

SCOPE

This design standard provides criteria for the proper selection of residential kW demand and multiple dwelling diversified demand based on dwelling type, dwelling size and major appliance usage.

PURPOSE

The Residential Demand Estimating Criteria was established to provide a uniform demand estimate for various residential dwelling types.

DEFINITIONS

Base load – refers to those dwellings whose electrical load consists of lights, refrigerator, electric range, dishwasher and receptacle load such as television, stereo, microwave, etc.

Major appliances – refers to central or through-the-wall air conditioning, electric heating, and electric water heating.

Dwelling type – refers to the classification of a residential dwelling as either single-family detached (no common walls with another dwelling, i.e., subdivision), single-family attached (one common wall or condominium/townhouse), multi-family (two or more common walls such as apartments) and mobilehome (regardless of length and width).




Residential Diversity Factor – refers to a multiplier applied to the sum of the individual service point (customer) demands connected to any single-phase or three-phase electric distribution system.

CRITERIA

A. Residential Demand Selection

The residential kW demand per unit selection is dependent on the dwelling type, dwelling square footage and major appliance usage or connected appliances.

1. Table 1 provides the kW demand per unit selection for dwellings in a project that are less than 3000 square feet. Select a square footage category based on the majority of dwellings. If a square footage is not obtainable, select a square footage category that is typical for that dwelling type, i.e., single-family detached (1300–1999), single-family attached and multi-family (0–1299).
2. Table 2 provides the kW demand selection for a dwelling that is 3000 square feet or greater, i.e., custom dwelling. To determine the kW demand from Table 2, add the connected appliance loads for each demand category and multiply this sum by the appropriate demand factor. The sum of these factors will provide the kW demand requirement.

	 Indicates Latest Revision	 Completely Revised	 Information Removed
REVISION	SDG&E DISTRIBUTION DESIGN MANUAL		5322.1
DATE 1-1-2000	RESIDENTIAL DEMAND ESTIMATING		
APPD HB <i>1/16/01</i>			

3. When both air conditioning and electric heating are installed in a dwelling, the higher of the two demand estimates shall be used.
4. Section B provides diversity factor(s) for serving three or more dwellings.

B. Residential Diversity Selection

The residential diversity factors are applied based on the number of customers being served, diversity factor category and dwelling type. The following guidelines shall apply when determining the diversified demand from Table 3:

1. Determine diversified demand based on the sum of the individual service point (customer) demands multiplied by the appropriate diversity factor.
2. When applying an air conditioning diversity factor, pay particular attention to the two subcategories (single-family detached and single-family attached or multi-family).


		Indicates Latest Revision		Completely Revised		Information Removed
5322.2	SDG&E DISTRIBUTION DESIGN MANUAL					REVISION
	RESIDENTIAL DEMAND ESTIMATING					DATE 1-1-2000 APPD HB <i>1/1/00</i>

TABLE 1 Residential Dwelling kW Demand Per Unit (Less Than 3000 sq. ft.)

Dwelling Type	Square Footage	KW DEMAND CATEGORIES (a)					
		Base Load	Air Cond.	Elec. Water Heating	Elec. Heating	Elec. Heating & Water Heating	A/C & Elec. Water Heating
single-family detached	0-1299	3.0	5.0	5.0	4.0	6.5	6.0
	1300-1999	4.0	6.0	6.0	5.0	7.5	7.0
	2000-2999	4.5	7.0	7.0	6.0	8.0	8.0
single-family attached (condo/townhouse)	0-1299	3.0	4.0	5.0	4.0	6.5	5.0
	1300-1999	4.0	5.0	6.0	5.0	7.5	6.0
	2000-2999	4.5	5.5	6.5	5.5	8.0	6.5
multi-family (apartments)	0-1299	1.5	3.5	3.5	4.0	6.5	4.5
	1300-1999	2.0	4.0	4.0	4.5	7.0	5.0
mobile-homes	0-1299	2.5	5.0	(b)	5.0	(b)	(b)
	1300-1999	3.0	6.0		6.0		

TABLE 2 Custom Residential Dwelling kW Demand (3000 sq. ft. or greater)

Demand Categories	Demand Factor	Connected Appliances	Connected kW Demand per Unit Estimate (c)
LIGHTS	.50	internal lighting	4-6
HVAC (heat pump)	.50	3 to 7-1/2 ton single or multiple units	1.35kW/ton
MAJOR APPLIANCES	.50	range water heater water heater (quick recovery) clothes dryer dishwasher heat strip	8-12 ea. 4.5 ea. 9 ea. 5.5 ea. 1.2 ea. 5-15 ea.
EXTERIOR LOADS	.50	tennis court lighting swimming pool equipment exterior lighting	varies varies varies
OTHER LOADS	.40	convenience outlets wine cellar sauna small motor load	varies

Indicates Latest Revision

Completely Revised

New Page

REVISION

SDG&E DISTRIBUTION DESIGN MANUAL

DATE 9-4-84

RESIDENTIAL DEMAND ESTIMATING

APPD CVN 

5322.3

TABLE 3 Residential Diversity Factors

Number Of Customers	Diversity factor categories		
	Base load electric heating electric water heating	Air conditioning	
		SF detached	MF, SF attached
1–2	1.00	1.00	1.00
3–4	.75	0.85	0.70
5–7	.65	0.80	0.65
8–14	.55	0.75	0.65
15 and above	.50	0.70	0.60

SF = single-family

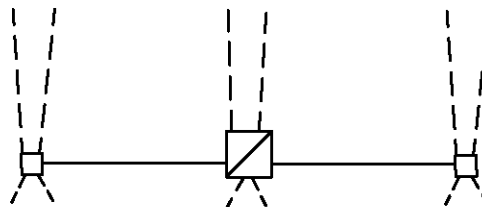
MF = multi-family

Notes:

- Ⓐ The kW demand provided in Table 1 represents the total demand requirement in each category.
- i.e., base load category = strictly base load
air conditioning category = base load plus
air conditioning load
- Ⓑ If kW demand is required for these categories, consult Design Planning.
- Ⓒ Use the kW demand per unit estimate in Table 2 as a check for submitted connected loads. These estimates can also be used if connected loads are not known.

Example 1:

Determine the diversified demand estimates for a 12 lot subdivision with single-family detached dwellings ranging from 1800–2400 square feet with 4 ton air conditioning. Assume the following distribution configuration:



Indicates Latest Revision

Completely Revised

New Page

5322.4

SDG&E DISTRIBUTION DESIGN MANUAL

RESIDENTIAL DEMAND ESTIMATING

REVISION

DATE 1-1-2000

APPD HB 1/16/00

Use Table 1 and 3 to determine diversified demand for this transformer and secondary/service system.

- dwelling type = single-family detached
- square footage range = 2000-2999 ①
- demand per unit from Table 1 = 7kW
- total demand (transformer) = 12x 7kW = 84kW
- total demand (either secondary) = 4 x 7kW = 28kW
- diversified demand from Table 3 (transformer) = .75 x 84kW = 63kW
- diversified demand from Table 3 (secondary) = .80 x 28kW = 22kW

The diversified demand of 63kW and 22kW would be used to size the transformer and secondaries respectively.

Example 2:

Determine the kW demand estimate for a custom home that is 4500 square feet with the following appliances being served:

Connected Appliance Load Breakdown ②



- air conditioning (2 units) - 1-3 ton, 1-5 ton
- electric range - demand not known (use estimate at 8kW)
- water heating - 4.5kW
- clothes dryer - 5.5kW
- heat strips - 2 at 5kW each
- tennis courts - 4kW
- swimming pool - 1-7 1/2 hp, 1-1 1/2 hp
- sauna - 8kW
- internal lighting - 5kW

The diversified kW demand for a custom home is obtained from Table 2 as follows:

- add the connected appliance loads in each demand category ②
- multiply by the appropriate demand factor
- the sum of these will produce total diversified kW demand

Demand Category ②		Sum of Connected Load	x	Demand Factor		Diversified Demand
Lights	=	5kW	x	.50	=	2.5kW
HVAC	=	11kW	x	.50	=	5.5kW
Major Appliances	=	28kW	x	.50	=	14kW
Exterior Loads	=	12kW	x	.50	=	6kW
Other Loads	=	8kW	x	.40	=	3.2kW
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total diversified kW demand						31.2kW

The total diversified kW demand of 31kW would be used to size transformer and secondary/service system.




		Indicates Latest Revision		Completely Revised		New Page
REVISION	SDG&E DISTRIBUTION DESIGN MANUAL					5322.5
DATE 1-1-87	RESIDENTIAL DEMAND ESTIMATING					
APPD CVN/ 						

Notes:

- ① The square footage range of 2000–2999 was selected because 7 of the 12 dwellings occupied this range.
- ② Consult Table 2 for the connected appliance load to demand category relationship.

References:

1. Design Standard 5222, Secondary and Service Guidelines, Secondary Conductors
2. Design Standard 5411, Voltage Drop, Secondary Conductors
3. Design Standard 5413, Voltage Fluctuation (flicker), Secondary Conductors
4. Design Standard 5431, Underground Voltage Drop and Flicker Nomograph
5. Design Standard 5432, Overhead Voltage Drop and Flicker Nomograph
6. Design Standard 5621, Initial Transformer Design Loading For Balanced Loads

	 Indicates Latest Revision	 Completely Revised	 New Page
5322.6	SDG&E DISTRIBUTION DESIGN MANUAL		REVISION
	RESIDENTIAL DEMAND ESTIMATING		DATE 9-4-84 APPD CVN 