THE WORK TRUCK SHOW®

GreenTruck SUMMIT

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FMVSS 111 Rear Visibility Full Compliance Requirements: How Commercial Vehicles Are Affected

Presented by: Susan Dehne, Senior Director of Technical Services, NTEA; and Steve Spata, Technical Assistance Director, NTEA

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FMVSS 111 rear vision system requirements

- Background
- Scope of new requirements and testing
- Timing/effective dates
- Meeting the requirements

What is FMVSS 111?

- Traditionally has been a visibility standard for mirrors
- Applies to all motor vehicles except trailers
- New rear vision system requirements added
- Why new rearview requirements?

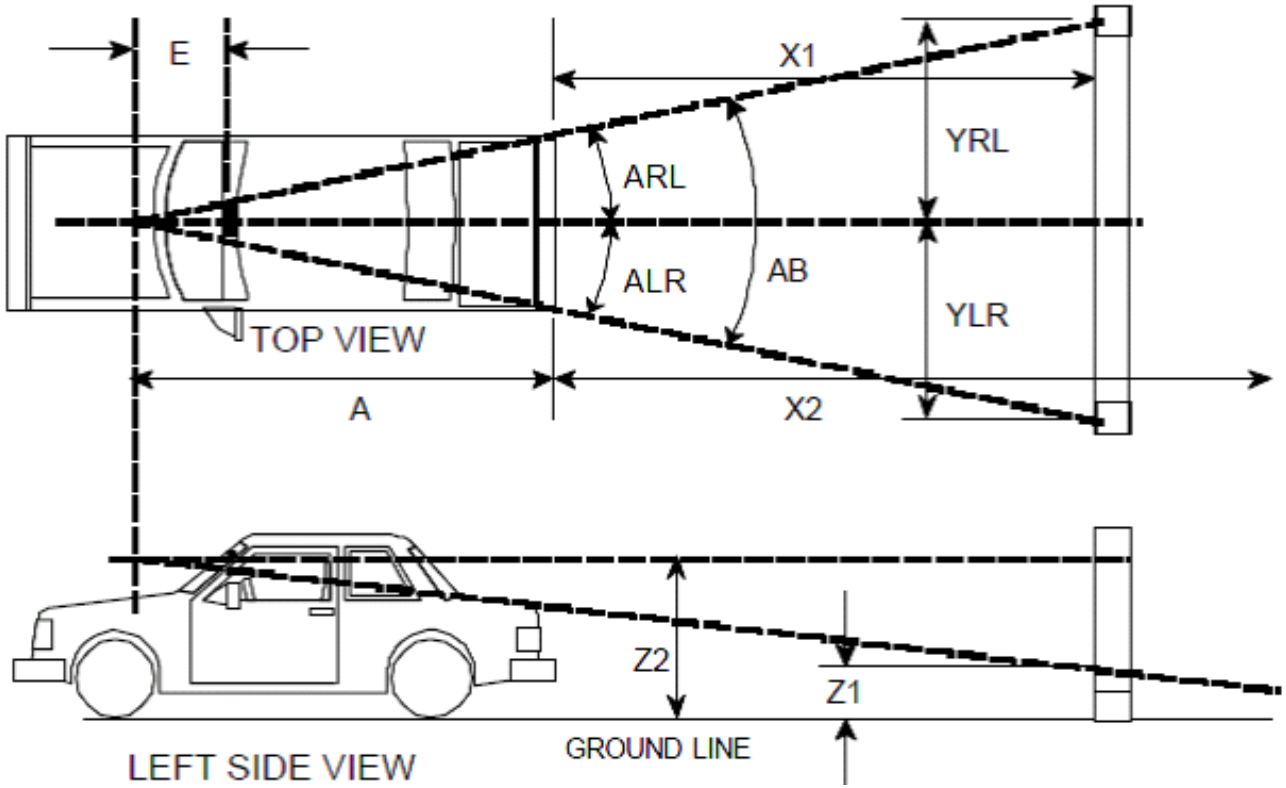
Background of new rearview requirements

Cameron Gulbransen Kids Transportation Safety Act of 2007 (K.T. Safety Act of 2007), Public Law 110–189, was passed on Feb. 28, 2008.

- Required NHTSA to revise the Federal standard for rearward visibility, specifically to reduce backing crashes involving children and disabled people
- Required NHTSA to develop new regulations for rearward visibility

Background of new rearview requirements

Traditional mirrors have an inherent problem of not being able to see directly behind the vehicle.



Background of new rearview requirements

The red patterns behind the vehicles show the area where a 600 mm (~23 1/2 inches) high cylinder would not be visible to an average male driver. [1]

[1] M. Paine, Vehicle Design and Research, A. Macbeth, Insurance Australia Group (IAG) and M. Henderson, Michael Henderson Consulting: THE DANGER TO YOUNG PEDESTRIANS FROM REVERSING MOTOR VEHICLES, Proceedings 18th International Technical Conference on the Enhanced Safety of Vehicles (2003) Australia, Paper No. 466

Background of new rearview requirements

NHTSA issued an ANPRM on March 4, 2009.

- NHTSA research found 292 fatalities and 18,000 injuries (3,000 of which are judged to be incapacitating) resulting from backover incidents every year.
  - Of those, 228 fatalities and 17,000 injuries were attributed to backover incidents involving passenger vehicles under 10,000 pounds.
- Pickups and SUVs account for more than half of all fatalities.

Background of new rearview requirements

The March 4, 2009 ANPRM study included different technologies:

- Rear-mounted convex mirrors
- Rearview video systems
- Sensor-based rear object detection systems
- Multi-technology (sensor + camera) systems

Background of new rearview requirements

NHTSA issued a NPRM on Dec. 7, 2010.

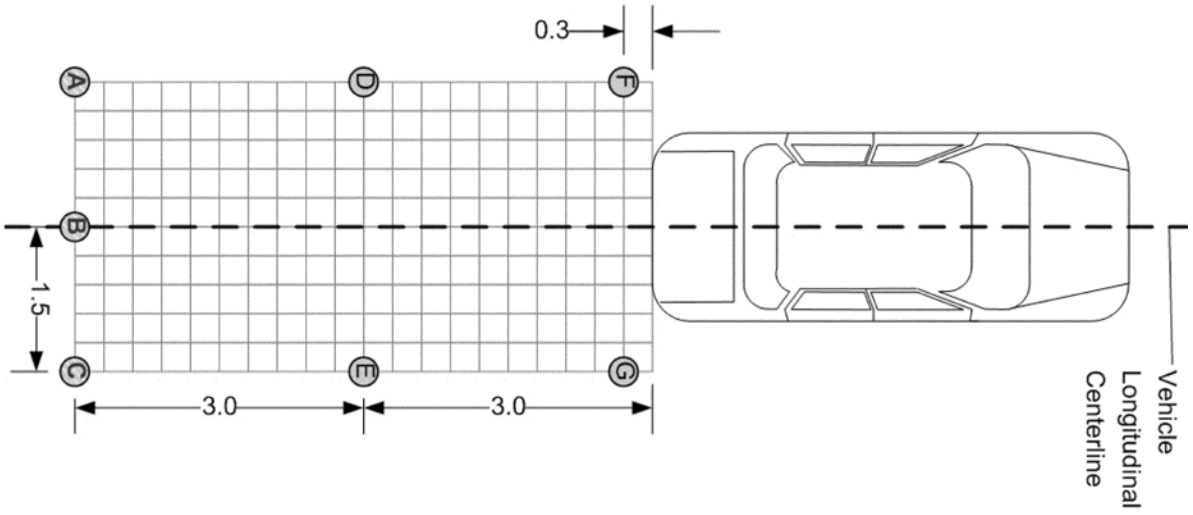
- Applied to all 10,000-pound or less GVWR vehicles except motorcycles and trailers
- Specifically, NHTSA proposed specifying an area immediately behind each vehicle that the driver must be able to see when the vehicle's transmission is in reverse

"It appears that, in the near term, the only technology available with the ability to comply with this proposal would be a rear visibility system that includes a rear-mounted video camera and an in-vehicle visual display."

Background of new rearview requirements

NHTSA issued its Final Rule on April 7, 2014.

Adjusted the phase-in schedule and test procedure from the FMVSS 111 NPRM



Scope of new rear vision system requirements

The new rear visibility regulation segregates into two main areas of performance requirements:

1. Field of view (FOV)
2. Image size

Image parameters

3. Response time
4. Linger time
5. Deactivation
6. Default view
7. Durability

System performance

Scope of new rear vision system requirements

New performance requirements

1. FOV
2. Image size
3. Response time
4. Linger time
5. Deactivation
6. Default view
7. Durability

Although FOV and image size are intertwined in regulation verbiage, only FOV is required until full compliance on May 1, 2018.

Rear vision system requirements

A **backing event** starts when the vehicle's direction selector is placed in reverse and ends at the manufacturer's choosing, when the vehicle forward motion reaches either:

- Speed of **10** mph,
- Distance of **10** meters traveled
- Continuous duration of **10** seconds

Rear vision system requirements

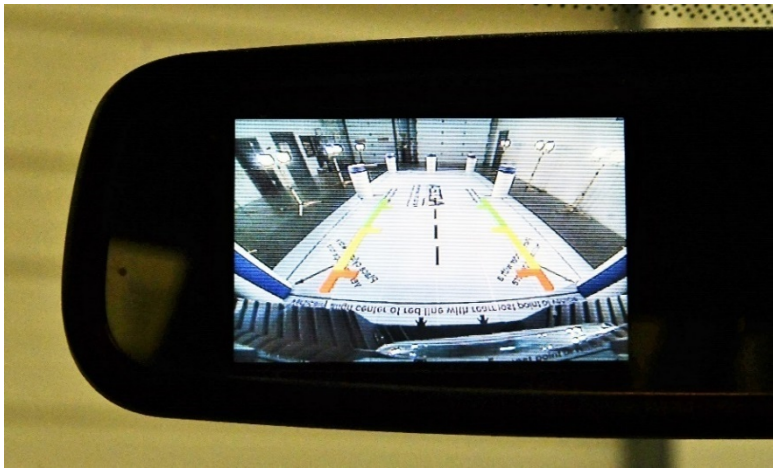
Response time
The rearview image meeting the requirements of S6.2.1 and S6.2.2, when tested in accordance with S14.2, shall be displayed within 2.0 seconds of the start of a backing event.

Linger time
The rearview image meeting the requirements of S6.2.1 and S6.2.2 shall not be displayed after the backing event has ended.

Rear vision system requirements

Deactivation

The rearview image meeting the requirements of S6.2.1 and S6.2.2 shall remain visible during the backing event until either, the driver modifies the view, or the vehicle direction selector is removed from the reverse position.



Default view

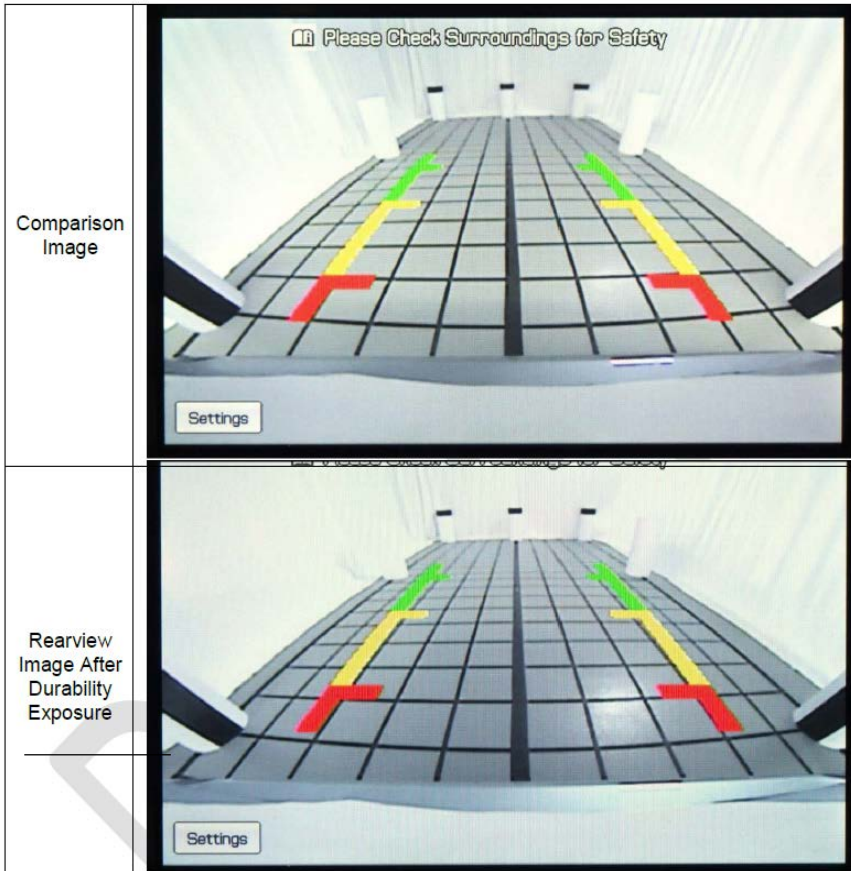
The rear visibility system must default to the rearview image meeting the requirements of S6.2.1 and S6.2.2 at the beginning of each backing event regardless of any modifications to the field of view the driver has previously selected.

Rear vision system requirements

Durability

The rear visibility system shall meet the field of view and image size requirements of S6.2.1 and S6.2.2 after each durability test specified in S14.3.1, S14.3.2, and S14.3.3

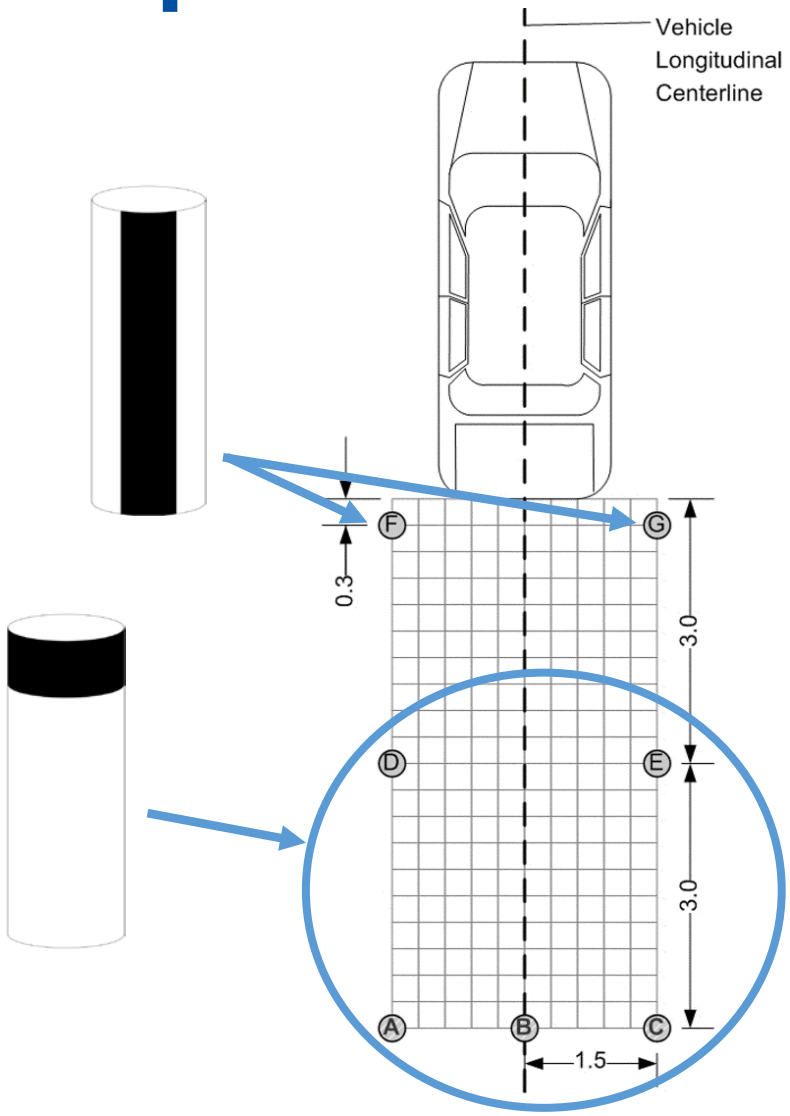
- Corrosion test procedure
- Humidity exposure test
- Temperature exposure test



Rear vision system requirements

FOV

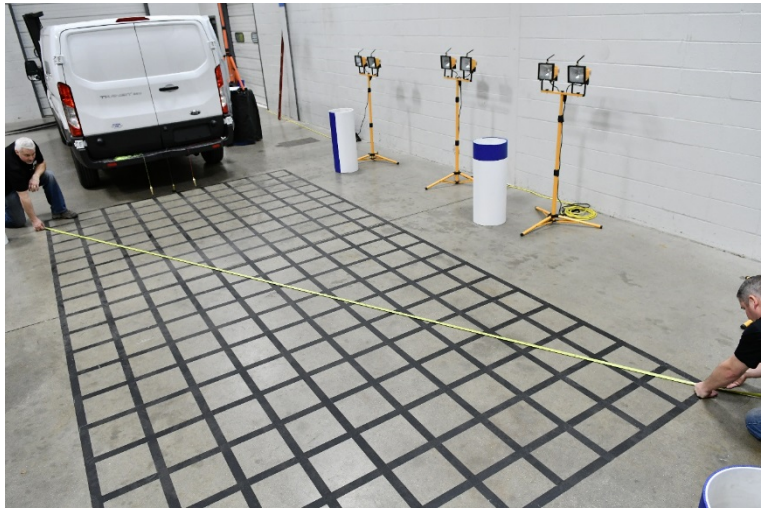
- Vertical striped objects are located at positions F and G, and horizontal banded objects are located at positions A through E
- Must see the full-width of the vertical stripe at objects F and G and the entirety of objects at A through E
- Reverse guideline overlays in the monitor must not cover the required view of the test objects



FOV — test area

Compliance assessments involve proper setup of the test area.

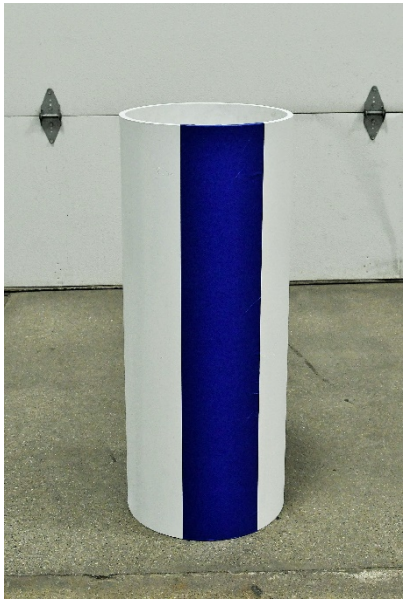
- Use grid, tarp, etc. to position test objects
- Lighting
- Vehicle prep: tire pressure, ballasting, etc.



FOV — test area

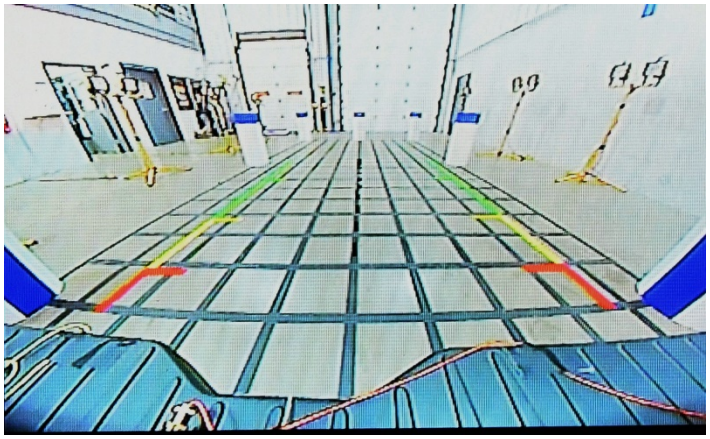
Compliance assessments involve proper setup of the test area.

Cylinders with striping

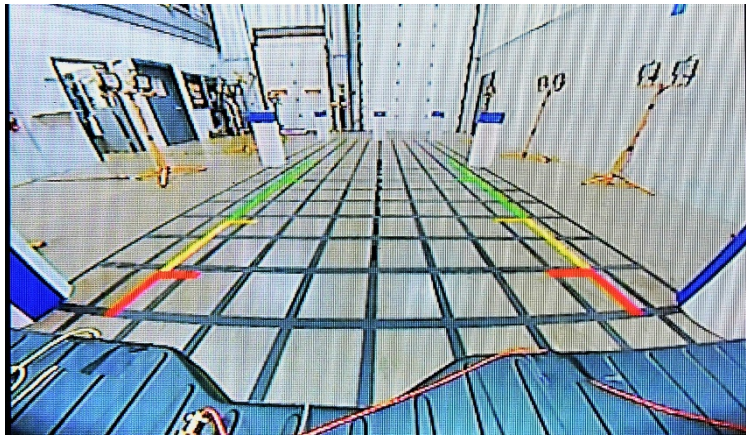


FOV — verification

Examples of compliant versus non-compliant FOV



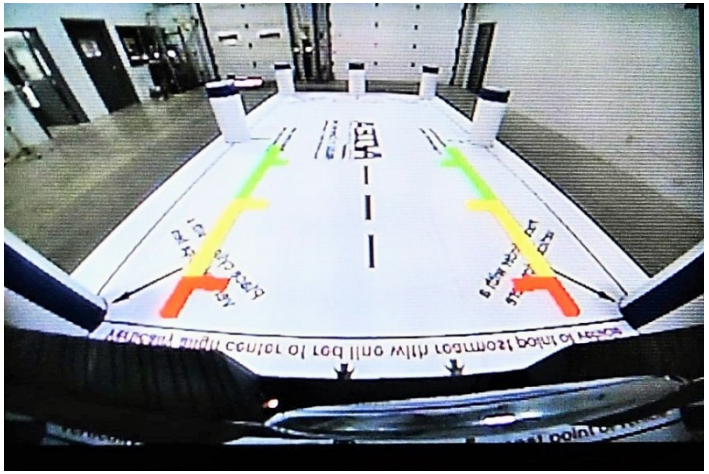
Compliant view



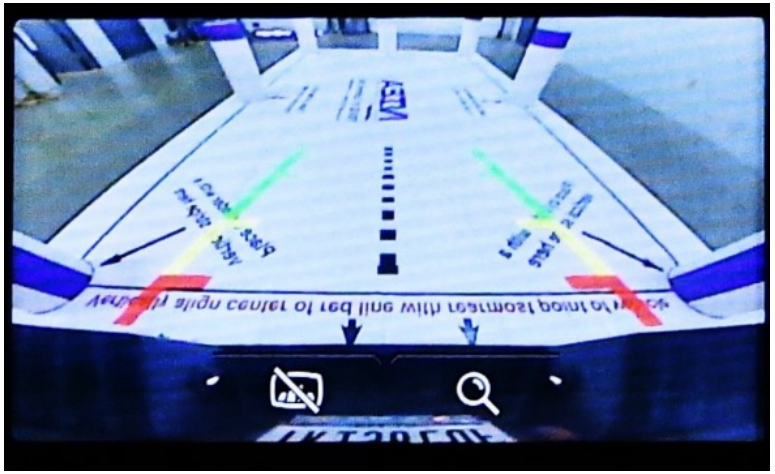
Non-compliant view

FOV — verification

Examples of compliant versus non-compliant FOV



Compliant view



Non-compliant view

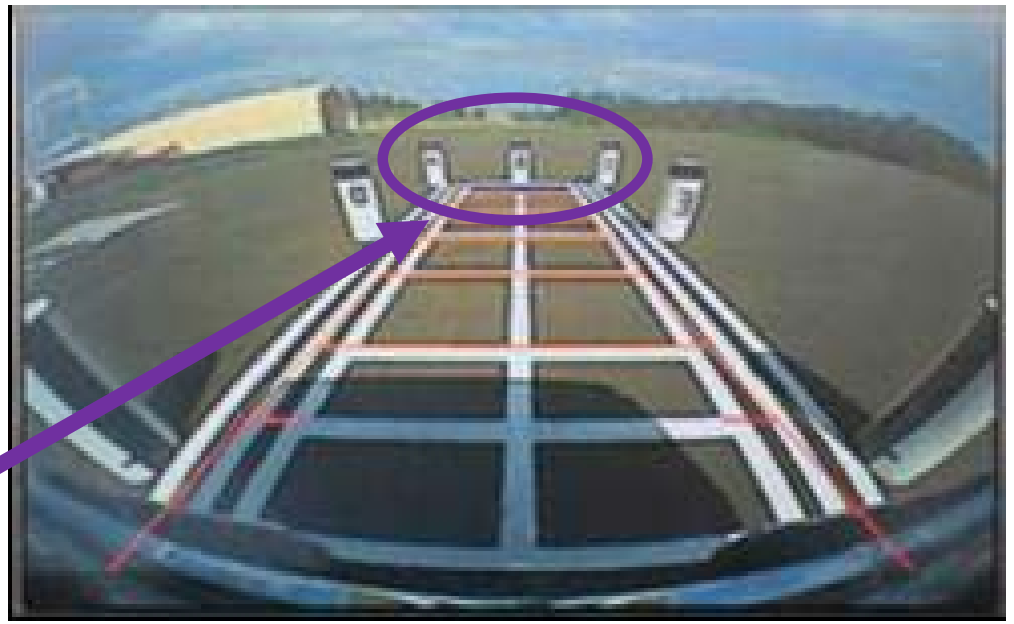
Rear vision system requirements

Image size

S6.2.2 Size. When the rearview image is measured in accordance with the procedures in S14.1, the calculated visual angle subtended by the horizontal width of

(a) All three test objects located at positions A, B, and C specified in S14.1.4 shall average not less than 5 minutes of arc; and

(b) Each individual test object (A, B, and C) shall not be less than 3 minutes of arc.



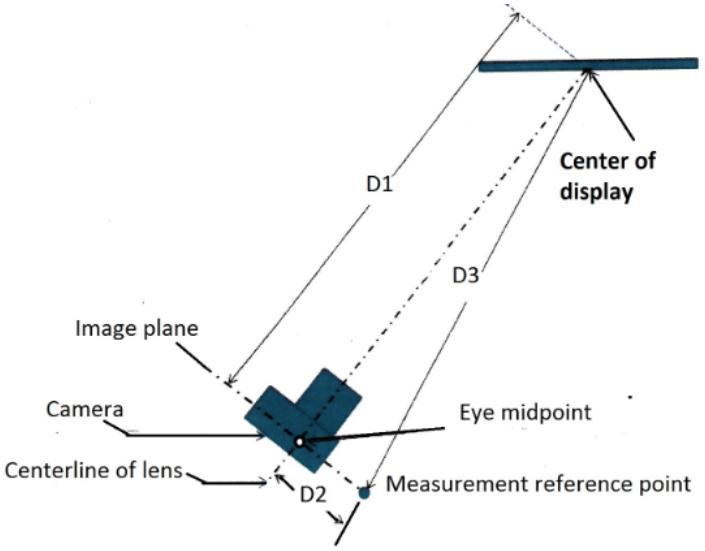
Rear vision system requirements

Image size

Figure 5. Rearview Image Measurement Fixture

Rear vision system requirements

Image size



$$\Theta_i = \sin^{-1}(c_i / (d * s))$$

What's the phase-in schedule?

- FOV phase-in compliance began for 10 percent of production vehicles on May 1, 2016; however, exclusions apply.
- Effective May 1, 2017, FOV compliance is required for 40 percent of production; however, some exclusions apply.
- Effective May 1, 2018, all aspects of FOV will apply to 100 percent of applicable vehicles.

What's the phase-in schedule?

The following vehicles do not need to meet FOV requirements between May 1, 2017 and April 30, 2018:

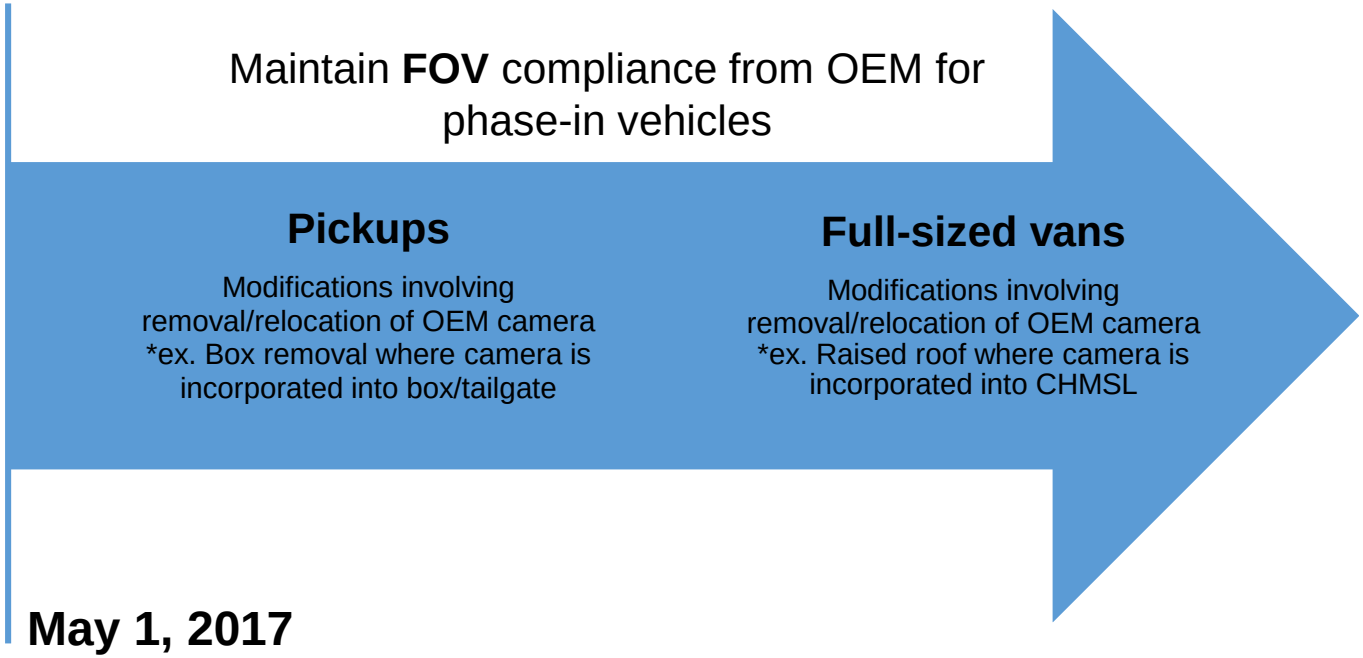
- Vehicles manufactured by small manufacturers or limited-line manufacturers.
- Vehicles manufactured in two or more stages before May 1, 2018.
- Vehicles originally compliant with FOV and altered before May 1, 2017.

What's the phase-in schedule?

However, vehicles previously certified as meeting FOV requirements before May 1, 2017 and altered on or after May 1, 2017 ***must*** continue to meet FOV requirements.

What does this mean for my business?

Vehicles that are altered with a 10,000-pound or less GVWR as of May 1, 2017



What happens on May 1, 2018?

100 percent of vehicles manufactured on or after May 1, 2018 with a 10,000-pound or less GVWR must meet all aspects of FMVSS 111 rear visibility.

- FOV
- Image size
- Response time
- Deactivation
- Default view
- Linger time
- Component durability

Everything has to meet everything — original, final-stage or altered-stage manufacture.

What does this mean for my business?

Vehicles that are completed or altered with a 10,000-pound or less GVWR as of May 1, 2018 must achieve full rear vision system compliance

May 1, 2017

Pickups

Modifications involving removal/relocation of OEM camera
*ex. Box removal where camera is incorporated into box/tailgate

Full-sized vans

Modifications involving removal/relocation of OEM camera
*ex. Raised roof where camera is incorporated into CHMSL

Maintain FOV compliance from OEM for phase-in vehicles

- FOV

May 1, 2018

Altered vehicles & those completed from incomplete vehicles: chassis-cabs, cutaways, etc.

Full rear vision system compliance

- FOV
- Image size
- Image response time
- Deactivation
- Component durability
- Image default view
- Image linger time

What about Canada?

Transport Canada has adopted equivalent requirements in CMVSS 111 for multi-stage vehicles and *extended the effective date until May 1, 2019.*

- Allows the work truck industry in Canada an additional year to work through compliance challenges with the new OEM vehicle systems

How you can achieve FOV compliance

First, understand if the new vehicle you are modifying is originally compliant as certified by the OEM.

- If it is compliant and you are altering it, you must maintain compliance.

How you can achieve FOV compliance

Then, maintain FOV compliance by either:

- Keeping the rearview camera in the OEM-production location (as received)
- Relocating the camera, if necessary to accommodate bodies and equipment, to a new, compliant location

Meeting requirements

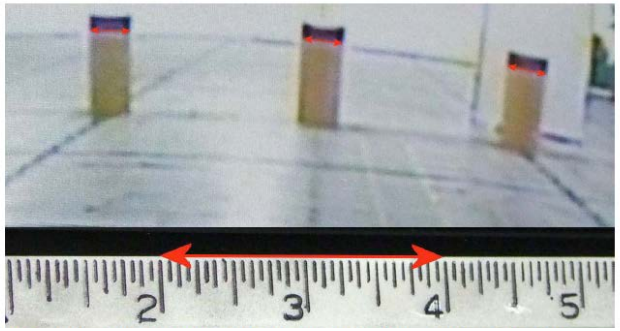
Potential compliance challenges

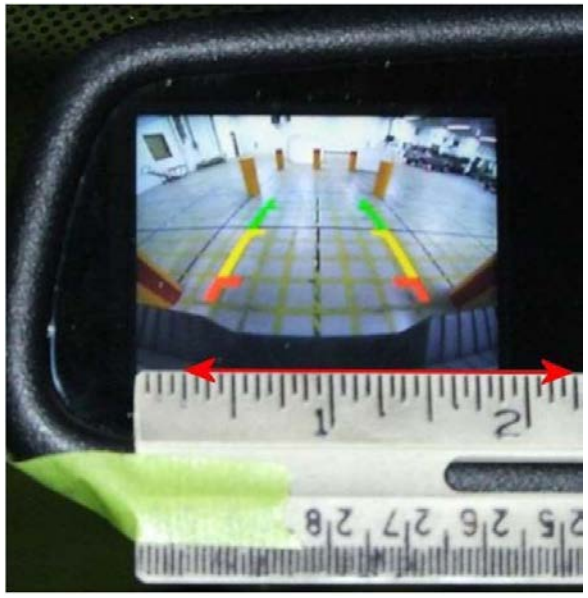
- Box removal and other altered vehicle modifications beginning May 1, 2017.
- Moving the camera could affect FOV until May 1, 2018.
- Moving the camera could affect both FOV and image size beginning May 1, 2018.

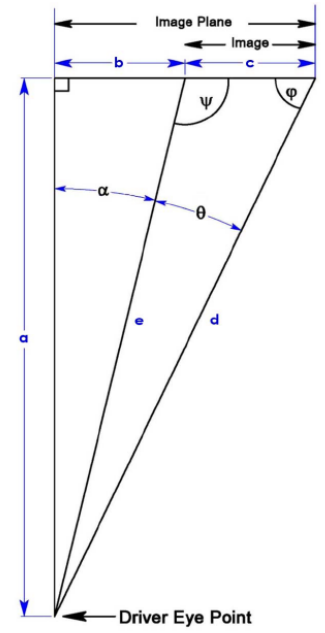
Rear vision system requirements

Image size

- Run FMVSS 111 test procedure
- Results specific to vehicle configuration, camera location, monitor, etc.
- Available labs?





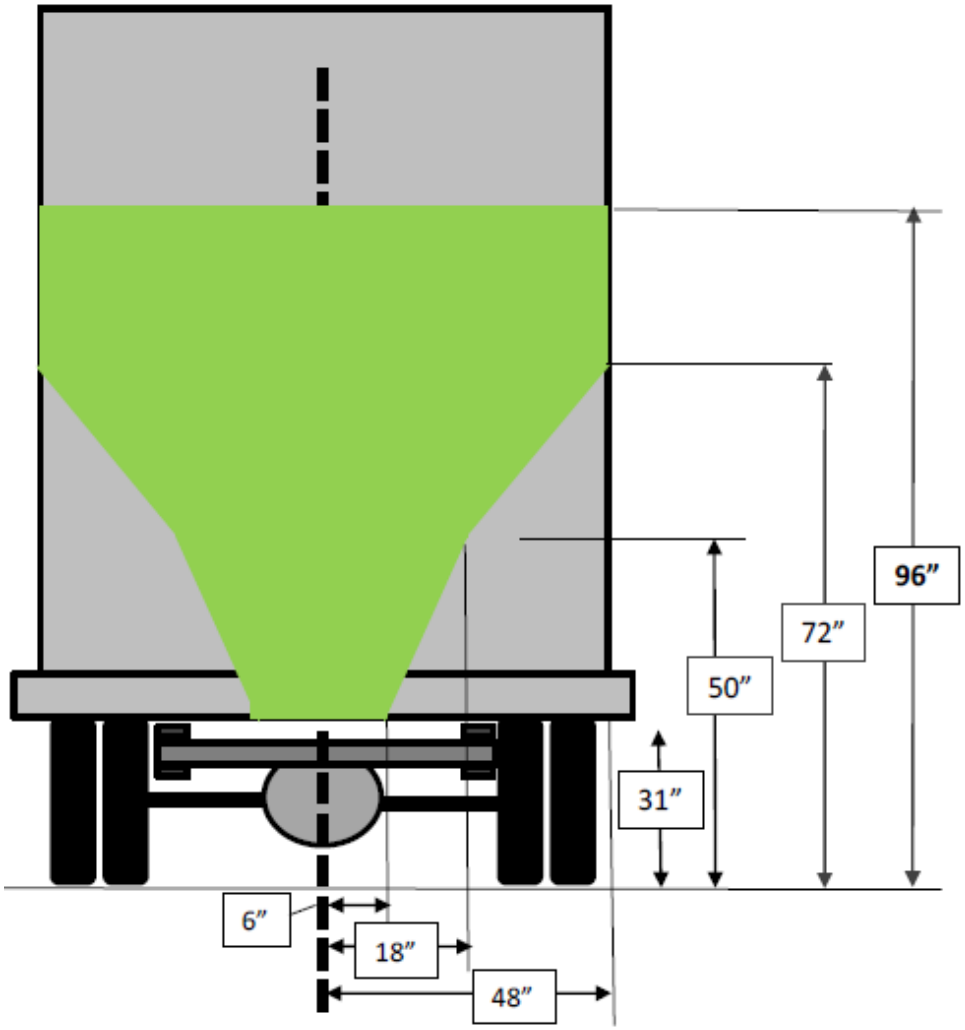


Geometry Used to Derived Subtended Visual Angle Equation

Rear vision system requirements

Image size

Or, look for information from chassis OEMs and vision system suppliers that provide representative locations for positioning cameras where image size AND FOV conformity can be achieved



Meeting requirements

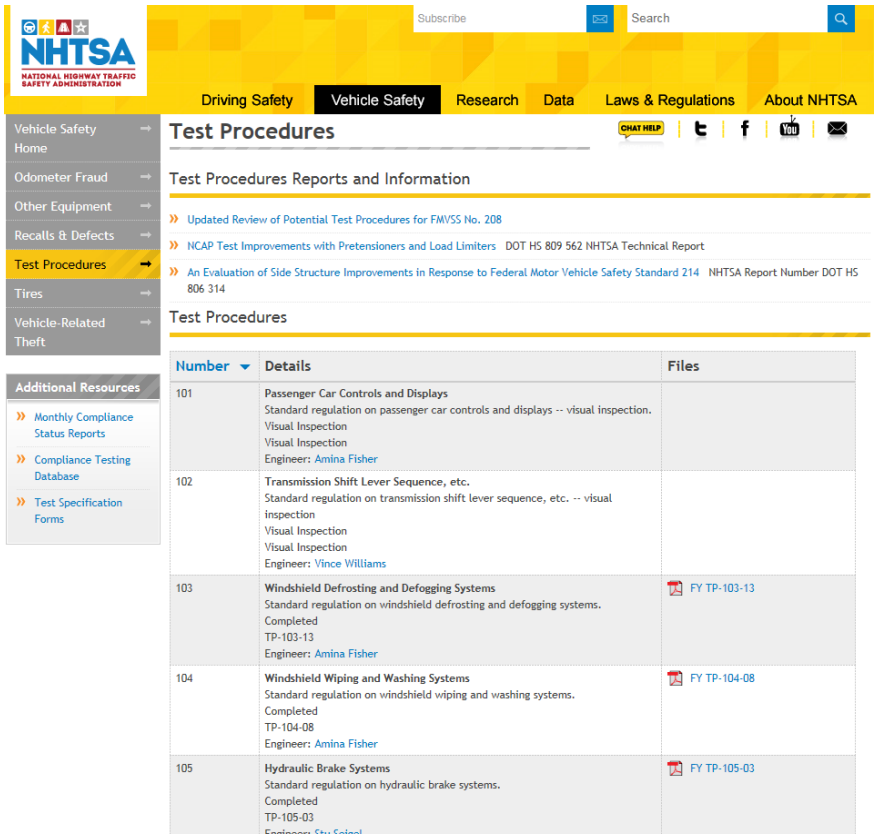
Equipment-related performance requirements

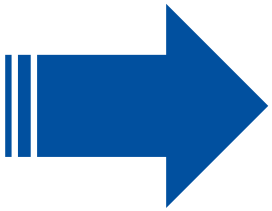
NHTSA is not requiring system suppliers to certify, so ask for compliance statements for the systems you purchase, related to image response time, deactivation, component durability, image default view and image linger time

Meeting requirements

NHTSA test procedure

http://tinyurl.com/k6dj8k9





DRAFT TP-111V-01
May 6, 2016

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 111

Rear Visibility

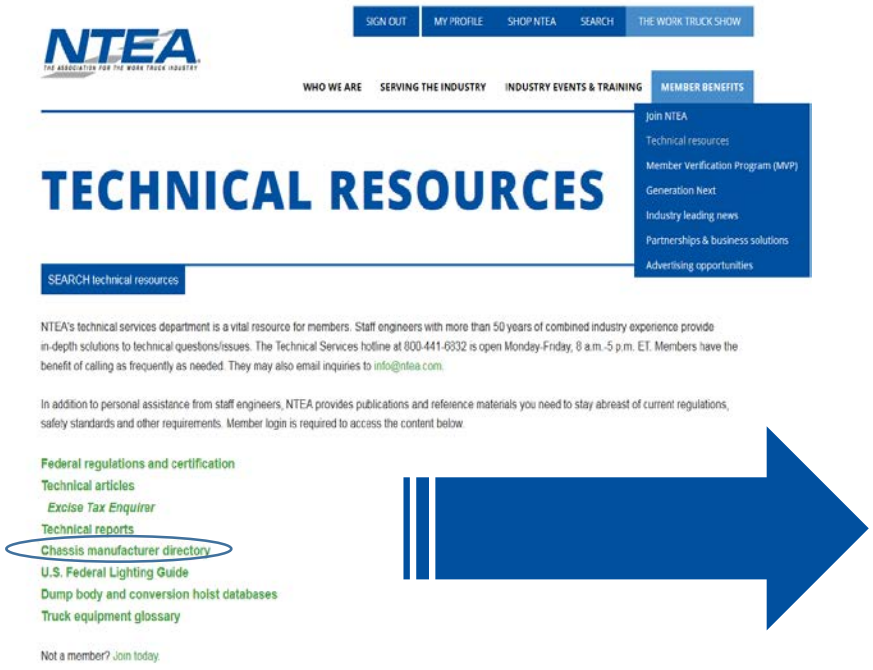
DRAFT

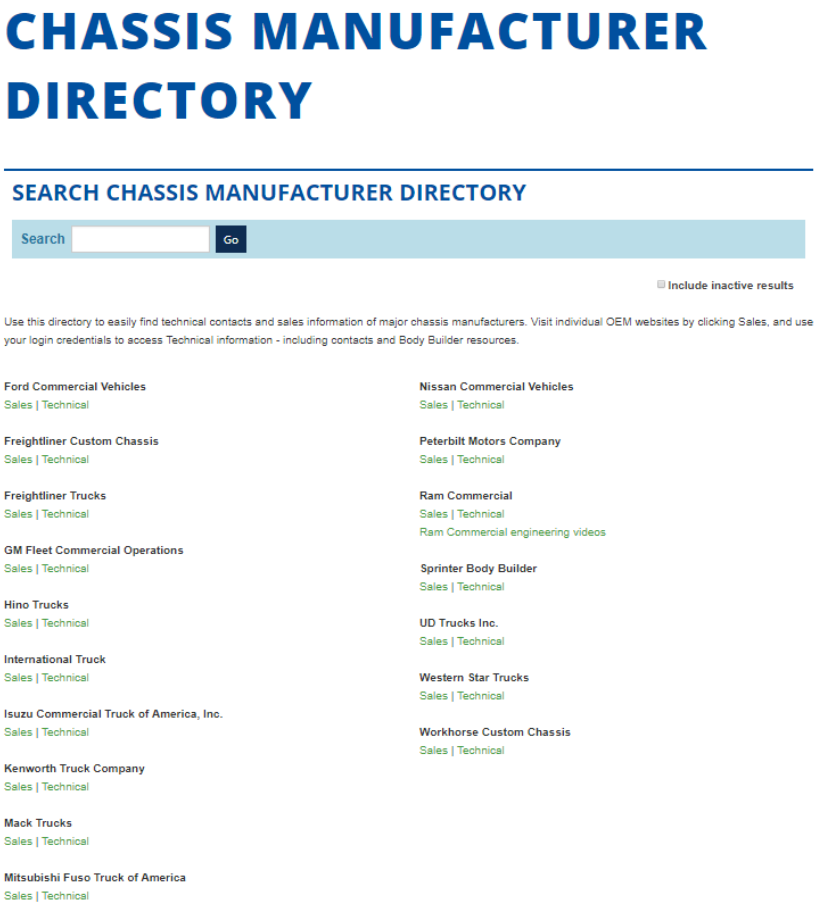
DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

ENFORCEMENT
Office of Vehicle Safety Compliance
Mail Code: NEF 220
1200 New Jersey Avenue, SE
Washington, DC 20590

Meeting requirements

OEM resources: NTEA chassis manufacturer portal





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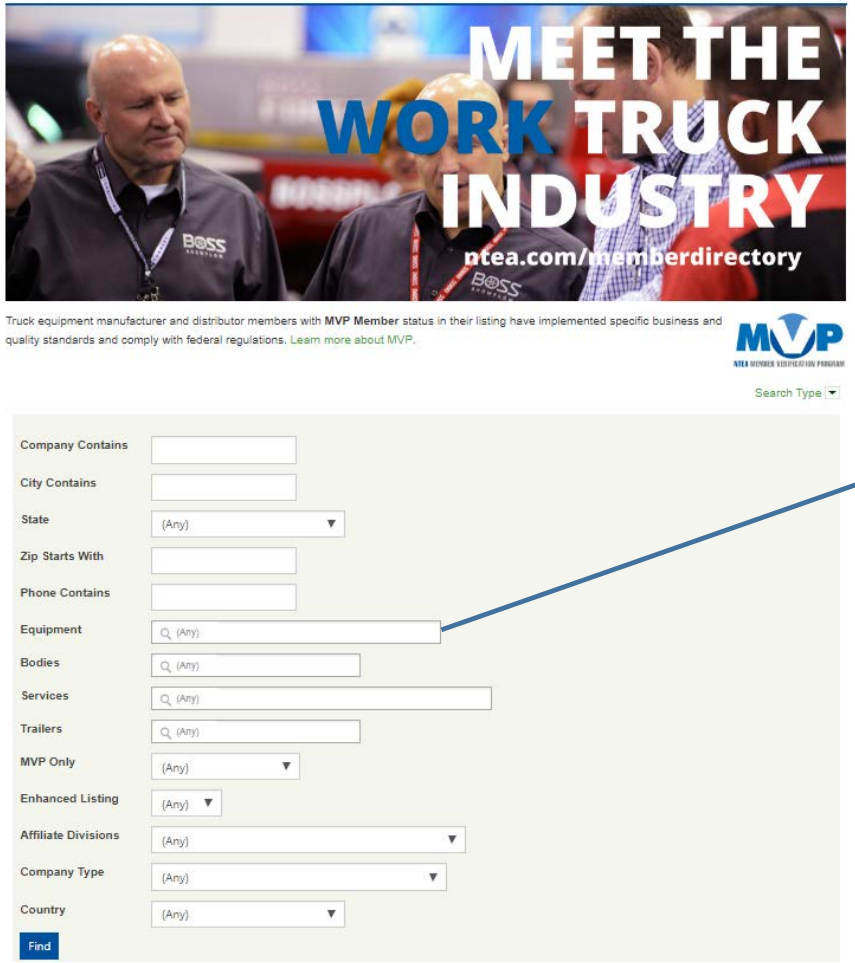
Technology suppliers

MEMBER DIRECTORY



Example search categories for **Equipment**:

- Backing Safety Systems
- Electronic Obstacle Detection
- Rearview Camera Systems
- Video Safety Systems
- Etc.

ntea.com/memberdirectory

Meeting requirements

NTEA resources. NTEA's Rear Visibility FMVSS 111 Field of View (Rearview Camera) Conformity Manual and Kit available on Shop NTEA (ntea.com/shopntea)

ITEM DETAIL

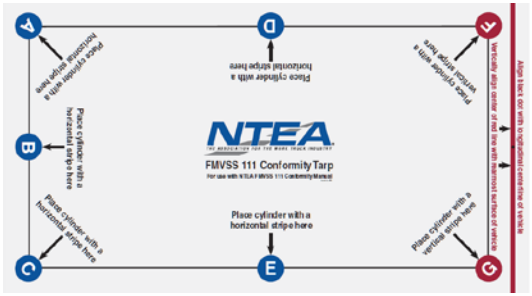
Continue Shopping

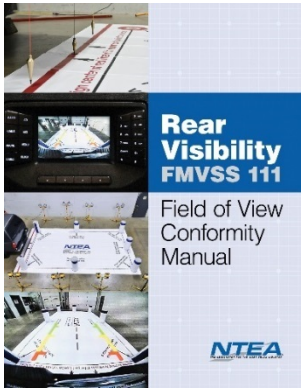
FMVSS 111 FIELD OF VIEW CONFORMITY MANUAL AND KIT

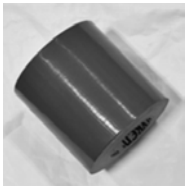
#2297 Member $499, Nonmember $649
Available while supplies last

Equipment manufacturers, distributors and upfitters that modify vehicles will want to better understand any design implications for truck mounted equipment that may impact rearview camera placement and FMVSS 111 conformance. *NTEA's Rear Visibility FMVSS 111 Field of View (Rearview Camera) Conformity Manual* and Kit includes a test manual to provide guidance in meeting the requirements of the field of view rear visibility portion of FMVSS 111 and an approximately 22-foot by 12-foot tarp and 60 yards of tape for use during testing procedures. The *Manual* is spiral-bound for ease of use and includes a materials list; a step-by-step test procedure; full-color photos and diagrams; and a test procedure checklist.

Discounted member price: ~~499.00~~
Your price: 649.00
Quantity: 1 Add to Cart







ntea.com/fmvss111rearvisibility

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FMVSS 111 at The Work Truck Show®

Conformance required by May 1, 2018

NTEA and The Work Truck Show® 2018: your resource for information on FMVSS 111 rear visibility conformity.

See live test demonstrations of how companies can conform with FMVSS 111 rear visibility system requirements in Booth 3400 during the following times:

Wednesday, March 7	1–1:30 p.m.; 3–3:30 p.m.
Thursday, March 8	1–1:30 p.m.; 3–3:30 p.m.

worktruckshow.com/fmvss111

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Questions?

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