

constructed, and maintained so that the driver of an in-transit vehicle can tighten them. However, the rules in this paragraph do not apply to a securement system in which the tiedown assembly consists of steel strapping or to a tiedown assembly which is not required by the rules in this section.

(49 U.S.C. 304, 1655; 49 CFR 1.48(b) and 301.60)

[38 FR 23522, Aug. 31, 1973, as amended at 47 FR 47837, Oct. 28, 1982; 59 FR 34718, July 6, 1994; 59 FR 43898, Aug. 25, 1994]

§ 393.104 Blocking and bracing.

(a) *Protection against longitudinal movement.* When a motor vehicle carries cargo that is not firmly braced against a front-end structure that conforms to the requirements of § 393.106, the cargo must be secured so that, when the vehicle decelerates at a rate of 20 feet per second per second, the cargo will remain on the vehicle and will not penetrate the vehicle's front-end structure.

(b) *Protection against lateral movement.* When a vehicle carries cargo that may shift sideways in transit, the cargo must either be securely blocked or braced against the sides, sideboards, or stakes of the vehicle or be secured by devices that conform to the requirements of paragraph (b)(2), (b)(3), or (b)(4) of § 393.100.

(c) *Effective date.* This section is effective on October 1, 1973.

[38 FR 23522, Aug. 31, 1973, as amended at 38 FR 25183, Sept. 12, 1973]

§ 393.106 Front-end structure.

(a) *General rule.* (1) Except as provided in paragraph (g) of this section, every cargo-carrying motor vehicle must be equipped with a headerboard or similar device of sufficient strength to prevent load shifting and penetration or crushing of the driver's compartment.

(2) On and after the effective dates specified in paragraph (h) of this section, every cargo-carrying motor vehicle must have a front-end structure that conforms to the rules in this section.

(b) *Location.* The front-end structure must be located between the vehicle's cargo and the vehicle's driver.

(c) *Height and width.* The front-end structure must extend either to a

height of 4 feet above the floor of the vehicle or to a height at which it blocks forward movement of any item of cargo being carried on the vehicle, whichever is lower. The front-end structure must have a width which is at least equal to the width of the vehicle or which blocks forward movement of any item of cargo being transported on the vehicle, whichever is narrower.

(d) *Strength.* The front-end structure must be capable of withstanding the horizontal forward static load specified in either paragraph (d) (1) or (2) of this section.

(1) For a front-end structure less than 6 feet in height, a horizontal forward static load equal to one half ($\frac{1}{2}$) of the weight of the cargo being transported on the vehicle uniformly distributed over the entire portion of the front-end structure that is within 4 feet above the vehicle's floor or that is at or below a height above the vehicle's floor at which it blocks forward movement of any item of the vehicle's cargo, whichever is less.

(2) For a front-end structure 6 feet in height or higher, a horizontal forward static load equal to four-tenths (0.4) of the weight of the cargo being transported on the vehicle uniformly distributed over the entire front-end structure.

(e) *Penetration resistance.* The front-end structure must be designed, constructed and maintained so that it is capable of resisting penetration by any item of cargo that contacts it when the vehicle decelerates at a rate of 20 feet per second per second. The front-end structure must have no aperture large enough to permit any item of cargo in contact with the structure to pass through it.

(f) *Substitute devices.* The requirements of this section may be met by the use of devices performing the same functions as a front-end structure, if the devices are at least as strong as, and provide protection against shifting cargo at least equal to, a front-end structure which conforms to those requirements.

(g) *Exemptions.* The following motor vehicles are exempt from the rules in this section:

§ 393.106

49 CFR Ch. III (10–1–02 Edition)

(1) A vehicle which is designed and used exclusively to transport other vehicles, if each vehicle it transports is securely tied down by devices that conform to the requirements of § 393.102.

(2) A pole trailer or semitrailer being towed by a truck tractor that is equipped with a front-end structure that conforms to the rules in this section.

(3) A full trailer being towed by a vehicle that is equipped with a front-end structure that conforms to the requirements of this section for a front-end structure.

(4) A full trailer being towed by a vehicle that is loaded in such a manner that the cargo on the towing vehicle conforms to the requirements of this section for a front-end structure.

(5) The rules in paragraphs (d) and (e) of this section do not apply to a motor vehicle manufactured before January 1, 1974.

(h) *Effective dates.* Cargo-carrying motor vehicles which are not exempted by paragraph (g) of this section must conform to the rules in this section as follows:

If the vehicle was manufactured—	It must conform to the rules in paragraph—	On and after—
Before Jan. 1, 1974.	(a), (b), and (f)	October 1, 1973 or the date it was manufactured, whichever is later.
Before Jan. 1, 1974.	(c)	January 1, 1975.
On or after Jan. 1, 1974.	(a) through (f) inclusive.	The date it was manufactured.

Paragraphs (d) and (e) of this section do not apply to a motor vehicle that was manufactured before January 1, 1974.

EFFECTIVE DATE NOTE: At 67 FR 61225, Sept. 27, 2002, subpart I to part 393 was revised effective December 26, 2002. For the convenience of the user, the revised text is set forth as follows.

Subpart I—Protection Against Shifting and Falling Cargo

§ 393.100 Which types of commercial motor vehicles are subject to the cargo securement standards of this subpart, and what general requirements apply?

(a) *Applicability.* The rules in this subpart are applicable to trucks, truck tractors, semitrailers, full trailers, and pole trailers.

(b) *Prevention against loss of load.* Each commercial motor vehicle must, when transporting cargo on public roads, be loaded and equipped, and the cargo secured, in accordance with this subpart to prevent the cargo from leaking, spilling, blowing or falling from the motor vehicle.

(c) *Prevention against shifting of load.* Cargo must be contained, immobilized or secured in accordance with this subpart to prevent shifting upon or within the vehicle to such an extent that the vehicle's stability or maneuverability is adversely affected.

§ 393.102 What are the minimum performance criteria for cargo securement devices and systems?

(a) *Performance criteria.* Cargo securement devices and systems must be capable of withstanding the following three forces, applied separately:

- (1) 0.8 g deceleration in the forward direction;
- (2) 0.5 g acceleration in the rearward direction; and
- (3) 0.5 g acceleration in a lateral direction.

(b) *Performance criteria for devices to prevent vertical movement of loads that are not contained within the structure of the vehicle.* Securement systems must provide a downward force equivalent to at least 20 percent of the weight of the article of cargo if the article is not fully contained within the structure of the vehicle. If the article is fully contained within the structure of the vehicle, it may be secured in accordance with § 393.106(b).

(c) *Prohibition on exceeding working load limits.* Cargo securement devices and systems must be designed, installed, and maintained to ensure that the maximum forces acting on the devices or systems do not exceed the working load limit for the devices under the conditions listed in paragraphs (a) and (b) of this section.

(d) *Equivalent means of securement.* Cargo that is immobilized, or secured in accordance with the applicable requirements of §§ 393.104 through 393.136, is considered as meeting the performance criteria of this section.

§ 393.104 What standards must cargo securement devices and systems meet in order to satisfy the requirements of this subpart?

(a) *General.* All devices and systems used to secure cargo to or within a vehicle must be capable of meeting the requirements of § 393.102.

(b) *Prohibition on the use of damaged securement devices.* All vehicle structures, systems, parts, and components used to secure cargo must be in proper working order when used to perform that function with no damaged or weakened components that will adversely affect their performance for cargo securement purposes, including reducing the working

Federal Motor Carrier Safety Administration, DOT

§ 393.106

load limit, and must not have any cracks or cuts.

(c) *Vehicle structures and anchor points.* Vehicle structures, floors, walls, decks, tiedown anchor points, headerboards, bulkheads, stakes, posts and associated mounting pockets used to contain or secure articles of cargo must be strong enough to meet the performance criteria of §393.102, with no damaged or weakened components that will adversely effect their performance for cargo securement purposes, including reducing the working load limit, and must not have any cracks or cuts.

(d) *Material for dunnage, chocks, cradles, shoring bars, blocking and bracing.* Material used as dunnage or dunnage bags, chocks, cradles, shoring bars, or used for blocking and bracing, must not have damage or defects which would compromise the effectiveness of the securement system.

(e) *Manufacturing standards for tiedown assemblies.* Tiedown assemblies (including chains, wire rope, steel strapping, synthetic webbing, and cordage) and other attachment or fastening devices used to secure articles of cargo to, or in, commercial motor vehicles must conform to the following applicable standards:

An assembly component of . . .	Must conform to . . .
(1) Steel strapping ^{1,2}	Standard Specification for Strapping, Flat Steel and Seals, American Society for Testing and Materials (ASTM) D3953-97, February 1998. ⁴
(2) Chain	National Association of Chain Manufacturers' Welded Steel Chain Specifications, November 15, 1999. ⁴
(3) Webbing	Web Sling and Tiedown Association's Recommended Standard Specification for Synthetic Web Tiedowns, WSTDA-T1, 1998. ⁴
(4) Wire rope ³	Wire Rope Technical Board's Wire Rope Users Manual, 2nd Edition, November 1985. ⁴
(5) Cordage	Cordage Institute rope standard: <ul style="list-style-type: none"> <li data-bbox="667 516 1365 540">(i) PETERS-2, Polyester Fiber Rope, three-Strand and eight-Strand Constructions, January 1993;⁴ <li data-bbox="667 540 1365 565">(ii) PPRS-2, Polypropylene Fiber Rope, three-Strand and eight-Strand Constructions, August 1992;⁴ <li data-bbox="667 565 1575 605">(iii) CRS-1, Polyester/Polypropylene Composite Rope Specifications, three-Strand and eight-Strand Standard Construction, May 1979;⁴ <li data-bbox="667 605 1449 630">(iv) NRS-1, Nylon Rope Specifications, three-Strand and eight-Strand Standard Construction, May 1979;⁴ and <li data-bbox="667 630 1176 654">(v) C-1, Double Braided Nylon Rope Specifications DBN, January 1984.⁴

¹ Steel strapping not marked by the manufacturer with a working load limit will be considered to have a working load limit equal to one-fourth of the breaking strength listed in ASTM D3953-97.

² Steel strapping 25.4 mm (1 inch) or wider must have at least two pairs of crimps in each seal and, when an end-over-end lap joint is formed, must be sealed with at least two seals.

³ Wire rope which is not marked by the manufacturer with a working load limit shall be considered to have a working load limit equal to one-fourth of the nominal strength listed in the manual.

⁴ See § 393.7 for information on the incorporation by reference and availability of this document.

(f) *Use of tiedowns.* (1) Tiedowns and securing devices must not contain knots.

(2) If a tiedown is repaired, it must be repaired in accordance with the applicable standards in paragraph (e) of this section, or the manufacturer's instructions.

(3) Each tiedown must be attached and secured in a manner that prevents it from becoming loose, unfastening, opening or releasing while the vehicle is in transit.

(4) All tiedowns and other components of a cargo securement system used to secure loads on a trailer equipped with rub rails, must be located inboard of the rub rails whenever practicable.

(5) Edge protection must be used whenever a tiedown would be subject to abrasion or cutting at the point where it touches an article of cargo. The edge protection must resist abrasion, cutting and crushing.

§ 393.106 What are the general requirements for securing articles of cargo?

(a) *Applicability.* The rules in this section are applicable to the transportation of all types of articles of cargo, except commodities in bulk that lack structure or fixed shape (e.g., liquids, gases, grain, liquid concrete, sand, gravel, aggregates) and are transported in a tank, hopper, box or similar device that forms part of the structure of a commercial motor vehicle. The rules in this section apply to the cargo types covered by the commodity-specific rules of § 393.122 through § 393.142. The commodity-specific rules take precedence over the general requirements of this section when additional requirements are given for a commodity listed in those sections.

(b) *General.* Cargo must be firmly immobilized or secured on or within a vehicle by structures of adequate strength, dunnage or dunnage bags, shoring bars, tiedowns or a combination of these.

(c) *Cargo placement and restraint.* (1) Articles of cargo that are likely to roll must be restrained by chocks, wedges, a cradle or other equivalent means to prevent rolling. The means of preventing rolling must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit.

(2) Articles or cargo placed beside each other and secured by transverse tiedowns must either:

(i) Be placed in direct contact with each other, or

(ii) Be prevented from shifting towards each other while in transit.

(d) *Minimum strength of cargo securement devices and systems.* The aggregate working load limit of any securement system used to secure an article or group of articles against movement must be at least one-half times the weight of the article or group of articles.

The aggregate working load limit is the sum of:

(1) One-half of the working load limit of each associated connector or attachment mechanism used to secure a part of the article of cargo to the vehicle; and

(2) One-half of the working load limit for each end section of a tiedown that is attached to an anchor point.

§ 393.108 How is the working load limit of a tiedown determined?

(a) The working load limit (WLL) of a tiedown, associated connector or attachment mechanism is the lowest working load limit of any of its components (including tensioner), or the working load limit of the anchor points to which it is attached, whichever is less.

(b) The working load limits of tiedowns may be determined by using either the tiedown manufacturer's markings or by using the tables in this section. The working load limits listed in the tables are to be used when the tiedown material is not marked by the manufacturer with the working load limit. Tiedown materials which are marked by the manufacturer with working load limits that differ from the tables, shall be considered to have a working load limit equal to the value for which they are marked.

(c) Synthetic cordage (e.g., nylon, polypropylene, polyester) which is not marked or labeled to enable identification of its composition or working load limit shall be considered to have a working load limit equal to that for polypropylene fiber rope.

(d) Welded steel chain which is not marked or labeled to enable identification of its grade or working load limit shall be considered to have a working load limit equal to that for grade 30 proof coil chain.

(e)(1) Wire rope which is not marked by the manufacturer with a working load limit shall be considered to have a working load limit equal to one-fourth of the nominal strength listed in the Wire Rope Users Manual.

(2) Wire which is not marked or labeled to enable identification of its construction type shall be considered to have a working load limit equal to that for 6 × 37, fiber core wire rope.

(f) Manila rope which is not marked by the manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in the tables of working load limits.

(g) Friction mats which are not marked or rated by the manufacturer shall be considered to provide resistance to horizontal movement equal to 50 percent of the weight placed on the mat.

TABLES TO § 393.108
[Working Load Limits (WLL), Chain]

Size mm (inches)	WLL in kg (pounds)				
	Grade 30 proof coil	Grade 43 high test	Grade 70 transport	Grade 80 alloy	Grade 100 alloy
1. 7 (1/4)	580 (1,300)	1,180 (2,600)	1,430 (3,150)	1,570 (3,500)	1,950 (4,300)
2. 8 (5/16)	860 (1,900)	1,770 (3,900)	2,130 (4,700)	2,000 (4,500)	2,600 (5,700)
3. 10 (3/8)	1,200 (2,650)	2,450 (5,400)	2,990 (6,600)	3,200 (7,100)	4,000 (8,800)
4. 11 (7/16)	1,680 (3,700)	3,270 (7,200)	3,970 (8,750)		
5. 13 (1/2)	2,030 (4,500)	4,170 (9,200)	5,130 (11,300)	5,400 (12,000)	6,800 (15,000)
6. 16 (5/8)	3,130 (6,900)	5,910 (13,000)	7,170 (15,800)	8,200 (18,100)	10,300 (22,600)
Chain Mark Examples:					
Example 1	3	4	7	8	10
Example 2	30	43	70	80	100
Example 3	300	430	700	800	1000

SYNTHETIC WEBBING

Width mm (inches)	WLL kg (pounds)
45 (1 3/4)	790 (1,750)
50 (2)	910 (2,000)
75 (3)	1,360 (3,000)
100 (4)	1,810 (4,000)

WIRE ROPE (6 x 37, FIBER CORE)

Diameter mm (inches)	WLL kg (pounds)
7 (1/4)	640 (1,400)
8 (5/16)	950 (2,100)
10 (3/8)	1,360 (3,000)
11 (7/16)	1,860 (4,100)
13 (1/2)	2,400 (5,300)
16 (5/8)	3,770 (8,300)
20 (3/4)	4,940 (10,900)
22 (7/8)	7,300 (16,100)
25 (1)	9,480 (20,900)

MANILA ROPE

Diameter mm (inches)	WLL kg (pounds)
10 (3/8)	90 (205)
11 (7/16)	120 (265)
13 (1/2)	150 (315)
16 (5/8)	210 (465)
20 (3/4)	290 (640)
25 (1)	480 (1,050)

POLYPROPYLENE FIBER ROPE WLL (3-STRAND AND 8-STRAND CONSTRUCTIONS)

Diameter mm (inches)	WLL kg (pounds)
10 (3/8)	180 (400)
11 (7/16)	240 (525)
13 (1/2)	280 (625)
16 (5/8)	420 (925)
20 (3/4)	580 (1,275)
25 (1)	950 (2,100)

POLYESTER FIBER ROPE WLL (3-STRAND AND 8-STRAND CONSTRUCTIONS)

Diameter mm (inches)	WLL kg (pounds)
10 (3/8)	250 (555)
11 (7/16)	340 (750)

POLYESTER FIBER ROPE WLL (3-STRAND AND 8-STRAND CONSTRUCTIONS)—Continued

Diameter mm (inches)	WLL kg (pounds)
13 (1/2)	440 (960)
16 (5/8)	680 (1,500)
20 (3/4)	850 (1,880)
25 (1)	1,500 (3,300)

NYLON ROPE

Diameter mm (inches)	WLL kg (pounds)
10 (3/8)	130 (278)
11 (7/16)	190 (410)
13 (1/2)	240 (525)
16 (5/8)	420 (935)
20 (3/4)	640 (1,420)
25 (1)	1,140 (2,520)

DOUBLE BRAIDED NYLON ROPE

Diameter mm (inches)	WLL kg (pounds)
10 (3/8)	150 (336)
11 (7/16)	230 (502)
13 (1/2)	300 (655)
16 (5/8)	510 (1,130)
20 (3/4)	830 (1,840)
25 (1)	1,470 (3,250)

STEEL STRAPPING

Width x thickness mm (inches)	WLL kg (pounds)
31.7 x .74 (1 1/4 x 0.029)	540 (1,190)
31.7 x .79 (1 1/4 x 0.031)	540 (1,190)
31.7 x .89 (1 1/4 x 0.035)	540 (1,190)
31.7 x 1.12 (1 1/4 x 0.044)	770 (1,690)
31.7 x 1.27 (1 1/4 x 0.05)	770 (1,690)
31.7 x 1.5 (1 1/4 x 0.057)	870 (1,925)
50.8 x 1.12 (2 x 0.044)	1,200 (2,650)
50.8 x 1.27 (2 x 0.05)	1,200 (2,650)

§ 393.110 What else do I have to do to determine the minimum number of tiedowns?

(a) In addition to the requirements of § 393.106, the minimum number of tiedowns required to secure an article or group of articles against movement depends on the length

of the article(s) being secured, and the requirements of paragraphs (b) and (c) of this section.

(b) When an article is not blocked or positioned to prevent movement in the forward direction by a headerboard, bulkhead, other cargo that is positioned to prevent movement, or other appropriate blocking devices, it must be secured by at least:

(1) One tiedown for articles 5 feet (1.52 meters) or less in length, and 1,100 pounds (500 kg) or less in weight;

(2) Two tiedowns if the article is:

(i) 5 feet (1.52 meters) or less in length and more than 1,100 pounds (500 kg) in weight; or

(ii) Longer than 5 feet (1.52 meters) but less than or equal to 10 feet (3.04 meters) in length, irrespective of the weight.

(3) Two tiedowns if the article is longer than 10 feet (3.04 meters), and one additional tiedown for every 10 feet (3.04 meters) of article length, or fraction thereof, beyond the first 10 feet (3.04 meters) of length.

(c) If an individual article is required to be blocked, braced or immobilized to prevent movement in the forward direction by a headerboard, bulkhead, other articles which are adequately secured or by an appropriate blocking or immobilization method, it must be secured by at least one tiedown for every 3.04 meters (10 feet) or article length, or fraction thereof.

(d) *Special rule for special purpose vehicles.* The rules in this section do not apply to a vehicle transporting one or more articles of cargo such as, but not limited to, machinery or fabricated structural items (e.g., steel or concrete beams, crane booms, girders, and trusses, etc.) which, because of their design, size, shape, or weight, must be fastened by special methods. However, any article of cargo carried on that vehicle must be securely and adequately fastened to the vehicle.

§ 393.112 Must a tiedown be adjustable?

Each tiedown, or its associated connectors, or its attachment mechanisms must be designed, constructed, and maintained so the driver of an in-transit commercial motor vehicle can tighten them. However, this requirement does not apply to the use of steel strapping.

§ 393.114 What are the requirements for front end structures used as part of a cargo securement system?

(a) *Applicability.* The rules in this section are applicable to commercial motor vehicles transporting articles of cargo that are in contact with the front end structure of the vehicle. The front end structure on these cargo-carrying vehicles must meet the performance requirements of this section.

(b) *Height and width.* (1) The front end structure must extend either to a height of 4 feet above the floor of the vehicle or to a

height at which it blocks forward movement of any item of article of cargo being carried on the vehicle, whichever is lower.

(2) The front end structure must have a width which is at least equal to the width of the vehicle or which blocks forward movement of any article of cargo being transported on the vehicle, whichever is narrower.

(c) *Strength.* The front end structure must be capable of withstanding the following horizontal forward static load:

(1) For a front end structure less than 6 feet in height, a horizontal forward static load equal to one-half (0.5) of the weight of the articles of cargo being transported on the vehicle uniformly distributed over the entire portion of the front end structure that is within 4 feet above the vehicle's floor or that is at or below a height above the vehicle's floor at which it blocks forward movement of any article of the vehicle's cargo, whichever is less; or

(2) For a front end structure 6 feet in height or higher, a horizontal forward static load equal to four-tenths (0.4) of the weight of the articles of cargo being transported on the vehicle uniformly distributed over the entire front end structure.

(d) *Penetration resistance.* The front end structure must be designed, constructed, and maintained so that it is capable of resisting penetration by any article of cargo that contacts it when the vehicle decelerates at a rate of 20 feet per second, per second. The front end structure must have no aperture large enough to permit any article of cargo in contact with the structure to pass through it.

(e) *Substitute devices.* The requirements of this section may be met by the use of devices performing the same functions as a front end structure, if the devices are at least as strong as, and provide protection against shifting articles of cargo at least equal to, a front end structure which conforms to those requirements.

SPECIFIC SECUREMENT REQUIREMENTS BY COMMODITY TYPE

§ 393.116 What are the rules for securing logs?

(a) *Applicability.* The rules in this section are applicable to the transportation of logs with the following exceptions:

(1) Logs that are unitized by banding or other comparable means may be transported in accordance with the general cargo securement rules of §§ 393.100 through 393.114.

(2) Loads that consist of no more than four processed logs may be transported in accordance with the general