

<p>49 CFR PART 571</p> <p>FMVSS No. 108</p> <p>LAMPS, REFLECTIVE DEVICES, AND ASSOCIATED EQUIPMENT</p>

Development of Standards

<i>No.</i>	<i>Revised</i>	<i>Issue Date</i>	<i>Effective Date</i>	<i>Date Presented by JASIC</i>	<i>Remarks</i>
1.	56FR56940	1991/11/7			
2.	57FR32738	1992/7/23			
3.	57FR58406	1992/12/10		1993/5/28	
4.	58FR3500	1993/1/11		1993/5/28	
5.	58FR3853	1993/1/12		1993/5/28	
6.	58FR3856	1993/1/12		1993/5/28	
7.	58FR11974	1993/3/2		1993/5/28	
8.	58FR12183	1993/3/3		1993/5/28	
9.	58FR13023	1993/3/9		1993/5/28	
10.	58FR52021	1993/10/6		1993/10/29	
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12.	58FR65673	1993/12/16		1994/1/21	
13.	59FR49355	1994/9/28		1994/10/28	
14.	59FR54835	1994/11/2		1994/11/28	
15.	60FR1750	1995/1/5	1995/2/6	1995/2/10	
16.	60FR8199	1995/2/13	1995/3/15	1995/3/24	
17.	60FR19681	1995/4/20	1995/3/22	1995/6/9	
18.	60FR46064	1995/9/5	1996/3/1	1995/10/5	
19.	60FR57949	1995/11/24	1995/12/26	1996/2/5	
20.	60FR58522	1995/11/29	1996/1/29	1996/2/5	
21.	61FR20497	1996/5/7	1996/6/6	1996/6/20	
22.	61FR41355	1996/8/8	1997/7/1	1996/9/20	
23.	61FR49976	1996/9/24	1996/10/24	1996/11/8	
24.	62FR10710	1997/3/10	1997/5/1	1997/4/17	
25.	62FR16709	1997/4/8	1997/7/1	1997/5/23	
26.	62FR40953	1997/7/31	1997/7/31	1997/9/19	

**Sec. 571.108 Standard No. 108;
Lamps, reflective devices, and associated equipment.**

S1. *Scope.*

This standard specifies requirements for original and replacement lamps, reflective devices, and associated equipment.

S2. *Purpose.*

The purpose of this standard is to reduce traffic accidents and deaths and injuries resulting from traffic accidents, by providing adequate illumination of the roadway, and by enhancing the conspicuity of motor vehicles on the public roads so that their presence is perceived and their signals understood, both in daylight and in darkness or other conditions of reduced visibility.

S3. *Application.*

This standard applies to:

- (a) Passenger cars, multipurpose passenger vehicles, trucks, buses, trailers (except pole trailers and trailer converter dollies), and motorcycles;
- (b) Retroreflective sheeting and reflex reflectors manufactured to conform to S5.7. of this standard; and
- (c) Lamps, reflective devices, and associated equipment for replacement of like equipment on vehicles to which this standard applies.

S4. *Definitions.*

Aiming Reference Plane means a plane which is perpendicular to the longitudinal axis of the vehicle and tangent to the forward most aiming pad on the headlamp.

Axis of reference means the characteristic axis of the lamp for use as the direction of reference ($H = 0$ degrees, $V = 0$ degrees) for angles of field for photometric measurements and for installing the lamp on the vehicle.

Beam contributor means an indivisible optical assembly including a lens, reflector, and light source, that is part of an integral beam headlighting system and contributes only a portion of a headlamp beam.

Cargo Lamp is a lamp that is mounted on a multipurpose passenger vehicle, truck, or bus for the purpose of providing illumination to load or unload cargo.

Cutoff means a generally horizontal, visual/optical aiming cue in the lower beam that marks a separation between areas of higher and lower luminance.

Direct reading indicator means a device that is mounted in its entirety on a headlamp or headlamp aiming or headlamp mounting equipment, is part of a VHAD, and provides information about headlamp aim in an analog or digital format.

Effective light-emitting surface means that portion of a lamp that directs light to the photometric test pattern, and does not include transparent lenses, mounting hole bosses, reflex reflector area, beads or rims that may glow or produce small areas of increased intensity as a result of uncontrolled light from an area of $1/2$ degree radius around a test point.

Effective projected luminous lens area means the area of the orthogonal projection of the effective light-emitting surface of a lamp on a plane perpendicular to a defined direction relative to the axis of reference. Unless otherwise specified, the direction is coincident with the axis of reference.

Filament means that part of the light source or light emitting element(s), such as a resistive element, the excited portion of a specific mixture of gases under pressure, or any part of other energy conversion sources, that generates radiant energy which can be

seen.

Flash means a cycle of activation and deactivation of a lamp by automatic means continuing until stopped either automatically or manually.

Fully opened means the position of the headlamp concealment device in which the headlamp is in the design open operating position.

Headlamp concealment device means a device, with its operating system and components, that provides concealment of the headlamp when it is not in use, including a movable headlamp cover and a headlamp that displaces for concealment purposes.

Headlamp test fixture means a device designed to support a headlamp or headlamp assembly in the test position specified in the laboratory tests and whose mounting hardware and components are those necessary to operate the headlamp as installed in a motor vehicle.

Integral beam headlamp means a headlamp (other than a standardized sealed beam headlamp designed to conform to paragraph S7.3. or a replaceable bulb headlamp designed to conform to paragraph S7.5.) comprising an integral and indivisible optical assembly including lens, reflector, and light source, except that a headlamp conforming to paragraph S7.8.5.2. or paragraph S7.8.5.3. may have a lens designed to be replaceable.

Multiple compartment lamp means a device which gives its indication by two or more separately lighted areas which are joined by one or more common parts, such as a housing or lens.

Multiple lamp arrangement means an array of two or more separate lamps on each side of the vehicle which operate together to give a signal.

Remote reading indicator means a device that is not mounted in its entirety on a headlamp or headlamp aiming or headlamp mounting equipment, but otherwise meets the definition of a direct reading indicator.

Replaceable bulb headlamp means a headlamp comprising a bonded lens and reflector assembly and one or two replaceable headlamp light sources, except that a headlamp conforming to paragraph S7.8.5.2. or paragraph S7.8.5.3. may have a lens designed to be replaceable.

Replaceable light source means an assembly of a capsule, base, and terminals that is designed to conform to the requirements of Appendix A or Appendix B of part 564 *Replaceable Light Source Information* of this Chapter.

Vehicle headlamp aiming device or VHAD means motor vehicle equipment, installed either on a vehicle or headlamp, which is used for determining the horizontal or vertical aim, or both the vertical and horizontal aim of the headlamp.

Visually/optically aimable headlamp means a headlamp which is designed to be visually/optically aimable in accordance with the requirements of paragraph S7.8.5.3. of this standard.

S5. *Requirements.*

S5.1. *Required motor vehicle lighting equipment.*

S5.1.1. Except as provided in succeeding paragraphs of this S5.1.1., each vehicle shall be equipped with at least the number of lamps, reflective devices, and associated equipment specified in Tables I and III and S7., as applicable. Required equipment shall be designed to conform to the SAE Standards or Recommended Practices referenced in those tables. Table I applies to multipurpose passenger vehicles, trucks, trailers, and buses, 80 or more inches in overall width. Table III applies to passenger cars and motorcycles and to multipurpose passenger vehicles, trucks, trailers, and buses, less than 80 inches in overall width.

S5.1.1.1. A truck tractor need not be equipped with turn signal lamps mounted on the rear if the turn signal lamps at or near the front are so constructed (double-faced) and so located that they meet the requirements for double-faced turn signals specified in SAE Standard

- (b) Any pair of lamps that are not required by this standard and are not optically combined with any lamps that are required by this standard, and which are used as DRLs to fulfill the specifications of S5.5.11.(a), shall be mounted at the same height, which shall be not more than 1.067m above the road surface measured from the center of the lamp on the vehicle at curb weight, and shall be symmetrically disposed about the vertical centerline of the vehicle.

S5.6. [Reserved]

S5.7. *Conspicuity Systems.*

Each trailer of 80 or more inches overall width, and with a GVWR over 10,000lbs., manufactured on or after December 1, 1993, except a trailer designed exclusively for living or office use, and each truck tractor manufactured on or after July 1, 1997, shall be equipped with either retroreflective sheeting that meets the requirements of S5.7.1., reflex reflectors that meet the requirements of S5.7.2., or a combination of retroreflective sheeting and reflex reflectors that meet the requirement of S5.7.3.

S5.7.1. *Retroreflective sheeting.*

Each trailer or truck tractor to which S5.7. applies that does not conform to S5.7.2. or S5.7.3. shall be equipped with retroreflective sheeting that conforms to the requirements specified in S5.7.1.1. through S5.7.1.5.

S5.7.1.1. *Construction.*

Retroreflective sheeting shall consist of a smooth, flat, transparent exterior film with retroreflective elements embedded or suspended beneath the film so as to form a non-exposed retroreflective optical system.

S5.7.1.2. *Performance requirements.*

Retroreflective sheeting shall meet the requirements of ASTM D 4956-90, *Standard Specification for Retroreflective Sheeting for Traffic Control*, for Type V Sheeting, except for the photometric requirements, and shall meet the minimum photometric performance requirements specified in Figure 29.

S5.7.1.3. *Sheeting pattern, dimensions, and relative coefficients of retroreflection.*

- (a) Retroreflective sheeting shall be applied in a pattern of alternating white and red color segments to the sides and rear of each trailer, and to the rear of each truck tractor, and in white to the upper rear corners of each trailer and truck tractor, in the locations specified in S5.7.1.4., and Figures 30-1 through 30-4, or Figure 31, as appropriate.
- (b) Except for a segment that is trimmed to clear obstructions, or lengthened to provide red sheeting near red lamps, each white or red segment shall have a length of 300mm +/- 150mm.
- (c) Neither white nor red sheeting shall represent more than two thirds of the aggregate of any continuous strip marking the width of a trailer, or any continuous or broken strip marking its length.
- (d) Retroreflective sheeting shall have a width of not less than 50mm (Grade DOT-C2), 75mm (Grade DOT-C3), or 100mm (Grade DOT-C4).
- (e) The coefficients for retroreflection of each segment of red or white sheeting shall be not less than the minimum values specified in Figure 29 of this standard for grades DOT-C2, DOT-C3, and DOT-C4.

S5.7.1.4. *Location.*

- (a) Retroreflective sheeting shall be applied to each trailer and truck tractor as specified below, but need not be applied to discontinuous surfaces such as outside ribs, stake post pickets on platform trailers, and external protruding beams, or to items of equipment such as door hinges and lamp bodies on trailers and body joints, stiffening beads, drip rails and rolled surfaces on truck tractors.
- (b) The edge of white sheeting shall not be located closer than 75mm to the edge of the luminous lens area of any red or amber lamp that is required by this standard.
- (c) The edge of red sheeting shall not be located closer than 75mm to the edge of the luminous lens area of any amber lamp that is required by this standard.

S5.7.1.4.1. *Rear of trailers.*

Retroreflective sheeting shall be applied to the rear of each trailer as follows, except that Element 2 is not required for container chassis or for platform trailers without bulkheads, and Element 3 is not required for trailers without underride protection devices:

- (a) Element 1: A strip of sheeting, as horizontal as practicable, in alternating colors across the full width of the trailer, as close to the extreme edges as practicable, and as close as practicable to not less than 375mm and not more than 1,525mm above the road surface at the stripe centerline with the trailer at curb weight.
- (b) Element 2: Two pairs of white strips of sheeting, each pair consisting of strips 300mm long of grade DOT-C2, DOT-C3, or DOT-C4, applied horizontally and vertically to the right and left upper contours of the body, as viewed from the rear, as close to the top of the trailer and as far apart as practicable. If the perimeter of the body, as viewed from the rear, is other than rectangular, the strips may be applied along the perimeter, as close as practicable to the uppermost and outermost areas of the rear of the body on the left and right sides.
- (c) Element 3: A strip of sheeting in alternating colors across the full width of the horizontal member of the rear underride protection device. Grade DOT-C2 material not less than 38mm wide may be used.

S5.7.1.4.2. *Side of trailers.*

Retroreflective sheeting shall be applied to each side of a trailer as follows:

- (a) A strip of sheeting, as horizontal as practicable, in alternating colors, originating and terminating as close to the front and rear as practicable, as close as practicable to not less than 375mm and not more than 1,525mm above the road surface at the stripe centerline with the trailer at curb weight, except that at the location chosen the strip shall not be obscured in whole or in part by other motor vehicle equipment or trailer cargo. The strip need not be continuous as long as not less than half of the length of the trailer is covered and the spaces are distributed as evenly as practicable.
- (b) If necessary to clear rivet heads or other similar obstructions, grade DOT-C2 retroreflective sheeting may be separated into two 25mm wide strips of the same length and color, separated by a space of not more than 25mm, and used in place of the retroreflective sheeting that would otherwise be applied.

S5.7.1.4.3. *Rear of truck tractors.*

Retroreflective sheeting shall be applied to the rear of each truck tractor as follows:

- (a) Element 1: Two strips of sheeting in alternating colors, each not less than 600mm long, located as close as practicable to the edges of the rear fenders, mudflaps, or the mudflap support brackets, to mark the width of the truck tractor. The strips shall be mounted as horizontal as practicable, in a vertical plane facing the rear,

on the rear fenders, on the mudflap support brackets, on plates attached to the mudflap support brackets, or on the mudflaps. Strips on mudflaps shall be mounted not lower than 300mm below the upper horizontal edge of the mudflap. If the vehicle is certified with temporary mudflap support brackets, the strips shall be mounted on the mudflaps or on plates transferable to permanent mudflap support brackets. For a truck tractor without mudflaps, the strips may be mounted outboard of the frame on brackets behind the rear axle or on brackets ahead of the rear axle and above the top of the tires at unladen vehicle height, or they may be mounted directly or indirectly to the back of the cab as close to the outer edges as practicable, above the top of the tires, and not more than 1,525mm above the road surface at unladen vehicle height. If the strips are mounted on the back of the cab, no more than 25% of their cumulative area may be obscured by vehicle equipment as determined in a rear orthogonal view.

- (b) Element 2: Two pairs of white strips of sheeting, each pair consisting of strips 300mm long, applied as horizontally and vertically as practicable, to the right and left upper contours of the cab, as close to the top of the cab and as far apart as practicable. No more than 25% of their cumulative area may be obscured by vehicle equipment as determined in a rear orthogonal view. If one pair must be relocated to avoid obscuration by vehicle equipment, the other pair may be relocated in order to be mounted symmetrically. If the rear window is so large as to occupy all the practicable space, the material may be attached to the edge of the window itself.

S5.7.1.5. *Certification.*

The letters DOT-C2, DOT-C3, or DOT-C4, as appropriate, constituting a certification that the retroreflective sheeting conforms to the requirements of S5.7.1.2., shall appear at least once on the exposed surface of each white or red segment of retroreflective sheeting, and at least once every 300mm on retroreflective sheeting that is white only. The characters shall be not less than 3mm high, and shall be permanently stamped, etched, molded, or printed in indelible ink.

S5.7.2. *Reflex Reflectors.*

Each trailer or truck tractor to which S5.7. applies that does not conform to S5.7.1. or S5.7.3. shall be equipped with reflex reflectors in accordance with this section.

- S5.7.2.1.
 - (a) Each reflex reflector shall conform to SAE Standard J594f, *Reflex Reflectors*, January 1977.
 - (b) Each red reflex reflector shall also provide, at an observation angle of 0.2 degree, not less than 300 millicandelas/lux at any light entrance angle between 30 degrees left and 30 degrees right, including an entrance angle of 0 degree, and not less than 75 millicandelas/lux at any light entrance angle between 45 degrees left and 45 degrees right.
 - (c) Each white reflex reflector shall also provide at an observation angle of 0.2 degree, not less than 1,250 millicandelas/lux at any light entrance angle between 30 degrees left and 30 degrees right, including an entrance angle of 0 degree, and not less than 300 millicandelas/lux at any light entrance angle between 45 degrees left and 45 degrees right.
 - (d) A white reflex reflector complying with S5.7.2.1.(a) and (c) when tested in a horizontal orientation may be installed in all orientations specified for rear upper locations in S5.7.1.4.1.(b) or S5.7.1.4.3.(b) if, when tested in a vertical orientation, it provides an observation angle of 0.2 degree not less than 1,680 millicandelas/lux at a light entrance angle of 0 degree, not less than 1,120 millicandelas/lux at any light entrance angle from 10 degrees down to 10 degrees up, and not less than 560 millicandelas/lux at any light entrance angle from 20

LOWER BEAM

Headlamp Type	2A1, 2C1, and 2G1	
Test points (degrees)	Candela max.	Candela min.
10U-90U	125	--
4U-8L and 8R	--	64
2U-4L	--	135
1.5U-1R to 3R	--	200
1.5U-1R to R	1,400	--
1U-1.5L to L	700	--
0.5U-1.5L to L	1,000	--
0.5U-1R to 3R	2,700	500
H-4L	--	135
H-8L	--	64
0.6D-1.3R	--	10,000
0.86D-V	--	4,500
0.86D-3.5L	12,000	1,800
1.5D-2R	--	15,000
2D-9L and 9R	--	1,250
2D-15L and 15R	--	1,000
4D-4R	12,500	--
4D-20L and 20R	--	300

FIGURE 29
MINIMUM PHOTOMETRIC PERFORMANCE OF RETROFLECTIVE SHEETING IN
CANDELLA/LUX/SQUARE METER

Entrance angle	Observation angle				Grade
	0.2 degree		0.5 degree		
	White	Red	White	Red	
- 4 degree.....	250	60	65	15	DOT-C2
30 degree.....	250	60	65	15	DOT-C2
45 degree.....	60	15	15	4	DOT-C2
- 4 degree.....	165	40	43	10	DOT-C3
30 degree.....	165	40	43	10	DOT-C3
45 degree.....	40	10	10	3	DOT-C3
- 4 degree.....	125	30	33	8	DOT-C4
30 degree.....	125	30	33	8	DOT-C4
45 degree.....	30	8	8	2	DOT-C4

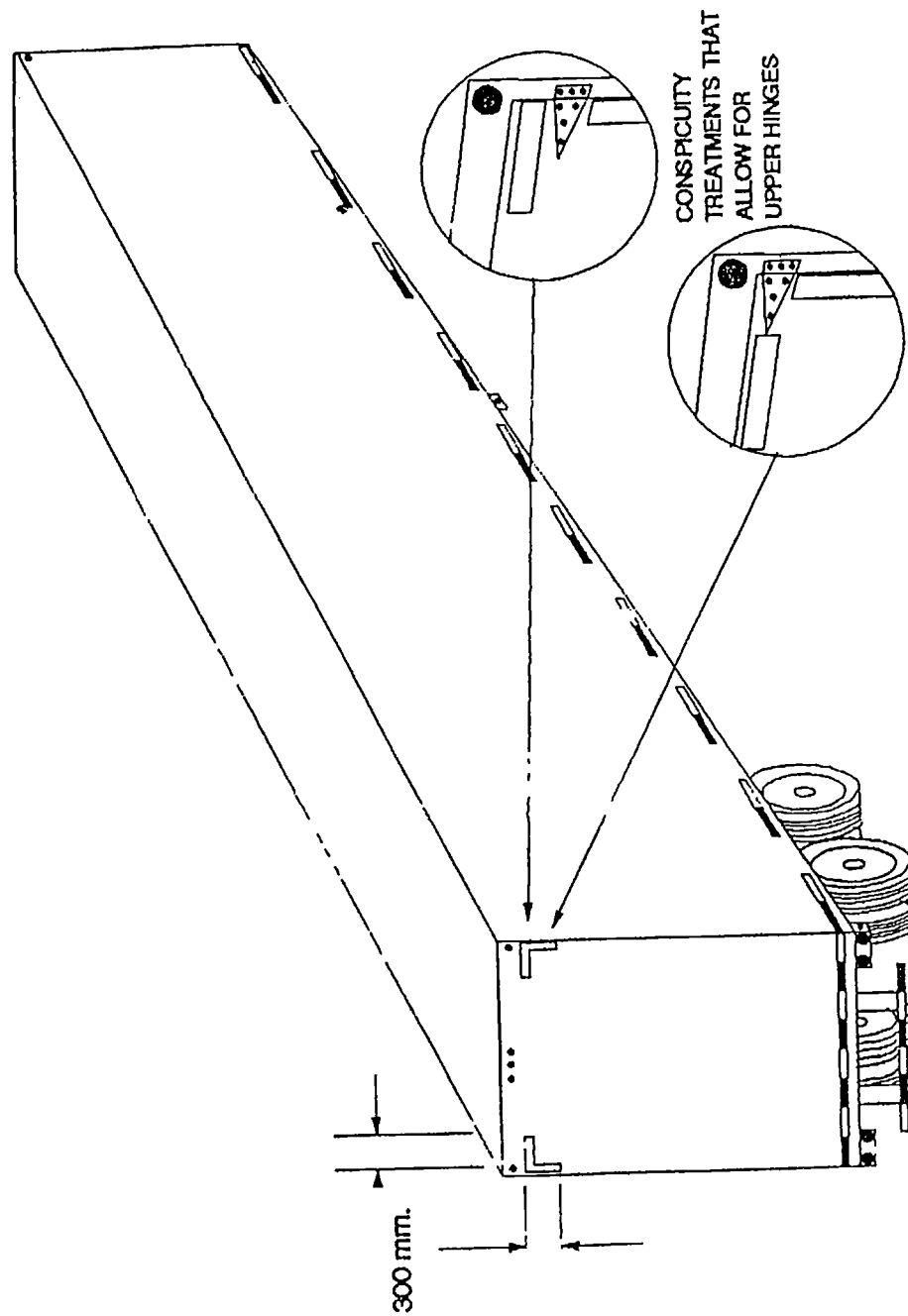


FIGURE 30-1
TRAILER CONSPICUITY TREATMENT EXAMPLE

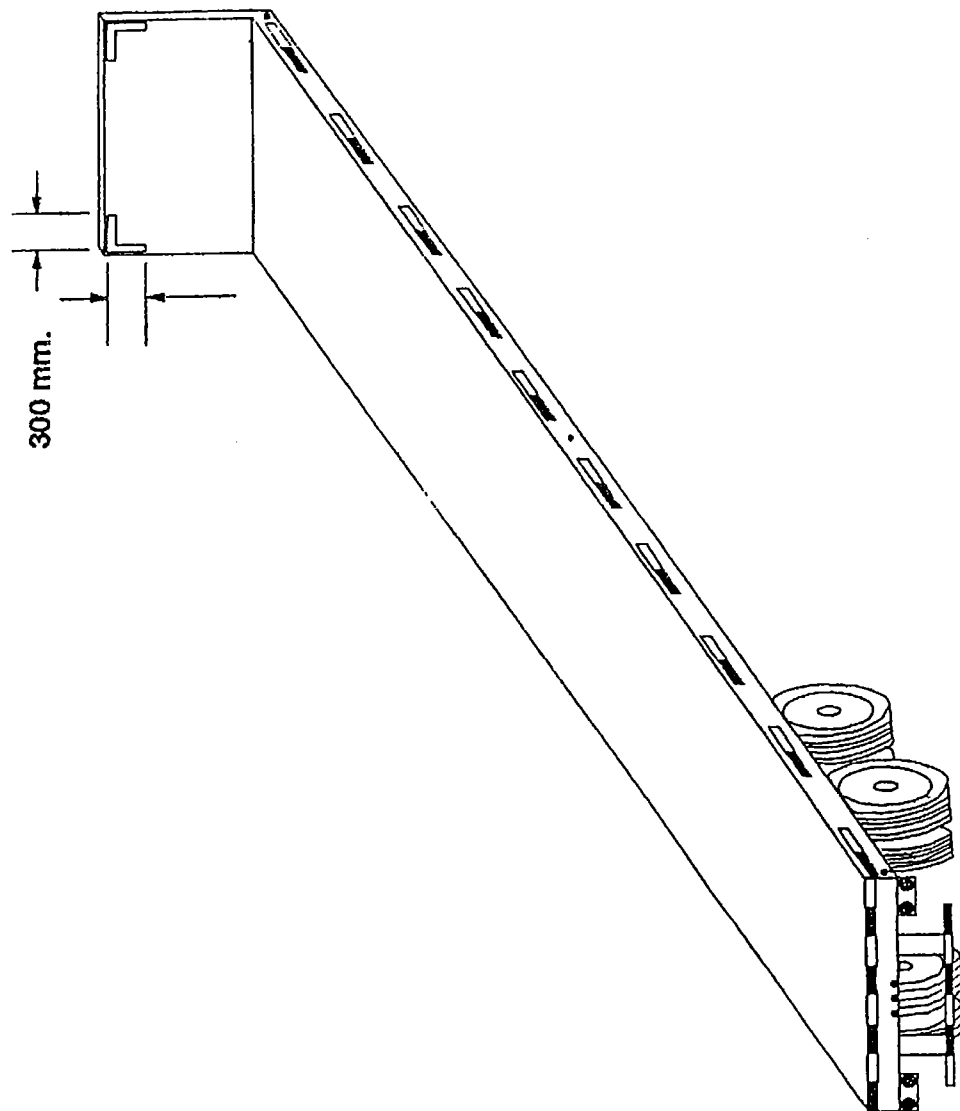


FIGURE 30-2
TRAILER CONSPICUITY TREATMENT EXAMPLE

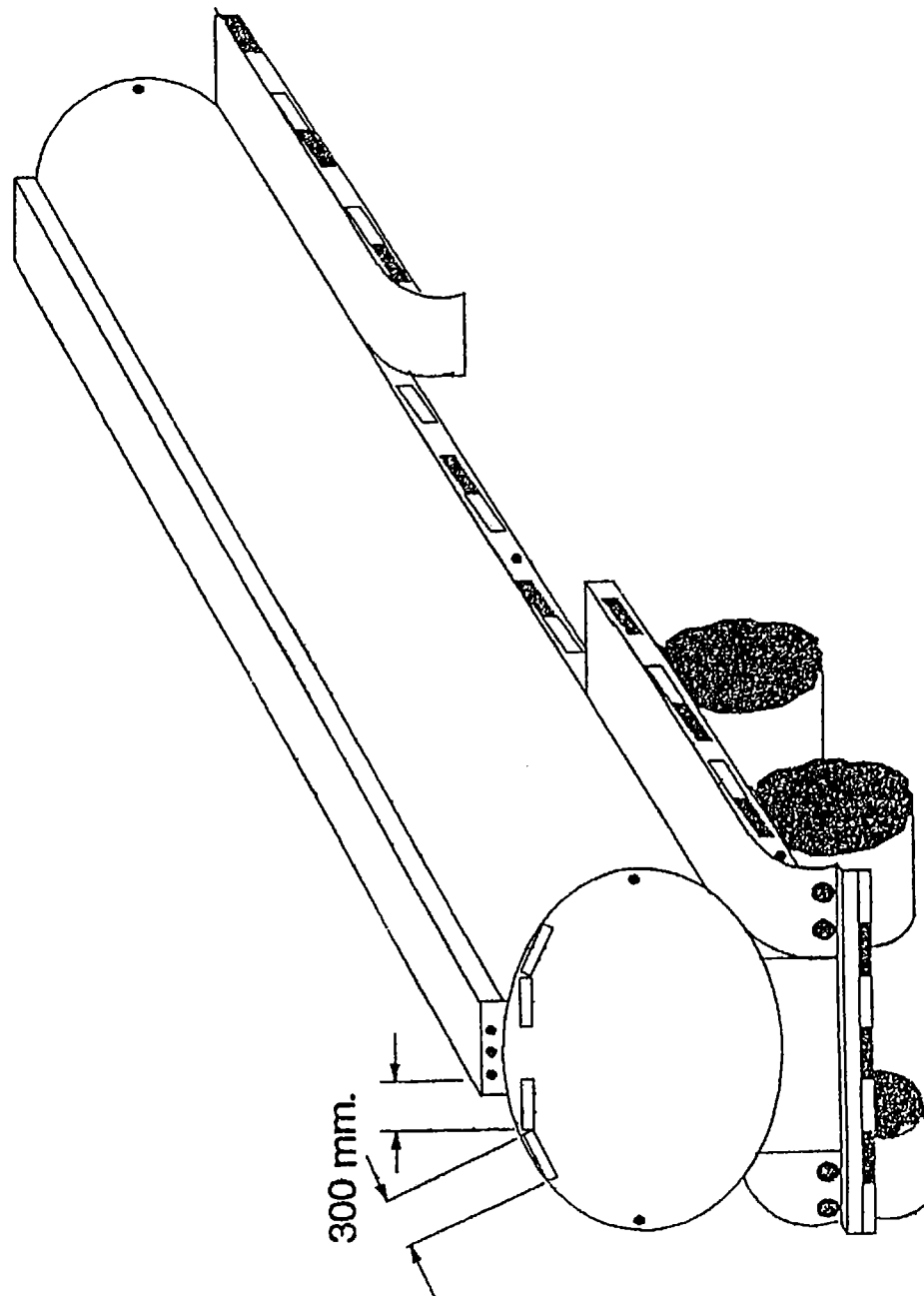


FIGURE 30-3
TRAILER CONSPICUITY TREATMENT EXAMPLE

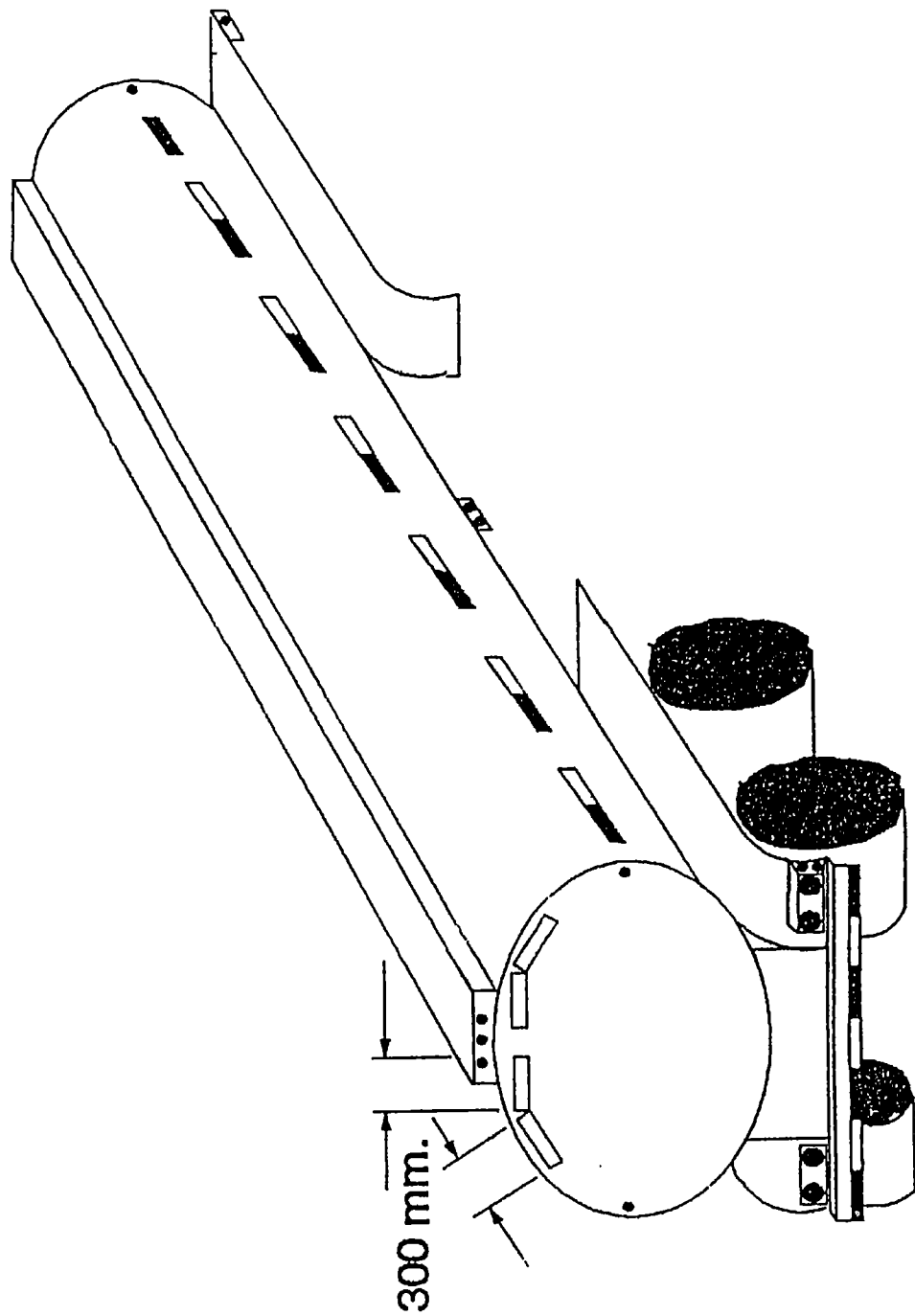


FIGURE 30-4
TRAILER CONSPICUITY TREATMENT EXAMPLE

TABLE I
REQUIRED MOTOR VEHICLE LIGHTING EQUIPMENT OTHER THAN HEADLAMPS
Multipurpose Passenger Vehicles, Trucks, Trailers, and Buses, of 80 or More Inches Overall Width

Item	Multipurpose passenger vehicles, trucks, and buses	Trailers	Applicable SAE standard or recommended practice (See S5. for subreferenced SAE materials)
Taillamps.....	2 red.....	2 red.....	J585e, September 1977.
Stoplamps.....	2 red.....	2 red.....	SAE J1398, May 1985.
License plate lamp.....	1 white.....	1 white.....	J587 October 1981.
Reflex reflectors.....	4 red; 2 amber.....	4 red; 2 amber.....	J594f, January 1977.
Side marker lamps.....	2 red; 2 amber.....	2 red; 2 amber.....	J592e, July 1972.
Backup lamp.....	1 white.....	None.....	J593c, February 1968.
Turn signal lamps.....	2 red or amber; 2 amber	2 red or amber;	SAE J1395, April 1985.
Turn signal operating unit.	1.....	None.....	J589, April 1964.
Turn signal flasher.....	1.....	None.....	J590b, October 1965.
Vehicular hazard warning signal operating unit.....	1.....	None.....	J910, January 1966.
Vehicular hazard warning signal flasher	1.....	None.....	J910, January 1966.
Identification lamps.....	3 amber; 3 red.....	3 red.....	J592e, July 1972.
Clearance lamps.....	2 amber; 2 red.....	2 amber; 2 red.....	J592e, July 1972.
Intermediate side marker lamps.	2 amber.....	2 amber.....	J592e, July 1972.
Intermediate side reflex reflectors.	2 amber.....	2 amber.....	J594f, January 1977.
Conspicuity.....	See S5.7.	See S5.7.	See S5.7.

