U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation:	EA 13-001		
Prompted by:	Consumer Complaints		
Date Opened:	02/21/2013	**Date Closed:**	12/01/2014
Investigator:	John Abbott	**Reviewer:**	Scott Yon
Approver:	Frank Borris		
Subject:	Child Seat Harness Buckle		

MANUFACTURER & PRODUCT INFORMATION

Manufacturer:	Graco Children's Products Inc.
Products:	2009-2012
Population:	Confidential
Problem Description:	Difficulty in unlatching the harness buckle, including complainants reportedly cutting the harness to remove their child.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	192	Confidential	Confidential
Crashes/Fires:	0	0	0
Injury Incidents:	0	0	0
Fatality Incidents:	0	0	0

ACTION / SUMMARY INFORMATION

Action: Close The Investigation. See Safety Recalls 14C-001 and 14C-004

Summary:

The Office of Defects Investigation (ODI) opened this investigation as PE12-031 on October 15, 2012 to investigate harness buckles in car seats produced by Graco Children's Products, Inc. (Graco). During the investigation ODI discovered that Graco used three different harness buckle designs in the manufacture of certain booster, convertible, and rear facing infant (RFI) car seats produced between 2005 and 2014. The three buckle designs are identified as the "Signature", "QT", and "QT3" which were all manufactured by AmSafe Commercial Products, Inc. All three buckles use unique internal latch components and operate differently, and all have different release button designs.

On February 7, 2014, Graco submitted a Defect Information Report (DIR) to recall 3,773,379 toddler and booster seats produced with the buckles described above. On March 7, 2014, Graco amended the DIR adding an additional 403,222 toddler and booster seats in the recall. Please see safety recall 14C-001 for details related to the recall.

On June 27, 2014, Graco submitted a second DIR recalling 1,910,102 RFI car seats produced with the QT1 buckle. This DIR also stated that Graco would conduct a Customer Satisfaction Campaign (CSC) to replace the Signature and QT3 buckles used on the non-recalled RFI models for the useful life of the car seat (seven years from the date of manufacture). Under the CSC, users of the non-recalled car seats can obtain a replacement buckle, free of charge, should they have a concern with their buckle. In addition to the approximately 6.1 million recalled car seats, the CSC covers approximately 2.3 million RFI car seats. Please see safety recall 14C-004 for additional details of the recall and CSC.

ODI is closing this investigation based on Graco's recall and CSC actions to replace the buckles in all of the car seats it produced with Signature, QT1 and QT3 buckles. Additional information concerning the investigation can be found in the closing report available on SaferCar.gov. The ODI reports cited above can be viewed at http://www-odi.nhtsa.dot.gov/owners/SearchSafetyIssues under the following ID numbers:

Convertible and Booster (162):
10454450,10454393,10450712,10446071,10445997,10445988,10445975,10428246,10421053,10418155,10413817,
10406827,10402771,10397449,10473717,10466250,10463507,10455029,10454295,10444493,10413648,10401202,
10475529,10467797,10444593,10433600,10414471,10414449,10410574,10392858,10384014,10383056,10366950,
10366522,10363586,10361369,10430498,10456547,10397307,10475529,10381470,10381465,10366645,10312165,
10477267,10478809,10481182,10481243,10481236,10481233,10481219,10482654,10482941,10483551,10483732,
10483940,10485417,10486165,10487751,10487824,10489662,10488855,10489296,10489536,10490292,10491819,
10493243,10493351,10493614,10493649,10493668,10493620,10494411,10494567,10494580,10494769,10494876,
10493716,10494635,10495130,10495042,10495301,10496034,10496146,10496063,10496344,10496470,10497637,
10497771,10498293,10498468,10498529,10499325,10499426,10499547,10499718,10499706,10499775,10500067,
10500604,10500828,10500814,10501073,10501314,10501480,10502290,10502580,10502711,10502990,10504056,
10504076,10505061,10504727,10504743,10505107,10505150,10505393,10508181,10508007,10509096,10509116,
10510061,10510620,10511254,10511591,10512725,10514281,10516073,10521015,10524253,10482283,10260861,
10260630,10260622,10260619,10260251,10524928,10526273,10526254,10531818,10533013,10533662,10535355,
10548933,10549812,10549404,10550369,10550731,10550926,10551551,10552014,10552114,10554347,10555537,
10556441,10558757,10559124,10561932,10561769,10561786,10562299,10563648

RFI (30):
10498308,10500767,10522316,10537013,10543486,10548186,10563919,10563975,10564046,10564031,10563953,
10564233,10564780,10565058,10566617,10566855,10567170,10568092,10569428,10569428,10572888,10572569,
10569423,10569147,10569219,10569403,10574483,10575760,10578740,10588204

I. Description Of The Recalled Car Seats

The recalled car seats included models that are forward facing (i.e. booster), convertible (i.e. rear facing to booster), and rear-facing infant (RFI) only car seats, as shown below. These car seats use a 5-point harness system with buckles that incorporate two buckle tongues and a centrally located release button.

Forward Facing

Convertible

Rear Facing Infant

II. Description and Operation Of The Harness Buckles

Graco used three unique buckle designs in the production of the recalled car seats. As shown in the images below, they are identified as the "Signature", and the QT buckles, "QT1" and "QT3".

Signature Buckle

QT1 Buckle

QT3 Buckle

The Signature buckle is the earliest buckle and was introduced in production in 2005. This design was a collaboration between AmSafe Commercial Products, Inc. ("AmSafe")[1] and Graco. The Signature buckle is a proprietary design and was used exclusively on Graco brand car seats only. The release button of the Signature buckle is distinctive in that it is a sliding button that must be depressed vertically downward to release the buckle tongues.

[1] AmSafe Commercial Products, Inc. is a provider of safety restraint products to various industries.

The QT buckles (QT1 and QT3) were designed by AmSafe and are commercially available to other manufacturers[2]. Graco introduced the QT1 buckle in production in July 2010. The QT1 buckle is an entirely different design compared to the Signature buckle. The internal latching mechanisms operate differently and the release button on the QT buckles is hinged at the bottom of the button and must be pushed inward at the top of the button to release the buckle tongues. Because the release button is hinged at the bottom, pushing it at the top provides the user with the most mechanical advantage. If the release button is pressed in a location other than at the top, greater force is required to release the buckle tongues.

Graco introduced the QT3 buckle, a modified version of the QT1, in production in November 2012. The design of the QT3 buckle for latching and unlatching is similar to that of the QT1 buckle described above. However, the QT3 buckle was modified by Amsafe in an effort to address Graco consumer complaints of difficult unlatching on the QT1 buckle. According to Graco, the modifications to the QT3 included a change to the profile of the release button and a change to the internal springs of the buckle. The modification to the button profile was intended to force (encourage) consumers to push the button at the top, where the most mechanical advantage can be realized, and thus making it easier to unlatch the buckle. The modifications to the internal springs were intended to provide a more consistent release force and to reduce the buckle tongue insertion force.

III. QT Buckle and Tongue Interaction When Latching/Unlatching

Interaction between the buckle and buckle tongues plays an important role in the unlatching of a QT buckle. The QT1 and QT3 buckle uses a unique design where the tongues are inserted into the buckle at a slight angle, tilted forward, (Figure 1, page 3) relative to the front surface where the button face is located. When the buckle tongues are fully inserted into the buckle, they tilt rearward away from the front surface as they move into a vertical and latched position (Figure 2, page 3). To release the buckle tongues from the latched position, the release button must be pushed in far enough to allow the buckle tongues to tilt forward towards the front face of the buckle, and through the same angle at which they were inserted (Figure 3, page 3). If the buckle tongues are restricted and not allowed to tilt forward[3], the tongues will not release from the latched position and the buckle cannot be unlatched. Accordingly, users who try to unlatch a QT buckle (even a fully functional buckle) in a manner that prevents the tongues from tilting forward will experience difficulties unlatching it. This is a design function of the QT buckle family.

[2] Evenflo and Baby Trend used AmSafe QT buckles on their products; both have conducted safety recalls at the closing of EA13-001. See NHTSA Recalls 14C-003 for Evenflo and 14C-002 for Baby Trend.

[3] This occurs if the top of the buckle is rotated away from the car seat occupant during unbuckling.

Figure 1 At Insertion

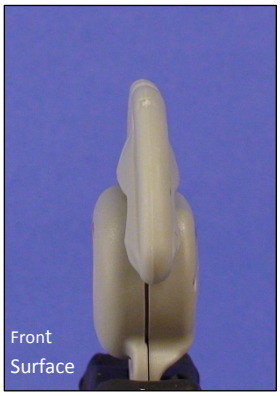

Figure 2 When Latched

Figure 3 When Unlatching

Federal Motor Vehicle Safety Standard No. 213

Federal Motor Vehicle Safety Standard No. 213; Child Restraint Systems, sets forth the performance requirements for child restraint systems, including harness buckle release forces (*see* CFR 49 FMVSS 213 Section 5.4.3.5 Buckle release). The standard requires that a harness buckle release when a force between a minimum of 9 and a maximum of 14 pounds is applied to the harness release button in a pre-crash test condition[4]. The upper limit of the requirement for buckle release force after the crash test is allowed to be as high as 16 pounds.

IV. Discussion

A "buckle" is defined (*see* 49 C.F.R § 571.209, at S3) as a "quick release connector which fastens a person in a seat belt assembly" a definition that includes the harness buckle in a car seat. Harness buckles that become difficult to unlatch, or that become stuck in a latched position are not operating to their design intent as a quick release connector for the harness assembly. Accordingly when a harness buckle of a car seat becomes difficult to unlatch, or becomes stuck in the latched position, it creates an unreasonable risk to safety in the event of a motor vehicle crash or other emergency situation (e.g., choking or other medical condition) where the child must be removed from the car seat quickly.

Throughout the investigation, Graco reported that the performance of the Signature, QT1, and QT3 harness buckles were being affected by contamination. Specifically, Graco stated that the root cause of the sticking and stuck buckles in the convertible and booster seats was contamination of the internal buckle components by food, dried liquid drinks, formula, etc. that migrated or seeped into the buckle during normal usage and impeded the buckle's internal mechanical function. The contamination effects are then experienced by the user as an increase in the force required to press the release button, or in the inability to unlatch the buckle. Graco also referenced the importance of pressing the hinged QT release button at the proper location, and cited other user-related factors (e.g. not loosening the harness tension before attempting to

[4] The FMVSS dynamic test simulates a 30 mph frontal collision.

unlatch the buckle, or pulling the harness buckle upward and tilted away from the occupant thereby preventing the tongues from releasing) which could aggravate or prevent unlatching of the QT buckles, even if it was uncontaminated.

Complaints of stuck or sticking seat belt or harness buckles are rarely received by ODI for any type of safety belt application, especially for car seats. ODI recognizes the importance of pressing the hinged QT button at the proper location, and acknowledges that contamination can affect the buckle's operation and cause the force required to press the release button to be greater than the FMVSS 213 allows, or even greater than some users can exert with their hands. Contamination is a potential concern for all buckles; however, contamination is a foreseeable consequence, especially for car seat applications. The agency did not accept Graco's arguments that harness buckles that become difficult to unlatch, or that become stuck in a latched position do not pose a risk to motor vehicle safety. Consequently, on January 14, 2014, ODI issued a recall request letter outlining the agency's position and requesting that Graco conduct a safety recall. Graco responded with the February 7th 2014 DIR for convertible and booster car seats only and further modified the DIR on March 7th 2014, to include additional car seats, as described in the closing resume.

After recalling the convertible and booster car seats, Graco continued to resist recalling the RFI car seats that used the same buckles as the recalled car seats, noting several reasons for this position. For instance, Graco noted that RFI car seats were intended (by design) to be removed from the vehicle with the child in place, and that therefore unlatching the buckle was not required[5]. Graco argued that this design feature of the RFI car seats significantly reduced the safety risk presented by a stuck buckle, including risks that occur in emergency situations. Additionally, and as noted in its June 27, 2014 DIR, Graco argued that the buckles on RFI car seats were less likely to become contaminated than the toddler seats which had already been recalled, citing the age and the developmental maturity of the infant occupant as a basis for this statement. In discussions with NHTSA, Graco characterized the RFI car seat complaint rates as comparatively low, arguing that such rates did not rise to a level requiring a recall action. Graco suggested the lower likelihood of buckle contamination was an explanation for the lower overall complaint rates of the RFI car seats as compared to the complaint rates for convertible and booster car seats.

At ODI's insistence, Graco conducted an extensive analysis, which ODI evaluated independently, of RFI buckle complaint data. The analysis showed that 83% of the Graco RFI complaint counts were for the QT1 buckle, with the remaining 17% being evenly split between the Signature and QT3 buckles. ODI also conducted peer analysis of buckle complaints in other car seat manufacturers and identified that there is some level of "noise," indicating consumer complaints related to the inability to unlatch buckles across the industry.

[5] The subject RFI car seats have a release handle that can be actuated to separate the seat from the seat base, the device that is secured to the vehicle seating structure. RFI car seats from many manufacturers use this same approach however the specific release mechanisms (the release lever/button style, its operation and location) vary from one brand to another.

Graco also provided data, which ODI independently confirmed, that the QT1 complaint experience in the recalled convertible and booster car seats was approximately four times higher than that of the QT1 experience in the RFI car seats. However, despite the disproportionate level of complaint rates between booster and convertible seats and RFI car seats, the agency did not agree with Graco's position that the RFI car seats did not pose an unreasonable risk to motor vehicle safety. The risk to motor vehicle safety is particularly concerning in a fire or in post-crash situations, where a vehicle may be damaged to an extent that the vehicle doors cannot be opened, and possibly preventing removal of the RFI car seat. Likewise, vehicle intrusion into the passenger compartment in high-impact crashes can compromise the structure of the vehicle to an extent that it can prevent removal of the RFI car seat from its base, or from the vehicle. Even where these are not factors, Good-Samaritans or emergency responders tending to the child occupant in a post-crash scenario may not be familiar with releasing the car seat from the base, will default to the buckle, in which case a sticking or stuck buckle could slow or prevent the child's removal.

However, based on the data that ODI analyzed, it appeared that there was a large disparity in the rate of complaints among the buckle types used in RFI car seats, with complaints involving QT1 buckles occurring almost ten times more than the QT3 or Signature buckles. Based upon the differences in Graco's own complaint data, as well as the results of the peer analysis, the agency insisted that Graco take further action to address the safety risks on the RFI car seat buckles. Accordingly, Graco conducted a recall of RFI car seats containing a QT1 buckle and a CSC for the QT3 and Signature buckles, as described in the June 27th 2014 DIR referenced above.

V. Graco's Recall and CSC Actions

Graco's safety recalls of the affected convertible, booster, and RFI car seats and the CSC on the non-recalled RFI car seats covers all car seats produced with "Signature, "QT1" and "QT3" buckles. All consumers with an affected buckle can receive a newly designed replacement buckle, free of charge. Registered owners for both the recall and CSC will receive recall notification by first class mail. Consumers can also contact Graco about the buckle recall or CSC on the internet at WWW.gracobucklerecall.com or call Graco toll free at 877-766-7470.