shall be smooth and permanently treated with a low friction material.

Rationale: This dimension is consistent with the committee's expressed previous consensus and the majority, but not all, of what has been safely applied in other parts of the world. The dimension also conforms with what has been used in California w/o problems. It would be logical to consider this experience. The last two sentences have been added with similar terminology as A17.1 rule 802.3f(3) for exactly the same reason of preventing footwear etc. from being caught.

- (b) On the incline, the area of any protrusion shall lie entirely above a line beginning on the vertical portion of the skirt panel 25 mm (1.0 in) above the step nose line. The lower surface shall be beveled not less than 10° upward and the upper surface shall be beveled not less than 15° downward. (See Figure 802.X.)

Rationale: Based on historical experience with use of these types of devices this should provide sufficient clearance and angle to prevent footwear from catching between the step nose and horizontal protrusion. The proposed clearance is also the value stipulated in EN 115 clause 5.1.5.6 on deflector device application. Clause 5.1.5.6 was added a number of years ago specifically for deflectors, thus it would be logical to accept the experience obtained in other parts of the world. The 25 mm dimension is also the historical value deemed necessary in A17.1 rule 802.3f(1) for many years. The 10 degree angle at this clearance is sufficient based on international history of installations at a 25 mm height over many years.

- (c) At the upper and lower landing, any protrusion shall lie entirely above a line beginning on the vertical portion of the skirt panel 50 mm (2.0 in) above the step nose line. The lower surface shall be beveled not less than 10° upward and the upper surface shall be beveled not less than 15° downward. Any rigid elements at the landings shall smoothly blend into rigid elements along the incline in accord with the radius of curvature of the transition zone.

Rationale: Based on historical experience this should provide sufficient clearance and angle to take care of the change in elevation at the comb and allow passage of footwear.

- (d) When attached to the skirt, rigid elements shall withstand a force of 900 N (200 lbf) perpendicular to the line of attachment of the element without detachment or permanent deformation. The force shall be applied to an area of 645 mm² (1.0 in²).

Rationale: This is a reasonable value which could withstand the force exerted by an adult's foot. Test plate area is specified; similar to rules for the step fatigue test, combplate, et cetera, a reasonable area is given.

(2) Flexible elements shall be in conformance with the following conditions:

- (a) The horizontal protrusion extending from the skirt surface above the step shall be 50 mm (2.0 in) maximum.
Rationale: To minimize restriction of usable step area.
- (b) They shall be capable of deflecting to an angle of 10° or greater above the horizontal.
Rationale: The requirement that the flexible part be capable of bending to above the 10 degree line covers the concern of easy withdrawal of a foot.
- (c) Non-continuous flexible elements shall be allowed to deflect to allow a maximum 9.5 mm (0.375 in) interference with any point on the step surface.
Rationale: Although this would only apply to a very small area of contact at the step nose, general rules are added to prevent damage. For example, to avoid the possibility of a brush providing a flat stepping surface by extending over two or more step cleats. Consideration was: center to center distance of step cleats in A17.1 rule 802.5e.
- (d) Continuous flexible elements shall not deflect such that they can contact the steps.
Rationale: Any step contact with continuous flexible elements could potentially cause damage to the elements.

2) Deflector Device Proposed Rule for Outdoor Escalators

Revise 807.2 Precipitation as follows:

807.2 Precipitation. A cover, directly over the horizontal projection of the escalator, shall be provided. The cover shall extend outward from the center line of the handrail so that a line extended from the edge of the cover to the center line of the handrail forms an angle of not less than 15° from the vertical. The sides may be open.

When the escalator is indirectly subject to snow or freezing rain, heaters shall be operated to prevent accumulation and freezing on the steps, and landing plates, and skirt deflector devices.

Drains shall be provided in the lower pit.

Rationale: Brushes and other devices, which could turn into hazardous blocks of ice, are addressed.

3) Deflector Device Proposed Rule for Alteration of Existing Escalators:

Add sentence to 1207.5c Balustrades:

Deflector devices shall comply with Rule 802.3j.

Note: The vertical dimensions on existing skirt panels may not allow full compliance. See Section 2.

Rationale: The vertical dimensions of existing escalator skirt panels may not allow full compliance with the rules. See Third paragraph of Section 2 which states. "The specific requirements of this Code may be modified by the authority having jurisdiction based upon technical documentation or physical performance verification to allow alternative arrangements that will assure safety equivalent to that which would be provided by conformance to the corresponding requirements of this Code."

For reference only:

EN 115 - 5.1.5.6 The skirting shall be vertical. The vertical distance h(2) between top end of skirting or bottom edge of projecting cover joints or the rigid part of deflector. Devices (for definition see 3.5) where installed and the tread surface of the steps, pallets or belt shall be not less than 25 mm (see figure 2).