Mack Chassis - Models - Anthem (AN), Pinnacle (PI, CXU, CHU) - Headlamp Aiming Instructions;

Internal Content

HEADLAMP AIMING INSTRUCTION & INSPECTION

1. MECHANICAL HEADLAMP AIMING REQUIRED

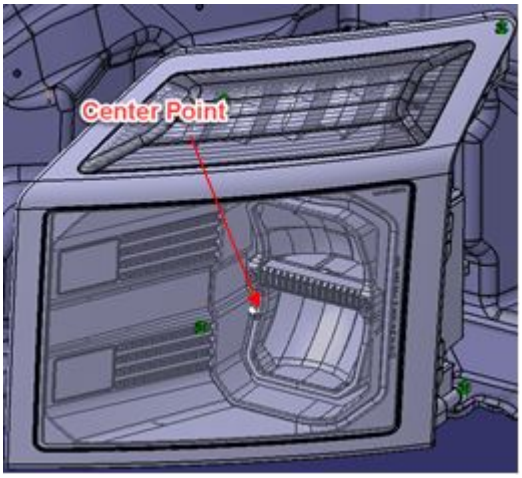
- LEVEL FLOOR REQUIRED PRIOR TO AIMING.
- ALL CHASSIS SUSPENSION AIR BAGS TO BE FULLY INFLATED PRIOR TO AIMING.

2. HEADLAMP AIMING:

Visual inspection may be performed on an aiming screen 25 feet (7.6 meters) in front of the vehicle.

Measure Headlamp center point from Ground. Headlamp center point is marked on Headlamp lens.

CXU Headlamp, Ext-Gen5



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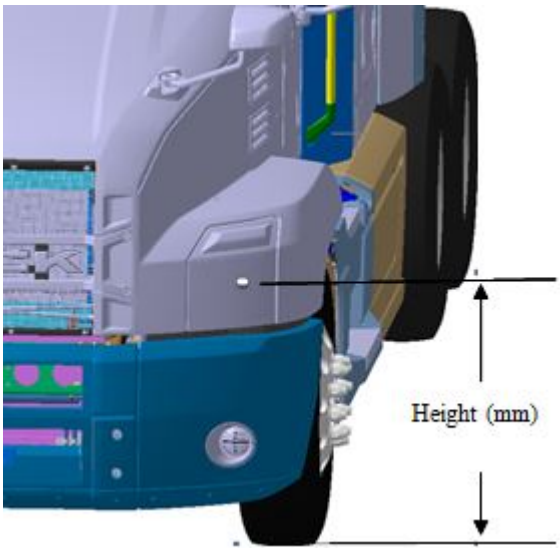
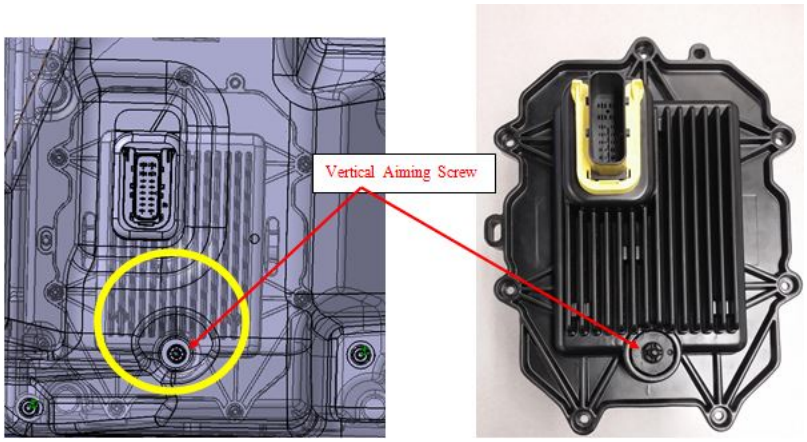


CXU Headlamp, Ext-Gen5, *with Rear Side Vertical Adjustment*



- 4 mm Hex Driver to be used for Vertical Aiming Feature
- Adjustment range: ±4°
- Vertical Adjustment Torque 2.75 Nm ±0.5 Nm
- Turning the aiming stud (found at the back of the lamp near the bottom of the black aluminum casting) clockwise will raise the headlamp, turning it counter-clockwise will lower the headlamp.
- **Do nr / r se power tools for adjustment.**

Tags k12085646 mack

For more information refer to Operation 3520-05-03-01 found in Impact.

Live UI

Related links and attachments

Operation 3520-05-03-01

Feedback

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to help improve the content of this article

Live UI

SURFACE VEHICLE STANDARD

J599™ NOV2015

Issued 1981-05
Revised 2015-11

Superseding J599 AUG1997

(R) Lighting Inspection Code

RATIONALE

This Standard has been fully revised to include improved visual/optical aim requirements, restructured to improve flow, understanding and usability. Additionally, all graphics were updated.

SAE J599 has been the primary reference document for headlamp and fog lamp aim information for many years. Last revised in 1997, it was due for reconsideration in 2002. Revisions to FMVSS-108 which allowed an alternative beam pattern, specifically Visual Optical Aim (VOA) type headlamps, made SAE J599 obsolete just a year after its publication, however

The allowance for VOA was intended to improve the consistency and repeatability of headlamp aim. With the traditional SAE beam pattern, proper aiming was difficult if no aiming equipment was available to use. The visual techniques outlined in SAE J599 were certainly adequate, but the attributes of the beam patterns and the difficulties of obtaining a totally dark environment when on a level surface limited repeatability significantly. The more distinct cutoff of a VOA pattern greatly enhances repeatability and theoretically will reduce the chance of misaim.

The differences between VOA beam patterns and traditional SAE beam patterns is substantial, however, and the procedures outlined in the 1997 version of J599 simply cannot be applied to VOA lamps. The American Association of Motor Vehicle Administrators (AAMVA) apparently recognized this fact after updating their Vehicle Inspection Handbook for 1999. They issued a memorandum to clarify how VOA lamps should be inspected and to what audit criteria they should be held. Their proposals were basically modifications on the existing J599. Unfortunately, the tolerances used by the AAMVA did not necessarily mesh with all VOA beam patterns, especially for horizontal aim inspection. This revision addressed these disparities by balancing the NHTSA rulemaking with the existing SAE J599 and the AAMVA memorandum.

The result was the deletion of the requirement to audit horizontal aim. In some ways, this seems extreme in that it theoretically allows lamps to be misaimed horizontally by an outrageous amount (say 20°). In fact, however, there is no disputing that “no requirement” is the only requirement which we can make. Since the VOA beam patterns in the USA are not required to have a visual cue for horizontal aim, there is no way to determine where such a lamp is aimed. Furthermore, if for some reason there is a visual cue in the pattern, it is not necessary for that cue to be at the VV line of the beam pattern. The “elbow”, “kink” or “z-step” in the pattern could be to the left or right of VV by design, as long as the lamp still meets the requirements of FMVSS-108.

In addition to addressing the advent of VOA headlamps, some other updates were made. All of the definitions were reexamined based on all existing SAE documents. Only those definitions unique to this document are retained. Throughout the document, some sentences were reworded and/or paragraphs were realigned to help clarify their intent. This was done with the hopes that individuals who are not familiar with automotive lighting would still be able to properly perform the aiming or aim inspection processes.

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TABLE OF CONTENTS

1. SCOPE

This code is intended only for the inspection and maintenance of lighting equipment on motor vehicles that are in use.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J387 Terminology - Motor Vehicle Lighting

SAE J581 Auxiliary High Beam Lamps

SAE J583 Front Fog Lamp

SAE J600 Headlamp Aim Test Machines

SAE J602 Headlamp Aiming Device for Mechanically Aimable Headlamp Units

SAE J2338 Recommendations of the SAE Task Force on Headlamp Mounting Height

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1383 Performance Requirements for Motor Vehicle Headlamps

SAE J1735 Harmonized Vehicle Headlamp Performance Requirements

2.2.2 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/

ANSI D7-1939 American National Standard Code for Inspection Requirements for Motor Vehicles

2.2.3 AAMVA Publications

Available from American Association of Motor Vehicle Administrators, 4301 Wilson Blvd. Suite 400, Arlington, VA 22203, Tel:703-522-4200, www.aamva.org.

Vehicle Inspection Handbook – Passenger Vehicles and Light Trucks

Vehicle Inspection Handbook –Trucks, Busses and Trailers

3. DEFINITIONS (SEE ALSO SAE J387 TERMINOLOGY-MOTOR VEHCILE LIGHTING)

3.1 GRADIENT

An objective measure of the light/dark boundary (cutoff) at the top of the light pattern produced by a low beam lamp.

3.2 VISUAL/OPTICAL AIMING

Terminology and markings used on headlamps in the USA and Canada which denote that a headlamp is to be aimed by visual or optical methods to an aiming screen or prepared wall.

3.2.1 VO (Visual/Optical)

Lens marking indicating a high beam lamp that is to be aimed by the center of its high intensity zone along its axis parallel to ground.

3.2.2 VOR (Visual/Optical – Right)

Lens marking indicating a low beam lamp that is to be aimed by using the cutoff gradient feature to the top, right side of the beam.

3.2.3 VOL (Visual/Optical –Left)

Lens marking indicating a low beam lamp that is to be aimed by using the cutoff gradient feature to the top, left side of the beam.

3.3 HIGH INTENSITY ZONE

The brightest observable portion of a beam pattern viewed on an aiming screen or wall. This hot spot is typically located at or near the center of the beam and may not be readily observable in all beam patterns.

3.4 VEHICLE HEADLAMP AIMING DEVICE (VHAD)

An aiming device such as a spirit level or calibrated scale and pointer, incorporated in a mechanically aimed headlamp system which allows for inspection and adjustment of headlamp aim in both vertical and horizontal axes without the use of equipment external to the vehicle.

4. GENERAL LAMP INSPECTION OTHER THAN HEADLAMP/FOG LAMP AIM

This includes the following types of lamps: headlamp, tail lamp, stop lamp, license plate illumination, clearance lamps, position (parking) lamps, turn signal lamps, marker lamps, reflex reflectors, and fog lamps.

4.1 General Lamp Inspection

Any of the following defects shall be cause for rejection.

4.1.1 Any light source in any lamp which fails to function properly.

4.1.2 An improperly connected circuit which does not light the proper light sources for the different switch positions.

4.1.3 A cracked, broken or missing lens.

4.1.4 A lens that is rotated, upside down, wrong side out, or is otherwise incorrectly installed. A lens marked “left” or “right”, not appropriately installed.

4.1.5 A separate type lens, the name of which does not correspond with the name stamped on the lamp body, unless specifically approved for use with that lamp body.

5. HEADLAMP AND FOG LAMP AIM SETUP FOR INSPECTION OR ADJUSTMENT

5.1 Equipment

All headlamp aim can be inspected and adjusted by visual means, either on a wall or screen located at a distance of 7.6 m (25 ft) ahead of the headlamps or on the view screen of an optical headlamp aiming machine. It is recommended, however, that mechanically aimable headlamps having raised aiming pads or features be inspected or adjusted for aim by mechanical aimers.

5.1.1 A mechanical aimer used shall conform to the requirements of SAE J602. The device shall be in good repair, calibrated, and used according to the manufacturer's instructions.

5.1.2 An aiming wall or screen should be of adequate size with a matte-white surface well shaded from extraneous light. It shall be properly adjusted to the floor area on which the vehicle stands. Provisions should be made for moving the screen (or its vertical centerline) so that it can be aligned with the vehicle axis. In addition to the vertical centerline, the screen should be provided with four laterally adjustable vertical tapes and two vertically adjustable horizontal tapes. The four movable vertical tapes should be located on the screen at the left and right limits called for in the specification with reference to centerlines ahead of each headlamp unit. The headlamp centerlines shall be spaced to either side of the fixed screen's vertical centerline on the screen by ½ the lateral distance between the light source centers of the pertinent headlamps. The horizontal tapes should be located on the screen at the upper and lower limits called for in the specifications with reference to the height of lamp centers and the plane on which the vehicle rests, not the floor on which the screen rests. See Figure 1.

5.1.3 A headlamp testing machine shall conform to the requirements of SAE J600. The device shall be in good repair, calibrated, and used according to the manufacturer's instructions. It shall use a confirmed algorithm for properly aiming VO, VOR and/or VOL headlamps – this type of machine should be used only for these types of headlamps.

5.2 Vehicle Preparation for Aim Inspection or Aim Adjustment

Before aim inspection or adjustment, the inspector shall:

5.2.1 Remove ice or mud from under fenders.

5.2.2 Set tire inflation pressures to the values specified on the vehicle tire information label or tire sidewall.

5.2.3 Check car springs for sag or broken leaves and suggest repair if required.

5.2.4 See that there is no load in the vehicle other than the driver (or appropriately placed equivalent ballast of 75 kg (165 lbs), fluids at full level, spare tire, tools and jack.

5.2.5 Check functioning of any automatic vehicle leveling systems and specific manufacturer's instructions pertaining to vehicle preparation for headlamp aiming. Suggest repair if required.

5.2.6 Clean lenses and if applicable, headlamp aiming pads.

5.2.7 Check for burnout of light source, broken aiming pads, and proper beam switching. Suggest repair if required.

5.2.8 Check if the vehicle has an automatic or manually adjusted headlamp aim leveling system. For a manual aim leveling, set the switch to position zero (0).

5.2.9 Place vehicle on a flat and level surface.

5.2.10 Stabilize suspension by rocking vehicle sideways.

5.2.11 After the suspension stabilization, measure the vertical height of the optical center of the headlamp's low beam light source and/or reference mark from the ground. This dimension will be required for comparison to Table 1, Table 2 or Table 3.

5.2.12 Mechanically aimable headlamps shall be "OFF" whenever mechanical aiming devices are attached to the aiming pads or features.

5.2.13 Review vehicle Owner's Manual for any headlamp aiming requirements that supersede those included in this standard.

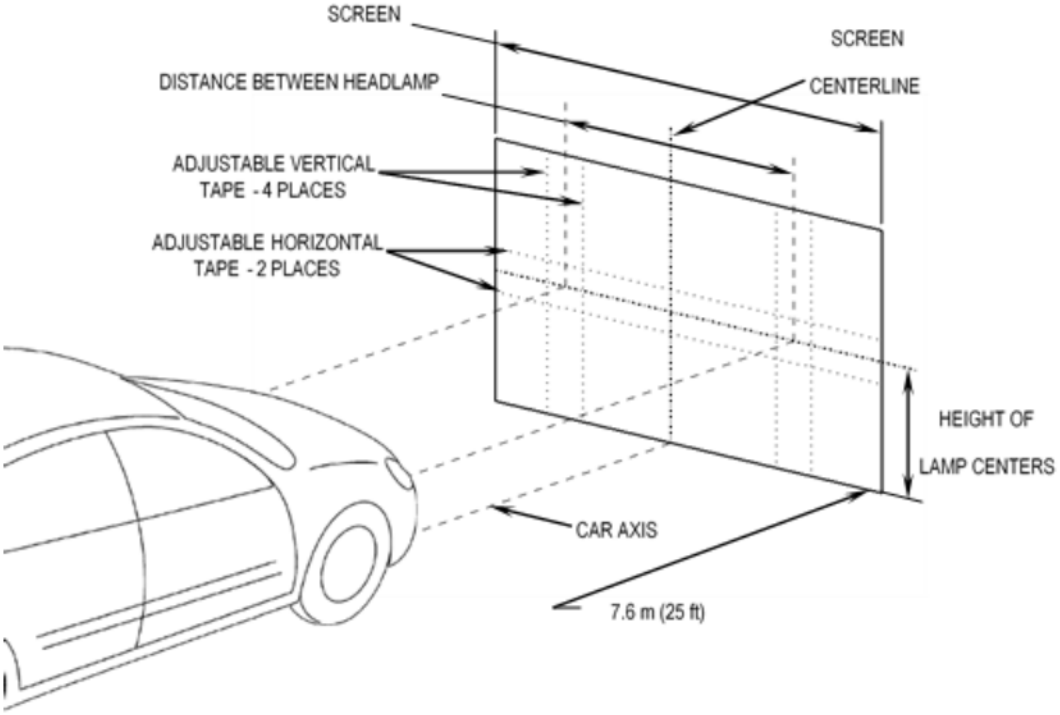

Figure 1 - Alignment of headlamp aiming screen

6. HEADLAMP AND FOG LAMP AIM INSPECTION LIMITS FOR VEHICLE INSPECTION FACILITIES

Complete the General Inspection and Aim Setup as defined in Section 4 and 5 respectively.

The following inspection limits apply to stations that conduct mandatory inspection of vehicles. Failure to meet the limits stated herein shall be cause for rejection.

6.1 Mechanically Aimed Lamps

6.1.1 It is recommended that mechanically aimable lamps be inspected using mechanical aimers (5.1.1). The aimers shall be calibrated for accuracy and shall be adjusted to provide compensation for the level slope of the floor in the aiming inspection area.

6.1.2 Vertical Aim Inspection Limits

Table 1 - Mechanical aim headlamp vertical low beam aim criteria

Case	Headlamp Mounting Height (**H**)	Nominal Vertical Aim Offset Below **H** ($\mathbf{H_o}$)	Vertical Aim Inspection Limits From Nominal Vertical Aim
1	56 to 90 cm (22 to 36 in)	No Offset	100 mm (4 in) Up to 100 mm (4 in) Down
2	90 to 120 cm (36 to 48 in)	50 mm (2 in) Below **H**	50 mm (2 in) Up to 150 mm (6 in) Down
3	120 to 140 cm (48 to 54 in)	64 mm (4 in) Below **H**	40 mm (1.5 in) Up to 165 mm (6.5 in) Down

6.1.3 Inspection Using Mechanical Aimers

6.1.3.1 The mechanical inspection limits for a high beam headlamp aimed independently of a low beam shall be 100 mm (4 in) up to 100 mm (4 in) down and 100 mm (4 in) left to 100 mm (4 in) right.

6.1.3.2 The mechanical aim inspection limits for the low beam headlamp or the low beam of dual-beam headlamp shall be 100 mm (4 in) left to 100 mm (4 in) right. The vertical aim inspection limits are given in 6.1.2 based on the height of the vertical center of the headlamp from the ground (Case 1 shown in Table 1).

6.1.4 Inspection Using Visual Method or Optical Aim Testing Machines

6.1.4.1 The inspection limits for a high beam headlamp aimed independently of a low beam shall be with the center of the high-intensity zone from 100 mm (4 in) up to 100 mm (4 in) down; and, from 100 mm (4 in) left to 100 mm (4 in) right of the vertical centerline of the lamp. (See Figure 2).

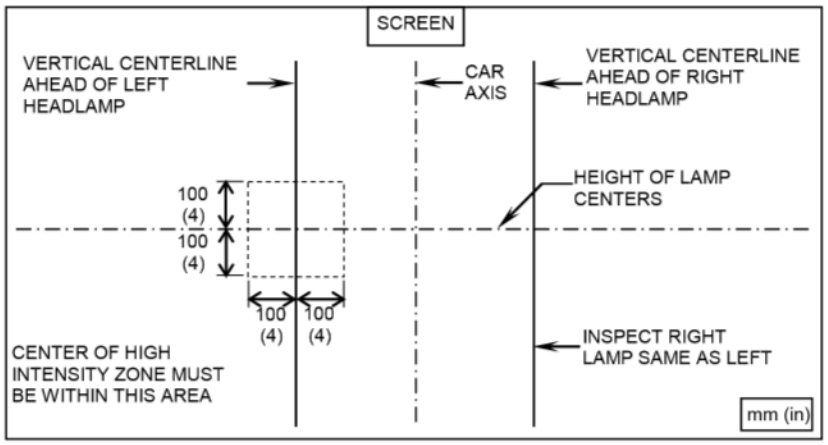

Figure 2 - Aim inspection limits for high beam headlamps

6.1.4.2 The inspection limits in the vertical direction for low beam headlamps or the low beam of a dual-beam headlamp, shall be as described in Table 1. In the horizontal direction, the left edge of the high-intensity zone shall be located from 100 mm (4 in) left to 100 mm (4 in) right of the vertical centerline of the lamp. (See Figure 3, Case 1 shown from Table 1).

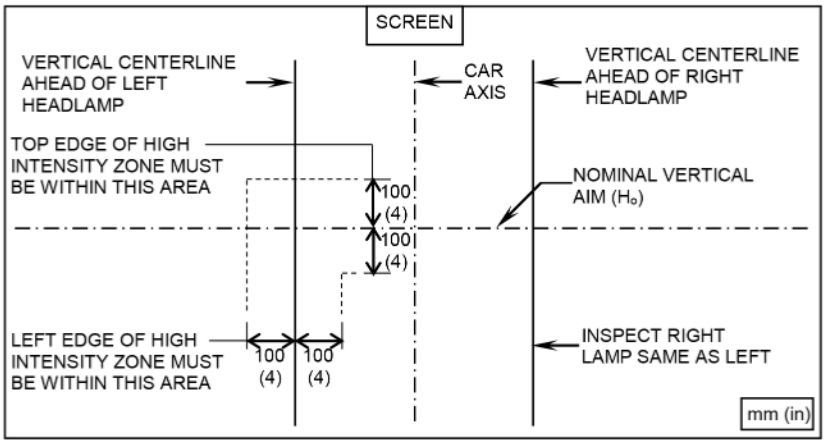

Figure 3 - Aim inspection limits for low beam headlamps which are not VOR or VOL

6.1.4.3 The visual inspection limits for symmetrical beam fog lamps installed with universal mounting applications, shall be with the top edge of the high intensity zone at horizontal or below and with the center of the high-intensity zone from 100 mm (4 in) left to 100 mm (4 in) right of the vertical centerline of the lamp. (See Figure 4).

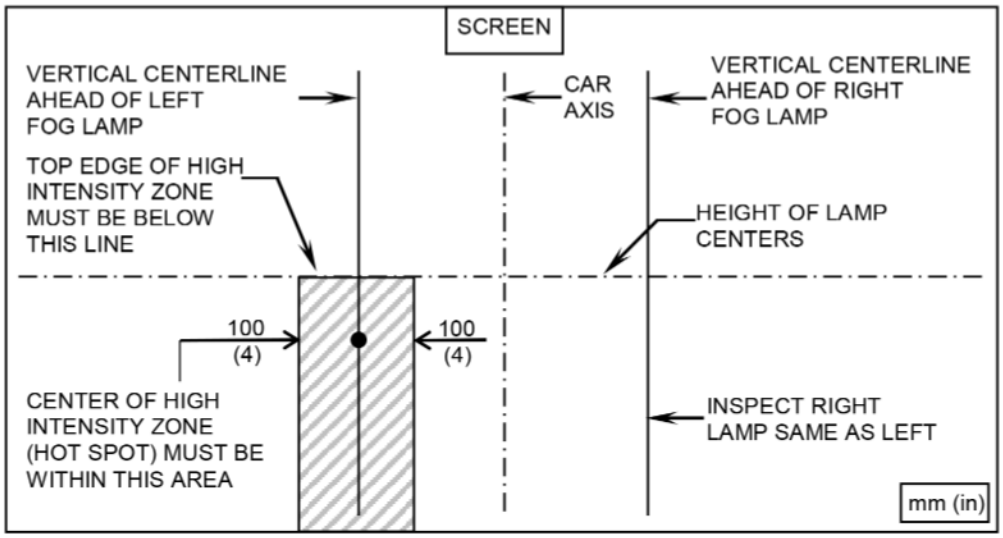

Figure 4 - Aim inspection limits for a symmetrical fog lamp beam (universal mounting application)

6.1.4.4 The visual inspection limits for symmetrical beam fog lamps, which are designed to be integrated into one specific vehicle, shall be with the top edge of the high-intensity zone at or below the horizontal plane of the lamp. (See Figure 5.)

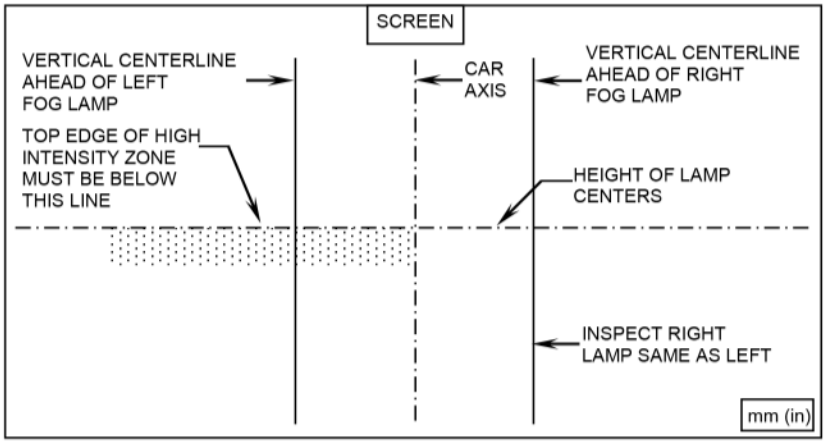

Figure 5 – Aim inspection limits for a symmetrical fog lamp beam (integrated mounting application)

6.2 Visual/Optical Aimed Lamps

6.2.1 Vertical Aim Inspection Limits

Table 2 - VO/VOR/VOL headlamp vertical low beam aim criteria

Case	Headlamp Mounting Height (**H**)	Nominal Vertical Aim Offset Below **H** ($\mathbf{H_o}$)	Vertical Aim Inspection Limits
1	56 to 90 cm (22 to 36 in)	No Offset	50 mm (2 in) Up to 75 mm (3 in) Down
2	90 to 120 cm (36 to 48 in)	50 mm (2 in) Below **H**	25 mm (1 in) Up to 100 mm (4 in) Down
3	120 to 140 cm (48 to 54 in)	64 mm (4 in) Below **H**	20 mm (0.75 in) Up to 105 mm (4.25 in) Down

6.2.1.1 The inspection limits for a VO high beam headlamp aimed independently of a low beam shall be with the center of the high-intensity zone from 100 mm (4 in) up to 100 mm (4 in) down; and, from 100 mm (4 in) left to 100 mm (4 in) right of the vertical centerline of the lamp. (See Figure 6).

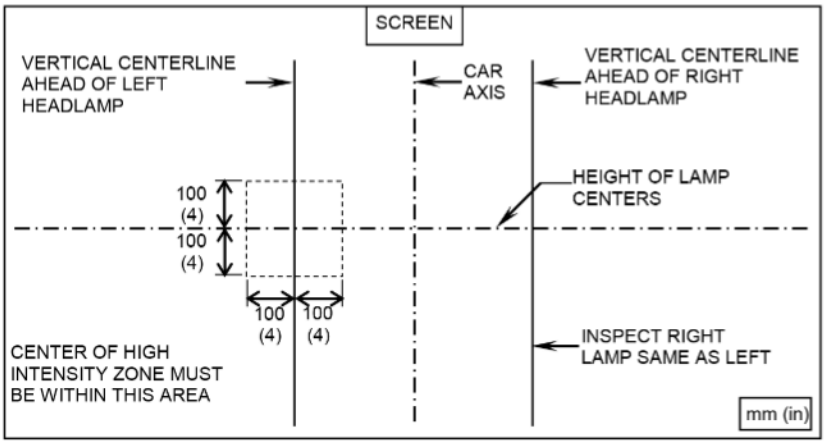

Figure 6 - Aim inspection limits for high beam headlamps

6.2.1.2 The inspection limits in the vertical direction for a VOR low beam headlamp shall be as described in Table 2. (See Figure 7, Case 1 shown from Table 2)

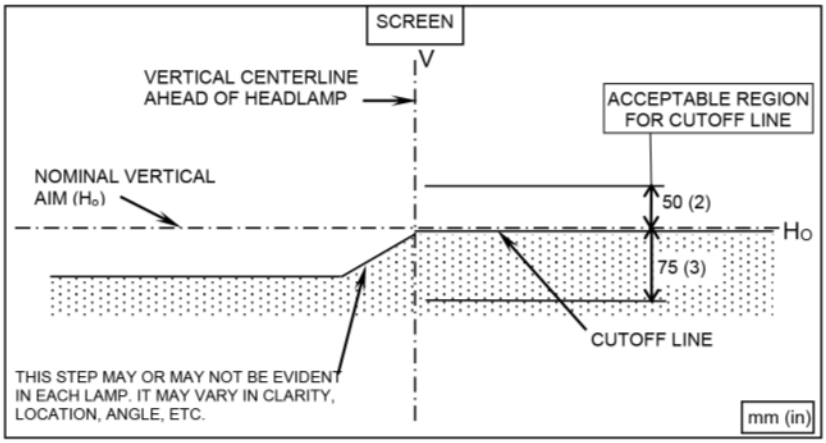

Figure 7 - Aim inspection limits for a VOR low beam

6.2.1.3 The inspection limits in the vertical direction for a VOL low beam headlamp shall be as described in Table 2. Note: VOL beam patterns may have cutoff lines similar to Figure 8a or 8b (See Figure 8a or 8b, Case 1 shown from Table 2)

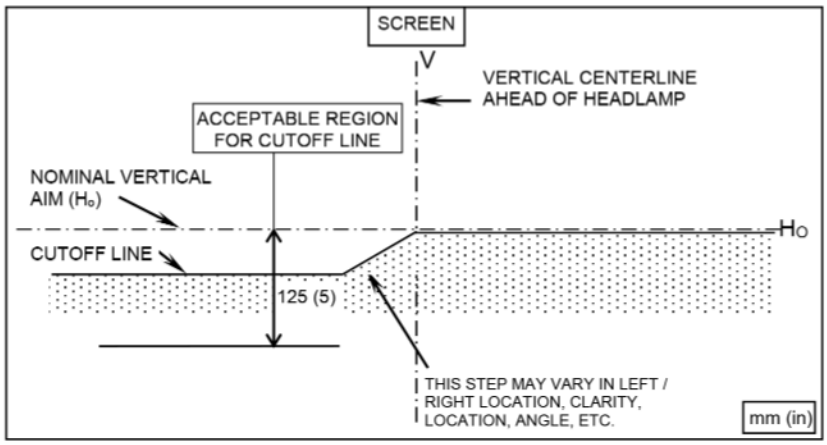

Figure 8A - Aim inspection limits for a VOL low beam

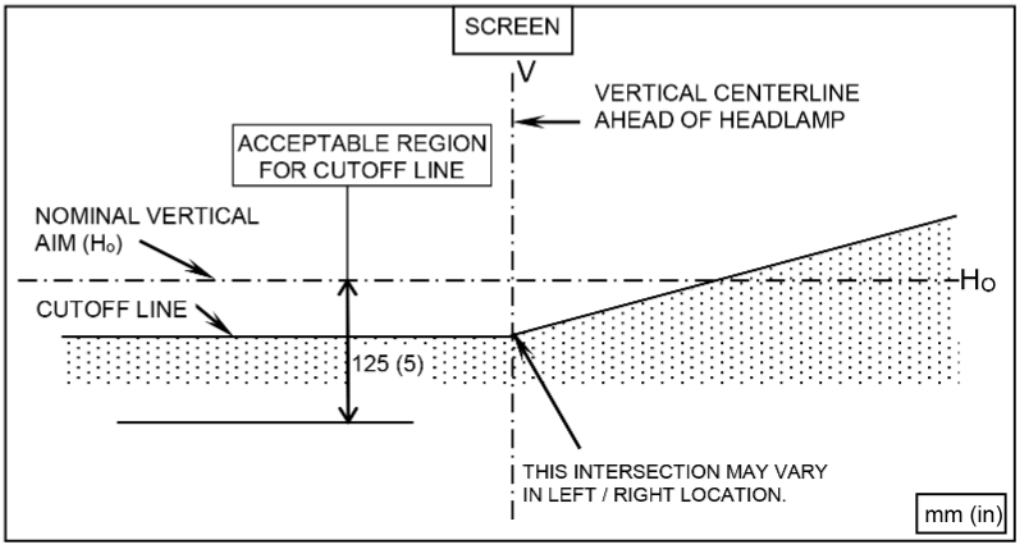

Figure 8B - Aim inspection limits for a VOL low beam

7. AIM ADJUSTMENT FOR VEHICLE SERVICE FACILITIES

The following aim adjustment requirements are to be followed by dealers, service stations, and others who do headlamp and fog lamp aim adjustment.

Complete the Aiming Setup as defined in Section 5.

It is recommended that mechanically aimable headlamps be aimed using mechanical aimers (5.1.1). The aimers shall be calibrated for accuracy and shall be adjusted to provide compensated compensation for the slope of the floor in the aiming area.

Table 3 - Headlamp vertical low beam aim criteria

Case	Headlamp Mounting Height (**H**)	Nominal Vertical Aim Offset Below **H** ($\mathbf{H_o}$)
1	56 to 90 cm (22 to 36 in)	No Offset
2	90 to 120 cm (36 to 48 in)	50 mm (2 in) Below **H**
3	120 to 140 cm (48 to 54 in)	64 mm (4 in) Below **H**

7.1 Mechanical Aim Lamps

7.1.1 If a high beam headlamp is aimed independently of a low beam lamp, its correct aim shall be 0-0 regardless of its height from the ground.

7.1.2 The correct nominal vertical aim of a low beam headlamp, or of a headlamp which combines the aiming of the low and high beams, is defined in Table 3.

7.1.3 Vehicle headlamps incorporating VHADs are to be aimed per the manufacturer's instructions.

7.2 Visual/Optical Aimed Lamps

7.2.1 If a high beam headlamp is aimed independently of the low beam, or is labeled "VO" on its lens, its correct aim is such that the center of the high intensity zone is located at the horizontal and straight ahead vertically. See Figure 9.

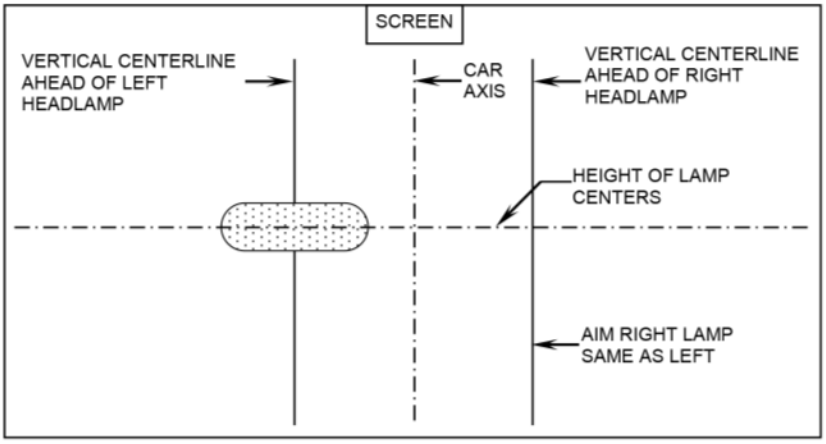

Figure 9 - High intensity zone location (shaded area) of a properly aimed high beam

7.2.2 The correct aim of a low beam headlamp, or of a headlamp which combines the aiming of the low and high beams, is defined per one of the following conditions:

7.2.2.1 Lamps which are labeled "VOR" on the lens are aimed using the horizontal cutoff line (usually the top edge of the high intensity zone) just to the right of the headlamp's vertical centerline. The correct aim is such that the cutoff is located per the nominal aim location defined in Table 3, see Figure 10. Although the overall shape of the beam pattern may vary from that shown in Figure 10, the portion used for setting the vertical aim will be primarily flat in nature as shown in that schematic. Lamps labeled "VOR" may or may not be equipped with means for horizontal adjustment. If horizontal adjustment capability is provided, it should be set per the manufacturer's instructions.

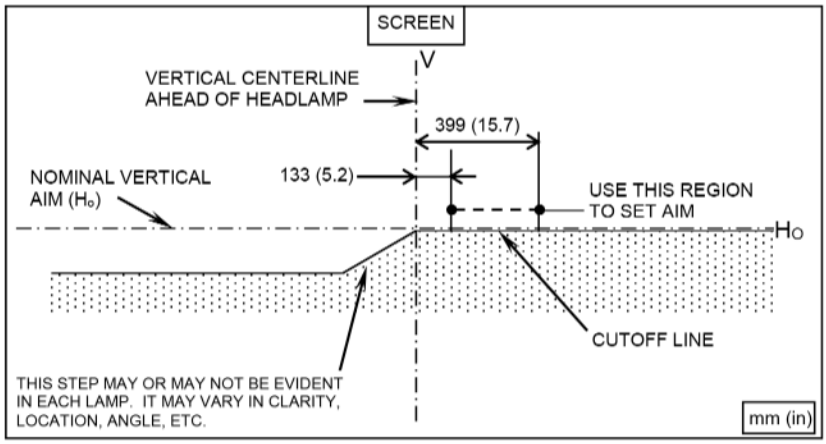

Figure 10 - Cutoff line location of a properly aimed VOR low beam

7.2.2.2 Lamps which are labeled "VOL" on the lens are aimed using the horizontal cutoff line (usually the top edge of the high intensity zone) just to the left of the headlamp's vertical centerline. The correct aim is such that the cutoff is located 53 mm (2.1 in) below the nominal aim location defined in Table 3; see Figures 11a and 11b (Case 1 shown from Table 3), which show two different general shapes of the overall beam pattern. Although the overall shape of the beam pattern may vary from that shown in Figure 11a or Figure 11b, the portion used for setting the vertical aim will be primarily flat in nature as shown in those schematics. Lamps labeled "VOL" may or may not be equipped with means for horizontal adjustment. If horizontal adjustment capability is provided, it should be set per the manufacturer's instructions. Lamps which meet CMVSS 108.1 (or have an "E" Marking) may also be aimed to "VOL" requirements, generally to Figure 11b.

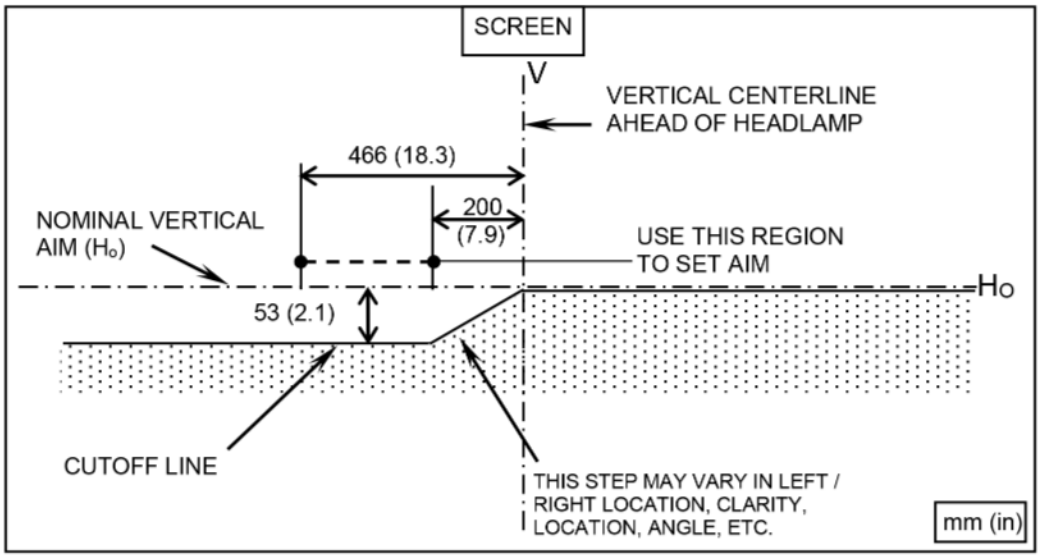

Figure 11A - Cutoff line location of a properly aimed VOL low beam

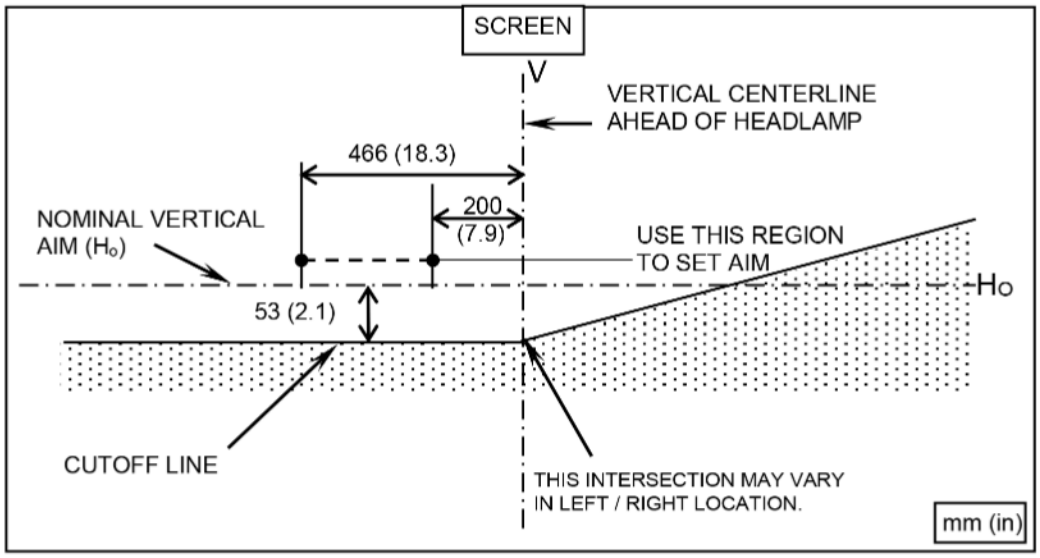

Figure 11B - Cutoff line location of a properly aimed VOL low beam

7.2.2.3 Lamps which are not labeled "VOR" or "VOL" are aimed based on the shape of the beam pattern when shone on an aiming screen. Lamps which use HB2 bulbs for the low beam are aimed per Section 7.2.2.2 above. The code HB2 will be on the outer lens of this type of headlamp. Other lamps are to be aimed vertically so that the top edge (the cutoff) of the high intensity zone just to the right of the headlamp's vertical centerline is located per the nominal aim location defined in Table 2. The correct horizontal aim is such that the left edge of the high-intensity zone is at the vertical centerline of the headlamp (see Figure 12).

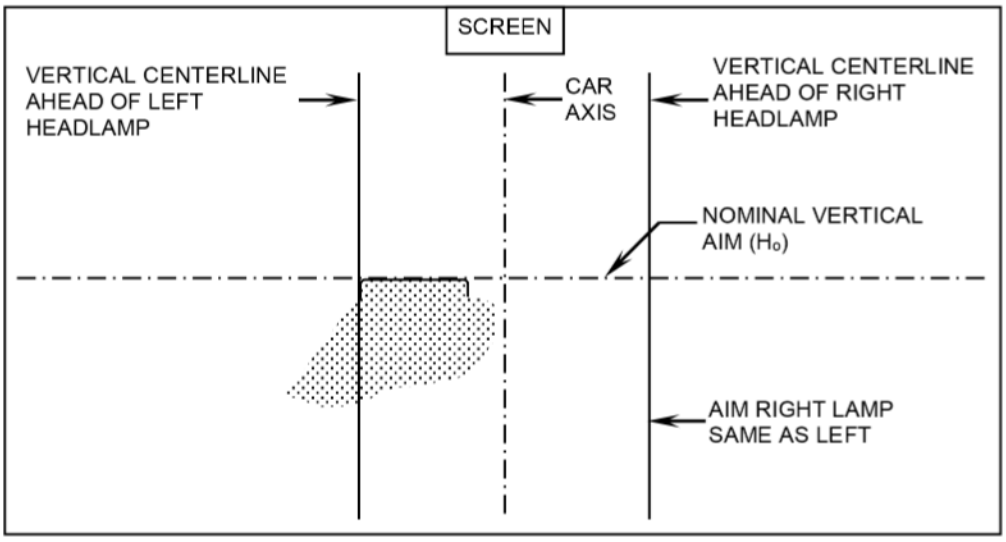

Figure 12 - High intensity zone location (shaded area) of a properly aimed low beam which is not a VOR or VOL

7.2.3 Headlamp Testing Machine Aiming (For VO, VOR and VOL labeled lamps only)

7.2.3.1 The headlamp testing machine should be used per the machine's manufacturer's instructions.

7.2.3.2 Care must be taken that the correct aiming algorithm is selected depending on if the lamp is of the VO, VOR or VOL type.

7.3 Fog Lamp Aim

7.3.1 Aim Adjustment for Service Facilities - Symmetrical Beams

7.3.1.1 The correct visual aim for fog lamps with (symmetrical beams) (SAE J583) is with the top edge of the high-intensity zone 10 cm (4 in) below horizontal and the center of the high-intensity zone vertically centered. (See Figure 13)

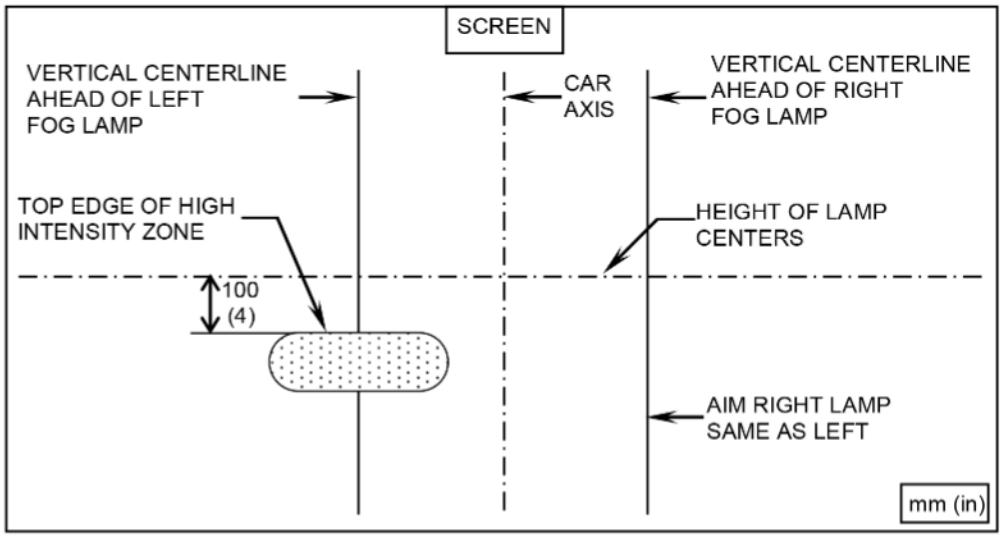

Figure 13 - High intensity zone location (shaded area) of a properly aimed symmetrical fog lamp beam

7.3.1.2 Aim Adjustment and Inspection Limits for Fog Lamps with asymmetrical beams shall be the same as for low beam headlamps. See Section 6.1.4.2 for Inspection and Section 7.2.2.3 for Adjustment.

8. NOTES

8.1 Marginal Indicia

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY THE SAE ROAD ILLUMINATION DEVICES STANDARDS COMMITTEE

APPENDIX A - HUMAN FACTORS EVALUATION

A.1 THE FOREGOING DOCUMENT WAS EVALUATED FROM THE STANDPOINT OF HUMAN FACTORS:

A.1.1 Obstacle Detection

It was noted that there was a slight detection loss when extremely high-mounted headlamps are aimed down based on theoretical (CHESS) modeling. The SAE committee took this information into account in coming to a conclusion.

A.1.2 Field Studies

Field tests were conducted on September 16, 1996 in Chelsea., MI, the glare of high-mounted headlamps compared to passenger car headlamps was studied as a means of determining equivalence.

NOTE: See also: Recommendations of the SAE Task Force on Headlamp Mounting Height, SAE J2338.