

RESIDENTIAL RANGES

ARTICLE 220-19

FOR MOST HOUSEHOLD RANGES WITH A NAMEPLATE RATING BETWEEN 1750W AND 12000W, TABLE 220-19 WILL GIVE THE ALLOWABLE DEMAND WITH LITTLE OR NO CALCULATION NECESSARY. USE COLUMN B FOR UNITS BETWEEN 1750W AND 3499W, COLUMN C FOR 3500W AND 8500W, AND COLUMN C FOR NAMEPLATES UP TO A MAXIMUM OF 12000W. IF THERE IS MORE THAN ONE RANGE, GO DOWN THE LEFT HAND COLUMN UNDER NUMBER OF APPLIANCES TO THE TOTAL NUMBER OF UNITS AND READ THE DEMAND OR DEMAND FACTOR.

EXAMPLE:

ONE RANGE WITH A NAMEPLATE OF 8000W = 6400W DEMAND (COLUMN C)
8 RANGES WITH NAMEPLATES OF 12000W = 23000W DEMAND (COLUMN A)

PER NOTE 4, YOU CAN COMBINE TWO OVENS AND A COOKTOP AND CALCULATE THEM AS A SINGLE RANGE.

FOR A SINGLE RANGE (OR SEVERAL RANGES FED FROM A COMMON FEEDER OR SERVICE) WITH A NAMEPLATE OVER 12000W (BUT NOT OVER 27000W), APPLY NOTE 1 PER THE FOLLOWING FORMULA:

- 1) NAMEPLATE MINUS 12000 = AMOUNT OVER THE BASE FOR COL. A
(round to the nearest whole number. eg 2.4 use 2, 2.6 use 3)
- 2) ANSWER FROM #1 TIMES 5% (.05) = % TO INCREASE FOR COL. A
- 3) ANSWER FROM #2 TIMES DEMAND FROM COLUMN A = INCREASE
- 4) ANSWER FROM #3 PLUS DEMAND FROM COL. A = TOTAL DEMAND

EXAMPLE:

FOUR 16KW RANGES FED FROM A SINGLE SERVICE.

$$\begin{aligned} 16-12 &= 4 \\ 4 \times .05 &= .2 \\ .2 \times 17 &= 3.4 \\ 3.4 + 17 &= 20.4 \text{ KW DEMAND} \end{aligned}$$

FOR SEVERAL RANGES OF DIFFERENT RATINGS, APPLY NOTE 2 TO AVERAGE THE DEMAND AND THEN APPLY NOTE 1 AS ABOVE.

EXAMPLE: THREE @ 15KW, THREE @ 12KW, TWO @ 22KW

$$\begin{aligned} 3 \times 15 &= 45 \\ 3 \times 12 &= 36 \\ 2 \times 22 &= 44 \end{aligned}$$

TOTAL = 125 DIVIDED BY 8 RANGES = 15.63KW AVERAGE APPLY 15.63KW FOR EIGHT RANGES TO NOTE 1 AS ABOVE.

MULTI-FAMILY STANDARD

LOAD	DEMAND	PHASE	NEUTRAL
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LIGHTING:

3 X _____ SF X _____ UNITS = _____
 3 X _____ SF X _____ UNITS = _____
 3 X _____ SF X _____ UNITS = _____

APPLIANCE:

1500 X 2 X _____ UNITS = _____
LAUNDRY: (IF PROVIDED, SEE 210-52(f) EXCEPTIONS)
 1500 X _____ UNITS = _____

TOTAL

FIRST 3000	100%	3000	3000
NEXT 117000	35%	_____	_____
REMAINDER	25%	_____	_____

APPLIANCES: (4 or more per 220-17)

WATER HEATER	75%	_____	_____
DISHWASHER	75%	_____	_____
DISPOSAL	75%	_____	_____
COMPACTOR	75%	_____	_____
INSTAHOT	75%	_____	_____
MICROWAVE	75%	_____	_____

DRYERS (PER 220-18 IF NEEDED)

RANGES (PER 220-19)		_____	_____
LARGER OF HEAT OR A/C	100%	_____	_____
LARGEST MOTOR	25%	_____	_____
<u>TOTAL NON-CONTINUOUS</u>		_____	_____

CONTINUOUS:

HALLWAY LIGHTING, OUTSIDE,
 PARKING LOT, SIGN, ECT. _____

TOTAL CALCULATED LOAD (ALL AT 100%) _____

**TOTAL NON-CONTINUOUS + 125% OF
 CONTINUOUS (FOR CONDUCTOR & O.C. DEVICE)** _____

SINGLE FAMILY – OPTIONAL

ARTICLE 220-30

LOAD	CONNECTED OR NAMEPLATE		
GENERAL LIGHTING	3 X _____ S. F. = _____		
SMALL APPLIANCE	2 (OR MORE) X 1500 = _____		
LAUNDRY	1 (OR MORE) X 1500 = _____		
ALL APPLIANCES AT NAMEPLATE RATING			
RANGE	_____		
DRYER	_____		
DISHWASHER	_____		
DISPOSAL	_____		
WATER HEATER	_____		
INSTAHOT	_____		
COMPACTOR	_____		
_____	_____		
_____	_____		
_____	_____		
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SUB-TOTAL	_____		
FIRST 10000VA	_____ 10000	100%	_____ 10000
REMAINDER	_____	40%	_____
<u>HEATING/AIR CONDITIONING</u>			
CONDITION 1 OR 2	_____	100%	_____
CONDITION 3 OR 4	_____	65%	_____
CONDITION 5	_____	40%	_____
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TOTAL LOAD			_____

SINGLE FAMILY – STANDARD

ARTICLE	LOAD	DEMAND	PHASE	NEUTRAL
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220-3(b) 3 X _____ SF = _____
 GENERAL LIGHTING

220-169(a) 1500 X 2(OR MORE) = _____
 SMALL APPLIANCE

220-16(b) 1500 X 1(OR MORE) = _____
 LAUNDRY

TOTAL					
220-11	FIRST 3000	3000	100%	3000	3000
	3001-120000	_____	35%	_____	_____
	120001- OVER	_____	25%	_____	_____

220-3(c)(1) APPLIANCES*

WATER HEATER	_____	_____	_____
DISHWASHER	_____	_____	_____
DISPOSAL	_____	_____	_____
INSTAHOT	_____	_____	_____
TRASH COMPACTOR	_____	_____	_____
MICROWAVE	_____	_____	_____

220-18	_____	_____	_____
DRYER	_____	_____	_____

220-19	_____	_____	_____
RANGE	_____	_____	_____

220-21 LARGER OF:	_____	_____	_____
HEAT	_____	_____	_____

AIR CONDITIONING	_____	_____	_____
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220-14 LARGEST MOTOR	_____	X .25	_____
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TOTAL	_____	_____	_____
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*220-17 75% FOR 4 MORE APPLIANCES FASTENED IN PLACE

COMMERCIAL – SINGLE VOLTAGE

120/208 VOLT

CONTINUOUS:

INTERIOR LIGHTING _____ W X S.F. = _____
PER 220-3 OR WA. ENERGY CODE

EXTERIOR LIGHTING; CONNECTED LOAD _____

SIGN (PER 600-6(B)&(C)); 1500 W MINIMUM _____

SHOW WINDOW (220-12) 200W X _____ L.F. _____

SUB-TOTAL _____

NON-CONTINUOUS:

HEAT _____

AIR CONDITIONING _____

COPIER _____

WATER HEATER _____

ELEVATOR _____

FAN _____

COFFEE OUTLET _____

DISHWASHER _____

LARGEST MOTOR X 25 % _____

SUB-TOTAL _____

CONDUCTOR SIZE = CONTINUOUS + NON-CONTINUOUS _____

OVERCURRENT = (CONTINUOUS X 125%)+ NON-CONTINUOUS _____

COMMERCIAL CALCULATION

22,000 SQ. FT. Building: (120/208 30 Service)

- (A) 17,000 SQ. FT. RETAIL STORE**
 $1,700 \times 3\text{VA} \times 1.25\% = 63,750\text{VA}$
- (B) 5,000 SQ. FT. STORAGE AREA**
 $5,000 \times .25 \times 1.25\% = 1,562\text{VA}$
- (C) 6 EA. – 7.5 H.P. COMPRESSOR MOTORS 208V THREE PHASE**
 $6 \times 7.5\text{HP} (24.2) \times 208 = 522,272\text{VA}$
- (D) 2 EA. – 3 H.P. MOTORS, 208V SINGLE PHASE**
 $2 \times 3\text{HP} (187) \times 208 = 7,779\text{VA}$
- (E) 8 EA. 120V DEDICATED CIRCUITS WITH 20 AMPERE LOAD.**
 $20 \text{ AMPS} \times 120\text{V} \times 8 = 19,200\text{VA}$
- (F) 88 EA. GENERAL PURPOSE RECEPTACLES**
 $88 \text{ G.P. RECPT.} \times 180\text{VA}$
- (G) 3 EA. – 30 KVA THREE PHASE HEAT UNITS**
 $30,000 \times 3 = 90,000\text{VA}$
- (H) 3 EA. – 5 H.P. THREE PHASE FAN MOTORS**
 $3 \times 5 \text{ H.P.} (16.7) \times 360 = 18,036\text{VA}$
- (I) 1 EA. 55,000VA SIGN CIRCUIT**
 $55,000\text{VA}$

NOTE: ALL LIGHTING CONTINUOUS

A. 759A

C. 1303A

B. 833A

D. 699A

VOLTAGE DROP

- 1) **To find the actual voltage drop in a circuit, use the following formula:**

$$VD = \frac{2 \times R \times L \times I}{1000}$$

R = The resistance of the wire / 1000' (use table 9, chapter 9, page 568)

L = The one way length of the circuit in feet

I = The maximum load of the circuit in amperes

- 2) **To find what the percentage drop is when the voltage is known:**

$$\% = \frac{VD \times 100}{\text{circuit voltage}}$$

- 3) **To determine the maximum allowable drop as a percentage:**

$$VD = \text{supply voltage} \times \text{the \% drop desired}$$

Examples:

A) Find the voltage drop of a 120 volt circuit, 280' long, serving a 43 amp load, supplied by a #6 copper wire

B) Express the VD as a percentage:

C) Determine the allowable voltage drop for a 5% maximum