



INVESTIGATION GUIDELINE

Revised December 2004

Structural Entrapment

I. Introduction

A. Background Information

In the area of hazards related to children, structural entrapment continues to be of concern. There is always the potential for a fatal injury when a child gets his/her head or neck caught in an opening in the structure of a product. If the child can not extricate himself or be freed by another person, strangulation or positional asphyxia may occur.

Examples of past problems with products' structural openings that created an entrapment hazard include:

- The space between a baby stroller's or high chair's seat and tray
- Headboard or footboard cutouts on cribs
- The space between crib slats
- Openings between structural components of bunk beds
- The V-shaped space at the top of an accordion-style baby gate or barrier
- Angles created by the structural components of playground equipment
- Openings between structural components of playground equipment

Although the examples listed above involve children's products other types of consumer products can be involved in structural entrapment incidents.

There are Federal standards that address structural entrapment hazards and adherence to these rules is mandatory under law. Examples of the Federal standards include:

- Part 1513 of the Federal Hazardous Substances Act Regulations (FHSA), Requirements for Bunk Beds sets requirements to reduce or eliminate the risk of children becoming entrapped in openings below the guardrails, or in other structures of the bunk bed.
- Part 1508 and 1509 of the FHSA, Requirements for Full Size Baby Cribs and Requirements for Non-Full Size Baby Cribs set requirements for crib components (such as slats, spindles and crib rods), stating that the distance between such components shall not exceed 2 3/8 inches at any point. There are also specific testing requirements for cutouts and partially-bounded openings (1508.11) to identify and eliminate entrapment areas, as well as requirements that manufacturers provide information regarding the size of mattresses to use to prevent entrapment between the mattress and crib ends or sides.

There are voluntary industry standards that include requirements to eliminate entrapment hazards with nursery products and playground equipment. Examples of these industry standards include:

- ASTM International's Standard Consumer Safety Specification for High Chairs (F404-99a) in its introductory statement cites the most common injury scenarios associated with high chairs. Among the hazards listed is entrapment between the tray and the seat. This safety performance specification attempts to minimize this hazard through a requirement for a passive crotch restraint system with a tray or other component that creates a completely bounded opening in front of the child occupying the high chair. The passive restraint resembles a post that either comes up from the seat area or down from the tray and bisects the opening thus creating leg openings on either side of the post. The goal is to prevent a child from slipping down between the seat and the tray and becoming entrapped or hanging through the opening with his/her head wedged or caught by the tray. There is a leg hole opening test in this standard (9.12 Leg Openings) that ensures a minimal opening on either side of the passive crotch post.
- ASTM International's Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, F1487-01 sets forth standards to minimize the likelihood of life-threatening or debilitating injuries. Among the hazards it strives to minimize is head entrapment. The standard states that public playground equipment shall be designed, constructed and assembled so that any accessible openings shall meet the performance requirements to reduce the risk of head or neck entrapment (by either a head first or feet first entry into the bounded space). Openings between the surfacing beneath the structure and the structure's bottom edge are exempt. There are test procedures for completely bounded (rigid and non-rigid openings) and partially bounded openings. Basically, an opening may present an entrapment hazard if distance between two opposite surfaces is greater than 3.5 inches, but less than 9 inches.

Information collected through structural entrapment-related investigations is used to analyze hazard scenarios, product failures, types of injuries, users of the products, etc. The analyzed data supports CPSC efforts such as information/education and standards development.

B. Product Category Description

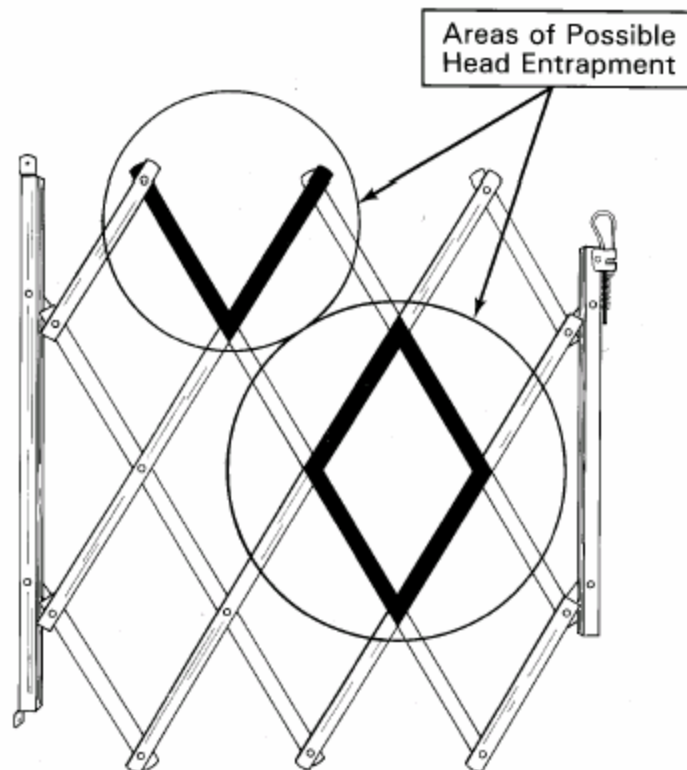
1. Definitions and General Description

These investigations are not limited to children's products or any specific category of products. Cases will be assigned on the basis of hazard rather than product. However the focus of the investigations will be products involved in incidents that have involved the structural entrapment of children. Most of the related products will be those intended for children, but not all, and may include the following (based on CPSC data):

- Playground Equipment
- High Chairs
- Cribs
- Strollers
- Recliner Chairs
- Accordion-style Baby Gates
- Bunk Beds
- Toddler Beds
- Infant Swings

Bounded openings with part of a structure/product on all four sides of the opening can be a hazard along with partially bounded openings with structure on only 2 or 3 sides. It is important to note that the entrapment space exists because of the way the product was designed and/or constructed and not because of a hardware or component failure. Figure 1 (below) illustrates the two types of structural openings. In this case, the highlighted diamond shape is a bounded opening and the highlighted V-shape is a partially bounded opening.

Figure 1: Bounded and Partially-Bounded Openings



Nursery product-related entrapment incident investigations that do not involve structural entrapment, as defined here are covered in the nursery products investigation guideline (Appendix 46, the March 2003 revision).

Openings in a product in either the horizontal or vertical planes may present an entrapment risk. Even openings that are low enough to allow the child's feet to touch the ground can be a strangulation risk to an entrapped child, because a younger child may not have the motor skills or cognitive ability to free themselves, especially if they are panicked or scared.

The key to prevention with a majority of these incidents is reducing, enlarging or eliminating an opening so that the intended user can either pass through the opening safely with their head and body or not pass through it at all.

2. Specific Items of Interest

Field Investigators shall conduct an on-site investigation, if the product is available. Otherwise, conduct a telephone interview. On-site investigations are the most desirable, since it affords the investigator the opportunity to gather the best information possible.

- a.) Document all manufacturer/brand and serial/model information, including production dates, if available.
- b.) Identify all labels regarding certification, testing or conformance with mandatory or voluntary standards. The text of any warning or age labeling on or accompanying the product is also of interest and should be documented and photographed, if possible.
- c.) Describe the area in which the child was entrapped. Any openings that were part of the entrapment scenario should be measured, diagrammed and photographed. A doll or manikin should be used, if possible, to reenact the position of the child at the time of the incident.
- d.) If the product was obtained second hand, please determine how and when it was obtained, and if warning or use instructions accompanied the product. Many older products are known to present an entrapment hazard. For instance, old or antique cribs can present an entrapment hazard because the crib slat spacing may pre-date the Federal standard.

C. Headquarters Contacts

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II. Instructions for Collecting Specific Information

Whether an on-site or telephone investigation is done, it is essential to provide a detailed description of the product and incident in order to provide a clear understanding of the sequence of events, before, during, and after the incident, and the circumstances involved. In these entrapment cases, an on-site is preferable because it will provide the best visual information, regarding the entrapment space and the product involved. It will be easier and more accurate when measurements and diagrams of the opening/space involved can be done on-site. Photographs from an on-site are paramount to understanding these incidents.

However, if the only option is a telephone investigation (rather than an on-site investigation), it is still important to obtain as much information about the product as possible. Ask the respondent to describe the product to you in detail, including features that are unique to that product and product identification, such as the model and date of manufacture. More importantly, ask the respondent if he/she can measure the opening for you even if it means a call back. If the respondent does not have the product, determine whether it was returned to the store or manufacturer, or if it was destroyed or discarded. Timely contact with the victim's family will improve the likelihood of accurate recollection by the respondent of the circumstances involved in the incident.

A. Synopsis

Describe the sequence of events, report the product(s) involved, the victim's activity during the incident and just prior to it, and how the victim became injured. Include the victim's age, sex and type of injury. Specify the location (e.g., home, daycare, etc.) where the incident occurred.

For data retrieval purposes, please include the following key words in the synopsis as appropriate: ENTRAPPED, HUNG, SUBMARINED, CAUGHT, ASPHYXIATED, STRANGLED

B. Description of Product

1. Description of Victim's Interaction with the Product

- a.) Diagram the way in which the victim's head/neck was entrapped and show the position of the victim's body.
- b.) Determine whether the child went feet first or head first into the opening when they became entrapped
- c.) Determine whether the child's head went completely through the opening or whether it became caught within the opening itself.

2. Information About the Product Itself

- a.) Describe the specific type of product involved and whether it was a product intended for children. Measure the overall dimensions of the product as well as the dimensions of the space where the entrapment occurred.
- b.) If the product was intended for children, were there any age recommendations provided? If so, what were they?
- c.) Describe the opening itself. Was it bounded on four sides or partially bounded? If it was partially bounded space describe where the opening to the space was (such as, at the top of the V-shape spacing along the top edge of an accordion-style baby gate). Describe whether the space was created by angle (like a "V" or "X") or was created by parallel components (like a square or rectangle).
- d.) Provide the name of the manufacturer, brand, model and serial number of the product.
- e.) If playground equipment was involved, determine who installed it and where it was installed. If it was not a retail purchase, indicate who designed it. If it was constructed from a kit, please indicate where the directions and components were obtained.
- f.) Did the product need any assembly when purchased? If so, who assembled it? Was it easy or complicated to assemble and were the instructions adequate? Was there any obvious error in the assembly of the product that may have led to the incident?
- g.) How old was the product? (Include date of purchase or installation in the case of playground equipment, if known.) Was it obtained new or used? If used, how old was the product when it was obtained?
- h.) How often was the product used by the victim (e.g., daily, weekly, etc.)? Had the product been used by more than one child and if so, did another child ever experience a similar entrapment incident involving the product?
- i.) Describe the condition of the product (e.g., like new, well used, damaged, etc.) Did deterioration of the product or failure to maintain it contribute to the incident in any way?
- j.) Had the product been modified, repaired or altered in any way? If so, please describe how and why. Had the product ever been taken apart? If so, how and for what purpose?
- k.) Were there any errors made in assembly/construction of the product that allowed the entrapment space to exist?

- 1.) Did the manufacturer specify any age, height or weight limitations for the product? If so, what were they?
3. Labeling and Instructional Literature
 - a.) Describe any labeling on the product. Indicate where it was located on the product and its exact wording. Determine if there was a certification seal on the product packaging.
 - b.) Obtain any instructional literature that came with the product. If the consumer no longer has the literature, did they read it when the product was first obtained? Were there any warnings or cautionary statements in the literature?
4. Guidance on Investigating Specific Products

Strollers and Carriages

- There is an ASTM standard for strollers and carriages with safety specifications addressing entrapment hazards in the openings of convertible carriage/strollers. (ASTM F 833-01 Standard Consumer Safety Performance Specification for Carriages and Strollers.)
- Identify the type of stroller involved and its features. Among the stroller designs currently on the market are umbrella, combination, jogging, double (side by side seating), tandem (one seat in back of the other), carriage and multi-occupant (often used at childcare facilities). Construction of individual strollers may vary from rigid to more flexible as in the case of a jogging or umbrella stroller. The combination strollers tend to be quite heavy and are often on the high end in terms of cost. Some strollers can be folded for ease of handling and storage.
- If the child “submerged” (slipped down) became entrapped in the opening between the seat and tray or the seat and horizontal restraint bar, please indicate if there were any active restraints in use at the time of the incident and what type they were (waist and crotch strap, waist strap, etc.).
- If there was a crotch strap on the stroller or carriage was it used with a horizontal restraint bar or a waist strap at the time of the incident?

Cribs

- The most common crib-related structural entrapment incidents occurred in the past with the spacing between vertical cribs slats and with decorative cut out spaces in the headboards of cribs. In both instances when the entrapment occurred the child’s head would go fully through the space, often resulting in hanging by the neck.
- There are Federal regulations for full-size baby cribs published in the Code of Federal Regulations in Title 16, Part 1508 (previously described in the background section at the beginning of this guideline). The law states that to prevent strangulation, slats, spindles, corner posts and rods cannot be more than 2 3/8 inches apart at any point. It also details the test to determine if any cutouts in the crib structure create a risk of head or neck entrapment.
- If crib slat spacing was involved, measure the space between slats and determine the age of the crib.

- Full size crib mattresses are supposed to be a standard size and should fit snugly with no gaps. If there is a gap between the mattress and crib and no apparent hardware failure, measure the gap. Determine if the incident mattress was intended for use in a full size crib.

High Chairs

- The ASTM voluntary standard for high chairs addresses entrapment between the feeding tray and seat. (ASTM F404-99a, Standard Consumer Safety Specification for High Chairs.)
- Many of the current problems with high chairs center around restraint systems. Among the hazards associated with high chair restraints are incidents of submarining (slipping down under the tray). With any type of structural entrapment in a high chair it is important to know whether the child was strapped into a restraint system during the incident and what type it was.
- Submarining has occurred even with high chairs that have a center crotch post (passive restraint). It is possible for a child to pull his/her leg out of a leg hole, put both legs in one leg hole opening and slip down enough to get their head caught between the seat and the passive restraint. If this type of incident was involved, document the dimensions of the area where the child was entrapped and what part of his/her body was caught.
- There have also been some cases with older high chairs where the child became entrapped between the arm rest and the seat.

Changing Tables

- There have been several recent incidents involving entrapment in the structure of the changing table under the changing surface. If the incident involved such an entrapment, record the dimensions of the opening.

Baby Gates and Barriers

- The ASTM standard for expansion gates and expandable closures addresses head and neck entrapment. (ASTM F 1004-00, Standard Consumer Safety Specifications for Expansion Gates and Expandable Enclosures.)
- Old accordion-style baby gates may still be obtainable second hand and can present an entrapment/hanging hazard in the V-shapes at the top of the gate. If one of these baby gates was involved in the incident, try to determine its age and how it was obtained.

Infant Swings

- The ASTM standard for infant swings addresses entrapment in leg holes. (ASTM F 2088-01, Standard Consumer Safety Specification for Infant Swings.)
- In recent years, there have been some entrapments in infant swings. If an entrapment occurred, determine in what part of the swing the child was entrapped. If the child “submarined” into a leg hole and became entrapped, determine the dimensions of the opening. These incidents can look very similar to the leg hole entrapments with high chairs. Determine whether restraint straps were in use at the time of the incident.

Toddler Beds

- The ASTM standard for toddler beds addresses head and neck entrapment in end structures, between the guard and side rails and in the mattress supports. (ASTM F1821-97, Standard Consumer Safety Specification for Toddler Beds.)
- If an entrapment involving a toddler bed occurred, specify and photograph the exact location of the entrapment and measure the area involved.

Bunk Beds

- As described in the Background Information section of this guideline, there is a Federal mandatory standard for bunk beds (Part 1513 of 16 CFR, Requirements for Bunk Beds). This law prescribes requirements to reduce or eliminate the risk of children dying or becoming severely injured from entrapment in structural openings in bunks beds. There are requirements in Part 1513 for guardrails and bed end structures to prevent the entrapment risks.
- The test methods for openings in the bunk bed structure are described in detail in 1513.4.
- Obtaining measurements of any opening on a bunk bed where an entrapment occurred is a must since there may be a violation of the Federal mandatory standard.

Playground Equipment

- As mentioned previously, there is an ASTM standard for public playground equipment (F 1487-01) that addresses entrapment hazards. In addition, ASTM International's F 1148-03, Standard Consumer Safety Performance Specification for Home Playground Equipment addresses head and neck entrapment hazards for rigid and non-rigid bounded openings.
- Openings in playground equipment structures between 3.5 and 9 inches present an entrapment hazard because they are large enough to permit a child's body to pass through, but not his head. If a child enters such an opening, feet first, he may get entrapped by the head and strangle/hang.
- Bicycle helmets or other helmets worn by a child on the playground can compound the problem. Even if an opening is in compliance with the standards it may not allow a child to pass through the space because the helmet adds additional inches to the child's head size. If a helmet was involved in the incident, please specify the type of helmet and its measurements, if possible. Also, photograph the helmet.
- Indicate whether the child entered the entrapment area head or feet first.
- Document the depth of the opening, if it has limited depth (like a flat vertical surface that butts up to the back of a set of stairs).
- The spacing between ladder rungs and stair treads are two classic examples of bounded openings on playground equipment. The entrapment space could also be, for example, between two platforms or two types of equipment in a multi-use structure.
- Most openings are rigid; however, non-rigid openings such as those in flexible nets also present entrapment hazards. The size and shape of these types of openings can be altered and distorted when force is applied even with normal use. If an incident occurred with a non-rigid opening, describe the type of material involved (rope, plastic, etc.) and any

characteristics that may have contributed to the enlargement, size or distortion of the opening.

C. Description of the Victim

1. What was the age of this child (in years and months) at the time of the incident?
2. What was the height and weight of the child at the time of the incident?
3. What is the sex of the child?
4. What developmental abilities did the child display? Could the child walk, roll over, sit up, etc.?
5. Determine any common behaviors the child displays that may have contributed to the incident. Did the child have any similar incidents previous to the current one with the product involved or other products? If so, please describe.
6. Determine what the child was wearing and if the attire had any bearing on the incident itself.
7. Please describe the type of any injury incurred in the incident, including the part of the body involved. If the incident resulted in a fatality, please determine the official cause of death.
8. Describe the medical treatment (e.g., tests, x-rays, observation, medication, etc.) received by the injured child and include the long-term prognosis. Specify whether the treatment was at home, in a doctor's office/clinic or at a hospital. If the child was hospitalized, document the length of the stay.

D. Description of Environment

1. Indicate whether there were any other children involved in the incident. Was the victim mimicking behaviors of other children when the entrapment occurred?
2. Determine how many adults were present in proximity to the victim and if they were actively supervising the victim.
3. Was the product being used indoors or outdoors? If the incident occurred outside, was the weather a factor (wet, dry, hot, etc.)?
4. Identify whether any surface characteristics (slick, rough, etc) were a possible factor in the incident.
5. Identify any environmental factors that may have contributed to a child not being able to extricate himself from an opening.
6. Were there any objects in the area that may have motivated the child to enter the opening, such as a toy on the other side?

III. Instructions for Photographing and/or Diagramming the Product

Photograph the entire product and the area of entrapment. Measure and diagram the opening /entrapment area configuration in it's entirety. Components of the product that were specifically involved in the incident should be photographed in detail from several angles, including close-ups.

Try to provide visual cues about the scale of an object/opening with a ruler or other measuring device in the photograph.

If possible, using a doll or a manikin close in size to the victim, photograph the position of the child in the product. This is particularly important in entrapment/hanging incidents.

Product labeling should also be photographed or diagrammed, indicating the position of the labeling on the product and the content of the labeling.

IV. Instructions for Obtaining Documents Related to the Investigation

If the incident resulted in a death, obtain copies of any official reports such as, police, EMS or coroner's/medical examiner's reports that are available. Additionally, if a severe injury occurred obtain any available official reports. Also obtain copies of any assembly instructions and owner's or safety manuals that came with the product. If an instructional video was provided with the product, please indicate what information was covered in the video. Whether literature or a video was provided, ask the consumer/caregiver to describe his understanding of the product's installation and usage instructions.