

Headlamp-Turn Signal Spacing —SAE J1221

SAE Information Report
Approved March 1978

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Report of Lighting Committee approved March 1978.

1. **Scope**—This information report is being issued to cover the principles and practical problems involved in locating automotive front turn signals with respect to the headlamp unit which contains the low beam; it also records testing and results obtained, which led to new criteria for turn signal location.

2. **Background**—For a substantial period of time, SAE J588, Turn Signal Lamps, has provided that, "The optical axis (filament center) of the front turn signal shall be at least 4 in from the inside diameter of the retaining ring of the headlamp unit providing the lower beam." More recently it was recognized that the 4 in requirement could realistically be waived if the turn signal intensity values were at least 2.5 times the otherwise required minimum output. Significant in the foregoing is the fact that optical center and filament center were said to be the same. As long as lamp bulbs were located in the centers of lamps, use of the filament center for the 4 in measurement was convenient and valid. See Fig. 1A. With the increase in bumper size, decrease in front end area, etc., on some car models, a practice was instituted to place the bulb toward one end of the lamp occasionally but to continue to measure off the 4 in requirement to the filament center. See Fig. 1B. Since, in such cases, the optical center had shifted, measurement to the filament center continued to be legal but did not provide for the same lamp performance. To further complicate the situation, dimensional limitations, in many cases, made it extremely difficult to provide a large enough turn signal lamp to produce at least 2.5 times the minimum requirements. Both functional and practical problems, therefore, were in need of better handling.

Early attempts to redefine the optical center included measurement of the unobstructed lamp output at H-V and then moving an opaque shield across the lamp face until the H-V output was reduced to 50% of the original value. Field tests of turn signal lamp performance established the validity of this procedure for determining the point (or line) to be used for the 4 in measurement. Lamp performance, so viewed, became relatively independent of the bulb placement. This method was not adopted, however, since it could only be used after completion of design and tooling. What was needed was a method for determining optical center reasonably closely when the vehicle and lamp were still in the design stage.

3. **Establishment of Method**—Outdoor tests were run on November 1, 1977 which proved the realism of using the geometric centroid of the turn signal lens as the point from which the measurement to the low beam headlamp unit should be made. Test equipment and procedures used are covered in detail in the Appendix to this information report.

4. **Test Results**—Based upon recognition distance equivalent to that of a lamp whose centroid is 4 in away from the inside edge of the retaining ring of the headlamp unit containing the lower beam, measurement standards are as follows:

4.1 Lamps whose centroids are 4 in (100 mm) or more from the lower beam unit must produce at least the minimum intensity values listed in SAE J588.¹

4.2 Lamps whose centroids are 3 in (75 mm) and less than 4 in (100 mm) from the lower beam unit must produce at least 1.5 times the minimum intensity values listed in SAE J588.²

4.3 Lamps whose centroids are 2.5 in (60 mm) and less than 3 in (75 mm) from the lower beam unit must produce at least 2 times the minimum intensity values listed in SAE J588.²

4.4 Spacing requirements are waived for those lamps which produce at least 2.5 times the minimum intensity values listed in SAE J588.¹

5. **Examples of Measurements**—The illustrations in Fig. 2 show common examples of headlamp-turn signal relative locations. Since all possible con-

figurations cannot be shown, administration of the measurement requirement should be conducted with reason rather than as a narrow, mathematical exercise. In Fig. 2E, for example, a common lamp construction is shown which illustrates the use of direct filament light for cosmetic purposes. Since the principal mass of light is that coming from the reflector, the centroid should be located on the lens with respect to the effective projected reflector area. Tests on a typical lamp having this type construction have verified this concept by showing that only 5–8% of the total light comes from that portion of the lens (the cosmetic portion) that is outside of the projected reflector area. Although not shown in Fig. 2, measurements have also indicated the validity of measuring from the lower beam headlamp unit to a point on the lens which is directly in front of the bulb filament, in the case of a non-reflectorized lamp which has Fresnel optics in the lens. S is used in the Fig. 2 examples to show the spacing to points from which measurement should be made; X marks the centroid locations.

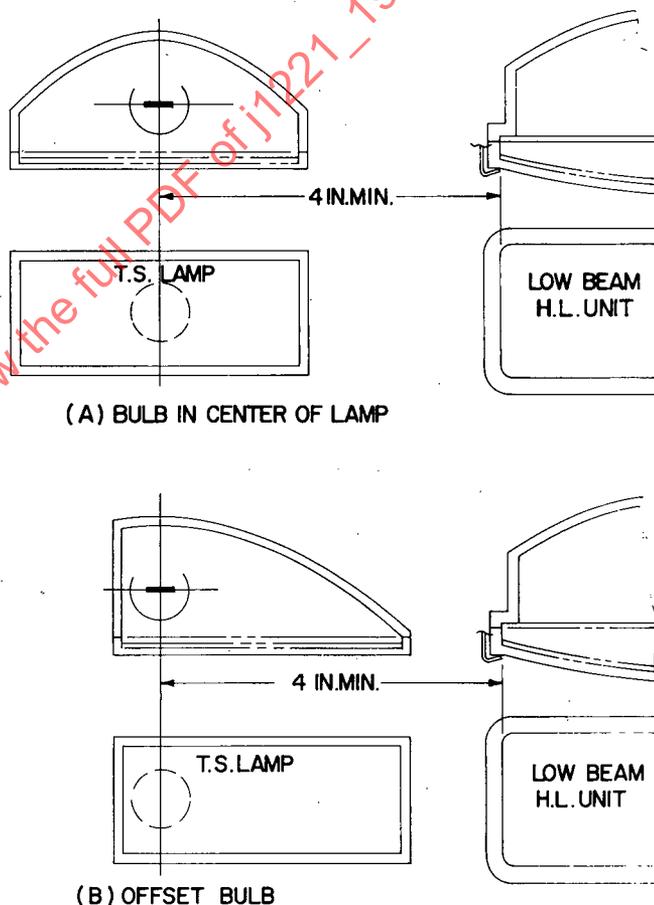
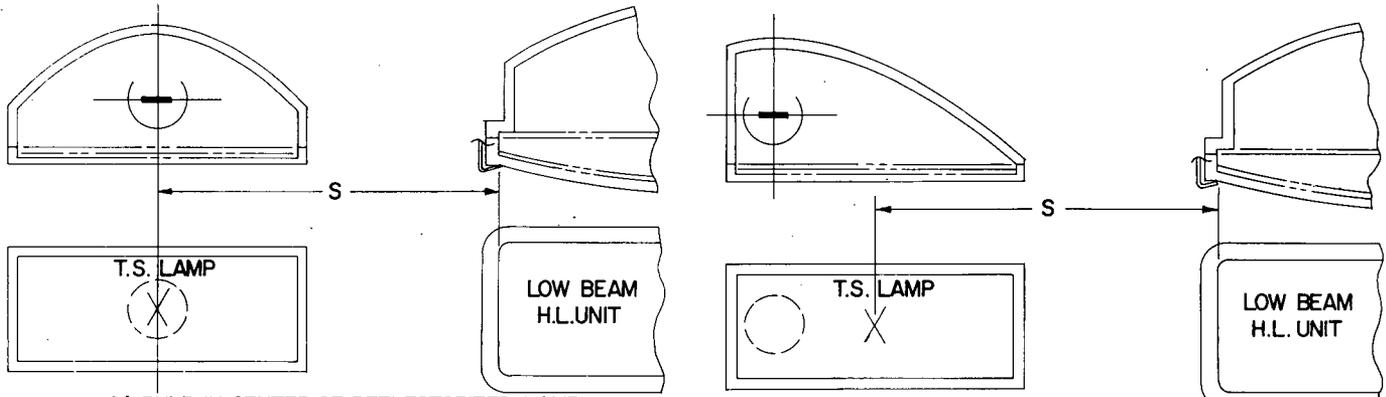


FIG. 1—BULB - HEADLAMP SPACING

¹Already in effect at time of November 1 test.

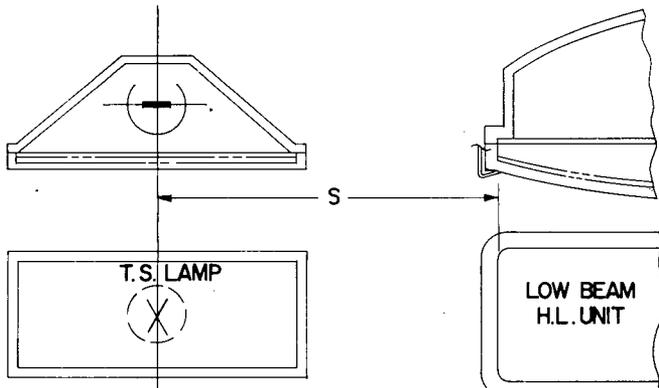
²Additional, optional criteria established by November 1 test.

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

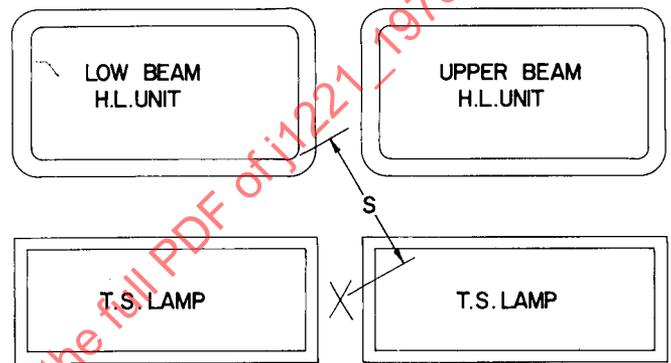


(A) BULB IN CENTER OF REFLECTORIZED LAMP

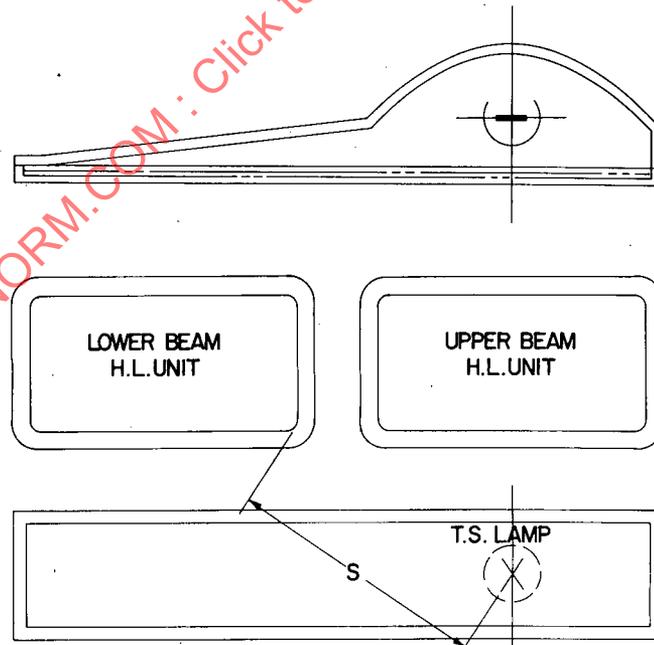
(C) OFFSET BULB



(B) BULB IN CENTER OF NON-REFLECTORIZED LAMP



(D) TWO COMPARTMENT OR TWO LAMP TURN SIGNAL



(E) SINGLE COMPARTMENT BUT WITH PROJECTED REFLECTOR AREA WHICH COVERS ONLY A PORTION OF LENS

FIG. 2—MEASUREMENT EXAMPLES

APPENDIX

FRONT TURN SIGNAL OPTICAL AXIS OBSERVATIONS

A1. Objective—To establish that using the centroid of the lighted portion of the lens designed for the signal function is equivalent to using the 50% H-V point³ on the lens as the optical axis.

A2. Evaluation—Observers will determine the distance from an approaching car that turn signal operation can be identified. The observers will start timing watches as soon as they can clearly identify that the turn signal lamp is flashing, stop the watch as the turn signal lamp passes their station, and record the elapsed time.

A3. Procedure—(A similar type procedure and lamps used in the SAE lighting observations October 27, 1976 will be used for this observation.)

A3.1 The turn signal lamp will be mounted outboard of the Type 2A sealed unit on the left hand side of the test car.

A3.2 All observations will be made with the test car headlamps on low beam and the turn signal lamp flashing continuously at 90 flashes/min with 50% on time.

A3.3 A 4-in spacing between the headlamp and either the centroid of the lens or the 50% H-V point on the lens will be used.

A3.4 The observers will be seated in stationary passenger cars spaced at approximately 300 ft (91 m) intervals, along the two-lane road with the lower beam headlamps illuminating the foreground.

A3.5 The test car will be driven at 20 mph past the observer cars so that all observers will have approximately 600–800 ft (183–244 m) clear view of the test car as it approaches their station.

A4. Test Conditions

A4.1 Yellow turn signal lamps using 1157 NA bulbs will be used at signal intensity of 200 cd uniform within the 10 deg zone.

A4.2 Both symmetrical and offset (non-symmetrical) design lamps shown on the attached sheet will be used. Both lamps are the same physical size having 12 in² of lens surface.

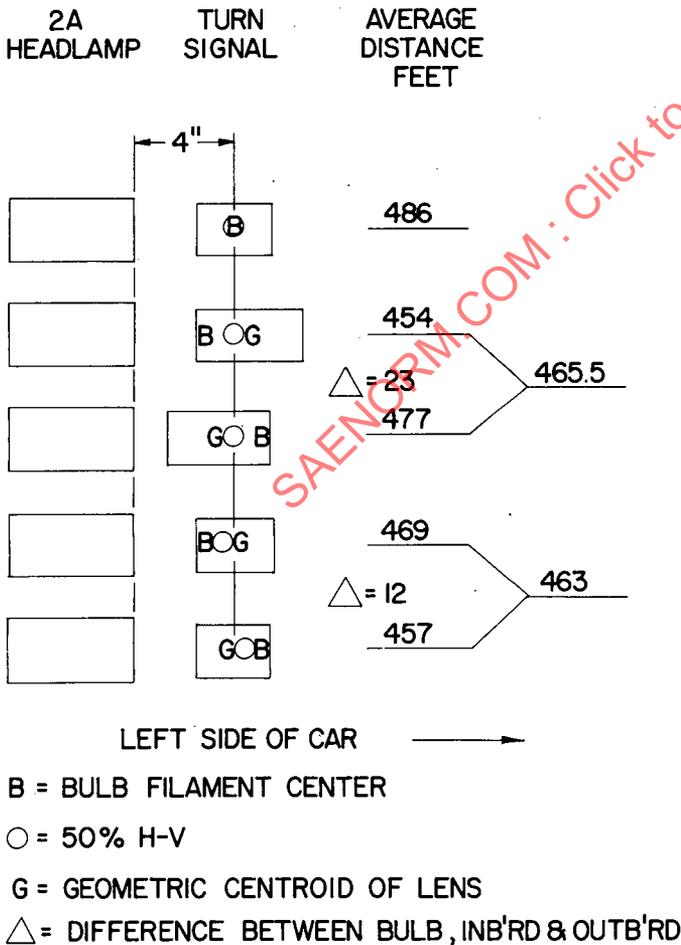
A4.3 All observations will be randomized and each condition will be observed two times during the observation period.

A5. Observation Results—The results of the observations are shown on the following page. These results are the averages of those determined by 34 observers. The evaluation was made on a straight, concrete test road under a moonlit sky, in a calm ambient temperature of approximately 55°F (13°C).

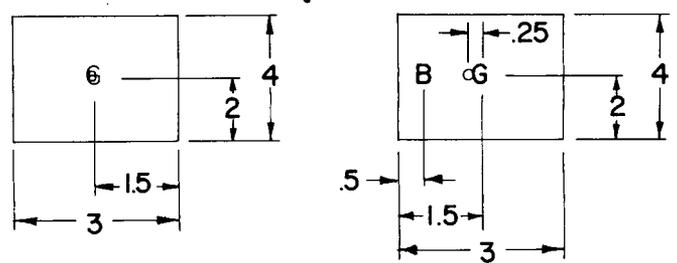
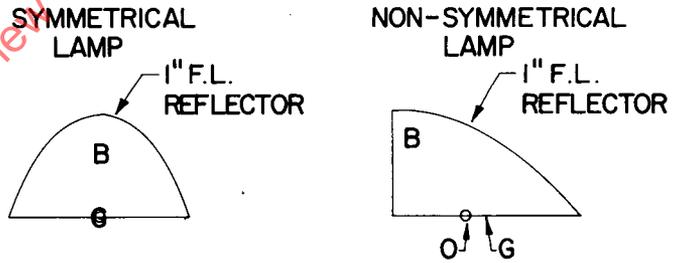
A6. Observation Conclusions—Using the geometric centroid of the lighted portion of the lens designed for the signal function is somewhat better than using the 50% H-V point on the lens, since recognition distances have lesser differences as a function of bulb placement.

³50% H-V point was identified in the second paragraph of Section 2 (Background).

OBSERVATION RESULTS



SIGNAL LAMP CONSTRUCTION



DIMENSIONS IN INCHES

B = BULB FILAMENT AXIS
 O = 50% H-V
 G = GEOMETRIC CENTROID OF LENS

FRONT TURN SIGNAL TO HEADLAMP SPACING OBSERVATIONS

B1. Objective—To determine front turn signal recognition distance relative to spacing and candela output to establish intermediate minimum design candela between the present 200–500 cd requirements relative to spacing between the headlamp and front turn signal.

B2. Evaluation—Observers will determine the distance from an approaching car that turn signal operation can be identified. The observers will start timing watches as soon as they can clearly identify that the turn signal lamp is flashing, stop the watch as the turn signal lamp passes their station, and record the elapsed time.

B3. Procedure—(A similar type procedure and lamps used in the SAE lighting observations October 27, 1976 will be used for this observation.)

B3.1 The turn signal lamp will be mounted outboard of the Type 2A sealed unit on the left hand side of the test car.

B3.2 All observations will be made with the test car headlamps on low beam and the turn signal lamp flashing continuously at 90 flashes/min with 50% on time.

B3.3 The spacing of the turn signal lamp to the headlamp will be varied.

B3.4 The observers will be seated in stationary passenger cars spaced at approximately 300 ft intervals, along the two lane road with the lower beam headlamps illuminating the foreground.

B3.5 The test car will be driven at 20 mph past the observer cars so that all observers will have approximately 600–800 ft clear view of the test car as it approaches their station.

B4. Test Conditions

B4.1 A yellow turn signal lamp of the Symmetrical Design shown on the attached sheet using an 1157 NA bulb will be used at signal intensities of 200, 300, and 400 cd uniform within the 10 deg zone.

B4.2 Spacing of the signal lamp to the headlamp—2.5, 2.75, 3.0, and 3.5 in for 300 cd and 400 cd observations, and 4 in for the 200 cd observations.

B4.3 All observations will be randomized and each condition will be observed twice during the observation period.

B5. Observation Results—The average findings of 34 observers are shown on the following page. The evaluation was made on the straight concrete test road under a moonlit sky, in a calm ambient temperature of approximately 55°F (13°C).

B6. Observation Conclusions—Based on equivalent recognition distance of the lamp at 4 in spacing and emitting 200 cd, the following is concluded:

B6.1 Lamps spaced between 3.0–4.0 in from the lower beam headlamp should emit at least 300 cd, or 1.5 times the minimum candela specified in SAE J588e.

B6.2 Lamps spaced between 2.5–3.0 in from the lower beam headlamp should emit at least 400 cd, or two times the minimum candela specified in SAE J588e.

B6.3 Lamps spaced closer than 2.5 in to the lower beam headlamp should emit at least 500 cd, or 2.5 times the minimum candela specified in SAE J588e.

This relationship is presented in graphical form on a following page.

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