

must be prepared by a registered professional engineer or registered architect, in accordance with acceptable engineering practice, the design loads of the MHCSS, and § 3285.301(d).

(c) All anchoring and foundation systems must be capable of meeting the loads that the home was designed to withstand required by part 3280, subpart D of this chapter, as shown on the home's data plate. Exception: Manufactured homes that are installed in less restrictive roof load zone and wind zone areas may have foundation or anchorage systems that are capable of meeting the lower design load provisions of the Standards, if the design for the lower requirements is either provided in the installation instructions or the foundation and anchorage system is designed by a professional engineer or registered architect.

(d) The installation instructions are to include at least the following information and details for anchor assembly-type installations:

(1) The maximum spacing for installing diagonal ties and any required vertical ties or straps to ground anchors;

(2) The minimum and maximum angles or dimensions for installing diagonal ties or straps to ground anchors and the main chassis members of the manufactured home;

(3) Requirements for connecting the diagonal ties to the main chassis members of the manufactured home. If the diagonal ties are attached to the bottom flange of the main chassis beam, the frame must be designed to prevent rotation of the beam;

(4) Requirements for longitudinal and mating wall tie-downs and anchorage;

(5) The method of strap attachment to the main chassis member and ground anchor, including provisions for swivel-type connections;

(6) The methods for protecting vertical and diagonal strapping at sharp corners by use of radius clips or other means; and

(7) As applicable, the requirements for sizing and installation of stabilizer plates.

§ 3285.402 Ground anchor installations.

(a) *Ground anchor certification and testing.* Each ground anchor must be manufactured and provided with installation instructions, in accordance with its listing or certification. A nationally recognized testing agency must list, or a registered professional engineer or registered architect must certify, the ground anchor for use in a classified soil (refer to § 3285.202), based on a nationally recognized testing protocol, or a professional engineer or registered architect must certify that the ground anchor is capable of resisting all loads in paragraph (b) of this section for the soil type or classification.

(b) *Specifications for tie-down straps and ground anchors—(1) Ground anchors.* Ground anchors must be installed in accordance with their listing or certification, be installed to their full depth, be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated, and be capable of resisting a minimum ultimate load of 4,725 lbs. and a working load of 3,150 lbs., as installed, unless reduced capacities are noted in accordance with note 11 of Table 1 to this section or note 12 of Tables 2 and 3 to this section. The ultimate load and working load of ground anchors and anchoring equipment must be determined by a registered professional engineer, registered architect, or tested by a nationally recognized third-party testing agency in accordance with a nationally recognized testing protocol.

(2) *Tie-down straps.* A 1¼ inch x 0.035 inch or larger steel strapping conforming to ASTM D 3953—97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4), Type 1, Grade 1, Finish B, with a minimum total capacity of 4,725 pounds (lbs.) and a working capacity of 3,150 pounds (lbs.) must be used. The tie-down straps must be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated. Slit or cut edges of coated strapping need not be zinc coated.

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(c) *Number and location of ground anchors.* (1) Ground anchor and anchor strap spacing must be:

(i) No greater than the spacing shown in Tables 1 through 3 to this section and Figures A and B to this section; or

(ii) Designed by a registered engineer or architect, in accordance with acceptable engineering practice and the requirements of the MHCSS for any conditions that are outside the parameters and applicability of the Tables 1 through 3 to this section.

(2) The requirements in paragraph (c) of this section must be used to determine the maximum spacing of ground anchors and their accompanying anchor straps, based on the soil classification determined in accordance with §3285.202:

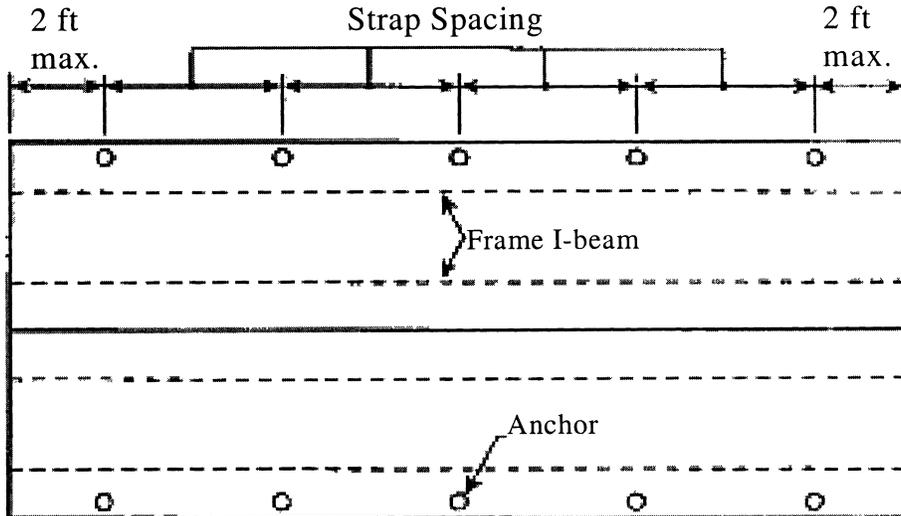
(i) The installed ground anchor type and size (length) must be listed for use in the soil class at the site and for the minimum and maximum angle permitted between the diagonal strap and the ground; and

(ii) All ground anchors must be installed in accordance with their listing or certification and the ground anchor manufacturer installation instructions; and

(iii) If required by the ground anchor listing or certification, the correct size and type of stabilizer plate is installed. If metal stabilizer plates are used, they must be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated. Alternatively, ABS stabilizer plates may be used when listed and certified for such use.

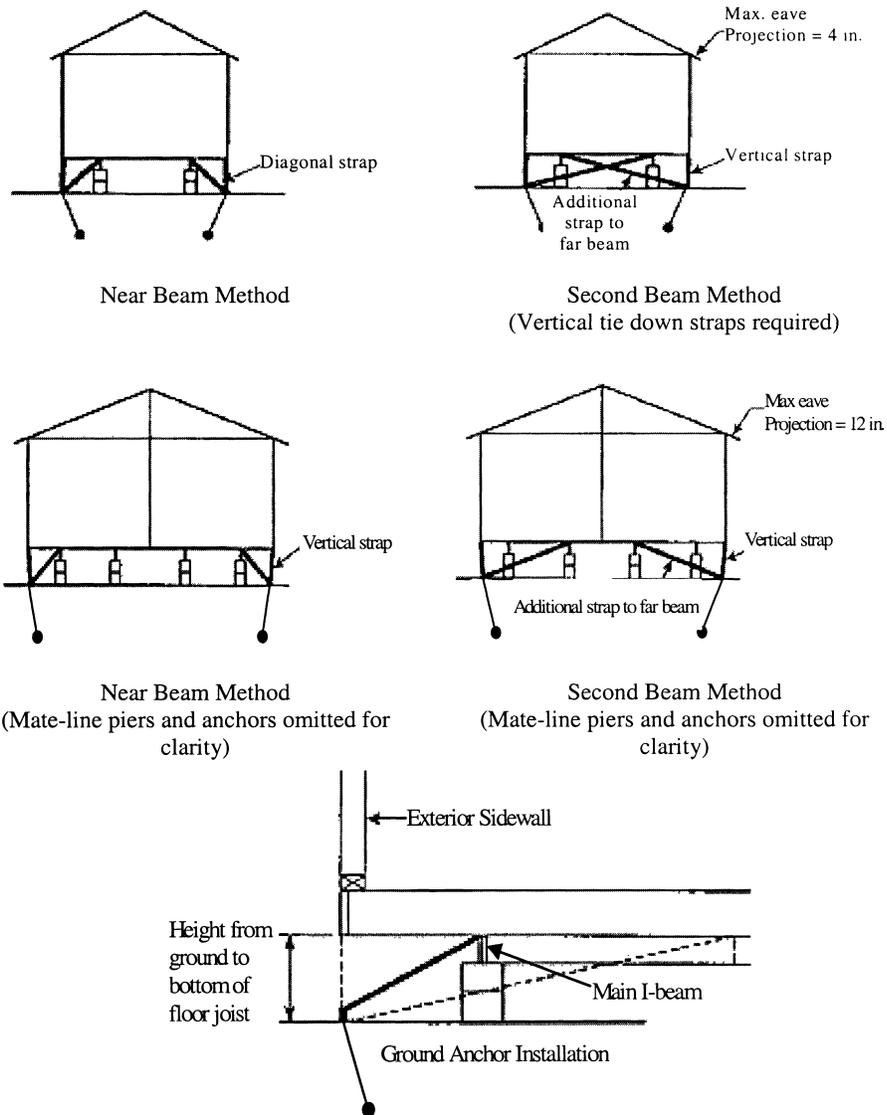
(3) *Longitudinal anchoring.* Manufactured homes must also be stabilized against wind in the longitudinal direction in all Wind Zones. Manufactured homes located in Wind Zones II and III must have longitudinal ground anchors installed on the ends of the manufactured home transportable section(s) or be provided with alternative systems that are capable of resisting wind forces in the longitudinal direction. See Figure C to §3285.402 for an example of one method that may be used to provide longitudinal anchoring. A professional engineer or registered architect must certify the longitudinal anchoring method or any alternative system used as adequate to provide the required stabilization, in accordance with acceptable engineering practice.

Figure A to § 3285.402 Ground Anchor Locations and Spacing – Plan View.



- NOTES:
1. Refer to Tables 1, 2, and 3 to this section for maximum ground anchor spacing.
 2. Longitudinal anchors not shown for clarity; refer to 3285.402(b)(2) for longitudinal anchoring requirements.

Figure B to § 3285.402 Anchor Strap and Pier Relationship.



- NOTES:
1. Vertical Straps are not required in Wind Zone I.
 2. The frame must be designed to prevent rotation of the main chassis beam, when the

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diagonal ties are not attached to the top flange of the beam. See § 3285.401(d)(3).

Figure C to § 3285.402 Longitudinal Anchoring

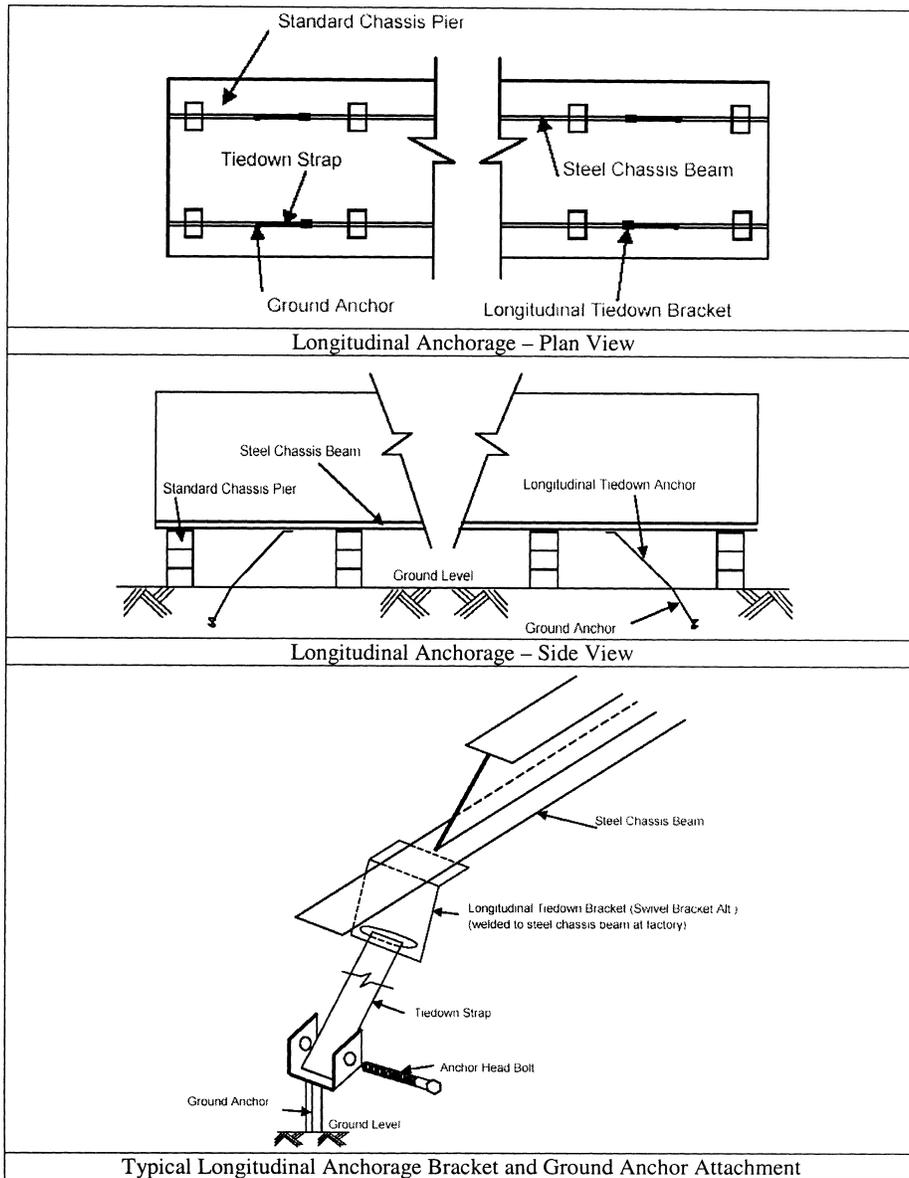


TABLE 1 TO § 3285.402—MAXIMUM DIAGONAL TIE-DOWN STRAP SPACING, WIND ZONE I

Nominal floor width, single section/multi-section	Max. height from ground to diagonal strap attachment	I-beam spacing	
		82.5 in.	99.5 in.
12/24 ft. 144 in. nominal section(s)	25 in	14 ft. 2 in	N/A
	33 in	11 ft. 9 in	N/A
	46 in	9 ft. 1 in	N/A
	67 in	N/A	N/A
14/28 ft. 168 in. nominal section(s)	25 in	18 ft. 2 in	15 ft. 11 in.
	33 in	16 ft. 1 in	13 ft. 6 in.
	46 in	13 ft. 3 in	10 ft. 8 in.
	67 in	10 ft. 0 in	N/A
16/32 ft. 180 in. to 192 in. nominal section(s)	25 in	N/A	19 ft. 5 in.
	33 in	19 ft. 0 in	17 ft. 5 in.
	46 in	16 ft. 5 in	14 ft. 7 in.
	67 in	13 ft. 1 in	11 ft. 3 in.

NOTES:

1. Table is based on maximum 90 in. side-wall height.
2. Table is based on maximum 4 in. inset for ground anchor head from edge of floor or wall.
3. Table is based on main rail (I-beam) spacing per given column.
4. Table is based on maximum 4 in. eave width for single-section homes and maximum 12 in. for multi-section homes.
5. Table is based on maximum 20-degree roof pitch (4.3/12).
6. Table is based upon the minimum height between the ground and the bottom of the floor joist being 18 inches. Interpolation may be required for other heights from ground to strap attachment.
7. Additional tie-downs may be required per the home manufacturer instructions.
8. Ground anchors must be certified for these conditions by a professional engineer, architect, or listed by a nationally recognized testing laboratory.
9. Ground anchors must be installed to their full depth, and stabilizer plates, if required by the ground anchor listing or certification, must also be installed in accordance with the listing or certification and in

accordance with the ground anchor and home manufacturer instructions.

10. Strapping and anchoring equipment must be certified by a registered professional engineer or registered architect, or listed by a nationally recognized testing agency to resist these specified forces, in accordance with testing procedures in ASTM D 3953-97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4).

11. A reduced ground anchor or strap working load capacity will require reduced tie-down strap and anchor spacing.

12. Ground anchors must not be spaced closer than the minimum spacing permitted by the listing or certification.

13. Table is based on a 3,150 lbs. working load capacity, and straps must be placed within 2 ft. of the ends of the home.

14. Table is based on a minimum angle of 30 degrees and a maximum angle of 60 degrees between the diagonal strap and the ground.

15. Table does not consider flood or seismic loads and is not intended for use in flood or seismic hazard areas. In those areas, the anchorage system is to be designed by a professional engineer or architect.

TABLE 2 TO § 3285.402—MAXIMUM DIAGONAL TIE-DOWN STRAP SPACING, WIND ZONE II.

Nominal floor width, single section/multi-section	Max. height from ground to diagonal strap attachment	Near beam method I-beam spacing		Second beam method I-beam spacing	
		82.5 in.	99.5 in.	82.5 in.	99.5 in.
12 ft/24 ft. 144 in. nominal section(s).	25 in	6 ft. 2 in	4 ft. 3 in	N/A	N/A
	33 in	5 ft. 2 in	N/A	N/A	N/A
	46 in	4 ft. 0 in	N/A	N/A	N/A
	67 in	N/A	N/A	6 ft 1 in	6 ft 3 in
14 ft/28 ft. 168 in. nominal section(s).	25 in	7 ft. 7 in	6 ft. 9 in	N/A	N/A
	33 in	6 ft. 10 in	5 ft. 9 in	N/A	N/A
	46 in	5 ft. 7 in	4 ft. 6 in	N/A	N/A
	67 in	4 ft. 3 in	N/A	N/A	N/A

TABLE 2 TO § 3285.402—MAXIMUM DIAGONAL TIE-DOWN STRAP SPACING, WIND ZONE II.—
Continued

Nominal floor width, single section/multi-section	Max. height from ground to diagonal strap attachment	Near beam method I-beam spacing		Second beam method I-beam spacing	
		82.5 in.	99.5 in.	82.5 in.	99.5 in.
16 ft/32 ft. 180 in. to 192 in. nominal section(s).	25 in	N/A	7 ft. 10 in	N/A	N/A
	33 in	7 ft. 6 in	7 ft. 2 in	N/A	N/A
	46 in	6 ft. 9 in	6 ft. 0 in	N/A	N/A
	67 in	5 ft. 4 in	4 ft. 7 in	N/A	N/A

NOTES:

1. Table is based on maximum 90 in. side-wall height.
2. Table is based on maximum 4 in. inset for ground anchor head from edge of floor or wall.
3. Tables are based on main rail (I-beam) spacing per given column.
4. Table is based on maximum 4 in. eave width for single-section homes and maximum 12 in. for multi-section homes.
5. Table is based on maximum 20-degree roof pitch (4.3/12).
6. All manufactured homes designed to be located in Wind Zone II must have a vertical tie installed at each diagonal tie location.
7. Table is based upon the minimum height between the ground and the bottom of the floor joist being 18 inches. Interpolation may be required for other heights from ground to strap attachment.
8. Additional tie downs may be required per the home manufacturer instructions.
9. Ground anchors must be certified by a professional engineer, or registered architect, or listed by a nationally recognized testing laboratory.
10. Ground anchors must be installed to their full depth, and stabilizer plates, if required by the ground anchor listing or cer-

tification, must also be installed in accordance with the listing or certification and in accordance with the ground anchor and home manufacturer instructions.

11. Strapping and anchoring equipment must be certified by a registered professional engineer or registered architect or must be listed by a nationally recognized testing agency to resist these specified forces, in accordance with testing procedures in ASTM D 3953-97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4).

12. A reduced ground anchor or strap working load capacity will require reduced tie-down strap and anchor spacing.

13. Ground anchors must not be spaced closer than the minimum spacing permitted by the listing or certification.

14. Table is based on a 3,150 lbs. working load capacity, and straps must be placed within 2 ft. of the ends of the home.

15. Table is based on a minimum angle of 30 degrees and a maximum of 60 degrees between the diagonal strap and the ground.

16. Table does not consider flood or seismic loads and is not intended for use in flood or seismic hazard areas. In those areas, the anchorage system is to be designed by a professional engineer or architect.

TABLE 3 TO § 3285.402—MAXIMUM DIAGONAL TIE-DOWN STRAP SPACING, WIND ZONE III.

Nominal floor width, single section/multi-section	Max. height from ground to diagonal strap attachment	Near beam method I-beam spacing		Second beam method I-beam spacing	
		82.5 in.	99.5 in.	82.5 in.	99.5 in.
12 ft./24 ft. 144 in. nominal section(s).	25 in	5 ft. 1 in	N/A	N/A	N/A
	33 in	4 ft. 3 in	N/A	N/A	N/A
	46 in	N/A	N/A	N/A	N/A
14 ft./28 ft. 168 in. nominal section(s).	67 in	N/A	N/A	N/A	N/A
	25 in	6 ft. 2 in.	5 ft. 7 in	N/A	N/A
	33 in	5 ft. 8 in	4 ft. 9 in	N/A	N/A
16 ft./32 ft. 180 in. to 192 in. nominal sections.	46 in	4 ft. 8 in	N/A	N/A	N/A
	67 in	N/A	N/A	N/A	N/A
	25 in	N/A	6 ft. 3 in	N/A	N/A
	33 in	6 ft. 1 in	5 ft. 11 in	N/A	N/A
	46 in	5 ft. 7 in	5 ft. 0 in	N/A	N/A
	67 in	4 ft. 5 in	N/A	N/A	N/A

NOTES: 1. Table is based on maximum 90 in. sidewall height.

2. Table is based on maximum 4 in. inset for ground anchor head from edge of floor or wall.

3. Table is based on main rail (I-beam) spacing per given column.

4. Table is based on maximum 4 in. eave width for single-section homes and maximum 12 in. for multi-section homes.

5. Table is based on maximum 20-degree roof pitch (4.3/12).

6. All manufactured homes designed to be located in Wind Zone III must have a vertical tie installed at each diagonal tie location.

7. Table is based upon the minimum height between the ground and the bottom of the floor joist being 18 inches. Interpolation may be required for other heights from ground to strap attachment.

8. Additional tie downs may be required per the home manufacturer instructions.

9. Ground anchors must be certified by a professional engineer, or registered architect, or listed by a nationally recognized testing laboratory.

10. Ground anchors must be installed to their full depth, and stabilizer plates, if required by the ground anchor listing or certification, must also be installed in accordance with the listing or certification and per the ground anchor and home manufacturer instructions.

11. Strapping and anchoring equipment must be certified by a registered professional engineer or registered architect or must be listed by a nationally recognized testing agency to resist these specified forces, in accordance with testing procedures in ASTM D 3953-97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4).

12. A reduced ground anchor or strap working load capacity will require reduced tie-down strap and anchor spacing.

13. Ground anchors must not be spaced closer than the minimum spacing permitted by the listing or certification.

14. Table is based on a 3,150 lbs. working load capacity, and straps must be placed within 2 ft. of the ends of the home.

15. Table is based on a minimum angle of 30 degrees and a maximum angle of 60 degrees between the diagonal strap and the ground.

16. Table does not consider flood or seismic loads and is not intended for use in flood or seismic hazard areas. In those areas, the anchorage system is to be designed by a professional engineer or architect.

§ 3285.403 Sidewall, over-the-roof, mate-line, and shear wall straps.

If sidewall, over-the-roof, mate-line, or shear wall straps are installed on

the home, they must be connected to an anchoring assembly.

§ 3285.404 Severe climatic conditions.

In frost-susceptible soil locations, ground anchor augers must be installed below the frost line, unless the foundation system is frost-protected to prevent the effects of frost heave, in accordance with acceptable engineering practice and § 3280.306 of this chapter and § 3285.312.

§ 3285.405 Severe wind zones.

When any part of a home is installed within 1,500 feet of a coastline in Wind Zones II or III, the manufactured home must be designed for the increased requirements, as specified on the home's data plate (refer to § 3280.5(f) of this chapter) in accordance with acceptable engineering practice. Where site or other conditions prohibit the use of the manufacturer's instructions, a registered professional engineer or registered architect, in accordance with acceptable engineering practice, must design anchorage for the special wind conditions.

§ 3285.406 Flood hazard areas.

Refer to § 3285.302 for anchoring requirements in flood hazard areas.

Subpart F—Optional Features

§ 3285.501 Home installation manual supplements.

Supplemental instructions for optional equipment or features must be approved by the DAPIA as not taking the home out of conformance with the requirements of this part, or part 3280 of this chapter, and included with the manufacturer installation instructions.

§ 3285.502 Expanding rooms.

The support and anchoring systems for expanding rooms must be installed in accordance with designs provided by the home manufacturer or prepared by a registered professional engineer or registered architect, in accordance with acceptable engineering practice.

§ 3285.503 Optional appliances.

(a) *Comfort cooling systems.* When not provided and installed by the home