

[Federal Register: February 12, 2003 (Volume 68, Number 29)] [Proposed Rules] [Page 7101-7104]  
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**DEPARTMENT OF TRANSPORTATION**

**National Highway Traffic Safety Administration**

49 CFR Part 571

[Docket No. NHTSA-02-13957; Notice 01]  
RIN 2127-AI97

**Glare from Headlamps and Other Front-Mounted Lamps: Adaptive Frontal-lighting Systems  
Federal Motor Vehicle Safety Standard No. 108; Lamps, Reflective Devices, and Associated  
Equipment**

**AGENCY:** National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

**ACTION:** Request for comments.

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**SUMMARY:** This document requests comments on Adaptive Frontal-lighting Systems (AFS). The automotive industry is introducing Adaptive Frontal-lighting Systems that can actively change the intensity and direction of headlamp illumination in response to changes in vehicle speed or roadway geometry, such as providing more light to the left in a left-hand curve. The agency is concerned that such headlighting systems may cause additional glare to oncoming drivers, change the easily recognizable and consistent appearance of oncoming vehicles, and have failure modes that may cause glare for long periods of time. The agency is also interested in learning whether these adaptive systems can provide any demonstrated reduction in crash risk during nighttime driving. Thus, the Agency is seeking information on these systems to assess their potential for a net increase or decrease in the risk of a crash. Of special interest to us are the human factors and fleet study research that may have been completed to assure these systems do not increase the safety risk for oncoming and preceding drivers.

**DATES:** Comments must be received on or before April 14, 2003.

**ADDRESSES:** Comments must refer to the docket and notice number cited at the beginning of this notice and be submitted to: Docket Management, Room PL-401, 400 Seventh Street SW., Washington, DC 20590. It is requested, but not required, that two copies of the comments be provided. The Docket Section is open on weekdays from 10 a.m. to 5 p.m. Comments may be submitted electronically by logging onto the Dockets Management System Web site at <http://dms.dot.gov>. Click on "Help" to obtain instructions for filing the document electronically.

**FOR FURTHER INFORMATION CONTACT:** For technical issues, please contact Mr. Richard L. Van Iderstine, Office of Rulemaking, NHTSA, 400 Seventh Street, SW., Washington, DC 20590. Mr. Van Iderstine's telephone number is (202) 366-2720 and his facsimile number is (202) 366-4329. For legal issues please contact Mr. Taylor Vinson, Office of Chief Counsel, at the same address. Mr. Vinson's telephone number is (202) 366-5263.

**SUPPLEMENTARY INFORMATION:** The development of Adaptive Frontal-lighting Systems (AFS) has been ongoing for about a decade. However, there are much earlier versions of such situation-adaptive headlighting that have been sold to the public. In the United States, the Tucker automobile was equipped with one, and in Europe, Citron manufactured automobiles with them, too. These had headlamps that would swivel with the steering system. In 1993, funded by the European Union's Eureka Project EU 1403, member countries and their manufacturers (BMW, Bosch, Daimler-Benz, Fiat, Ford, Hella, Magneti-Marelli, Opel, Osram, Philips, PSA, Renault, Valeo, Volkswagen, Volvo, and ZKW) began defining requirements for AFS. Additionally, Japanese and North American manufacturers have been developing these systems. The goal of these AFS is to actively control headlamp beam pattern performance to meet the dynamic illumination needs of changing roadway geometries and visibility conditions.

Today, this goal has been partially realized by several lighting manufacturers who have developed systems incorporating various aspects of AFS functionality. An initial application, called "bending light," automatically reaims the lower beam headlamps to the left or right depending on the steering angle of the vehicle, with the intent to better illuminate curves in the roadway. Also, it is likely that these initial bending light offerings will have part of the light emitted from the headlamp move within the beam to the left or right to increase the amount of light shining into the curve. There are other ideas being explored that, for example, would reduce the intensity of illumination in well-lit urban driving situations, reduce the intensity of lower beam foreground light in wet weather to lessen the light that reflects off the roadway into other drivers' eyes, and various other performance changes.

Prototype systems have been demonstrated by motor vehicle lighting companies to motor vehicle manufacturers, and recently to government lighting experts from numerous countries around the world. This was last done in Geneva, Switzerland in the Spring of 2000, during the Forty-Fourth Session of the Meeting of Experts on Lighting and Light Signalling (GRE) where ten different AFS prototypes were available on cars for driving. The GRE is a subgroup of the United Nations' (UN) World Forum for Harmonization of Vehicle Regulations (WP.29).

In order to introduce this new headlighting technology in Europe, regulations have to be modified within the UN Economic Commission for Europe, under its 1958 Agreement titled: "Agreement concerning the Adoption of Uniform Technical Prescriptions (Rev.2)." The first amendment to accommodate swiveling (or bending) of the low beam function in these regulations is scheduled for final voting at the March 2003 session of WP.29. AFS installation on motor vehicles in the European market could occur sometime after approval by WP.29. The second stage is forecast to be considered for approval in 2005. This could include roadway illumination for specific situations, such as highway, suburban, urban roads, inclement weather, and additional cornering lighting whose technical descriptions may be found in the formal draft document presented to the GRE (see TRANS/WP.29/GRE/2002/18--Proposal for a New Draft Regulation: "Uniform Provisions Concerning the Approval of Adaptive Frontlighting System (AFS) for Motor Vehicles" at <http://www.unece.org/trans/main/wp29/wp29wgs/wp29gre/grenwdoc/gre0218e.pdf>).

AFS implementation by U.S. vehicle manufacturers in North America currently is in the development stage. However, foreign manufacturers could begin marketing the bending function in the United States in the near future. Under Federal Motor Vehicle Safety Standard No. 108, Lamps, reflective devices and associated equipment, the bending light performance (by automatically reaiming

the lamp) is not prohibited because the Standard does not specifically address the initial or subsequent aim of a headlamp in a headlighting system. The Standard addresses only aimability requirements. See the letter from the Chief Counsel, NHTSA, to Mr. Mark Cronmiller, VDO North America, dated July 7, 1999 (<http://www.nhtsa.dot.gov/cars/rules/interps/files/20061.ztv.html>). Mr. Cronmiller had asked about future "smart" headlighting systems that adjust headlamp aim vertically and/or horizontally according to driving conditions (e.g., vertically for oncoming traffic, horizontally around curves in the road). The Chief Counsel responded that paragraph S7.8 of Standard No. 108 prescribes headlamp aiming hardware requirements under static conditions only. Once a headlamp is installed on a vehicle, its aim is fixed, but may be adjustable by mechanical means when the vehicle is at rest. A limited ability to adjust vertical aim on some vehicles is also provided by vehicle leveling devices. Standard No. 108 does not require that headlamps be aimed at the time the vehicle is manufactured and certified as conforming to all applicable Federal motor vehicle safety standards. If there is a requirement for correct headlamp aim on new vehicles, it would be that of a State's motor vehicle authority at the time the vehicle is first registered for highway use in that State. The letter continued by saying that, if a "smart" headlamp system meets the static aiming hardware requirements of Standard No. 108, a dynamic aiming feature is permissible. We also said that at that time that we had no specific plans to regulate or require headlamps with dynamic aim features, but were monitoring them to form an impression as to their suitability for use under American driving conditions, and to learn if there are any problems of maintenance of aiming integrity, or durability, involved in their use. At a minimum, we would be concerned about the need for fail-safe performance to assure that aim would return to nominally correct, straight ahead in the event of a failure.

We note that S5.3.1.1 of Standard No. 108 also requires that lamps and reflective devices must be installed such that their photometric requirements are met on motor vehicles and that no other part of the vehicle shall prevent that. As such, the additional hardware added to achieve AFS must not prevent headlamps, or any other required lamps, from meeting the required performance in any manner whether AFS is operating or not. Additionally, for the bending light mechanization where some of the light in the nominal beam pattern is actively redirected, the photometric requirements of the headlamp must be met regardless of active changes in the light distribution within the beam.

The balance between roadway illumination and glare is something that has always concerned us. The public shares our concern, too, as evidenced by the unprecedented response to Docket 8885, NHTSA's docket on glare from headlamps. Besides the more than four thousand comments to date, that docket has the highest number of Internet visits of all dockets in the DOT Docket Management System: more than 64,000 hits. The public's concern is that glare is increasing at an alarming rate whether from approaching vehicles or rear view mirrors. Thus, the agency is concerned whether the implementation of AFS will produce a volume of complaints similar to those in Docket 8885 regarding the installations of high intensity discharge, high-mounted, and supplemental headlamps.

Given this concern, we have a number of questions for drivers, and the lighting and the motor vehicle industries, relative to the safety, implementation and use of AFS, especially as it may be offered to the U.S. market. These questions are:

### **Questions for Drivers**

Question 1: Do you have problems seeing around curves because of the limitations of the headlamps on the vehicles that you drive, or because of glare from an approaching vehicle? Please describe the problems, including road, ambient lighting, and weather conditions.

Question 2: Is the glare that you described above worse than the glare from vehicles approaching on straight roads? Is it because the light is brighter or because it is longer lasting?

Question 3: Under what nighttime driving conditions have you thought you needed extra headlight illumination to help you see the road, signs, or objects: When turning at intersections, when

driving on curved roads, at intersections, driving in rain, when driving in fog, when driving on interstate highways, driving in cities, etc.?

Question 4: Under what nighttime driving conditions have you thought that the oncoming headlights seemed more glaring than usual: On right-hand curves, on left-hand curves, on high-speed roads, at intersections in cities, on hilly roads?

Question 5: What types of objects are most difficult for you to see when driving at night: Pedestrians, lane markings, street signs, stop signs, overhead guide signs, debris on road, animals, etc.?

Question 6: For a "bending light" AFS that added more illumination to the right side on right-hand curves and to the left on left-hand curves, what aspects of lamp design concern you the most: That lamp failure might reduce visibility; that added light on left-hand curves would increase glare to oncoming drivers; that the motion of the lights would be annoying; that the added light would not be bright enough to significantly increase the visibility distance.

Question 7: If a headlighting rating were available for new vehicles in the same manner as crashworthiness and rollover star ratings, would you use these headlighting ratings in the decisions that lead to your purchase of a new vehicle? On a scale of 1 to 10 with 1 being of little value and 10 being extremely important, how might you rate the importance of the headlamp rating, if available, to your purchase decision for a new vehicle?

### **Questions for Industry**

Question 8: Have manufacturers evaluated prototype AFS-equipped vehicles at night to determine whether changes in the intensity and direction of illumination may cause misdirection of any driver's gaze toward the newly lighted or intensified area, or away from objects that are still important for driving safety? Please describe the evaluations and provide copies if available.

Question 9: Do moving beams (from bending light or the increase or decrease in intensity) either increase or decrease the level of driver fatigue compared to non-AFS lighting? Please provide all available research information about this issue.

Question 10: Have vehicle manufacturers evaluated prototype AFS-equipped vehicles at night as occupants of other vehicles to evaluate the potential glare from AFS? If so, please describe the evaluation and the results. Are there other assessment methods used to assess the glare from the AFS before vehicle manufacturers commit to a particular AFS design? Please provide the results of all alternative assessments conducted for AFS.

Question 11: What assessment is made of potential glare from AFS at points in the beam pattern that are currently unregulated?

Question 12: Are there any current lamp or vehicle manufacturer corporate design guidelines for AFS that deal with unregulated points in the beam pattern? If so, please indicate what those guidelines are and explain why the manufacturer believes they are appropriate.

Question 13: To what extent do lamp and vehicle manufacturers consider the reports and work by the Society of Automotive Engineers and other non-governmental bodies on the subject of glare in designing the performance of AFS on their vehicles? In answering this question, manufacturers are asked to provide a list of the reports, papers and data that they found useful in establishing design guidelines. Please provide specific examples of internal glare limits that have been adopted as a result of these references.

Question 14: While we are aware of many studies to demonstrate and promote the efficacy of AFS, we are not aware of a single study that has been done on the effects on other drivers facing AFS-equipped vehicles or on drivers using AFS-equipped vehicles. Please identify any such studies.

Question 15: Has glare been studied specifically for younger and older drivers facing or preceding the various modes of AFS operation on vehicles? If so, please list the studies.

Question 16: Has diminished recognition of presence, or the perception of distance or closure rate to an oncoming AFS vehicle ever been studied? If so, please list the studies and findings.

Question 17: What fail-safe features for each possible mode of AFS operation have been developed and studied that will prevent glare to oncoming and preceding drivers? Please describe them.

Question 18: What fail-safe features for each possible mode of AFS operation have been developed and studied that will prevent no greater risk to the driver using it than when non-AFS headlighting fails?

Question 19: What studies have been done to demonstrate whether AFS adds safety value? What value is that and how was it measured? Please identify and provide the findings of such studies.

Question 20: What are the anticipated incremental costs of adding the various designs of AFS features to halogen headlighting systems?

Question 21: What are the anticipated incremental costs of adding the various designs of AFS features to high intensity discharge headlighting systems?

Question 22: What are the anticipated incremental costs of adding the various designs of AFS features to light emitting diode headlighting systems?

Question 23: Presumably, the added illumination in curves is intended to reduce the risk of a crash. However, because most crashes are on straight roads (because of the predominance of straight roads), how does the presumed incremental benefit compare to the added cost of AFS? Does the incremental benefit outweigh the potential for additional glare to oncoming or preceding drivers in a curve or intersections or during an AFS failure? Why?

Question 24: Should AFS designs be incorporated as separate, regulated lighting systems that operate independently of the primary headlighting system?

Question 25: Given that known AFS prototype designs are intended to use more headlamp replaceable light sources than currently permitted, should AFS headlamps be limited in total luminous flux?

Question 26: Should AFS headlamps have unlimited luminous flux if automatic headlamp leveling and cleaning are incorporated, as currently mandated in Europe for headlamps that have light sources that are rated at 2000 lumen or more?

Question 27: What is the feasibility of reducing the intensity of AFS lamps during low speed, dense traffic, or high ambient illumination conditions? Please describe how this might be accomplished.

Question 28: Are there requirements in Standard No. 108 that are barriers to the implementation of AFS? If there are barriers, in accordance with the published lighting policy of the agency (NHTSA docket 98-4281, at: [http://dms.dot.gov/search/document.cfm?documentid=46284 & docketid=4281](http://dms.dot.gov/search/document.cfm?documentid=46284&docketid=4281)), what data exist showing safety benefits to justify amending the Standard to permit AFS?

Question 29: Should AFS be mandatory? What data exists showing safety benefits to justify amending the Standard to require AFS? If not mandatory, why not?

Question 30: Should AFS be permitted as a replacement for non-AFS headlighting systems. If so, why, and what safeguards are necessary beyond that necessary for new OEM installations? If not, why not?

## **Rulemaking Analyses and Notices**

### **Executive Order 12866 and DOT Regulatory Policies and Procedures**

This request for comment was not reviewed under Executive Order 12866 (Regulatory Planning and Review). NHTSA has analyzed the impact of this request for comment and determined that it is not significant within the meaning of the Department of Transportation's regulatory policies and procedures. The agency anticipates if a proposal and ultimately a final rule should result from this

request for comment, new requirements would apply to the applicable vehicles and items after the specified implementation date. The request for comment seeks to determine the ramifications of the introduction of adaptive frontal headlighting systems that are intended to enhance safety under a variety of driving conditions. The systems do so by varying the performance and aim of each headlamp's beam in a manner coincident with providing, for example, more illumination in the direction of a motor vehicle's turn, and other situations where the vehicle's manufacturer deems that more or less light is desired by the driver.

### **How do I Prepare and Submit Comments?**

Your comments must be written and in English. To ensure that your comments are correctly filed in the Docket, please include the docket number of this document in your comments.

Your comments must not be more than 15 pages long (49 CFR 553.21). We established this limit to encourage you to write your primary comments in a concise fashion. However, you may attach necessary additional documents to your comments. There is no limit on the length of the attachments.

Please submit two copies of your comments, including the attachments, to Docket Management at the address given at the beginning of this document, under ADDRESSES.

### **How can I be Sure that my Comments were Received?**

If you wish Docket Management to notify you upon its receipt of your comments, enclose a self-addressed, stamped postcard in the envelope containing your comments. Upon receiving your comments, Docket Management will return the postcard by mail.

### **How do I Submit Confidential Business Information?**

If you wish to submit any information that you do not want to be made public, under a claim of confidentiality, you should submit three copies of your complete submission to the Chief Counsel, NHTSA, at the address given at the beginning of this document under FOR FURTHER INFORMATION CONTACT. This submission must include the information that you are claiming to be private, that is, confidential business information. In addition, you should submit two copies from which you have deleted the private information, to Docket Management at the address given at the beginning of this document under ADDRESSES. When you send a comment containing information claimed to be confidential business information, you should include a cover letter that provides the information specified in our confidential business information regulation, 49 CFR part 512.

### **Will the Agency Consider Late Comments?**

We will consider all comments that Docket Management receives before the close of business on the comment closing date indicated at the beginning of this notice under DATES. To the extent possible, we will also consider comments that Docket Management receives after that date. If Docket Management receives a comment too late for us to consider in developing a proposed response to these glare issues, we will consider that comment as an informal suggestion for future rulemaking action.

### **How Can I Read the Comments Submitted by Other People?**

You may read the comments received by Docket Management at the address and times given near the beginning of this document under ADDRESSES.

You may also see the comments on the Internet. To read the comments on the Internet, take the following steps:

- (1) Go to the Docket Management System (DMS) Web page of the Department of Transportation (<http://dms.dot.gov/>).
- (2) On that page, click on "search."
- (3) On the next page (<http://dms.dot.gov/search/>), type in the multi-digit docket number shown at the heading of this document. In this case, the docket number is "NHTSA-2001-13957", you would type "13957".
- (4) After typing the docket number, click on "search".
- (5) The next page contains docket summary information for the docket you selected. Click on the comments you wish to see.

You may download the comments. Although the comments are imaged documents, instead of the word processing documents, the ".pdf" versions of the documents are word searchable. Please note that even after the comment closing date, we will continue to file relevant information in the Docket as it becomes available. Further, some people may submit late comments. Accordingly, we recommend that you periodically search the Docket for new material.

**Authority:** 49 U.S.C. 322, 30111, 30115, 30117, and 30166; delegations of authority at 49 CFR 1.50, and 501.8.

Issued on: February 6, 2003.

**Stephen R. Kratzke,**

Associate Administrator for Rulemaking.

[FR Doc. 03-3505 Filed 2-11-03; 8:45 am]

**BILLING CODE 4910-59-P**