



U.S. CONSUMER PRODUCT SAFETY COMMISSION  
4330 EAST WEST HIGHWAY  
BETHESDA, MD 20814

Caroleene Paul  
Mechanical Engineer  
Division of Mechanical Engineering  
Directorate for Engineering Sciences

Tel: 301-504-7540  
Fax: 301-504-0533  
Email: cpaul@cpsc.gov

April 14, 2011

Ms. Kathleen Woods  
Director of Standards  
Outdoor Power Equipment Institute  
341 South Patrick Street  
Alexandria, VA 22314

Dear Ms. Woods:

On January 11, 2011, the U.S. Consumer Product Safety Commission (CPSC) staff received the second canvass draft of ANSI/OPEI B71.9-20XX, *American National Standard for Multipurpose Off-Highway Utility Vehicles*.<sup>1</sup> CPSC staff reviewed the draft and believes that the proposed standard does not adequately address vehicle stability, vehicle handling, and occupant protection performance.

#### Vehicle Stability

The proposed standard includes significant changes to the first canvass draft of ANSI OPEI B71.9-20XX in the area of lateral stability. Section 8.8 *Dynamic Stability* introduces a dynamic test for lateral stability. The proposed dynamic test is a drop throttle J-turn test at 20 mph with a hand wheel steering input of 180 degrees. The intent of a drop throttle test is to input the desired steering angle with the accelerator released while the vehicle is traveling in a straight path at the specified speed. When the test is executed properly, the results will be highly repeatable for a given vehicle. J-turns conducted in this manner have been employed historically to measure characteristics of vehicle lateral stability.

The proposed test procedure specifies that the J-turn test should be conducted on a paved high-friction surface with a coefficient of friction of 0.8. The test procedure further specifies that the loading condition should approximate that of an operator plus one passenger. The draft standard also specifies that the dynamic test should be performed in the "most open driveline configuration," meaning that the selectable driveline features should be set in two-wheel drive mode, and differentials should be unlocked. A vehicle subjected to the proposed J-turn test

---

<sup>1</sup> The comments in this letter are those of the CPSC staff and have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

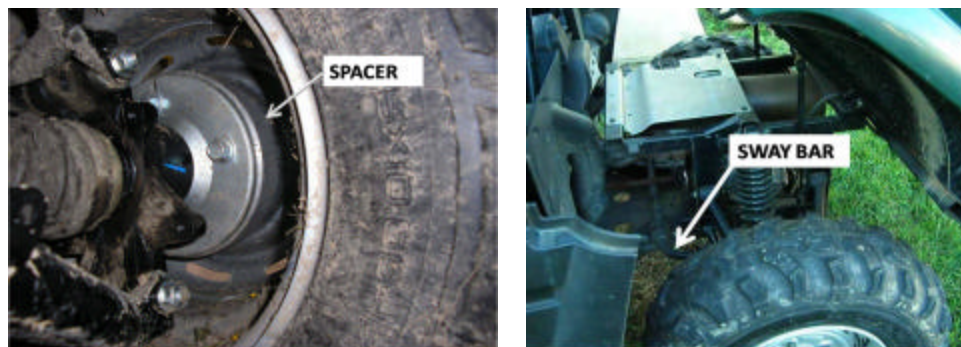
would be considered to have acceptable lateral stability performance if it did not experience two-wheel lift of two inches or more during the test.

CPSC staff is encouraged that OPEI has proposed a dynamic test requirement related to lateral stability performance for off-highway vehicles. Staff agrees that such a test is necessary; that the test should be conducted on a uniformly high-friction surface (*i.e.*, paved surface); and that the loading for the test should approximate the condition of a driver plus one passenger. Additionally, staff agrees that the “open driveline configuration” is the appropriate vehicle test condition. However, staff does not agree that the specific test protocol or the acceptance limits proposed will be adequate to identify and discriminate problematic vehicle behavior.

OPEI has proposed 20 mph as the test speed and 180 degrees as the only hand wheel steering input for this drop throttle J-turn test. This set of conditions will produce a unique lateral acceleration profile during the turn for each vehicle design. The magnitude and duration of the lateral acceleration profile in the turn will be dependent upon the rate of vehicle speed deterioration and the severity of the turn resulting from the vehicle’s steering geometry. However, some vehicles with high rolling resistance and low sensitivity steering may be accepted by this test and still have inferior lateral stability characteristics. A more meaningful test would include instrumentation to measure and record the lateral acceleration and would vary the steering angle to determine the minimum lateral acceleration needed to achieve two-wheel lift. Measuring the lateral acceleration directly would eliminate the influence of considerations such as rolling resistance and steering ratio from the outcome. CPSC staff’s experience with J-turn rollover threshold testing indicates that a relevant value for minimum lateral acceleration at two-wheel lift can be defined.

### Vehicle Handling

CPSC staff continues to believe that steady state oversteer is an undesirable and unstable steering control mode for vehicles. Therefore, staff believes that a test to measure steering gradient and an acceptance criterion for handling characteristics is necessary. CPSC staff’s experience with vehicle dynamic testing has shown that altering the steering characteristics of a vehicle is not difficult. Staff successfully altered the steering characteristics of a vehicle that originally exhibited steady state oversteer by adding spacers to the rear wheels and removing the rear sway bar (see Figure 1).



**Figure 1. Modifications to improve steering characteristics.**

The effectiveness of the modifications in improving the vehicle from oversteer (blue lines) to understeer (red and orange lines) is illustrated in the vehicle diagram shown in Figure 2.



Figure 2. Steering diagram of unmodified vehicle and modified vehicle in clockwise (CW) and counterclockwise (CCW) directions.

### Occupant Protection

The proposed standard includes additional equipment requirements to section 5.1 *Occupant Protective Systems* of ANSI OPEI B71.9–20XX. Section 5.1.3, *Occupant Restraints*, requires, at a minimum, a three-point seat belt for each seating position in the vehicle. Section 5.1.3.2 *Seat Belt Reminder System* requires that a visual seat belt warning activate for at least 8 seconds when the vehicle is turned on. The seat belt warning can be deactivated if the operator latches the seat belt, but this requirement is optional. Section 5.1.4, *Occupant Side Retention Devices*, requires vehicles to be equipped with occupant side retention devices that reduce the possibility of entrapment of a belted occupant between the vehicle and the terrain in the event of a quarter-turn rollover.

### *Seat Belt Reminder*

CPSC staff does not believe the proposed 8-second warning light will be as effective in changing user behavior as the seat belt warning requirements for passenger cars in the Federal Motor Vehicle Safety Standards (FMVSS) Standard No. 208, *Occupant Crash Protection*.

FMVSS 208 requires an active seat belt reminder that is dependent upon the latch status of the seat belt; the user is motivated to latch the seat belt to remove the reminder. In comparison, the proposed mandatory 8-second light requirement in the canvass draft has no feedback to educate or motivate the user to latch the seat belts.

### *Occupant Side Retention Devices*

OPEI has proposed a requirement for physical barriers or design features of the vehicle to reduce the possibility of entrapment of a properly belted occupant's head, upper torso, and limbs between the vehicle and the terrain in the event of a quarter-turn rollover. However, OPEI has not specified any procedures to test the side retention devices and has not specified that the side retention devices must meet any performance requirements.

CPSC staff's review of incidents involving recreational off-highway vehicles (ROVs) indicates that a significant hazard pattern includes full or partial excursion of an occupant during a 90-degree quarter-turn rollover of the vehicle. In addition, occupant head crush by the vehicle (in many cases the vehicle's rollover protective structure) occurs in many of the full and partial occupant excursion incidents. CPSC staff recommends that the OPEI members conduct vehicle rollover simulation tests to develop a performance-based occupant protection test that limits the head excursion of properly belted occupants (from 5<sup>th</sup> percentile adult females to 95<sup>th</sup> percentile adult males) to specified areas within the vehicle, during a rollover event. Limiting the head excursion of an occupant will also reduce excursion of an occupant's upper torso. Additionally, CPSC staff believes that all occupant protection equipment should be designed to protect from 5<sup>th</sup> percentile adult females to 95<sup>th</sup> percentile adult males.

Thank you for this opportunity to comment. CPSC staff looks forward to continued communication with OPEI regarding the ANSI/OPEI B71.9-20XX draft standard. If you have any questions or comments, please feel free to contact me.

Sincerely,



Caroleene Paul

cc: Colin Church, CPSC Voluntary Standards Coordinator