National Rural Electric Cooperative Association

Manufactured Housing Research Alliance

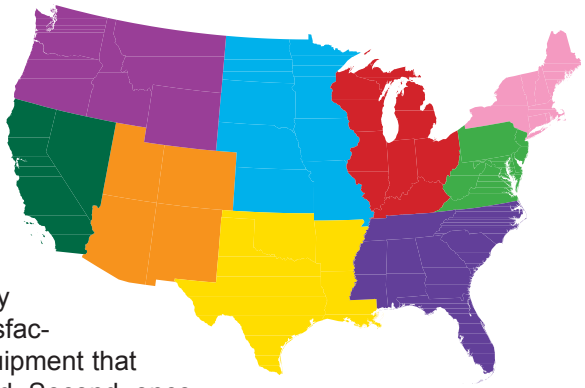
Manufactured Home Cooling Equipment Sizing Guidlines

United States Environmental Protection Agency

Tennessee Valley Authority

For ENERGY STAR® qualified manufactured homes and homes built to the HUD standards[1]

Oversizing cooling equipment: a costly mistake



The guidelines offer a simple look-up procedure to assist equipment specifiers, HVAC contractors, home installers, retailers, manufacturers, and electric utility staff select heat pump and air conditioner capacity for new manufactured homes. The guidelines were developed to help eliminate the all-too-common problem of choosing equipment with far more cooling capacity than the home needs.

Oversized HVAC equipment is recognized as a common industry problem that erodes energy efficiency and lowers customer satisfaction. Consumers overpay in two ways. First, they are buying equipment that has more cooling capacity and is more expensive than they need. Second, once installed, oversized equipment cycles on and off frequently, shortening equipment life, lowering efficiency, and increasing power bills. Oversized equipment also can lead to moisture problems within the home.

ENERGY STAR

ENERGY STAR is a nationally recognized, voluntary labeling program designed to identify and promote energy-efficient homes, buildings, and products to consumers and business owners across the United States. The U.S. Environmental Protection Agency is responsible for administering the ENERGY STAR for Homes program. An ENERGY STAR qualified home is at least 30% more energy efficient in its heating, cooling and water heating than a comparable home built to the 1993 Model Energy Code. This increased level of energy efficiency is met by successfully integrating an energy efficient building envelope (effective insulation, tight construction, advanced windows), energy efficient air distribution (air-tight, well-insulated ducts), and energy efficient equipment (space heating and cooling and hot water heating).

ENERGY STAR qualified homes typically require less cooling capacity because their high insulation levels and tight construction slow the transfer of heat from outside into the home, and their tight air distribution systems minimize the loss of conditioned air from the ducts.

[1]Thermal provisions of the Manufactured Housing Construction and Safety Standards, Subpart F, Section §3280

How to use the sizing guidelines

The sizing guidelines consist of a set of nine maps covering the continental U.S. and the **Sizing Table** containing recommended cooling equipment sizes in tons. The maps are divided into counties. Contiguous counties that have the same sizing recommendations are combined into **Sizing Groups**.[1] The maps and **Sizing Table** are available on the Web at http://www.mhrahome.org and http://www.energystar.gov.

Follow these steps to determine your recommended size:

1. Find the county where the home will be sited on the map and determine the corresponding **Sizing Group** number.
2. Find the row corresponding to the **Sizing Group** on the **Sizing Table**. The rows on the table are color-coded to match the colors on the map.
3. Determine the conditioned **Floor Area** of the home and read across the top row of the table locating the pair of columns containing that area.
4. To find the required cooling equipment capacity in tons for a heat pump or air conditioner, read down the column that corresponds to the **Floor Area** and across the row that corresponds to the **Sizing Group**.
5. The left-hand column in each pair represents the appropriate cooling equipment size for ENERGY STAR qualified homes. The right-hand column in each pair represents the size (in tons of cooling capacity) for homes built to the HUD-standards thermal requirements.

Example:

- An ENERGY STAR qualified home is to be installed in **Richmond County** near Ocala, Florida.
- The map indicates that Richmond County is in a **Sizing Group 50**.
- The home is a 28 ft. by 56 ft. multisection containing **1,568 square feet** of conditioned living space (28 ft. x 56 ft.=1,568 sq. ft.).
- Referring to the **Sizing Table**, read across the row labeled **Sizing Group 50** and down the column containing 1,568 square feet **(1,441 to 1,680)**.
- Read down the left-hand (blue) column for an **ENERGY STAR** qualified home.
- This home requires a **3 Ton** heat pump.

[1]Some counties are divided into more than one sizing group.

Sizing charts are available for other regions of the U.S. For information on obtaining sizing guidance for other areas, please visit the Manufactured Housing Research Alliance web site at: http://www.mhrahome.org.

The Manufactured Housing Research Alliance developed the sizing charts. MHRA is a non-profit membership organization comprised of firms actively engaged in the manufactured housing business. Wrightsoft Corporation performed the engineering analysis. The technical basis for the values that appear on the chart is Right-J™, an Air Conditioning Contractors of America (ACCA)-endorsed software version of ACCA Manual J, Load Calculation for Residential Winter and Summer Air Conditioning, Seventh Edition.

Floor Area (square feet)	Up to 840		841 to 1,120		1,121 to 1,280		1,281 to 1,440		1,441 to 1,680		1,681 to 1,960		1,961 to 2,240		2,241 to 2,520		2,521 to 2,760		2,761 to 3,000	
Sizing Group	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD	ENERGY STAR	HUD
1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2	2	2.5	2.5	2.5
2	1	1	1.5	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5
3	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5
4	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5
5	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5
6	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5
7	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2	2.5	2.5	2.5	2.5	3
8	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5	3	3
9	1	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5	2.5	2.5	3	2.5	3
10	1	1	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3
11	1	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3	3.5
12	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5
13	1	1.5	1.5	1.5	1.5	2	2	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3	3.5
14	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3	3	3.5
15	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3	3.5
16	1.5	1.5	1.5	2	2	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3	4
17	1.5	1.5	1.5	2	1.5	2	2	2	2	2.5	2.5	2.5	2.5	3	3	3.5	3	3.5	3	4
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50	2	2	2	2.5	2.5	3	2.5	3	3	3.5	3.5	4	3.5	4.5	4	5	4	5.5	4	5.5
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53	1.5	2	2	2.5	2.5	3	2.5	3	2.5	3.5	3	4	3.5	4.5	3.5	5	4	5.5	4	6
54	1.5	2	2	2.5	2.5	3	2.5	3	3	3.5	3	4	3.5	4.5	4	5	4	5.5	4	6
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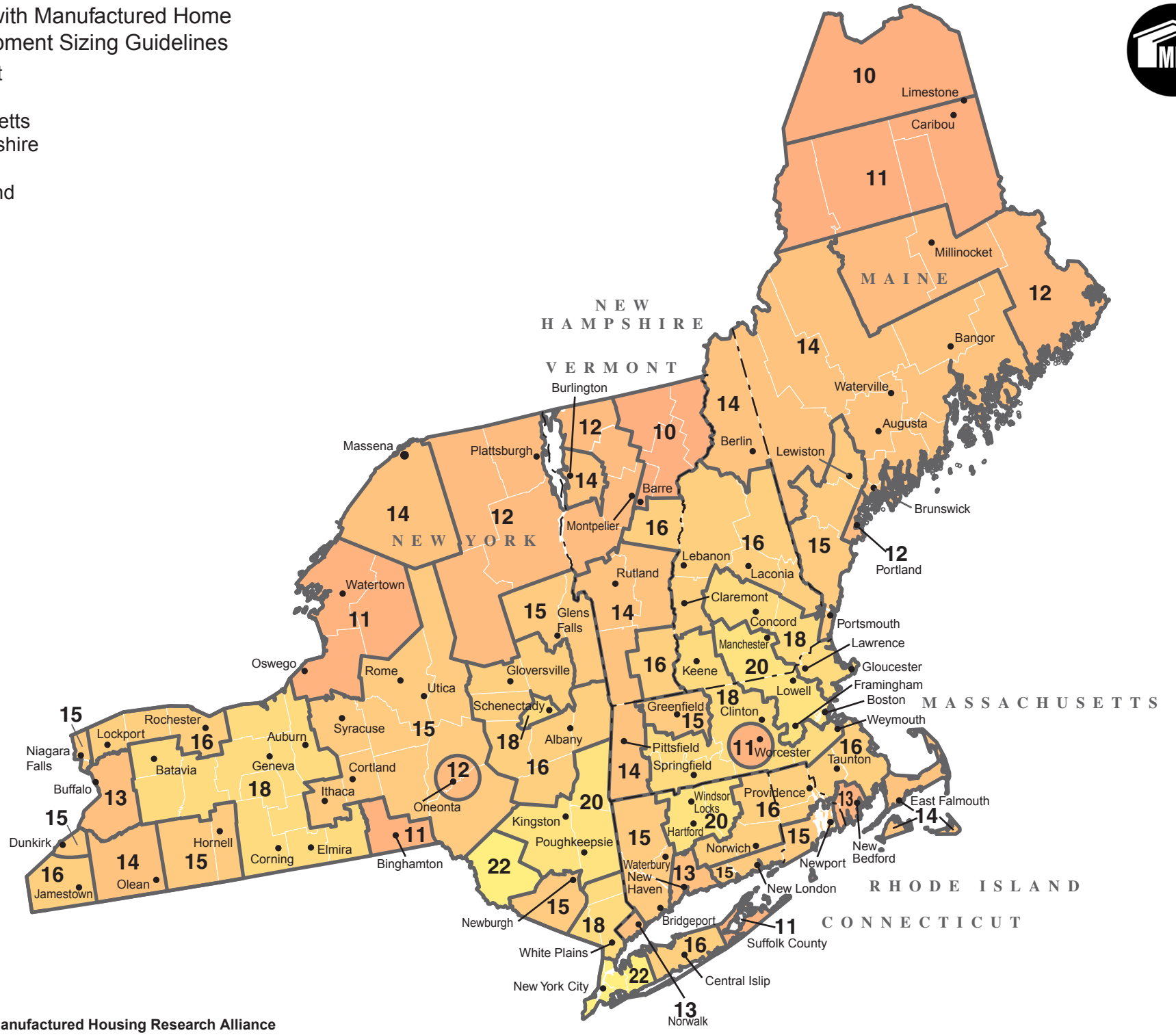
57	2	2	2.5	2.5	2.5	3	3	3	3.5	3.5	3.5	4	4	4.5	4.5	5	4.5	5.5	5	6
58	1.5	2	2	2.5	2	3	2.5	3.5	2.5	3.5	3	4	3.5	4.5	3.5	5	3.5	5.5	4	6
59	2	2	2	3	2.5	3	2.5	3.5	3	3.5	3	4	3.5	4.5	4	5	4	5.5	4	6
60	2	2	2.5	3	2.5	3	3	3.5	3.5	3.5	3.5	4	4	4.5	4.5	5	4.5	5.5	5	6
61	2	2	2.5	3	2.5	3	2.5	3.5	3	4	3.5	4.5	4	5	4	5.5	4.5	6	4.5	6.5
62	1.5	2.5	2	3	2.5	3	2.5	3.5	3	4	3	4.5	3.5	5	4	5.5	4	6	4.5	6.5
63	2	2.5	2.5	3	2.5	3	2.5	3.5	3	4	3.5	4.5	4	5	4	5.5	4.5	6	4.5	6.5
64	2	2.5	2.5	3	3	3	3	3.5	3.5	4	4	4.5	4.5	5	4.5	5.5	5	6	5	6.5
65	2	2.5	2.5	3	2.5	3.5	3	3.5	3.5	4	3.5	4.5	4	5	4.5	5.5	4.5	6	5	7
66	2	2.5	2.5	3	3	3.5	3	3.5	3.5	4	4	4.5	4.5	5.5	4.5	6	4.5	6.5	5	7
67	2	2.5	3	3	3	3.5	3	3.5	3.5	4	4	4.5	4.5	5.5	5	6	5	6.5	5.5	7
68	2.5	2.5	3	3	3	3.5	3.5	3.5	4	4.5	4.5	5	5	5.5	5	6	5.5	6.5	5.5	7
69	2	2.5	2.5	3	3	3.5	3	4	3.5	4.5	4	5	4.5	5.5	4.5	6	5	6.5	5	7
70	2.5	3	3	3.5	3.5	4	3.5	4	4	4.5	4.5	5.5	5	6	5.5	6.5	5.5	7	6	8
71	2.5	3	3	3.5	3.5	4	3.5	4.5	4	5	4.5	5.5	5.5	6	5.5	7	5.5	7.5	6	8

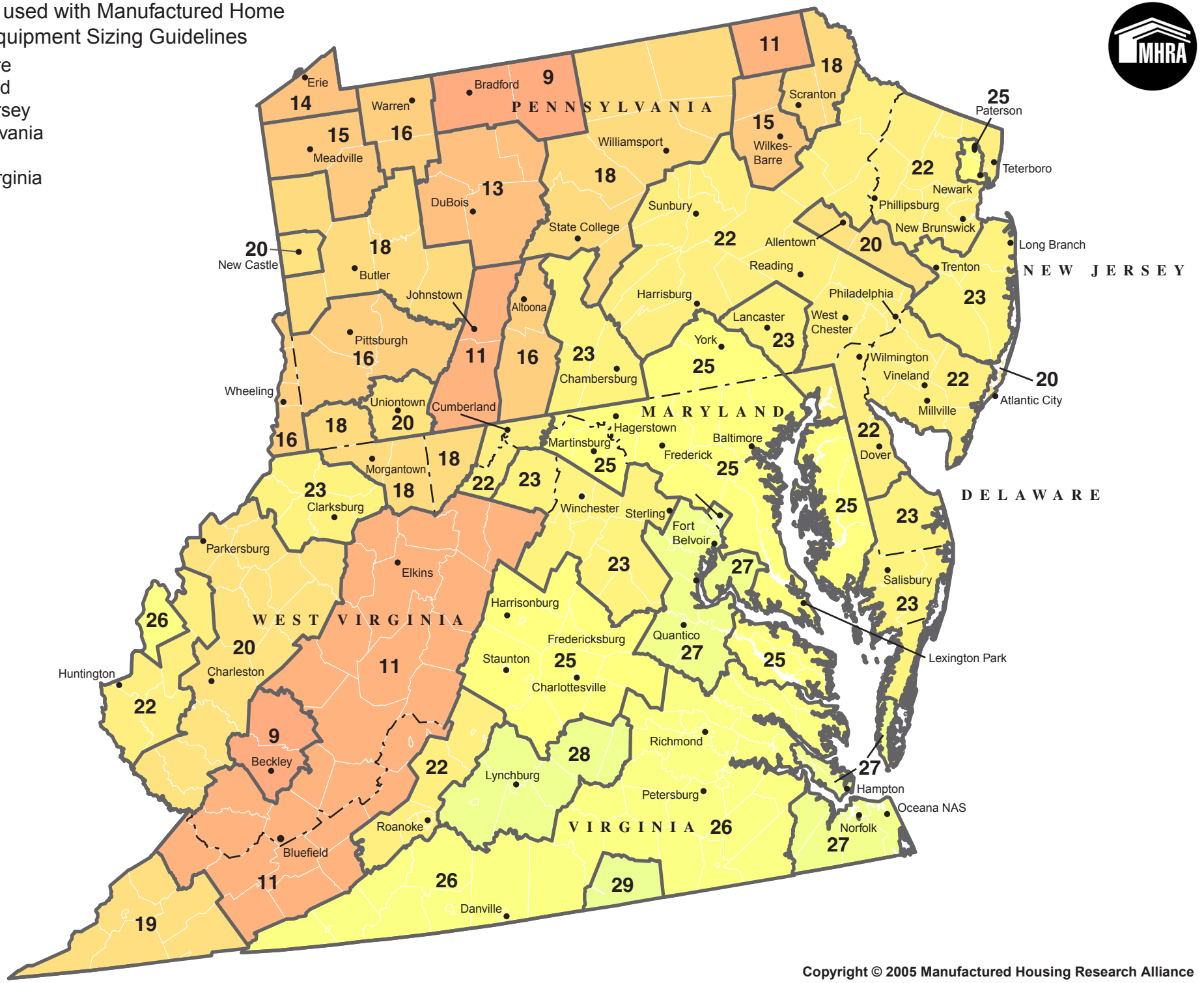
Map for use with Manufactured Home
Cooling Equipment Sizing Guidelines

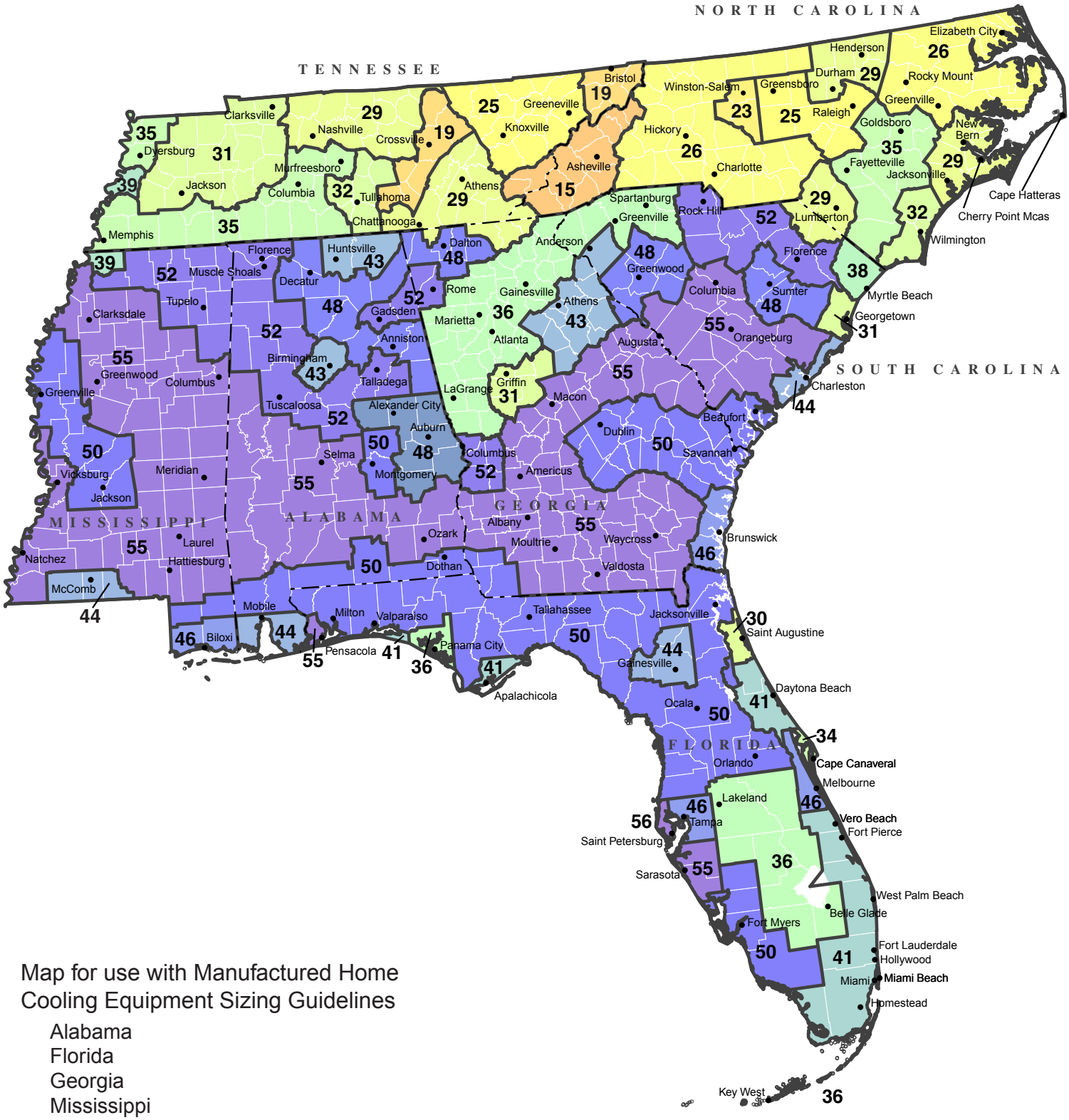
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- New York
- Rhode Island
- Vermont



Map to be used with Manufactured Home Cooling Equipment Sizing Guidelines

Delaware
Maryland
New Jersey
Pennsylvania
Virginia
West Virginia



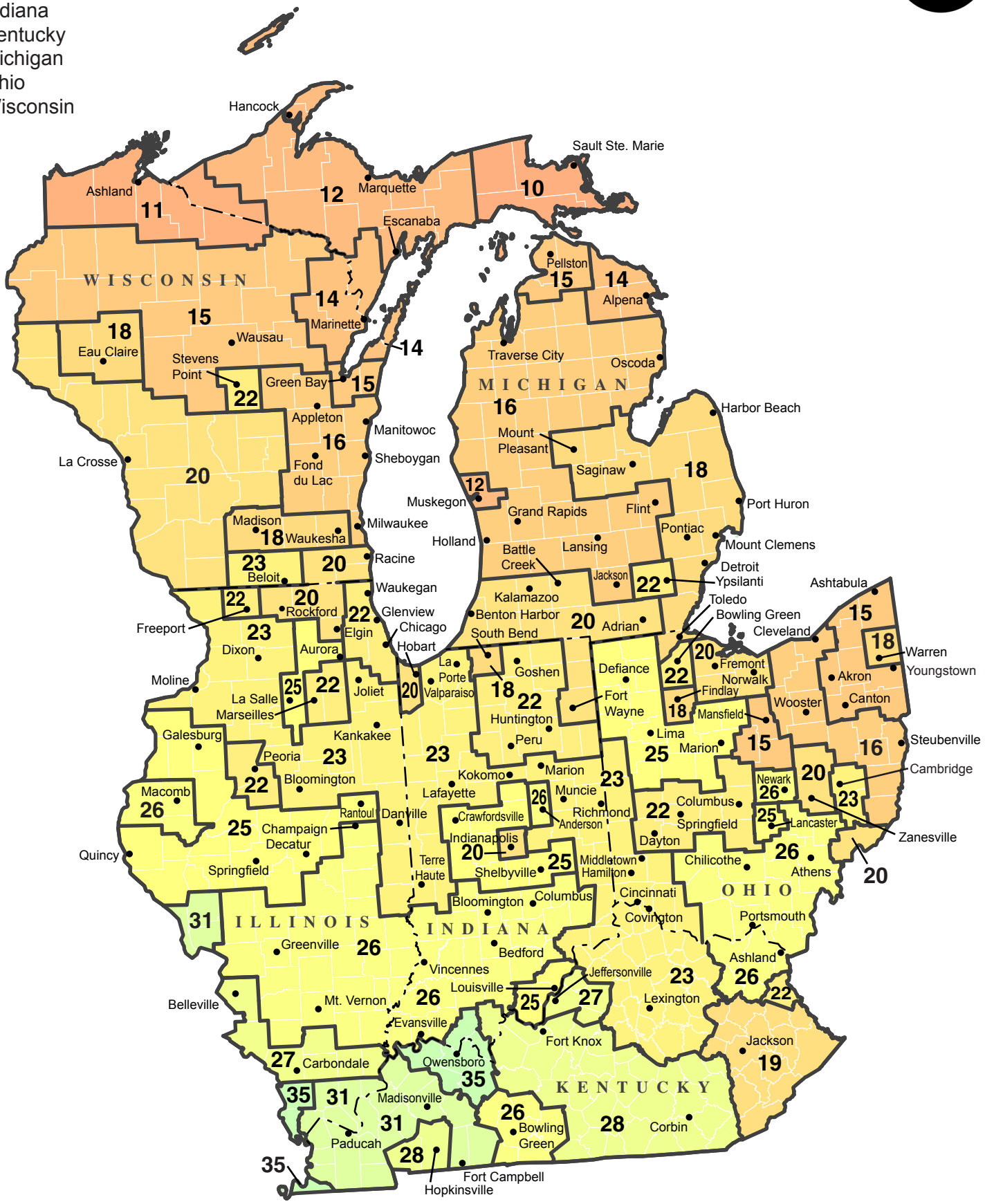


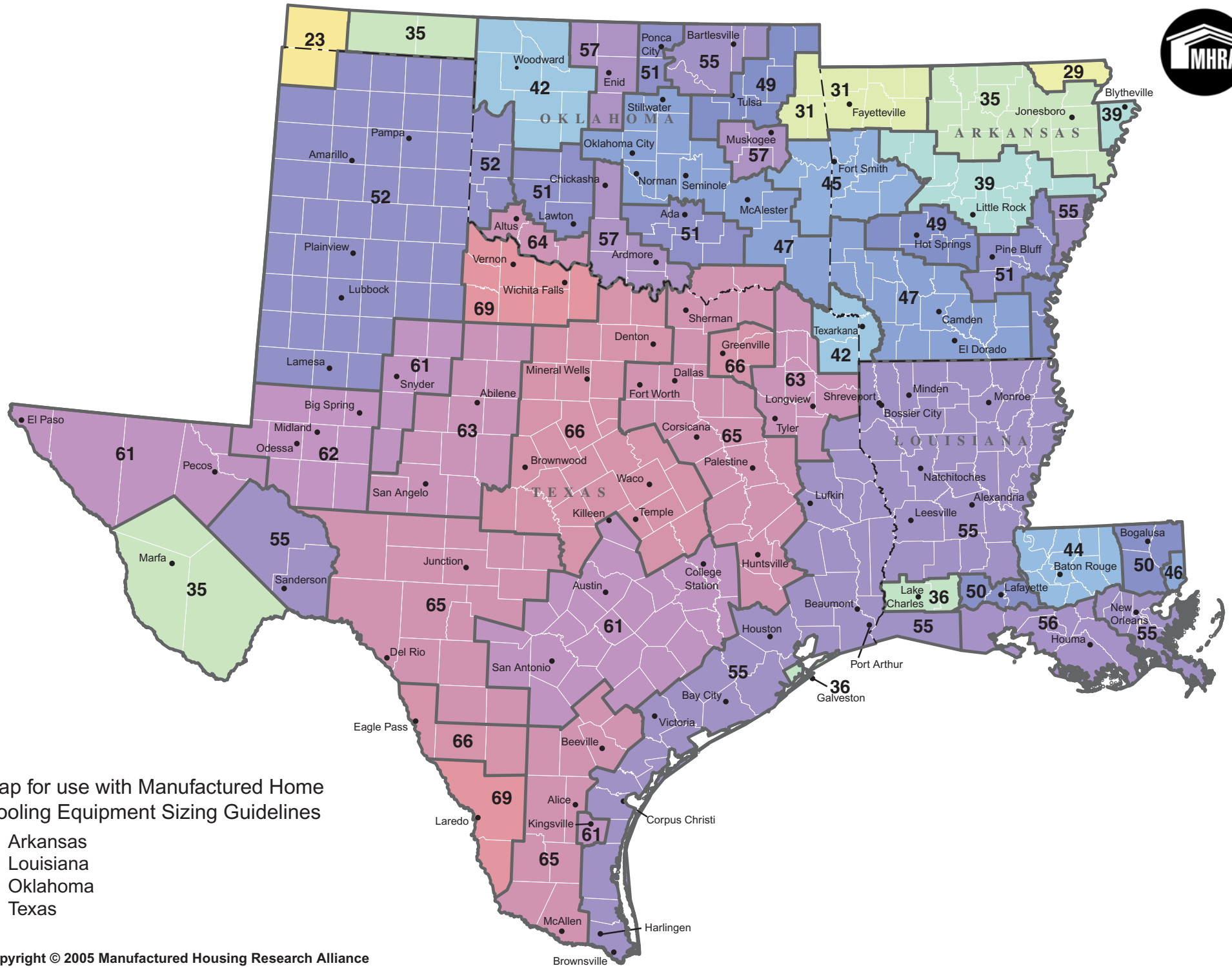
Map for use with Manufactured Home Cooling Equipment Sizing Guidelines

- Alabama
- Florida
- Georgia
- Mississippi
- North Carolina
- South Carolina
- Tennessee

Map for use with Manufactured Home
Cooling Equipment Sizing Guidelines

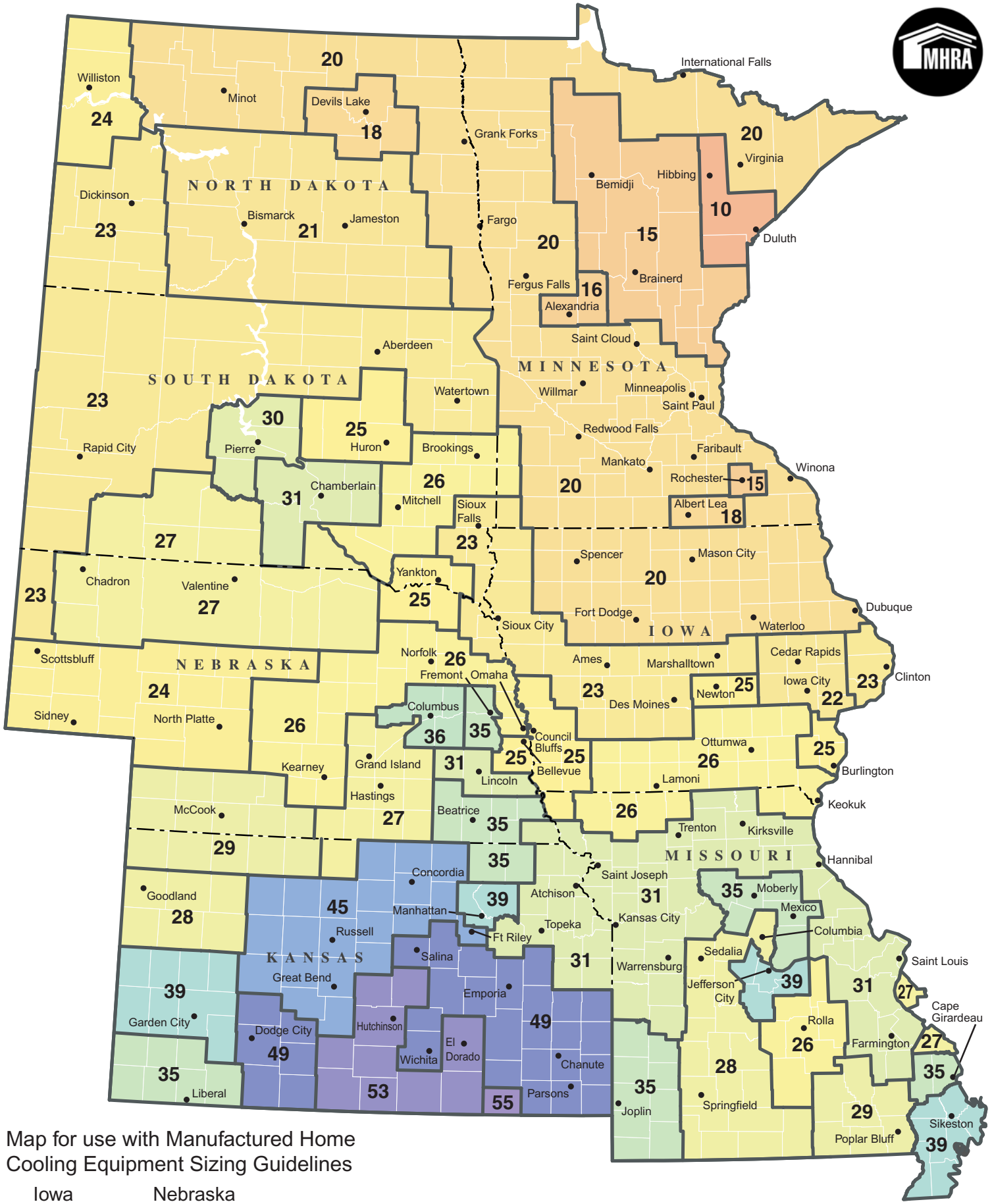
Illinois
Indiana
Kentucky
Michigan
Ohio
Wisconsin





Map for use with Manufactured Home Cooling Equipment Sizing Guidelines

- Arkansas
- Louisiana
- Oklahoma
- Texas

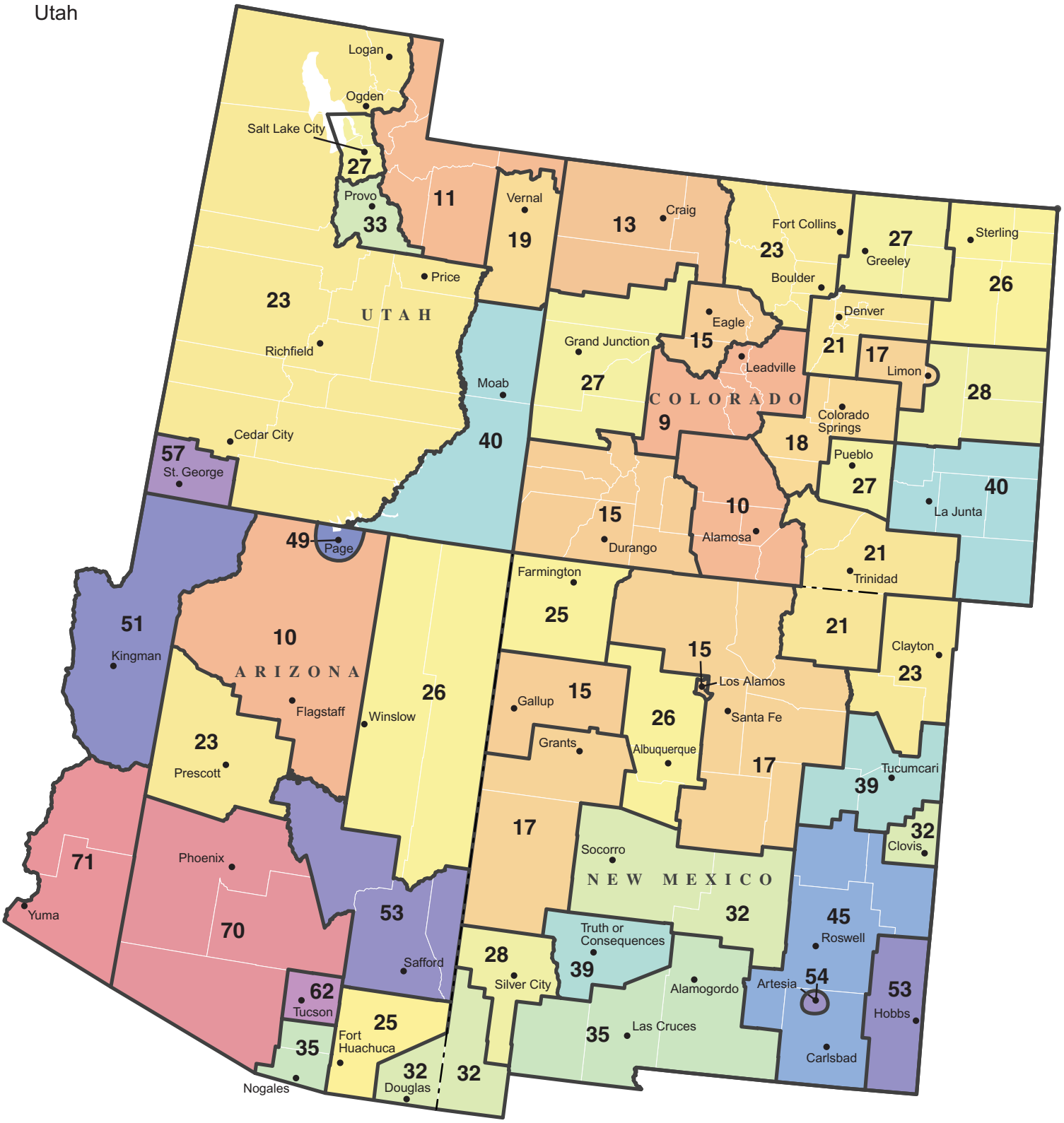


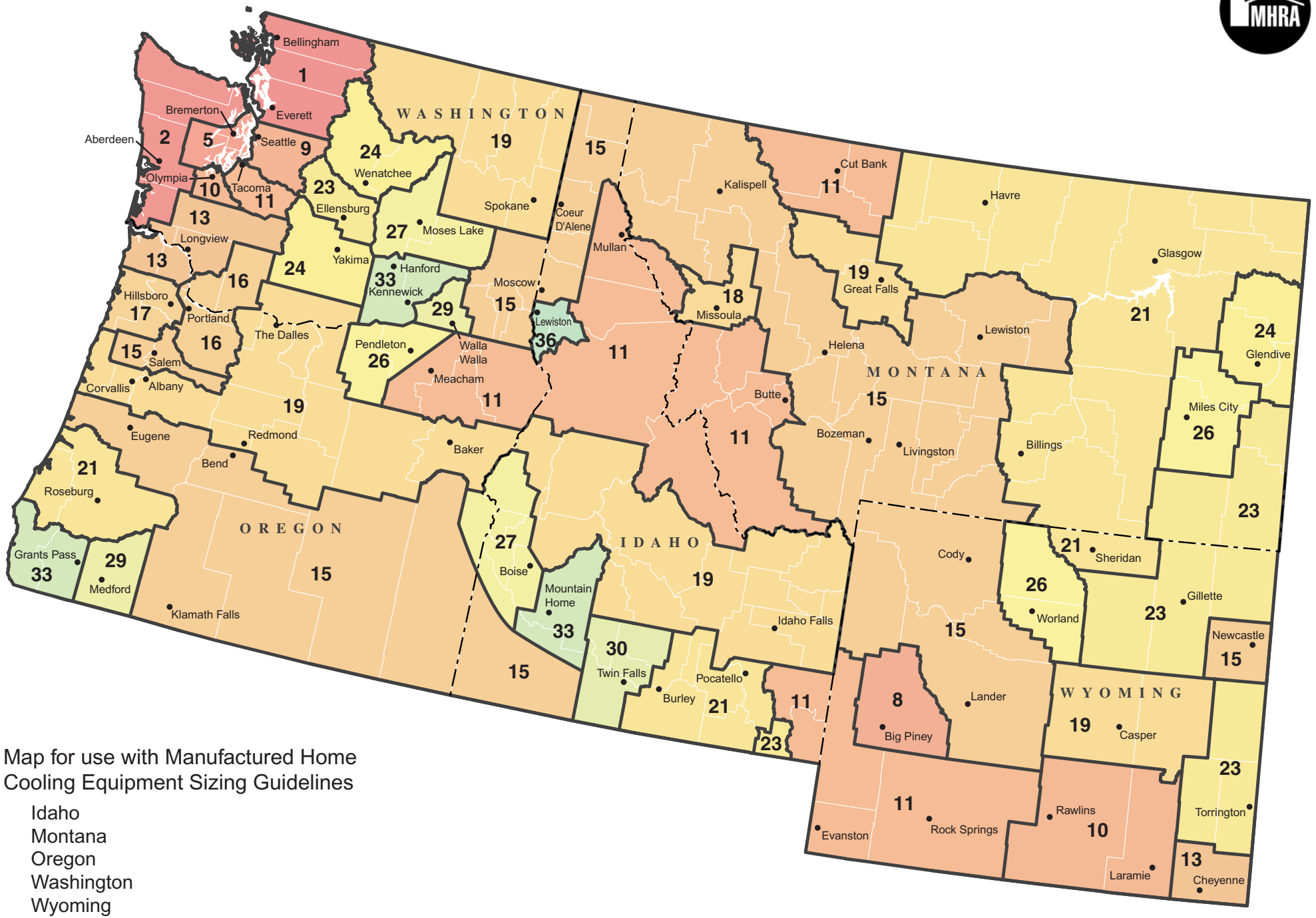
Map for use with Manufactured Home Cooling Equipment Sizing Guidelines

Iowa	Nebraska
Kansas	North Dakota
Minnesota	South Dakota
Missouri	

Map for use with Manufactured Home
Cooling Equipment Sizing Guidelines

Arizona
Colorado
New Mexico
Utah





Map for use with Manufactured Home Cooling Equipment Sizing Guidelines

- Idaho
- Montana
- Oregon
- Washington
- Wyoming

Map for use with Manufactured Home Cooling Equipment Sizing Guidelines

California
Nevada

City	Sizing Group Number
Alameda	9
Concord	39
Covina	32
Downey	24
El Cajon	7
Escondido	13
Fairfield	28
Glendale	39
Hamilton City	11
Laguna Beach	9
Lancaster	45
Livermore	49
Long Beach	21
Los Angeles	11
Merced	39
Modesto	45
Mount Shasta	17
Mountain View	15
Napa	35
Oakland	9
Oceanside	10
Ontario	47
Oxnard	9
Palmdale	59
Pasadena	32
Paso Robles	45
Petaluma	22
Pomona	53
Redlands	56
Richmond	9
Riverside	47
Salinas	7
San Bernardino	60
San Diego	11
San Fernando	24
San Francisco	7
San Jose	24
San Luis Obispo	17
Santa Ana	13
Santa Barbara	9
Santa Maria	11
Santa Monica	9
Santa Paula	15
Santa Rosa	32
Stockton	39
Ukiah	32
Victorville	47