



Regulations current to Apr 12, 2013

§571.11 Standard No. 111; Rearview mirrors.

S1. **Scope.** This standard specifies requirements for the performance and location of rearview mirrors.

S2. **Purpose.** The purpose of this standard is to reduce the number of deaths and injuries that occur when the driver of a motor vehicle does not have a clear and reasonably unobstructed view to the rear.

S3. **Application.** This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, schoolbuses and motorcycles.

S4. Definitions.

Convex mirror means a mirror having a curved reflective surface whose shape is the same as that of the exterior surface of a section of a sphere.

Effective mirror surface means the portions of a mirror that reflect images, excluding the mirror rim or mounting brackets.

Unit magnification mirror means a plane or flat mirror with a reflective surface through which the angular height and width of the image of an object is equal to the angular height and width of the object when viewed directly at the same distance except for flaws that do not exceed normal manufacturing tolerances. For the purposes of this regulation a prismatic day-night adjustment rearview mirror one of whose positions provides unit magnification is considered a unit magnification mirror.

S5. Requirements for passenger cars.

S5.1 **Inside rearview mirror.** Each passenger car shall have an inside rearview mirror of unit magnification.

S5.1.1 **Field of view.** Except as provided in S5.3, the mirror shall provide a field of view with an included horizontal angle measured from the projected eye point of at least 20 degrees, and a sufficient vertical angle to provide a view of a level road surface extending to the horizon beginning at a point not greater than 61 m to the rear of the vehicle when the vehicle is occupied by the driver and four passengers or the designated occupant capacity, if less, based on an average occupant weight of 68 kg. The line of sight may be partially obscured by seated occupants or by head restraints. The location of the driver's eye reference points shall be those established in Motor Vehicle Safety Standard No. 104 (§571.104) or a nominal location appropriate for any 95th percentile male driver.

S5.1.2 **Mounting.** The mirror mounting shall provide a stable support for the mirror, and shall provide for mirror adjustment by tilting in both the horizontal and vertical directions. If the mirror is in the head impact area, the mounting shall deflect, collapse or break away without leaving sharp edges when the reflective surface of the mirror is subjected to a force of 400 N in any forward direction that is not more than 45° from the forward longitudinal direction.

S5.2 Outside rearview mirror—driver's side.

S5.2.1 **Field of view.** Each passenger car shall have an outside mirror of unit magnification. The mirror shall provide the driver a view of a level road surface extending to the horizon

from a line, perpendicular to a longitudinal plane tangent to the driver's side of the vehicle at the widest point, extending 2.4 m out from the tangent plane 10.7 m behind the driver's eyes, with the seat in the rearmost position. The line of sight may be partially obscured by rear body or fender contours. The location of the driver's eye reference points shall be those established in Motor Vehicle Safety Standard No. 104 (§571.104) or a nominal location appropriate for any 95th percentile male driver.

S5.2.2 Mounting. The mirror mounting shall provide a stable support for the mirror, and neither the mirror nor the mounting shall protrude farther than the widest part of the vehicle body except to the extent necessary to produce a field of view meeting or exceeding the requirements of S5.2.1. The mirror shall not be obscured by the unwiped portion of the windshield, and shall be adjustable by tilting in both horizontal and vertical directions from the driver's seated position. The mirror and mounting shall be free of sharp points or edges that could contribute to pedestrian injury.

S5.3 Outside rearview mirror passenger's side. Each passenger car whose inside rearview mirror does not meet the field of view requirements of S5.1.1 shall have an outside mirror of unit magnification or a convex mirror installed on the passenger's side. The mirror mounting shall provide a stable support and be free of sharp points or edges that could contribute to pedestrian injury. The mirror need not be adjustable from the driver's seat but shall be capable of adjustment by tilting in both horizontal and vertical directions.

S5.4 Convex mirror requirements. Each motor vehicle using a convex mirror to meet the requirements of S5.3 shall comply with the following requirements:

S5.4.1 When each convex mirror is tested in accordance with the procedures specified in S12. of this standard, none of the radii of curvature readings shall deviate from the average radius of curvature by more than plus or minus 12.5 percent.

S5.4.2 Each convex mirror shall have permanently and indelibly marked at the lower edge of the mirror's reflective surface, in letters not less than 4.8 mm nor more than 6.4 mm high the words "Objects in Mirror Are Closer Than They Appear."

S5.4.3 The average radius of curvature of each such mirror, as determined by using the procedure in S12., shall be not less than 889 mm and not more than 1,651 mm.

S6. Requirements for multipurpose passenger vehicles, trucks, and buses, other than school buses, with GVWR of 4,536 kg or less.

S6.1 Each multipurpose passenger vehicle, truck and bus, other than a school bus, with a GVWR of 4,536 kg or less shall have either—

(a) Mirrors that conform to the requirements of S5.; or

(b) Outside mirrors of unit magnification, each with not less than 126 cm² of reflective surface, installed with stable supports on both sides of the vehicle, located so as to provide the driver a view to the rear along both sides of the vehicle, and adjustable in both the horizontal and vertical directions to view the rearward scene.

S7. Requirements for multipurpose passenger vehicles and trucks with a GVWR of more than 4,536 kg and less than 11,340 kg and buses, other than school buses, with a GVWR of more than 4,536 kg.

S7.1 Each multipurpose passenger vehicle and truck with a GVWR of more than 4,536 kg and less than 11,340 kg and each bus, other than a school bus, with a GVWR of more than 4,536 kg shall have outside mirrors of unit magnification, each with not less than 323 cm² of

reflective surface, installed with stable supports on both sides of the vehicle. The mirrors shall be located so as to provide the driver a view to the rear along both sides of the vehicle and shall be adjustable both in the horizontal and vertical directions to view the rearward scene.

S8. *Requirements for multipurpose passenger vehicles and trucks with a GVWR of 11,340 kg or more.*

S8.1 Each multipurpose passenger vehicle and truck with a GVWR of 11,340 kg or more shall have outside mirrors of unit magnification, each with not less than 323 cm² of reflective surface, installed with stable supports on both sides of the vehicle. The mirrors shall be located so as to provide the driver a view to the rear along both sides of the vehicle and shall be adjustable both in the horizontal and vertical directions to view the rearward scene.

S9. *Requirements for School Buses.* When a school bus is tested in accordance with the procedures of S13, it shall meet the requirements of S9.1 through S9.4.

S9.1 Outside Rearview Mirrors. Each school bus shall have two outside rearview mirror systems: System A and System B.

S9.2. System A shall be located with stable supports so that the portion of the system on the bus's left side, and the portion on its right side, each:

(a) Includes at least one mirror of unit magnification with not less than 323 cm² of reflective surface; and

(b) Includes one or more mirrors which together provide, at the driver's eye location, a view of:

(1) For the mirror system on the right side of the bus, the entire top surface of cylinder N in Figure 2, and that area of the ground which extends rearward from cylinder N to a point not less than 61 meters from the mirror surface.

(2) For the mirror system on the left side of the bus, the entire top surface of cylinder M in Figure 2, and that area of the ground which extends rearward from cylinder M to a point not less than 61 meters from the mirror surface.

S9.3(a) For each of the cylinders A through P whose entire top surface is not directly visible from the driver's eye location, System B shall provide, at that location:

(1) A view of the entire top surface of that cylinder.

(2) A view of the ground that overlaps with the view of the ground provided by System A.

(b) Each mirror installed in compliance with S9.3(a) shall meet the following requirements:

(1) Each mirror shall have a projected area of at least 258 cm², as measured on a plane at a right angle to the mirror's axis.

(2) Each mirror shall be located such that the distance from the center point of the eye location of a 25th percentile adult female seated in the driver's seat to the center of the mirror shall be at least 95 cm.

(3) Each mirror shall have no discontinuities in the slope of the surface of the mirror.

(4) Each mirror shall be installed with a stable support.

(c) Each school bus which has a mirror installed in compliance with S9.3(a) that has an average radius of curvature of less than 889 mm, as determined under S12, shall have a label visible to the seated driver. The label shall be printed in a type face and color that are clear and

conspicuous. The label shall state the following:

“USE CROSS VIEW MIRRORS TO VIEW PEDESTRIANS WHILE BUS IS STOPPED. DO NOT USE THESE MIRRORS TO VIEW TRAFFIC WHILE BUS IS MOVING. IMAGES IN SUCH MIRRORS DO NOT ACCURATELY SHOW ANOTHER VEHICLE'S LOCATION.”

S9.4(a) Each image required by S9.3(a)(1) to be visible at the driver's eye location shall be separated from the edge of the effective mirror surface of the mirror providing that image by a distance of not less than 3 minutes of arc.

(b) The image required by S9.3(a)(1) of cylinder P shall meet the following requirements:

(1) The angular size of the shortest dimension of that cylinder's image shall be not less than 3 minutes of arc; and

(2) The angular size of the longest dimension of that cylinder's image shall be not less than 9 minutes of arc.

S10. *Requirements for motorcycles.*

S10.1 Each motorcycle shall have either a mirror of unit magnification with not less than 8065 mm² of reflective surface, or a convex mirror with not less than 6450 mm² of reflective surface and an average radius of curvature not less than 508 mm and not greater than 1524 mm, installed with a stable support, and mounted so that the horizontal center of the reflective surface is at least 279 mm outward of the longitudinal centerline of the motorcycle. The mirror shall be adjustable by tilting in both the horizontal and vertical directions.

S11. ***Mirror Construction.*** The average reflectance of any mirror required by this standard shall be determined in accordance with SAE Standard J964 OCT84 (incorporated by reference, see §571.5). All single reflectance mirrors shall have an average reflectance of at least 35 percent. If a mirror is capable of multiple reflectance levels, the minimum reflectance level in the day mode shall be at least 35 percent and the minimum reflectance level in the night mode shall be at least 4 percent. A multiple reflectance mirror shall either be equipped with a means for the driver to adjust the mirror to a reflectance level of at least 35 percent in the event of electrical failure, or achieve such reflectance level automatically in the event of electrical failure.

S12. *Determination of radius of curvature.*

S12.1 To determine the average radius of curvature of a convex mirror, use a 3-point linear spherometer, which meets the requirements of S12.2, at the 10 test positions shown in Figure 1 and record the readings for each position.

S12.2 The 3-point linear spherometer has two outer fixed legs 38 mm apart and one inner movable leg at the midpoint. The spherometer has a dial indicator with a scale that can be read accurately to .0025 mm, with the zero reading being a flat surface.

S12.3 The 10 test positions on the image display consist of two positions at right angles to each other at each of five locations as shown in Figure 1. The locations are at the center of the mirror, at the left and right ends of a horizontal line that bisects the mirror and at the top and bottom ends of a vertical line that bisects the mirror. None of the readings are within a 6.4 mm border on the edge of the image display.

S12.4 At each position, the spherometer is held perpendicular to the convex mirror-surface and a record is made of the reading on the dial indicator to the nearest .0025 mm.

S12.5 Convert the dial reading data for each of the 10 test positions to radius of curvature calculations using Table I. Consider the change as linear for dial readings that fall between two numbers in Table I.

S12.6 Calculate the average radius of curvature by adding all 10 radius of curvature calculations and dividing by ten.

S12.7 Determine the numerical difference between the average radius of curvature and each of the 10 individual radius of curvature calculations determined in S12.5.

S12.8 Calculate the greatest percentage deviation by dividing the greatest numerical difference determined in S12.7 by the average radius of curvature and multiply by 100.

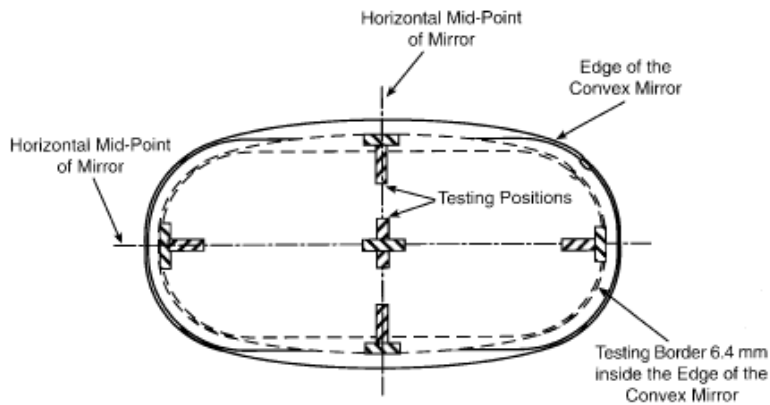


Figure 1—LOCATION OF TEN CONVEX MIRROR TESTING POSITIONS
All dimensions in millimeters (mm)

Table I—Conversion Table From Spherometer Dial Reading to Radius of Curvature

Dial reading	Radius of curvature(Inches)	Radius of curvature(mm)
.00330	85.2	2164.1
.00350	80.4	2042.92
.00374	75.2	1910.1
.00402	70.0	1778.0
.00416	67.6	1717.0
.00432	65.1	1653.5
.00450	62.5	1587.5
.00468	60.1	1526.5
.00476	59.1	1501.1
.00484	58.1	1475.7
.00492	57.2	1452.9
.00502	56.0	1422.4
.00512	54.9	1394.5
.00522	53.9	1369.1
.00536	52.5	1333.5
.00544	51.7	1313.2
.00554	50.8	1290.3

.00566	49.7	1262.4
.00580	48.5	1231.9
.00592	47.5	1206.5
.00606	46.4	1178.6
.00622	45.2	1148.1
.00636	44.2	1122.7
.00654	43.0	1092.2
.00668	42.1	1069.3
.00686	41.0	1041.4
.00694	40.5	1028.7
.00720	39.1	993.1
.00740	38.0	965.2
.00760	37.0	939.8
.00780	36.1	916.9
.00802	35.1	891.5
.00822	34.2	868.7
.00850	33.1	840.7
.00878	32.0	812.8
.00906	31.0	787.4
.00922	30.5	774.7
.00938	30.0	762.0
.00960	29.3	744.2
.00980	28.7	729.0
.01004	28.0	711.2
.01022	27.5	698.5
.01042	27.0	685.8
.01060	26.5	673.1
.01080	26.0	660.4
.01110	25.3	642.6
.01130	24.9	632.5
.01170	24.0	609.6
.01200	23.4	594.4
.01240	22.7	576.6
.01280	22.0	558.8
.01310	21.5	546.1
.01360	20.7	525.8
.01400	20.1	510.5
.01430	19.7	500.4
.01480	19.0	482.6

.01540	18.3	464.8
.01570	17.9	454.7
.01610	17.5	444.5
.01650	17.1	434.3
.01700	16.6	421.6
.01750	16.1	408.9
.01800	15.6	396.2
.01860	15.1	383.5
.01910	14.7	373.4
.01980	14.2	360.7
.02040	13.8	350.5
.02100	13.4	340.4
.02160	13.0	330.2
.02250	12.5	317.5
.02340	12.0	304.8
.02450	11.5	292.1
.02560	11.0	279.4
.02680	10.5	266.7
.02810	10.0	254.0
.02960	9.5	241.3
.03130	9.0	228.6
.03310	8.5	215.9

S13. *School bus mirror test procedures.* The requirements of S9.1 through S9.4 shall be met when the vehicle is tested in accordance with the following conditions.

S13.1 The cylinders shall be a color which provides a high contrast with the surface on which the bus is parked.

S13.2 The cylinders are 0.3048 m high and 0.3048 m in diameter, except for cylinder P which is 0.9144 m high and 0.3048 m in diameter.

S13.3 Place cylinders at locations as specified in S13.3(a) through S13.3(g) and illustrated in Figure 2. Measure the distances shown in Figure 2 from a cylinder to another object from the center of the cylinder as viewed from above.

(a) Place cylinders G, H, and I so that they are tangent to a transverse vertical plane tangent to the forward-most surface of the bus's front bumper. Place cylinders D, E, F so that their centers are located in a transverse vertical plane that is 1.8288 meters (6 feet) forward of a transverse vertical plane passing through the centers of cylinders G, H, and I. Place cylinders A, B, and C so that their centers are located in a transverse vertical plane that is 3.6576 meters (12 feet) forward of the transverse vertical plane passing through the centers of cylinders G, H, and I.

(b) Place cylinders B, E, and H so that their centers are in a longitudinal vertical plane that passes through the bus's longitudinal centerline.

(c) Place cylinders A, D, and G so that their centers are in a longitudinal vertical plane that is

tangent to the most outboard edge of the left side of the bus's front bumper.

(d) Place cylinders C, F, and I so that their centers are in a longitudinal vertical plane that is tangent to the most outboard edge of the right side of the bus's front bumper.

(e) Place cylinder J so that its center is in a longitudinal vertical plane 0.3048 meters (1 foot) to the left of the longitudinal vertical plane passing through the centers of cylinders A, D, and G, and is in the transverse vertical plane that passes through the centerline of the bus's front axle.

(f) Place cylinder K so that its center is in a longitudinal vertical plane 0.3048 meters (1 foot) to the right of the longitudinal vertical plane passing through the centers of cylinders C, F, and I, and is in the transverse vertical plane that passes through the centerline of the bus's front axle.

(g) Place cylinders L, M, N, O, and P so that their centers are in the transverse vertical plane that passes through the centerline of the bus's rear axle. Place cylinder L so that its center is in a longitudinal vertical plane that is 1.8288 meters (6 feet) to the left of the longitudinal vertical plane tangent to the bus's most outboard left surface (excluding the mirror system). Place cylinder M so that its center is in a longitudinal vertical plane that is 0.3048 meters (1 foot) to the left of the longitudinal vertical plane tangent to the left side of the bus. Place cylinder N so that its center is in a longitudinal vertical plane that is 0.3048 meters (1 foot) to the right of the longitudinal vertical plane tangent to the right side of the bus. Place cylinder O so that its center is in a longitudinal vertical plane that is 1.8288 meters (6 feet) to the right of the longitudinal vertical plane tangent to the right side of the bus. Place cylinder P so that its center is in a longitudinal vertical plane that is 3.6576 meters (12 feet) to the right of the longitudinal vertical plane tangent to the right side of the bus.

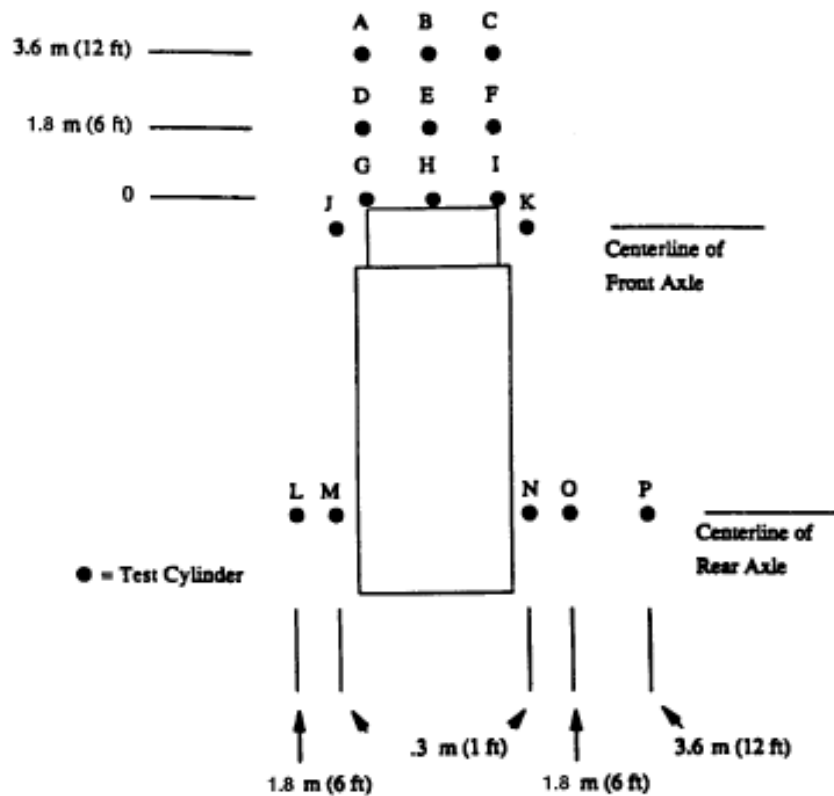


Figure 2.—Location of Test Cylinders for School Bus Field-of-View Test
All Dimensions in Meters (m)

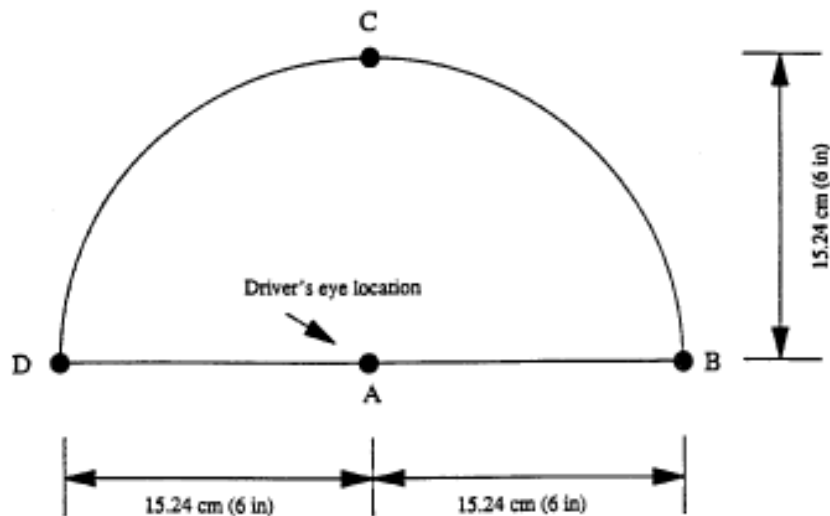


Figure 3.

Camera Locations for School Bus Field-of-View Test

S13.4 The driver's eye location is the eye location of a 25th percentile adult female, when seated in the driver's seat as follows:

(a) The center point of the driver's eye location is the point located 68.58 centimeters (27 inches) vertically above the intersection of the seat cushion and the seat back at the longitudinal centerline of the seat.

(b) Adjust the driver's seat to the midway point between the forward-most and rear-most positions, and if separately adjustable in the vertical direction, adjust to the lowest position. If an adjustment position does not exist at the midway point, use the closest adjustment position to the rear of the midpoint. If a seat back is adjustable, adjust the seat back angle to the manufacturer's nominal design riding position in accordance with the manufacturer's recommendations.

S13.5 Adjustable mirrors are adjusted before the test in accordance with the manufacturer's recommendations. Such mirrors are not moved or readjusted at any time during the test.

13.6 Place a 35 mm or larger format camera, or video camera, so that its image plane is located at the center point of the driver's eye location or at any single point within a semicircular area established by a 15.24 centimeter (6 inch) radius parallel to and forward of the center point (see figure 3). With the camera at any single location on or within that semicircle look through the camera and the windows of the bus and determine whether the entire top surface of each cylinder is directly visible.

S13.7 For each cylinder whose entire top surface is determined under paragraph 13.4 of this

section not to be directly visible at the driver's eye location,

(a) Place a comparison chart (see figure 4) above the mirror that provides the fullest view of the cylinder in situations where a cylinder is partially visible through more than one mirror.

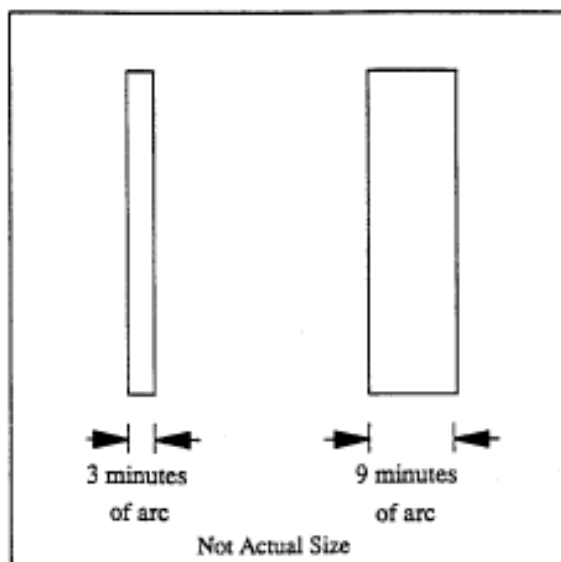


Figure 4.

Comparison Chart for Indirect Field-of-View Measurements

The width of the bars in Figure 4 indicating three minutes of arc and nine minutes of arc are derived from the following formula:

For 3 minutes of arc:

$$X=D \times 0.000873,$$

Where:

X=the width of a line, in the unit of measurement D, representing 3 minutes of arc;

D=distance from center point of driver's eye location to the center of the mirror's surface; and

0.000873=tangent of 3 minutes of arc.

For 9 minutes of arc:

$$X=D \times 0.002618,$$

Where:

X=the width of a line, in the unit of measurement D, representing 9 minutes of arc;

D=distance from center point of driver's eye location to the center of the mirror's surface; and

0.002618=tangent of 9 minutes of arc.

(b) Photograph each cylinder through the mirror(s) that provides a view of the cylinder. Photograph each cylinder with the camera located so that the view through its film or image plane is located at any single location within the semicircle established under 13.4, [POINT A,B,C, OR D] ensuring that the image of the mirror and comparison chart fill the camera's view finder to the extent possible.

13.8 Make all observations and take all photographs with the service/entry door in the closed position and the stop signal arm(s) in the fully retracted position.

[41 FR 36025, Aug. 26, 1976, as amended at 41 FR 56813, Dec. 30, 1976; 47 FR 38700, Sept. 2, 1982; 48 FR 38844, Aug. 26, 1983; 48 FR 40262, Sept. 6, 1983; 56 FR 58516, Nov. 20, 1991; 57 FR 57015, Dec. 2, 1992; 58 FR 60402, Nov. 16, 1993; 60 FR 15692, Mar. 27, 1995; 63 FR 28929-28931, May 27, 1998; 63 FR 51000, Sept. 24, 1998; 69 FR 18497, Apr. 8, 2004; 77 FR 758, Jan. 6, 2012]