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## APPENDIX A

### 2-5.4 Anchors and Ties.

**2-5.4.1 Capacity of Anchors.** Each approved ground anchor, when installed, shall be capable of resisting an allowable working load at least equal to 3,150 lbs. (1429 kg) in the direction of the tie plus a 50 percent overload (4,725 lbs. or 2143 kg total) without failure.

**2-5.4.2 Anchoring Equipment.** Anchoring equipment, when installed, shall be capable of resisting an allowable working load equal to or exceeding 3,150 lbs. (1429 kg) and shall be capable of withstanding a 50 percent overload (4,725 lbs. or 2143 kg total) without failure of either the anchoring equipment or the attachment point on the manufactured home. When the stabilizing system is designed by a qualified registered professional engineer or architect, alternative working loads may be used provided the anchoring equipment is capable of withstanding a 50 percent overload. All anchoring equipment shall be listed or labelled as being capable of meeting all

the requirements of this section.

**2-5.4.3 Anchor Installation Specifications.** Each type anchor suitable for this purpose shall have specification data showing the soil classification(s) for which it qualifies.

**2-5.4.4.** Anchors designed for connection of multiple ties shall be capable of resisting the combined working load and overload consistent with the intent expressed herein, and shall be installed to resist resultant forces.

**2-5.4.5 Selection of Anchors.** Anchor selection shall be based on a determination of the soil class at the depth the anchor helical plate will be installed.

**2-5.4.6 Other Anchoring Devices.** Other anchoring devices meeting the requirements of this section shall be permitted if acceptable to the authority having jurisdiction.

**2-5.4.7 Depth of Anchors.** All anchors shall be installed to the full depth shown in the anchor manufacturer's installation instructions. The load-carrying portion of the ground anchors shall extend below the frost line.

**2-5.4.8 Ties.** Strappings or other approved methods or material shall be used for ties. All ties shall be fastened to ground anchors and drawn tight with turnbuckles or other adjustable tensioning devices or devices supplied with the ground anchor.

(a) Tie materials shall be capable of resisting an allowable working load of 3,150 lbs. (1429 kg) with no more than 2 percent elongation and shall withstand a 50 percent overload (4,725 lbs. or 2143 kg total). Ties shall comply with the weathering requirements of 2-5.4.16.

(b) Ties shall connect the ground anchor and the main structural steel frame (I-beam or other shape) which runs lengthwise under the manufactured home. Ties shall not connect to steel outrigger beams which fasten to and intersect the main structural frame unless specifically stated in the manufacturer's installation instructions.

(c) Connection of the cable frame tie to the manufactured home I-beam or equivalent main structural frame member shall be by a 5/8-in. (16-mm) drop-forged closed eye bolt through a hole drilled in the center of the I-beam web or other approved methods. The web shall be reinforced if necessary to maintain the designed I-beam strength.

(d) Cable ends shall be secured with at least three U-bolt-type cable clamps with the U portion of the clamp installed on the short (dead) end of the cable to assure strength equal to that required by 2-5.4.8(a).

**2-5.4.9 Number of Ties.** The minimum number of ties per side for various lengths of manufactured homes in hurricane and nonhurricane zones shall be in accordance with Table 2-5.4.9.

**2-5.4.10 Location of Ties.** When continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, both ties shall be permitted to be connected to a single ground anchor, provided that either the anchor used is capable of carrying both loadings, or that the load capacity of the total number of anchors used is equal to 3150 lbs. (1429 kg) working load plus 50 percent overload (4725 lbs. or 2143 kg) times the number of ties specified in Table 2-5.4.9.

**2-5.4.11 Spacing of Vertical Ties.** Vertical ties shall be evenly spaced as practicable over rafters or over studs along the length of the manufactured home with not more than 8 ft. (2.44 m) open-end spacing on each end.

**2-5.4.12 Special Ties.** Clerestory roofs and add-on sections of expandable manufactured homes shall have provisions for vertical ties at the exposed ends.

**2-5.4.13 Alternate Method Using Strapping.** If the alternate method incorporating straps specified in Table 2-5.4.9 is used, the baling straps shall be wrapped completely around the manufactured home passing under the main steel frame, with both ends of each strap fastened together under tension. The straps shall be in accordance with Section 2-5.4.8. The method used to connect the ends of the strap shall not reduce the allowable working load and overload. Straps shall be installed in accordance with the requirements for ties in 2-5.4.8 through 2-5.4.16.

**2-5.4.14 Tensioning Device Design.** Tensioning devices such as turnbuckles or yoke-type fasteners shall be ended with a clevis or forged or welded eyes.

**2-5.4.15 Permanency of Connections.** Anchoring equipment shall be designed to prevent self-disconnection when ties are slack. Open hook ends shall not be used in any part of the anchoring system.

**2-5.4.16 Resistance to Weather Deterioration.** All anchoring equipment exposed to weathering shall have a resistance to weather deterioration at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 ounces per sq. ft. (0.19 kg/m<sup>2</sup>) on each side of the surface coated, as determined by ASTM Standard Methods of Test for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles (ASTM A90-B).

Note: Slit or cut edges of zinc-coated steel strapping do not need to be zinc coated.

**Table 2-5.1.5  
Nondesignated Footing Areas for Allowable  
Soil Bearing Capacity**

	Roof Live Load 20 (psf) South Zone 75 (psf)				Roof Live Load 30 (psf) Middle Zone 85 (psf)				Roof Live Load 40 (psf) North Zone 95 (psf)			
	Single Section		Multi- Section***		Single Section		Multi- Section***		Single Section		Multi- Section***	
Width of Units up to and including (ft.)**	12	14	12	14	12	14	12	14	12	14	12	14
Tributary Pier Spacing (ft.)**	6	8	8	8	6	6	8	8	6	6	8	8
Pier Load (lb.)**	2700	3150	3600	4200	3060	3570	4080	4760	3420	3990	4560	5320

Allowable Soil Bearing Capacity	Minimum Required Footing Area (sq. in.)												
	1000 psf		1500 psf		2000 psf		3000 psf		4000 psf		6000 psf		8000 psf
1000 psf	389	454	518	605	441	514	588	685	493	575	657	766	
1500 psf	259	302	346	403	294	343	392	457	328	383	438	511	
2000 psf	194	227	259	302	220	257	294	343	246	287	328	383	
3000 psf	.	151	173	202	147	171	196	229	164	192	219	255	
4000 psf	.	.	.	151	.	.	147	171	.	.	164	192	
6000 psf	.	.	.	.	.	.	.	.	.	.	.	.	
8000 psf	.	.	.	.	.	.	.	.	.	.	.	.	

**Notes:**

- a) Rear cantileaver or floor beyond the frame is assumed to be less than 2 feet.
- b) For units wider than the dimensions shown in Table 2-5.1.5, an engineering analysis will be needed to determine pier spacing.
- c) Individual supports shall not bear a design load greater than 8,000 lb., 14,000 lb. ultimate. Minimum required footings shall be not less than 144 sq. in. (1 sq ft.). All values above 144.0 shown. Unit(s) is supplied with overhanging eaves, see manufacturer's installation instructions.
- d) To convert to SI units, use the following equivalents: 1 in. = 25.40 mm; 1ft. = 0.3048 m; 1 psf = 4.882 kg/m<sup>2</sup>; 1 ft.<sup>2</sup> = 0.0929 m<sup>2</sup>.
- \*\*\* See appropriate column for individual section width selected. Multiple section homes may have concentrated roof support which will require special consideration.

psf	kg/m <sup>2</sup>	Soil Type
2000	9765	Loose sand clay soils or medium soft clay
3000	14647	Firm or stiff clay
4000	19530	Loose fine sand or compact inorganic silt soils
6000	29295	Compact sand-clay soils
8000	39059	Loose coarse to medium compact fine sand

**Notes:**

- e) The above table may be used if the soil characteristics are not known. If the soil type is unknown, the following resources may be consulted to determine the soil type/bearing capacity: (a) local authority having jurisdiction; (b) Soil conservation district; (c) United States Geological Survey; (d) the Soil Conservation Service of the U.S. Department of Agriculture; (e) highway department. If none of the above resources can provide information on the soil type, a qualified professional engineer can be used to determine the soil type.
- f) See other requirements in Chapter 2 for information on manufactured home stabilizing systems.
- g) Where natural soils or controlled fills cannot meet this design, a prepared surface shall be provided to a sufficient depth to meet the minimum load-bearing capacity specified herein.

Table 2-5.4.9

**Number of Ties Required per Side of Single Section<sup>1</sup> Manufactured Homes<sup>2</sup>**  
 This table is based on a minimum working load per actor of 3,150 lbs. (1429 kg) with a 50 percent overload ( 4725 lb. (2143 kg ) total)

A	B	C	D	E	F	G	H	I
Hurricane Resistive				Nonhurricane Resistive				
Length of <sup>3</sup> Manuf. Home (ft) <sup>*</sup>	Alternate Method <sup>4</sup>				Alternate Method			
	No. of Vertical Ties	No. of Diagonal Ties	No. of Baling Straps	No. of Diagonal Ties <sup>4</sup>	No. of Vertical Ties	No. of Diagonal Ties <sup>5</sup>	No. of Baling Straps	No. of Diagonal Ties <sup>6</sup>
Up to 40	2	4	2	5	2	3	2	3
40 to<46	2	4	2	6	2	3	2	3
46 to<49	2	5	2	6	2	3	2	3
49 to<54	3	5	3	7	2	3	2	3
54 to<58	3	5	3	7	2	4	2	4
58 to<64	3	6	3	8	2	4	2	4
64 to<70	3	6	3	9	2	4	2	5
70 to<73	3	7	3	9	2	4	2	5
73 to<84	4	7	4	10	2	5	2	5

1 Double section manufactured homes require only the diagonal ties specified in column C or G

2 Except when the anchoring system is designed and approved by a registered professional engineer or architect

3 Length of manufactured home (as used in this table) means length excluding draw bar.

4 Alternate Method. When this method is used, an approved wall reinforcement means shall be provided. If baling is used to accomplish reinforcement, the provisions of 2-5.4.13 shall apply.

5 Diagonal ties in this method shall deviate at least 45 degrees from a vertical direction.

6 Diagonal ties in this method 45 degrees +/- 5 degrees from vertical and shall be attached to the nearest main frame member.

\* for conversion meters, 1 ft. = 0.3048 m rounding off the total length to zero decimal points.