CPSA 6 (b)(1) Cleared
No Mfrs/PrvtLblrs or Products Identified
Excepted by
Firms Notified,
Comments Processed.

LOG OF MEETING

SUBJECT: Trampolines - ASTM F08-17 Subcommittee Meeting

DATE OF MEETING: May 20, 1999

DATE OF LOG ENTRY: May 26, 1999

PERSON SUBMITTING LOG: George F. Sushinsky

LOCATION: Sheraton Hotel
Seattle, WA

CPSC ATTENDEE(S): George F. Sushinsky, Scott Heh (first hour)

NON-CPSC ATTENDEE(S): Members and Guests of ASTM F 08.17
An attendance list is not yet available but is being mailed to attendees. It will be attached to this log when available

SUMMARY OF MEETING:

Subcommittee chairman, Patrick Welsh (Hedstrom) called the meeting to order and passed out an agenda (attachment 1). A membership update showed that the subcommittee has 42 members (19 producers, 2 users, 19 general interest, and 2 unclassified). The chairman announced that this is a balanced subcommittee. Lani Loken-Dahle was asked to be the secretary of the group. After introductions, the minutes of the last meeting were approved without change. Mr. Welsh announced that there were submissions from CPSC and Sean Gorman of Sealed Air Corp. to be considered during the task group discussions. These documents had been faxed to the subcommittee members earlier in the week but most members did not have the submissions. George Luciw, the subcommittee's ASTM liaison was asked to get copies made (attachment 2).

It was announced that the standard, F 381 "Standard Consumer Safety Specification for Components,Assembly, and Use of a Trampoline," was in the process of being printed as amended through the previous balloting process. An avenue for disseminating copies was sought. Because of copyright restrictions the standard could only be obtained through ASTM. Ms Loken-Dahle is the head of the International Trampoline Industry Association, a 100-member organization that publishes a newsletter. It was suggested that the newsletter publish an outline of the new requirements and the method to obtain copies of the standard.

John Kuchno remarked that the subcommittee's tasks groups were considering changes to the standard and urged the members to move the process forward. At this point the task groups discussions occurred.

Institutional Trampolines Task Group:

Ms. Loken-Dahle reported for this task group. She told the subcommittee that there were three levels of trampolines - Consumer, Institutional, and Competitive. Consumer trampolines are subject to the ASTM F 381 standard; competitive meet FIG norms (see attachment 3); while institutional fall between the other two categories. Institutional trampolines are found at schools, are usually rectangular, and are seeing tremendous growth in numbers because of the upcoming Olympics. International standards for trampolines were discussed. There is a European standard that is in final draft awaiting release. The task group appeared to be exploratory and did not seem to have a deliverable on their future agenda.

A general discussion ensued. It was noted that comments by Michael Shanok (page 4 of the Dec 10, 1998 minutes) were to be addressed when the standard was reballoted. His comments concerned some wording changes to sections 7.3.2 and 7.3.2.4. Art Mittelstaedt (inter-city Testing and Consulting Corp.) requested that language be added to the standard for safety surfacing around the trampoline. Bud Nichols (Jump King) noted that surround courts were becoming popular and George Sushinsky, CPSC, suggested that if they continue as a popular option the subcommittee may need to address their performance in a new standard. The chairman asked Mr. Mittelstaedt to address his request in the form of a proposal.

Padding Task Group:

Mr. Welsh summarized the issues before the Padding Task Group starting with three proposals he sent to subcommittee members for comments (attachment 2). The proposals were (1) delete the severity index requirement of F381 and adopt peak G and time interval requirements, (2) a drop test procedure for padding, and (3) a wind test procedure for padding retention. In his letter to the subcommittee members dated 1 Feb 99, Mr. Welsh encouraged the manufacturers to conduct the proposed tests and report their findings to him by the end of February. Two sets of comments were received (CPSC and Gorman). Based on comments received, especially those from CPSC, Mr. Welsh withdrew proposal 1 in lieu of a proposal from CPSC for a systems check requirement and proposal 3 as too variable. He then asked George Sushinsky to explain the CPSC request to add a system check requirement to the standard.

The systems check requirement was adapted from a similar requirement in ASTM F 1446 "Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear." Mr. Sushinsky explained the requirements and the CPSC experience with use of this procedure for equipment set up for impact attenuation measurements of headgear and playground surfacing. He noted the similarities in the types of measurements and equipment used in testing these products and their relationship to the equipment and procedures for trampoline padding. As part of the CPSC proposal, to add a system check procedure to the F 381 standard, there was a recommended round-robin procedure intended to provide the manufacturers and other subcommittee with the data needed as rationale to add the system check requirement. The recommended system check and round robin procedure use a specified spherical impactor dropped onto a Modular Elastomer Programmer (MEP) to establish the peak output of the impact attenuation system. Sean Gorman vigorously objected

to the proposal. He stated that he would be unable to participate in this round robin because of the use of the spherical impactor, with its different shape and mass and dropped from a different height, represents an unknown quantity in terms of trampoline pad testing with the specified flat-faced cylinder. Mr. Sushinsky explained that the relationship between the different missiles was taken into account in the round robin test procedure. After much back and forth discussion, it was agreed that the round robin would be revised to highlight testing with the trampoline missile and include, as an option, tests with the spherical impactor. The round robin procedure was to be revised in two to three weeks so that laboratories and manufacturers could participate in the testing and have the results completed in time for a late Summer or early Fall task group meeting at CPSC.

Proposal 2 from Mr. Welsh is primarily intended to address injuries occurring as a result of stepping or jumping on the padding and pushing the padding through the springs. Mr. Sushinsky stated that CPSC did not have incident data to support a rationale for this scenario. He noted instead CPSC's desire to have padding attachments strengthened. CPSC data show that injuries resulting from impacts with springs and frames occur when pads are missing, slide off the springs and frame, or have attachments that break. Mr. Sushinsky related the results of tensile tests of padding attachments from seven trampolines. The strength of the attachment varied substantially (40 to 250 pounds of tensile force) and appeared highly dependent on the width of the attachment and the amount and style of the stitching. The subcommittee requested data and the procedures used in the tests. (The subcommittee chairman had not received the sanitized copy of the data sent for the subcommittee's consideration.) Mr. Sushinsky noted that one manufacturer passed the padding impact requirements, had high strength attachments, and no reported injuries on the frame or springs in the CPSC data.

Mr. Welsh noted that the pads are the weak link in the trampoline. He said frames last "forever", springs and mats are generally okay, but pads generally last only a season. A discussion ensued on the length of a season, the expectations of safety devices (e.g. brakes on a car), and the responsibility of both the manufacturer and the consumer.

A "to do" list was prepared for the padding task group. It included:

- Revision of the Round Robin (Gorman and CPSC)
- Drafting of tensile requirements (CPSC)
- Preparation for a task group meeting at CPSC.

Mr. Gorman asked why the subcommittee has not addressed issues he wrote about a year ago including operational testing issues such as the number of impacts, and whether the foam is tested separately or as covered with vinyl as supplied with the product. These issues were left unresolved.

Mr. Sushinsky added two more comments for discussion and consideration by the manufacturers. He noted that routine surveillance of labeling on trampoline cartons showed that some manufacturers were not adhering to the minimum size of lettering for labels as called for in ANSI 535. In addition, with regard to spring integrity, he noted that Commission staff continues to receive reports of spring distortion and breakage. The subcommittee members

were enjoined to address these issues as individuals involved in the manufacturing of trampolines and in terms of performance requirements in ASTM F 381.

The next meeting of the subcommittee is the week of December 7, 1999 in New Orleans.

The meeting adjourned at 12:12 p.m.

ATTACHMENT 1

ASTM Trampolines & Related Equipment
Subcommittee Meeting –F08.17
May 20, 1999
Seattle, Washington

Agenda

I. Welcome and identification of those present

II. Membership update - 42 members; 19 prod, 2 user, 19 General Interest, 2 Undesignated

III. Approval of minutes from last meeting

IV. Status of F381-99

V. Brief reports of task groups

- A. Institutional trampolines
- B. Padding

VI. Discussion regarding amendments to F381-99

- A. Potential amendments to section 7.3.2
- B. Potential amendments to sections 8.2.2 and 8.3.3
- C. Other amendments
- D. Padding task group issues
  1. report on impact and attachment tests
  2. severity index issues
  3. review of proposed test methods

VII. Consideration of schedule and next meeting

VIII. Summarize and close

ATTACHMENT 2

Facsimile Cover Sheet

Hedstrom Corporation

Quality Department
Sunnyside Road
Bedford, PA 15522

Phone (814) 623-9041
Fax (814) 623-2651

From: Patrick Welsh

To:

Date: 17 May 99

Number of pages (including cover sheet): 16

Dear Task Group Member and Colleague,

Please find the following 2 proposals submitted by Ms. Jean Kennedy of the Consumer Product Safety Commission and myself as Chairman. Mr. Sean Gorman has offered comments on the original proposal submitted by the Chairman and I have included these as well.

Ms. Kennedy's proposal outlines a systems check requirement that must be completed before performing the head impact test described in F381 and F355. The requirements for severity index have not been changed. My proposal indicates a change to the head impact testing and the adoption of the test method specified in the bicycle helmet standard. Upon further discussion of the head impact test method with several colleagues, I believe our goals would be better accomplished by remaining with the severity index requirement. I am willing to withdraw my first proposal and discuss the adoption of the systems check requirement proposed by Ms. Kennedy. Also, comments were well taken on my third proposal for the outdoor weathering requirement for the trampoline pad. Several members were concerned that the test method described in my third proposal would not be easily reproducible and consistent. Therefore, I am willing to withdraw this proposal. However, I support a drop test or static load requirement, as described by my second proposal, and invite discussion on this issue.

Please be prepared to discuss these proposals at the subcommittee meeting in Seattle.

Respectfully submitted,

Patrick Welsh
Hedstrom Corporation

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Jean Kennedy
Compliance Officer
Division of Recalls and Compliance
Office of Compliance

Tel: 301-504-0608 ext.1390
Fax: 301-504-0359
Email: jkennedy@cpsc.gov

May 14, 1999

Mr. Patrick Welsh
Chair, Trampoline Padding Task Group
Hedstrom Corporation
P.O. Box 432
Sunnyside Road
Bedford, PA 15522

RE: CPSC Revisions and Proposals for ASTM F381-99 Trampoline Standard.

Dear Mr. Welsh:

The Commission staff has reviewed your proposals on trampoline pad testing provided to the Trampoline Padding Task Group. CPSC staff has the following comments on the proposals to address the hazards associated with trampoline pads.

CPSC staff recommends that the Trampoline Subcommittee address two issues related to testing of trampoline padding: (1) reproducibility of impact test results, and (2) the development of test requirements for padding retention. The staff recommends no change to the 450 SI impact performance requirement at this time.

The CPSC staff recommends adding instrument system check requirements, used in the ASTM F1446-97 standard for headgear, to improve trampoline padding test reproducibility. This requirement includes use of a modular elastomer programmer (MEP) and a specific spherical impactor to check the testing instruments before and after performing the 6.1 performance requirements. The proposed systems check requirement is attached for subcommittee review and balloting, following the successful results of the round robin systems check testing. Also attached is a list of testing labs that we know are equipped to perform these tests.

Padding is a protective component part of a trampoline only if its attachments are sufficiently constructed so the pad will cover the springs and frame at all times. In respect to proposals 2 and 3, the staff believes that they do not address pad attachments that break from use. Pad attachments that break leave users in danger of injury from contacts with springs or frames. Head, foot, arm, and back fractures, as well as internal organ injuries, have occurred when users fell on springs and frames without padding or padding that was loose and not in place. Data shows no injuries that have occurred on pads that were pushed down between springs or blown off by wind.

In the past, consumers reported that fabric or vinyl ties that attached the padding to the frame have broken easily. These failures can result from a combination of expected use and design. CPSC staff believes a requirement that tests the strength of pad attachments is paramount for the trampoline safety

standard. Staff recommends the task group develop a requirement that specifies a minimum pull force that pad attachments will meet without failing.

In terms of design, CPSC staff examined pad attachments made of cloth, cord, or elastic; ties that had single, double stitching, or double-axis stitching; and inner sectional ties and frame ties. As part of the examination, CPSC staff has conducted pull force testing on pad attachments to determine breakaway forces of several pad types. Differences in the strength of individual attachments were noted based on their design. These differences affect padding retention and we will be prepared to discuss our test results at the upcoming meeting.

In addition to the strength of individual attachments, the strength of the pad attachment as a system is of concern. We suggest that the subcommittee explore the development of requirements for the number of attachments and/or the strength of the entire pad system.

UV, heat, cold and moisture that degrade thread used in pad construction and attachments, may contribute to pad failures. Because these products are likely to stay outdoors, the force tests should be reapplied to the same padding attachments and the padding system that has been exposed to laboratory accelerated testing of UV, heat, cold, and moisture which equates to the expected life of the product. The force tests should be repeated at intervals during the environmental testing to determine the decrease in attachment strength. From these tests, the task group can recommend reasonable specific force requirements for trampoline padding attachments.

In the interim while the task group proceeds with testing requirements for pad attachments, CPSC staff encourages firms to explore and employ alternative methods that prevent their pad attachments from breaking and keep pads in place on trampolines.

Sincerely,

Jean Kennedy
Trampoline Task Group

cc: Members of Trampoline Padding Task Group

May 14, 1999
CPSC DRAFT

Trampoline
Round Robin Testing

1.Equipment

All test equipment shall conform to the requirements in ASTM F355 and ASTM F381.

The combined total mass of the spherical impactor drop assembly, which consists of the spherical impactor and instrumented support assembly, shall be 5.0 ± 0.1 kg (11.00 ± 0.22 lb).

The spherical impactor shall be a 146 mm (5.75 in) diameter aluminum sphere that is mounted on the ball-arm connector of the drop assembly.

The combined total mass of the trampoline missile drop assembly, which consists of the test missile and instrumented support assembly, shall be 9.00 ± 0.18 kg (20.0 ± 0.4 lb).

The MEP shall be 152 mm (6 in) in diameter and 25 mm (1 in) thick, and shall have a durometer of 60 ± 2 Shore A.

The MEP shall be affixed to the top surface of a flat 6.35 mm (¼ in) thick aluminum plate. The geometric center of the MEP pad shall be aligned with the vertical axis of the accelerometer.

2. Description of the Test Rig

Prior to any testing, each participating lab shall provide in writing a detailed description of any equipment intended to be used for testing. The description shall include the test rig(s) in detail, including the following items:

- make of test rig (if purchased as a system)
- age of test rig
- distance between the guidewires on twin-wire rigs.
- gauge/type of guidewires and wire tension for twin-wire rigs
- accelerometer type, size and filtering information
- accelerometer mounting details
- angle between the ball-arm and vertical
- mass of the drop frame (twin wire) or drop carriage (monorail)
- material of the drop frame or drop carriage
- mass of drop assembly
- velocity measurement system
- spherical impactor mass and dimensions and mounting details
- trampoline impact missle (dimensions, mass and mounting details)
- each lab's MEP (dimensions, material, hardness)

3.Procedures-Parts A & B

Part A

A.1 Each participating lab shall conduct impact tests by dropping the spherical impactor (this will be provided by CPSC if the lab does not have one) six times, at intervals of 75 ± 15 seconds, onto the CPSC MEP (this will

be provided by CPSC), as described below.

The spherical impactor shall be dropped in a guided free fall, using a monorail or guide-wire test apparatus, onto the MEP fixed to a rigid base.

Each impact shall occur at the same position on the MEP.

The spherical impactor shall be dropped onto the MEP at an impact velocity of 5.44 m/s ± 2% (Typically, this requires a minimum drop height of about 1.51 meters (4.95 ft) plus a height adjustment to account for friction losses.)

A.2 Each participating lab shall conduct impact tests similar to A.1 above by dropping the spherical impactor six times, at intervals of 75 ± 15 seconds, at an impact velocity of 5.44 m/s, onto their own MEP.

A.3 Each participating lab shall drop the spherical impactor six times, at intervals of 75 ± 15 seconds, onto the CPSC MEP, as described in A.1 above, but at an impact velocity of 3.46 m/sec ± 2% (Typically, this requires a minimum drop height of 0.61 m (2.0 ft) plus a height adjustment to account for friction losses).

A.4 Each participating lab shall conduct impact tests similar to A.3 above by dropping the spherical impactor six times, at intervals of 75 ± 15 seconds, at an impact velocity of 3.46 m/s, onto their own MEP.

A.5 Each participating lab shall drop a trampoline test missile six times, at intervals of 75 ± 15 seconds, onto the CPSC MEP at an impact velocity of 3.46 m/sec ± 2% (Typically, this requires a minimum drop height of 0.61 m (2.0 ft) plus a height adjustment to account for friction losses.

A.6 Each participating lab shall conduct impact tests similar to A.5 above by dropping the trampoline test missile six times, at intervals of 75 ± 15 seconds, at an impact velocity of 3.46 m/s onto their own MEP.

A.7 For testing in Parts A & B, each lab shall record the test results as described in Section 4 (Report). All test results shall be provided to and reviewed by CPSC staff and the Trampoline Subcommittee members.

A.8 Only after the test results have been examined by CPSC and the Trampoline Subcommittee members and are shown to be reproducible will the next procedure, Part B, be undertaken.

Part B

B.1 Prior to conducting B.2, and then again after, perform the Instrument Systems Check Procedure in Section 17 of ASTM F1446. This involves six impacts with the spherical impactor onto their own MEP, at intervals of 75 ± 15 seconds, and an impact velocity of 5.44 m/s.

B.2

Following the procedure and equipment specifications in ASTM F381 and ASTM F355, using the trampoline missile, each participating lab shall conduct six drop impact tests onto each pad sample (manufacturers' pad samples will be collected and distributed by CPSC).

4.Report

Each participating lab shall report the following information:

- Description of how the Severity Index was calculated, and provide a sample calculation showing calculation procedure.

- Description of, and results from, each lab's velocity measurement system check.

- For each impact, report the following data:

  - Actual drop height
  - Peak-g
  - Dwell time in milliseconds at ≥ 200-g
  - Dwell time in milliseconds at ≥ 150-g
  - Severity Index
  - Impact Velocity
  - Electronic format filename
  - Notes

- The ambient environment of the laboratory (temperature and humidity) measured within 3 meters of the impact site on each test day.

- Each impact shall be provided in electronic form (readable with a spreadsheet or database program)

- Hard copy printouts of each impact trace (with detailed labels and axis markings).

- Videotape-Each lab shall videotape each procedure, including two drop impact tests with the spherical impactor onto the CPSC MEP and two drop impact tests onto the their own MEP using the trampoline test missile.

The videotapes of each lab's tests shall be sent to the CPSC in VHS, 8-mm, or Hi-8 mm format.

To: The F08.17 Subcommittee on Trampolines
From: Jean Kennedy, CPSC Office of Compliance
Scott Snyder, CPSC Division of Engineering
Scott Heh, CPSC Division of Engineering
Date: May 11, 1999
RE: PROPOSED REQUIREMENT FOR F381-99 TRAMPOLINE STANDARD
[FOR INCLUSION ON THE NEXT BALLOT]

The following performance requirement is proposed for inclusion on the next ballot. This requirement to improve the padding impact attenuation testing procedures is submitted by CPSC staff:

6.1.1 The system instrumentation shall be checked before and after each series of tests by dropping the spherical impactor (see F1446; 3.1.17) on the MEP pad (see F1446; 3.1.10 at an impact velocity of 5.44m/s (±2%). The peak acceleration obtained during this impact should be 389 ±8g. Three such impacts, at intervals of 75 ±15s, shall be performed before and after each series of tests. If the peak acceleration obtained in the pretest impacts differs by more than 5% from the peak acceleration obtained in the posttest impacts, recalibration of the instruments and transducers is required, and all data obtained during that series of padding tests should be discarded.

Please be aware that this proposed requirement has not been reviewed or approved by the Commission.

Testing Labs
for
Instrument System Checks (ref ASTM F1446:17.1)
and
Impact Attenuation Testing

Sports Biomechanics Impact Research Lab
Dr. P. David Halstead (Chairman of the ASTM F08.53 headgear standard committee)
Engineering Institute for Trauma and Injury Prevention
153 Alumni Memorial Building
The University of Tennessee
Knoxville, TN 37996-1506
Phone (615) 974-2070. Fax (615) 974-2016
email: dhalstead@utk.edu

Head Protection Research Lab (formerly at USC)
David Thom, VP and General Manager

Hugh H. Hurt, Jr., President

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Intertek Testing Services
John Sabelli or Karen Strumlock
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P. Welsh

Trampoline Pad Task Group – Proposals

Proposal 1 – DROPPED/WITHDRAWN

The task group recommends that the severity index requirement be deleted from section 5.3 of ASTM F381. The test method would instead specify peak G and time measurement values as follows.

The time duration of the impulse during impact when measured at the 200 G line shall not exceed 3 ms and shall not exceed 6 ms when measured at the 150 G line. The peak acceleration of any impact shall not exceed 200 G's. All three drops should be reported on the test report.

For purposes of clarification, the 3 drops described in F355, section 10.6, shall be conducted on the same specimen. A minimum of 2 specimens shall be used for each test.

Rationale

Interpretation of the round robin test data indicates that there is significant variation in test results between laboratories performing the head impact test method specified in ASTM F381 and F355. Members of the task group consider the severity index calculation, as specified in F355, to be a source of variation. The severity index calculation may not be clearly understood by the industry and thus has become a source of confusion. In an effort to improve consistency of test results, the severity index calculation will be eliminated and replaced with peak G and time measurement values. These values were adopted from ASTM F1447-94, Standard Specification for Protective Headgear Used in Bicycling.

Proposal 2

The task group recommends that the following drop test procedure be adopted and performed on trampoline frame pads.

The drop test must be performed on a finished pad assembled to a trampoline per the manufacturer's instructions. A fixture that simulates the trampoline's frame and spring design may also be used in lieu of a fully assembled trampoline.

The impactor shall consist of a 50 lb. mass with an impact surface of 3.5" x 6" nominal. The impactor can be manufactured from a 2x4 piece of lumber that is 6" long with the 50 lb. mass attached. The 50 lb. mass must not extend past the edges of the impact surface.

The impactor shall be attached to a pulley or some other quick release mechanism that allows the impactor to free fall once released. The impactor may also be attached to a guidance system, provided the system does not introduce significant friction during free fall.

Test Procedure

Center the impactor over the frame pad halfway between two springs. Raise the impact surface to a height of 12" above the pad. Release the impactor by means of a quick release mechanism. The impactor shall be dropped at the same location two times without rearranging the pad. Move the impactor to different locations on the pad and repeat the procedure two more times.

The frame pad fails if: 1) The impact surface penetrates more than 6" below the top surface of the springs 2) the padding attachments fail or become separated from the frame or pad 3) any other component of the frame pad fails.

Rationale

The drop test is designed to simulate a jumper's foot walking or landing on a frame pad during use. The above test is a safety requirement that will assure that a jumper's foot or leg will not pass through the space between the springs if he/she accidentally jumps or walks on the pad. The drop test will not, however, prevent the trampoline frame or springs from becoming uncovered if a jumper walks or lands on the pad. It should be noted that manufacturers warn consumers not to jump or walk onto the pad. However, it is foreseeable that some jumpers may accidentally walk or land on the frame pad, creating the need for this test requirement.

Proposal 3 — DROPPED/WITHDRAWN

The task group recommends the following wind test procedure be adopted and performed on trampoline frame pads.

A trampoline must be assembled according to the manufacturer's assembly instructions. Be sure to assemble the trampoline in an area that is not sheltered from the wind by buildings, trees, fences, etc. The trampoline shall be exposed to natural wind for a period of 5 days. During this time, the trampoline shall be exposed to wind speeds not less than 15 M.P.H. The wind speed should be measured a minimum of three separate times each day. The wind speed-readings should be taken during times of wind gust and each of the readings shall indicate 15 M.P.H. or greater. A hand held anemometer or other suitable wind speed measuring device shall be used to take the readings. The frame pad shall not be reattached or adjusted during the test period.

The frame pad fails if: 1) the padding attachments fail or become separated from the frame or pad 2) the padding is displaced to such an extent that the trampoline frame or springs become exposed to the jumper.

Rationale

The frame pad should remain attached to the trampoline frame during average wind loads. The above test will simulate how a particular frame pad will react to such loads.

It should be noted that the above test would demonstrate the short-term ability of the frame pad to survive wind loads. This test is not designed to measure a frame pads ability to withstand degradation caused by U.V. radiation, rain, snow or other weather phenomenon.

SEAN GORMAN

Sealed Air Corporation

TEN OLD SHERMAN TURNPIKE / DANBURY, CONNECTICUT 06810 (203) 791-3500 / FAX 791-3618

February 23, 1999

Pat Welch
Hedstrom Corporation
P.O. Box 432
Bedford, PA 15522

Mr. Welch:

Thank you for the opportunity to comment on the three proposals (2/1/99) involving trampoline pad testing and subsequent specifications.

I commend you for your initiative in developing these proposals, however, I believe that these proposals have significant technical shortcomings and weak rationale. Certainly I think there are opportunities here to improve the existing standard, ASTM F 381, but I don't think the rationale fully supports the changes that are recommended.

Allow me to make several comments on the proposals, with Proposal 1 being our primary area of interest:

Proposal 1:

As I interrupt the proposal: Trampoline padding is to be tested in accordance to ASTM F355 by using two specimens that are each impacted 3 times in the same location. The peak acceleration of <u>any</u> impact shall not exceed 200 G's. Additionally, the duration shall not exceed 3 ms at the 200 G point and 6 ms at the 150 G line for each impact. All three drops for each of the two specimens shall be reported (total of 6 tests).

<u>Rationale</u>: Current lab to correlation is poor and is suspected to be related to the calculation of the severity index. Proposed acceptance levels were adopted from ASTM F1447-94, Standard Specification for Protective Headgear Used in Bicycling.

Comments:

1. There is no rationale stated that supports why the adoption of performance levels used in F1447 are valid for trampoline applications - only implied.

2. The current revision of ASTM F1447 has a 98 designation and the acceptance criteria does not match the proposed criteria as suggested by the rationale. ASTM F1447-98 states that the peak acceleration of any impact shall not exceed 300 G's when tested in accordance to ASTM F1446 without any criteria for pulse durations. Additionally, this 300 G criteria is established for a headform missile impacting any one of three anvils (flat, hemispherical, and curbstone) from a specified height depending on anvil. For example, the flat anvil is impacted from a drop height equivalent to 2.0 meters (6.65 feet).

   Would 300 G's from 6.65 feet using a headform shaped missile (5.0 kg or 11 lbs.) yield the same injury prevention level as a 20 lb., 20 in^2 cylindrical shaped missile from 2 feet (F 381 sec. 5.3)? This is assuming that F355 would still be the specified test method versus the adoption of F1446.

3. What is the rationale that suggests 3 ms at 200 G's and 6 ms at 150 G's yields acceptable injury prevention?

4. I believe there was additional reasons for why the lab to lab tests did not correlate well, besides just the confusion on the severity index calculation. Additional variables that were not addressed include, impact velocity measurement location, seismic mass, filtering, variations in material from lab to lab, and digitizing rates of instrumentation.

   Additionally, who is to say that the proposed criteria of 200 peak G's could be duplicated in a round robin test if the labs are not performing the test in accordance to the apparatus requirements in ASTM F355, sec. 6?

5. The current version of F381 and this proposal still fails to clarify the test specimen. If the purpose is to test the finished pad including any covering, it should say so. If the purpose is to test just the core material or a pad that has no covering, the standard should state this.

6. As interrupted, all 6 tests on the two specimens would have to meet the criteria of 200 G max and the appropriate time durations. If one of the impacts fails to meet 6 ms duration at 150 G's, but is below 200 G's, is that a pass or fail?

7. I would like to suggest that the Task Group investigate whether or not a head injury criteria (HIC) is more appropriate for our application. ASTM F1292 appendix explains in the rationale behind using the HIC and states that head injuries are not believed to be life threatening if the HIC does not exceed 1000 (see attached).

Proposal 2:

1. The purpose needs to be clarified in this proposal. It states a drop test is to be performed, but fails to state why?

2. The description of the impactor needs to be described better because it is not very clear as proposed.

3. How is drop height measured? Ruler or velocity sensor? How is *significant* friction defined?

Proposal 3:

1. It appears that there could be large variations in wind speed conditions from one test to another, thus making any test difficult to duplicate. The purpose of performing any kind of simulated testing would be for the test to be replicated. Being able to replicate the test is important because if any design changes are made, the test needs to be replicated to determine the effects of the change.

2. The proposed test raises a lot of questionable scenarios. Considering the test is to last 5 days, if there is too much wind or too little wind during this time frame, considerable test time would be wasted.

3. Maybe an alternative test with large fans yielding certain wind conditions would be more appropriate?

I am in favor of advancing the specifications of trampolines in these areas of concerns, however, I think these proposals need to be refined a little further.

I am available to discuss these comments at your convenience and can be reached at (203) 791-3698.

Regards,

Sean P. Gorman
Marketing Technical Support Manager
Polyethylene Foams

temperature conditions within the sample to the variable recovery of the material.

14.2.2 Variations in the impact velocity brought about by changes in drop height or friction in the drop guidance mechanism.

14.2.3 Use of headforms other than ANSI metal headform "C" or missiles of other weights or configurations (spherical, hemispherical, flat, etc.) will cause substantial variation in results.

15. Keywords

15.1 impact attenuation; playground; surface system

APPENDIX

(Nonmandatory Information)

X1. RATIONALE

X1.1 This specification addresses the impact attenuation requirements of surfacing materials used under and around playground equipment. A Consumer Product Safety Commission study of playground equipment-related injuries treated in U.S. hospital emergency rooms indicated that the majority resulted from falls from equipment to the underlying surface.

X1.1.1 Because head impact injuries from a fall have the potential for being life threatening, the more shock absorbing and attenuating a surface can be made, more is the likelihood that the severity of the injury will be reduced. In addition to the measurement of a peak deceleration of the head during impact plus the time duration over which the head decelerates to a halt is significant. Therefore, a mathematical formula is used to derive a value known as head injury criteria (HIC). Head impact injuries are not believed to be life threatening if the HIC does not exceed a value of 1000.

X1.1.2 However, it should be recognized that safety surfacing meeting these test measurements will not prevent nonlife-threatening injuries from occurring. The Consumer Product Safety Commission states, "It is self evident that a fall onto a shock absorbing surface is less likely to cause a serious injury than a fall onto a hard surface. However, it should be recognized that all injuries due to falls cannot be prevented no matter what playground surfacing material is used."

X1.2 This specification is limited to a test for *g*-max, HIC, and conditions that affect them, that is, drop height, temperature, etc. Other physical property factors could be taken into account in the comparison of surface systems, but currently are beyond the scope of this specification. These factors should be considered and included after being studied.

and

- tested successfully by an FIG approved testing institute.
  In exceptional cases (where no testing procedures have been decided yet), the TR-COM-President or a person designated by the TR-COM-President will test the equipment (instead of the testing institute) and has to confirm that the equipment was tested successfully.

The costs for testing by the testing institute or the TR-COM President have to be paid by the manufacturer. The Secretary General may require a deposit.

Certificates are valid for two years. After two years, a new Certificate can be issued by the Secretary General without further testing or approval, provided the Norms have not changed in the meantime.

A fee of Swiss Francs 3'000.-- will be charged for a new Certificate and for a prolongation. This fee includes the right to use the FIG logo, have one free page of advertisement in both the FIG Trampoline Handbook and the FIG Bulletin and to be listed in the FIG Handbook (address list) as official FIG manufacturer and in the official list of FIG Approved Suppliers (Manufacturers), which is regularly published to all member federations with the FIG Bulletin.

Each piece of equipment requires its own Certificate. A different bed, springs, frame, size etc. is considered as a another piece of equipment.

f) Certificates

Manufacturers who provide equipment for World- Intercontinental and Continental Championships and the FIG World Cup Final receive an extra certificate free of charge. Member Federations may issue such certificate for their National competitions, provided the equipment used has an FIG Certificate.

g) Testing procedures and norms for testing to be applied by the approved FIG testing institute

The testing institute (see Address List) will control the respective equipment as listed under 1.1 to 1.7 (Trampoline) and 3.1 to 3.3 (Tumbling) and follow the testing procedures as listed under 1.8 (Trampoline) and 3.5 (Tumbling).
Testing procedures for Double Mini-Trampolines are being developed at this time and may be introduced at any time by the FIG. Until such testing procedures are introduced, the Double Mini-Trampolines are tested by the TR-COM-President (see e). The TR-COM-President will control the Double Mini-Trampolines as listed under 2.1 to 2.4 and may ask for or use any further testing procedure or practical test as he deems necessary.

ATTACHMENT 5

1. TRAMPOLINE

1.1 Frame

1.1.1 Interior measurements of the frame, with bed under tension, but without frame pads:

Length	5050mm	+ /- 60mm
Width	2910mm	+ /- 50mm
Height of bed (from floor)	1155mm	+ /- 05mm

1.1.2 For safety reasons the profile of the frame must have rounded edges.

1.2 Trampoline Bed

1.2.1 Dimensions of the bed under tension, ready for use:-

Length	4280mm	+ /- 60mm
Width	2140cm	+ /- 50mm

1.2.2 The bed must be constructed from light coloured bands, webs, strings etc which must be held together in such a way that they are not displaced during use.

1.2.2.1 Web Construction:
Width of web under tension 5,5 mm +/-1,5 mm
Distance between any two webs 16mm (max.)

1.2.2.2 String Construction
Width of strings under tension 3mm +/-1mm
Distance between any two strings no greater than 10mm

1.2.3 The bed must be strong enough to withstand wear, and not tear when in use.

1.2.4 The jumping zone must be marked out clearly in red on the middle of the bed.

Length	2150mm	+/- 40mm
Width	1080mm	+/- 40mm

The centre of the bed must be indicated by a red cross.

Dimensions	700mm	/- 30mm

1.3 Suspension
The bed must be suspended with springs in such a way as to present no danger to users.
The tension on the bed should be such that the bed stabilises within 1 second after contact.

1.4 Area free of obstruction beneath the bed

1.4.1 The trampoline must be constructed so that the competitor will not touch any part of the frame beneath the bed.

1.5 Safety Padding

1.5.1 The frame and springs must be entirely covered by a shock absorbing padding, the maximum thickness of which must not be greater than 55mm. The padding must not cover any part of the bed.

1.5.2 The padding should be firmly fixed to the frame without hindering the normal action of the bed and springs. Nor should it cause noise through flapping.

1.5.3 The bottom of the padding, at the side of the bed, should not protrude above the level of the bed by more than 50mm.

1.6 Safety Platform

1.6.1 Platforms must be placed at both ends of the trampoline. The platform must be made of a framework which is firmly attached to the trampoline. The platforms must be constructed so that it is shock absorbent and the surface must be covered with a shock absorbing mat, firmly fixed to the platforms.

The mats must have the following dimensions:-

Length	3025mm	+/- 25mm
Width	2025mm	+/- 25mm
Thickness at the bedside	75mm	+/- 05mm
Thickness at the end	210mm	+/- 10mm

The platforms dimensions must be such, that the mats are sufficiently supported to ensure, that on landing, it supports the weight of the competitor without collapsing or folding.

1.6.2 The mat covering the platform must extend to the edge of the bed (covering the springs).

1.6.3 The base of any Wheel stands must also be covered with padding.

1.7 Spotter mats

1.7.1 Spotter Mats must be constructed of a medium density foam and covered with a material which will slide easily.

1.7.2 The mats must be provided with two handles on one side of the mat.

1.7.3 Dimensions:-

Length	1700mm	+/- 300mm
Width	1000mm	+/- 100mm
Thickness	100mm	+/- 30mm

1.8 Testing procedures and norms to be applied by the testing institute

1.8.1 Definition

For the purposes of these testing procedures, the following definition apply.
Deflection: The ability of the bed of a trampoline to deform to an impac expressed as maximum deflection under defined test conditions.
Height of Rebound: The ability of the trampoline to return elastic energy after a vertical impact expressed as a maximum height of rebound unde defined test conditions.
Deviation to the Side during Rebound: The ability of the trampoline t return few elastic energy in horizontal direction after a vertical impact. It i expressed as horizontal distance between the vertical falling line and th highest height of rebound position under defined test conditions.

1.8.2 Test of Elastic Properties

1.8.2.1 Principle
A falling mass is dropped onto the trampoline and the three dimensional positions of the mass are measured during impac onto the bed and during the first rebound after impact.

1.8.2.2 Test mass and drop height:
The test body is a metal sphere completely filled with sand with a diameter of 40 ± 1cm and a mass of 60 ± 0.5 kg. To attach a magnetic fixation the sphere has a plated side (diameter 8 cm) Beside the plated area there are two small ears to attach safely ropes. The safety ropes should prevent uncontrolled movement of the sphere after the first rebound from the bed of the trampoline equivalent to the use of overhead spotting rigs in trampolining.
The fall height shall be 400 ± 2 cm.

1.8.2.3 Release Mechanism:
The sphere is fixed at the defined drop height by means of a magnet. By switching off the magnet the sphere is released and allowed to fall vertically onto the trampoline.

1.8.2.4 Data Capture and Processing:
Instrumentation to record and calculate the three-dimensiona positions of the sphere during impact and at the first rebound t determine the required parameters for elasticity. The rebound parameters must be measured with an error less than 2cm. th deflection of the bed during impact must be measured with an error less than 1cm.

(i.e.: Use at least two video cameras (min. frequency 50 Hz) capturing the movements above the bed of the trampoline and calculate the coordinates by three-dimensional cinematografic analysis utilizing DLT or a similar technique. The deflection of the bed during impact can be determined by using one camera and two-dimensional cinematografic analysis).

1.8.2.5 Test Piece:
The test piece is a new, unused trampoline with safety padding but without safety platform if it is removeable. The trampoline should stay on a smooth and solid gymfloor.

1.8.2.6 Conditioning and Test Temperature:
Condition the trampoline mounted for use for a minimum of 24h at the test temperature of (21±3) °C.

1.8.2.7 Procedure:
Carry out tests on the trampoline at the 4 locations indicated in figure 1.
Carry out three tests at each test location.
Raise the sphere to the required height of 400 cm. Release the mass and allow it to fall vertically onto the trampoline with a free movement to the maximum height of the first rebound.
Check the video-recordings after every test. If there is any deviation during the free fall of the sphere (i.e. by pulling at the overhead safety rigs at a too early moment) repeat the test.

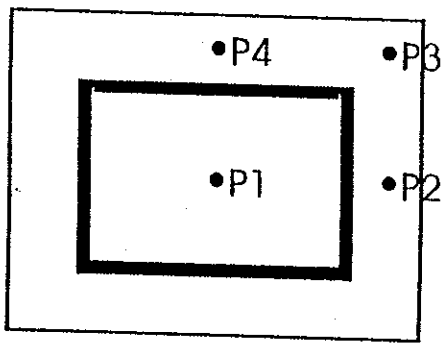

Fig. 1: Test locations on the bed with marked jumping zone according to paragraph 1.2.4. The locations P1 to P4 are the midpoints to related parts of the bed and the marked out jumping zone.

1.8.2.8 Parameters:
Calculate the following parameters for every test by use of three-dimensional measurement techniques:
Height of Rebound: Maximal height (measured in cm) of the sphere above the bed during rebound from the first impact after a free fall from 400 cm.
Deviation to the Side at Rebound: Horizontal Distance (measured in cm) between the line of the fall (from 400cm) and the highest position of the sphere during rebound.
Deflection of the bed: Maximal deflection (measured in cm) of the bed during impact of the sphere after a free fall from 400cm

1.8.2.9 Expression of Results:
Each test location being tested 3 times, the retained values for each point are the mean values of the 3 measurements.

1.8.2.10 Requirements for Elasticity:
When tested according 1.8.2.1 to 1.8.2.9 the trampoline shall comply with the values given in table 1.

Measurement point	Height of Rebound	Deviation to the Side	Deflection of the Bed
P1	330 < x < 355	not needed	92 < x < 99
P2	x < 355	not needed	not needed
P3	x < 355	not needed	not needed
P4	x < 355	155 < x < 190	not needed

Tab. 1: Figures for trampolines tested according to 1.8.2.1 to 1.8.2.9

1.8.3 Test Report

The test report shall include the following information:
a) reference to these testing procedures, FIG Handbook 1999,
b) complete identification of the trampoline tested including manufacturer's reference and date of fabrication;
c) the temperature of test;
d) the dimensions of the trampoline as per paragraph 4;
e) the mean values of the parameters measured of every test point;
f) details of any deviation from the procedure.