2025
ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

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MAIN TABLE OF CONTENTS

SUMMARY OF CHANGES

DATE	STANDARD PAGES	QTY	FILE NAME
09/20/24	NEW RELEASE, 6101, 6114, 6201, 6222	5	DMFMO2024v0920.pdf
02/21/25	5201, 5223	2	DMFMO2025v0221.pdf

MAIN TABLE OF CONTENTS

ARCHIVED BOOKS AVAILABLE ON THE INTERNAL VERSION

5000
GENERAL
INFORMATION

5000
GENERAL
INFORMATION

5000 - No FMO standards for this section.

5100
OVERHEAD LAYOUT SYSTEMS

5100
OVERHEAD LAYOUT SYSTEMS

5100 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5200
UNDERGROUND
LAYOUT SYSTEMS

5200
UNDERGROUND
LAYOUT SYSTEMS

MAIN TABLE OF CONTENTS

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	ORIGINAL ISSUE	JIK	KNM	FRC	KRG	02/13/2025	D						

Indicates Latest Revision	Completely Revised	X New Page	Information Removed

TABLE OF CONTENTS

DM5223 FIELD MAINTENANCE ONLY

ALL VERSIONS LISTED IN FMO ARE SUPERSEDED BY THEIR CURRENT VERSION FOUND INSIDE THE ELECTRIC DISTRIBUTION DESIGN MANUAL.

REVISION HISTORY:

02/21/2025: DM5223 MOVED TO FMO

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	6114 MOVED TO FMO	JIK	KNM	FRC	KRG	02/13/2025	D						

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SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SINGLE FAMILY RESIDENTIAL SECONDARY SYSTEMS

SHEET 1 OF 1

FMO DM5223

SCOPE

This design standard provides the residential secondary and service system optimum array tables used in conjunction with the General Design Criteria provided in Design Manual 5222. These tables represent an economic analysis of secondary and service system design alternatives, on a cost per lot basis, for approximately 9600 different array possibilities.

PURPOSE

The optimum array tables shall be used for residential single-family subdivision design to insure the lowest cost system is installed.

DEFINITIONS

NONE

OPTIMUM ARRAY TABLE APPLICATION

A. The optimum array tables provide the optimum array configuration, transformer size and secondary/service cable selections based on KW demand, secondary distance, and service distance. The instructions for properly applying the optimum array tables are as follows:

1. Determine KW Demand

   Determine the KW demand per lot for the subdivision from the Residential Demand Estimating Criteria, Design Manual 5322.

2. Determining Secondary Distance

   The secondary footage and structure (Transformer Pad or Handhole) placement is dictated by the lot front footage, street width, and meter location. Typically, the structures will be placed at the load center to serve as many meters as possible from one location. This requires the secondary footage to span from one to four lots or the street width. Therefore, the secondary footage is determined by:

   a. Measuring the distance across the number of lots being spanned or the distance across the street

   b. Adding footage to the overall distance for cable tools (Design Manual 5922). The typical secondary footage for a subdivision should be determined by measuring several lot combinations and using the most common footage(s) as a benchmark for optimum array selections.

3. Determining Service Distance

   The service distance for a single-sided array service or double-sided array short service is equal to the service panel setback. The double-sided array long service is equal to the service panel setback plus the distance from the originating structure across the street to the property line. The service panel setback is either an estimated or measured distance from behind the sidewalk at the property line to the service panel location. Additional footage shall be added to this distance from the service cable tails (Design Manual 5922).

4. Selecting Optimum Arrays

   Select the subdivision single-sided and/or double-sided optimum array configuration from the table with the appropriate KW demand, secondary and service lengths. The optimum array selection for the subdivision may be used for each individual array whose secondary and service footage does not differ from the typical by more than ten feet. Otherwise, an individual array selection must be made.

TABLE OF CONTENTS

a. There are a sufficient number of optimum array tables to address most of the system configurations that will be encountered in residential subdivisions. However, when the required system configuration does not permit selection of an optimum array, consult Design Manual 5222, General Design Procedures Paragraph 7.

b. The short service on single and double-sided arrays (Service to the homes on the same side of the street as the transformer) is 2 - #2 and 1 - #4 Al unless a note to the contrary appears below the table.

c. Listed below are the double-sided array, long service, and corresponding short service distances.

d. The arrays are symmetrical about the transformer unless a note to the contrary is shown.

Double-sided array

Long Service	Short Service
150'	50'
140'	50'
130'	50'
120'	40'
110'	40'
100'	30'
90'	30'
80'	20'

5. The subdivision should now be blocked off in groups of lots corresponding to the number of customers that can be served by the selected optimum array(s):

a. A single-sided and double-sided array combination can be used effectively to serve lots of irregular width or layout (Such as in a cul-de-sac). The combination array must be constructed as shown in Example 3 where the variation can only be used directly off the transformer; not as an extension from any of the handholes.

b. Additional lots may be served from any handhole in an optimum array provided the number of runs connected in the handhole do not exceed the handhole capacity (Presently 6). However, the voltage drop, flicker, and transformer loading limits must be satisfied based on Design Manuals 5431 and 5621.

TABLE OF CONTENTS

EXAMPLES

Select the single-sided optimum array for a subdivision having USA cable an average secondary distance of 120' (55' lot fronts, 6' additional for USA cable tails), average service length of 40' (30' service panel setback, 6' additional for USA cable tails), serving 1200 square foot homes with electric water heating.

1. From the optimum array table on Design Manual 5223.4, the single-sided optimum array for 120' secondary and 40' service serves six customers with a 25 KVA as shown below.

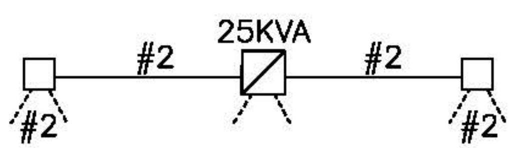
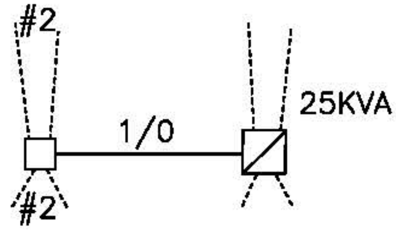


TABLE OF CONTENTS

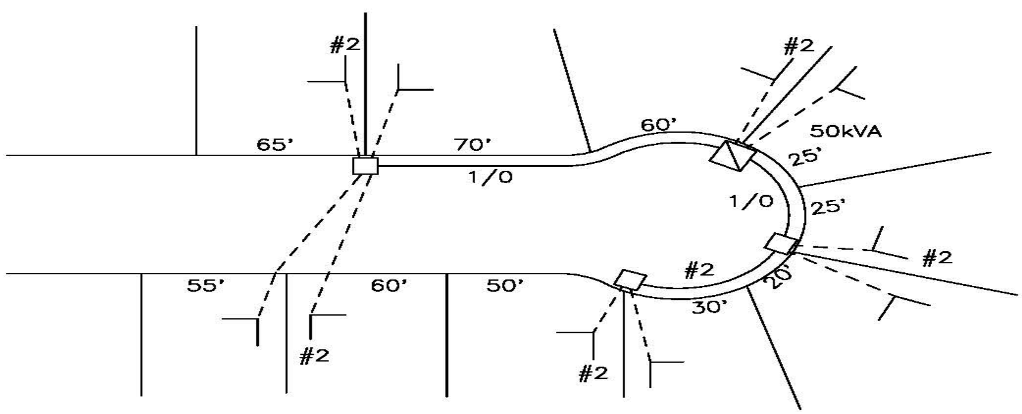
Select the double-sided optimum array for the subdivision described in Example 1 having a 90′ long service (50′ wide streets).

2. From the optimum array table on Design Manual 5223.4, the double-sided optimum array for this combination serves eight customers with a 25 KVA as shown below.



Select the combination optimum array having 1200 square foot homes with electric water heating (Single-sided and Double-sided) to serve the cul-de-sac shown below. The lot front footages are provided; short-service length is 40′, long-service length is 90′.

3. The resulting combination optimum array serves ten customers, 4 double-sided (140′ secondary) and six single-sided (60′ secondaries). The transformer loading for ten customers is 36 KW. Therefore, a 50 KVA transformer is selected.



REFERENCES

A. Design Manual 5223 – Residential Distribution System Design

B. Design Manual 5712 – Secondary Handhole Elimination

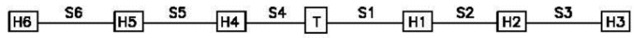
C. Design Manual 5411 – Voltage Drop & Flicker Application Guidelines

D. Study – "Reduced Secondary and Service System Cost Through Optimum Single-Family Residential Design", May 1985

E. Design Manual 5922 – Cable Tail Length Requirements

F. Design Manual 5322 – Residential Demand Estimating

REV	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
C						F					
B	FORMATTING	JIK	-	-	02/21/2020	E					
A	ORIGINAL ISSUE	-	CVN	RDG	01/01/1987	D					



Sq. Ft.: 0–1299 SINGLE–SIDED

3kW Base Load (BL)

Sec Ft	Serv Ft	S1–S2–S3	# Cust
25kVA			
60–70	20–50	1/0–#2–#2	14
80–100	20–50	#2–#2	10
110	20–40	#2–#2	10
110	50	1/0–#2	10
120–130	20–50	1/0–#2	10
140	20–40	1/0–#2	10
140	50	1/0–1/0	10
150	20–50	1/0–1/0	8(S)

5kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1–S2–S3	# Cust
25kVA			
60	20–40	3/0–1/0–1/0	14
60	50	3/0–1/0–1/0	12(u)
70	20–50	1/0–#2	10
80–140	20–50	#2	6
150	20–40	#2	6
150	50	1/0	6

5kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1–S2	# Cust
25kVA			
60–80	20–50	1/0–#2	8(s)
90–100	20–40	1/0–1/0	8(s)
90–100	50	1/0–1/0	8(a)
110	20	#2	6
110	20–50	3/0–1/0	8(s)
120	20–40	#2	6
120	50	3/0–1/0	8(s)
130–150	20–50	#2	6

4kW Electric Heater(EH)

Sec Ft	Serv Ft	S1–S2	# Cust
25kVA			
60–80	20–50	#2–#2	10
90	20–50	1/0–#2	10
100–110	20–50	1/0–1/0	10
120	50	1/0–1/0	10
120	20–40	#2	6
130–150	20–50	#2	6

3kW A/C Option

Sec Ft	Serv Ft	S1–S2	# Cust
25kVA			
60	20–50	#2	10
70	20–30	#2	10
70	40–50	1/0–#2	10
80	20	#2	10
80	30–50	1/0–#2	10
90	20–50	1/0–#2	10
100	20–30	1/0–#2	10
100	40–50	1/0–1/0	10
110	20–40	1/0–1/0	10
110	50	1/0–1/0	8(s)(a)
120	20–30	1/0–1/0	10
120	40	1/0–1/0	10(e)
120	50	1/0–1/0	8(s)(a)
130–150	20–50	#2	6

DOUBLE–SIDED

3kW Base Load (BL)

Sec Ft	Serv Ft	S1–S2	# Cust
25kVA			
60	80–140	#2–#2	16
60	150	1/0–#2	16(a)
70	80	#2–#2	16
70	90–150	1/0–#2	16(a)
80	80–130	1/0–#2	16(a)
80	140–150	1/0–1/0	16(a)
90	80–90	1/0–#2	16
90	100–150	1/0–1/0	16(a)
100	80–130	1/0–1/0	16(a)
100	140–150	#2	12
110	80–100	1/0–1/0	16(a)
110	110–150	#2	12
120–140	80–150	#2	12
150	80–150	1/0	12

5kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1–S2–S3	# Cust
75kVA			
60	80	3/0–1/0	16(a)
60	90–120	3/0–1/0	16(s)(a)
60	130–140	3/0–1/0	16(t)(a)
60	150	3/0–3/0	20(e)
70	80–90	3/0–3/0	16(t)
70	100–110	3/0–3/0	20(e)
70	120–140	3/0–3/0	16(s)(a)
70	150	3/0–3/0	16(k)
80	80–110	3/0–3/0	16(t)(a)
80	140	3/0–3/0	16(t)(j)
80	150	350–3/0	20(e)
50kVA			
80	120–130	1/0	12
90	80–110	1/0	12
90	120–130	1/0	12
90	140–150	1/0	12(f)
100	80	1/0	12
100	90–130	1/0	12(f)
100	140–150	3/0	12(f)
110	80–130	1/0	12(f)
110	140–150	3/0	12(f)
120	80–110	1/0	12(f)
120	120–140	3/0	12(f)
120	150	3/0	12(n)
130	80–90	3/0	12
130	100–130	3/0	12(f)
130	140–150	3/0	12(n)
140	80–90	3/0	12
140	100–130	3/0	12(f)
140	140–150	3/0	12(n)
150	80–90	3/0	12
150	100–130	3/0	12(f)
150	140–150	3/0	12(n)

5kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1–S2	# Cust
50kVA			
60	80–150	3/0–1/0	20
70	80–150	3/0–1/0	20(e)
80	80–110	3/0–3/0	20
80	120	3/0–3/0	16(t)
90	80	3/0–3/0	20(e)
25kVA			
80	130–150	1/0	8
90	90–150	1/0	8
100–110	80–150	1/0	8
120	80–130	1/0	8
120	140–150	1/0	8(c)
130	80–100	1/0	8
130	110–150	1/0	8(c)
140	80–90	1/0	8
140	100–150	1/0	8(c)
150	80–120	1/0	8(c)
150	130–150	3/0	8

4kW Electric Heater(EH)

Sec Ft	Serv Ft	S1–S2	# Cust
50kVA			
60	80–150	1/0–1/0	20
70–80	80–150	3/0–1/0	20
90	80–140	3/0–1/0	20
25kVA			
90	150	#2	8
100	80–150	#2	8
110	80–130	#2	8
110	140–150	1/0	8
120	80–90	#2	8
120	100–150	1/0	8
130–150	80–150	1/0	8

3kW A/C Option

Sec Ft	Serv Ft	S1–S2	# Cust
50kVA			
60	80–90	1/0–#2	20
60	100–110	1/0–1/0	20
60	120–150	1/0–1/0	20(e)
70	80–100	1/0–1/0	20
70	110–150	1/0–1/0	20(e)
80	80–90	1/0–1/0	20
80	100–140	1/0–1/0	20(e)
80	150	3/0–1/0	20(e)
90	80–120	1/0–1/0	20(e)
90	130–150	3/0–1/0	20(e)
100	80–110	1/0–1/0	20(e)
100	120–140	3/0–1/0	20(e)
100	150	3/0–3/0	20(e)
110	80	1/0–1/0	20(e)
110	120–150	3/0–3/0	20(e)
25kVA			
110	90–110	1/0	8
120–150	80–150	1/0	8

a)H2=1/0, b)H3=1/0, c)H1=1/0, d)H4=1/0, e)H2–H5=1/0–1/0, f)H1–H4=1/0–1/0, g)H2–H4=1/0–1/0
h)H3–H6=1/0–1/0, i)H3–H5=1/0–1/0, j)H2=3/0, l)H3–H5=3/0–1/0, m)H2–H4=1/0–3/0, n)H1–H4=3/0–3/0
o)H2–H5=3/0–3/0, p)H2–H4=3/0–3/0, q)H1–H2–H4=1/0–1/0–1/0, r)H1=3/0
s)S4=#2, t)S4–1/0, u)S4–S5=1/0–#2, v)S4–S5=1/0–1/0, w)S2–S4=3/0–1/0, x)S4=3/0

TABLE OF CONTENTS

REV	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
C						F					
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SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SINGLE FAMILY RESIDENTIAL SECONDARY SYSTEMS

H6 —S6— H5 —S5— H4 —S4— T —S1— H1 —S2— H2 —S3— H3

Sq. Ft.: 1300-1999 SINGLE-SIDED

4kW Base Load (BL)

Sec Ft	Serv Ft	S1-S2	# Cust
	25kVA		
60-80	20-50	#2-#2	10
90	20-50	1/0-#2	10
100-110	20-50	1/0-1/0	10
120	50	1/0-1/0	10
120	20-40	#2	6
130-150	20-50	#2	6

6kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1-S2	# Cust
	50kVA		
60-70	20-50	1/0-1/0	10
80	20-50	1/0-1/0	10(e)
90	20	3/0-1/0	10
90	30-50	3/0-1/0	10(e)
100	20	3/0-3/0	10
100	30-50	3/0-3/0	10(e)
110	20-50	3/0-3/0	10(e)
120	20-40	3/0-3/0	8(t)
120	50	3/0-3/0	8(a)
	25kVA		
130	20-40	1/0	6
130	50	1/0	6
140-150	20-40	1/0	6
140-150	50	1/0	6(f)

6kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1-S2-S3	# Cust
	50kVA		
60	20	3/0-1/0-1/0	14
60	30	3/0-1/0-1/0	12(u)
60	40-50	3/0-1/0-1/0	12(u)(B)
70	20-50	3/0-3/0-3/0	12(v)
	25kVA		
80-120	20-50	#2	6
130	20-40	#2	6
130	50	1/0	6
140-150	20-50	1/0	6

5kW Electric Heater(EH)

Sec Ft	Serv Ft	S1-S2	# Cust
	25kVA		
60-80	20-50	1/0-#2	8(s)
90-100	20-40	1/0-1/0	8(s)
90-100	50	1/0-1/0	8(a)
110	20	#2	6
110	30-50	3/0-1/0	8(s)
120	20-40	#2	6
120	50	3/0-1/0	8(s)
130-150	20-50	#2	6

4kW A/C Option

Sec Ft	Serv Ft	S1-S2	# Cust
	50kVA		
60	40-50	1/0-1/0	8(s)(a)
70	40	1/0-1/0	10
	25kVA		
60	20-30	1/0-1/0	8(s)(a)
70	20-30	3/0-1/0	8(s)
70	40-50	3/0-1/0	8(s)(a)
80	20	3/0-1/0	8(s)
80	30-40	3/0-1/0	8(t)(f)
80	50	1/0	6
90	20-50	1/0	6
100	20-40	1/0	6
100	50	1/0	6(f)
110	20-30	1/0	6
110	40-50	1/0	6(f)
120	20-30	1/0	6
120	40	1/0	6(f)
120	50	3/0	6
130	20	1/0	6
130	30	1/0	6(f)
130	40-50	3/0	6
140	20	1/0	6(f)
140	30-50	3/0	6
150	20	1/0	6(f)
150	30-40	3/0	6
150	50	3/0	6(f)

a)H2=1/0, b)H3=1/0, c)H1=1/0, d)H4=1/0, e)H2-H5=1/0-1/0, f)H1-H4=1/0-1/0, g)H2-H4=1/0-1/0
h)H3-H6=1/0-1/0, i)H3-H5=1/0-1/0, j)H2=3/0, l)H3-H5=3/0-1/0, m)H2-H4=1/0-3/0, n)H1-H4=3/0-3/0
o)H2-H5=3/0-3/0, p)H2-H4=3/0-3/0, q)H1-H2-H4=1/0-1/0-1/0, r)H1=3/0
s)S4=#2, t)S4=1/0, u)S4-S5=1/0-#2, v)S4-S5=1/0-1/0, w)S2-S4=3/0-1/0, x)S4=3/0

DOUBLE-SIDED

4kw Base Load (BL)

Sec Ft	Serv Ft	S1-S2	# Cust
	50kVA		
60	80-150	1/0-1/0	20
70-80	80-150	3/0-1/0	20
90	80-140	3/0-1/0	20
	25kVA		
90	150	#2	8
100	80-150	#2	8
110	80-130	#2	8
110	140-150	1/0	8
120	80-90	#2	8
120	100-150	1/0	8
130-150	80-150	1/0	8
120	100-150	1/0	8
130-150	80-150	1/0	8

6kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1-S2	# Cust
	75kVA		
60	80-100	3/0-3/0	16(a)(t)
60	110-150	3/0-3/0	16(g)(t)
70	80-100	1/0	12
70	110-150	350-3/0	16(g)(t)
80	80-90	1/0	12
80	100-130	350-3/0	16(g)(t)
80	140-150	3/0	12(f)
90	80-90	1/0	12
90	100-150	1/0	12(f)
100	80	1/0	12
100	90-130	1/0	12(f)
100	140-150	3/0	12(f)
110	80-130	1/0	12(f)
110	140-150	3/0	12(f)
120	80-110	1/0	12(f)
120	120-140	3/0	12(f)
120	150	3/0	12(n)
130	80-90	3/0	12
130	100-130	3/0	12(f)
130	140-150	3/0	12(n)
140	80-90	3/0	12
140	100-130	3/0	12(f)
140	140-150	3/0	12(n)
150	80-90	3/0	12
150	100-120	3/0	12(f)
150	130-150	3/0	12(n)

6kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1-S2	# Cust
	75kVA		
60	80110	3/0-3/0	20
60	120-150	3/0-3/0	20(e)
70	80	3/0-3/0	20
70	90-100	3/0-3/0	20(e)
70	110	1/0	12
80	80-100	3/0-3/0	20(e)
80	110	1/0	12
	50kVA		
70	120-150	1/0	12
80	120-140	1/0	12
80	150	1/0	12(e)
90	80-120	1/0	12
90	130-150	1/0	12(f)
100	80-110	1/0	12
100	120-150	1/0	12(f)
110	80	1/0	12
110	90-150	1/0	12(f)
120	80-120	1/0	12(f)
120	130-150	3/0	12
130	80	1/0	12(f)
130	90-140	3/0	12
130	150	3/0	12(f)
140	80-120	3/0	12
140	130-150	3/0	12(f)
150	80-110	3/0	12
150	120-150	3/0	12(f)

5kW Electric Heater(EH)

Sec Ft	Serv Ft	S1-S2	# Cust
	50kVA		
60	80-150	3/0-1/0	20
70	80-150	3/0-1/0	20(e)
80	80-110	3/0-3/0	20
80	120	3/0-3/0	16(t)
90	80	3/0-3/0	20(e)
	25kVA		
80	130-150	1/0	8
90	90-150	1/0	8
100-110	80-150	1/0	8
120	80-130	1/0	8
120	140-150	1/0	8(c)
130	80-100	1/0	8
130	110-150	1/0	8(c)
140	80-90	1/0	8
140	100-150	1/0	8(c)
150	80-120	1/0	8(c)
150	130-150	3/0	8

4kW A/C Option

Sec Ft	Serv Ft	S1-S2	# Cust
	75kVA		
60	80	3/0-1/0	20
60	90-120	3/0-1/0	20(e)
60	130-140	3/0-3/0	20(e)
60	150	3/0-3/0	20(e)
70	80-120	3/0-1/0	20(e)
70	130	3/0-3/0	20(e)
70	140-150	3/0-3/0	20(e)
80	80-100	3/0-1/0	20(e)
80	110-130	3/0-3/0	20(e)
80	140-150	3/0-3/0	20(a)
90	80-120	3/0-1/0	20(e)
90	140-150	3/0-3/0	20(a)
100	80	3/0-1/0	20(e)
100	90-110	3/0-3/0	20(e)
100	140-150	3/0-3/0	20(a)
	50kVA		
90	130	3/0-3/0	16(t)(w)
100	120	3/0-3/0	16(t)(w)
100	130	3/0-3/0	16(w)
110	80-90	1/0	12(f)
110	100-150	3/0	12(f)
120	80-90	1/0	12(f)
120	100-130	3/0	12(f)
120	140-150	3/0	12(n)
130	80-90	1/0	12(f)
130	100-130	3/0	12(f)
130	140-150	3/0	12(n)
140	80-120	3/0	12(f)
140	130-150	3/0	12(n)
150	80-120	3/0	12(f)

TABLE OF CONTENTS

REV	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
C						F					
B	FORMATTING	JIK	-	-	02/21/2020	E					
A	ORIGINAL ISSUE	-	CVN	RDG	01/01/1987	D					

X Indicates Latest Revision | Completely Revised | New Page | Information Removed

SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SINGLE FAMILY RESIDENTIAL SECONDARY SYSTEMS

FMO DM5223.5

H6 — S6 — H5 — S5 — H4 — S4 — T — S1 — H1 — S2 — H2 — S3 — H3

Sq. Ft.: 2000–2999 SINGLE–SIDED

4.5kW Base Load (BL)

Sec Ft	Serv Ft	S1–S2	# Cust
25kVA			
	20–50	#2	10
70–80	20–50	1/0–#2	10
90–100	20–50	1/0–1/0	10
	20–50	1/0–1/0	8(e)(a)
120–150	20–50	#2	6
60			
110			

7kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1–S2	# Cust
75kVA			
60	20–40	3/0–1/0	10
60	50	3/0–1/0	10(e)
70	20–50	3/0–3/0	10
80	20–40	3/0–3/0	10
80	50	3/0–3/0	10(e)
90	20–30	3/0–3/0	10
90	40	3/0–3/0	10(e)
90	50	3/0–3/0	10(a)
100	20	3/0–3/0	10
100	30–40	3/0–3/0	10(e)
100	50	3/0–3/0	10(e)
75kVA			
110	20–40	1/0	6
110	50	3/0	6
120	20–30	1/0	6
120	40	1/0	6(f)
120	50	3/0	6
130	20–30	1/0	6
130	40	1/0	6(f)
130	50	3/0	6
140	20–30	1/0	6
140	40–50	3/0	6
150	20–40	3/0	6
150	50	3/0	6(f)

7kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1–S2	# Cust
50kVA			
60	20–50	1/0–1/0	10
70	20–40	1/0–1/0	10
70	50	1/0–1/0	10(e)
80	20–50	3/0–1/0	10
90	20–30	3/0–1/0	10
90	40–50	3/0–1/0	10(e)
100	20–50	3/0–3/0	10
110	20–40	3/0–3/0	10
110	50	3/0–3/0	10(e)
120	20–30	3/0–3/0	10
120	40	3/0–3/0	8(t)
120	50	3/0–3/0	8(t)(a)
130–150	20–50	1/0	6

6kW Electric Heater(EH)

Sec Ft	Serv Ft	S1–S2–S3	# Cust
50kVA			
60	20	3/0–1/0–1/0	14
60	30	3/0–1/0–1/0	12(u)
60	40–50	3/0–1/0–1/0	12(u)(b)
70	20–50	3/0–1/0–3/0	12(v)
25kVA			
80–120	20–50	#2	6
130	20–40	#2	6
130	50	1/0	6
140–150	20–50	1/0	6

4.5kW A/C Option

Sec Ft	Serv Ft	S1–S2–S3	# Cust
50kVA			
60	20	3/0–3/0–1/0	14
60	30	3/0–3/0–1/0	14(h)
60	40–50	3/0–3/0–3/0	14(h)
70	20–30	3/0–3/0–3/0	14(h)
70	40	1/0	6(f)
70	50	3/0–1/0	10(e)
80–90	50	3/0–3/0	10(e)
100–110	50	3/0–3/0	10(e)
25kVA			
80	20	1/0	6
80	30–40	1/0	6(f)
90–100	20–40	1/0	6(f)
110	20–30	3/0	6
110	40	3/0	6(f)
120	20	3/0	6
120	30–40	3/0	6(f)
120	50	3/0	6(n)
130	20	3/0	6
130	30	3/0	6(f)
130	40–50	3/0	6(n)
140	20	3/0	6(f)
140	30–40	3/0	6(n)
140	50	350	6
150	20	3/0	6(f)
150	30	3/0	6(n)
150	40	350	6
150	50	350	6(f)

DOUBLE–SIDED

4.5kW Base Load (BL)

Sec Ft	Serv Ft	S1–S2	# Cust
50kVA			
	80–100	1/0–1/0	20
	110–150	3/0–1/0	20
	80–100	1/0–1/0	20(e)
	110–140	3/0–1/0	20
60	150	3/0–1/0	20(e)
60			
70			
70			
70			
	80–110	3/0–1/0	20
	120–150	3/0–1/0	20(e)
	80–90	3/0–1/0	20(e)
	100–110	3/0–3/0	20
80	80–110	3/0–3/0	20
80			
25kVA			
90			
90–10[illegible]	120–150	1/0	8
100–1[illegible]	80–150	1/0	8
	80–140	1/0	8
	150	1/0	8(c)
	80–120	1/0	8
130	130–150	1/0	8(c)
130	80–110	1/0	8
140	120–150	1/0	8(c)
140			
150			
150			

7kW Air Conditioning (A/C)

Sec Ft	Serv Ft	S1–S2	# Cust
100kVA			
60	150	350–3/0	16(x)(a)
70	150	350–3/0	16(x)(p)
80	150	350–350	16(x)(a)
75kVA			
60	80–120	1/0	12(f)
60	130–140	3/0	12(f)
70	80	3/0	12
70	90–140	3/0	12(f)
80	80	3/0	12
80	90–130	3/0	12(f)
80	140	3/0	12(n)
90	80	3/0	12
90	90–120	3/0	12(f)
90	130–150	3/0	12(n)
100	80–120	3/0	12(f)
100	130–150	3/0	12(n)
110	80–110	3/0	12(f)
110	120–150	3/0	12(n)
120	80–100	3/0	12(f)
120	110–150	3/0	12(n)
130	80–100	3/0	12(f)
130	110–150	3/0	12(n)
140	80–90	3/0	12(f)
140	100–140	3/0	12(n)
140	150	350	12(n)
150	80–90	3/0	12(f)
150	100–140	3/0	12(n)
50kVA			
150	150	350	8(r)

7kW Electric Water Heater (EWH)

Sec Ft	Serv Ft	S1–S2	# Cust
75kVA			
60	80	3/0–3/0	20(e)
60	90–120	3/0–3/0	16(t)(j)
60	130	3/0–3/0	16(t)(j)
60	140–150	3/0–3/0	16(t)(k)
70	80–120	3/0–3/0	16(t)(j)
70	130	3/0–3/0	16(t)(k)
70	120–150	350–3/0	16(t)(g)
80	80–90	350–3/0	16(t)(a)
80	100–150	350–3/0	16(t)(g)
50kVA			
90	80–100	1/0	12(f)
90	110–120	3/0	12
90	130–150	3/0	12(f)
100	80–100	3/0	12
100	110–150	3/0	12(f)
110	80–90	3/0	12
110	100–150	3/0	12(f)
120	80	3/0	12
120	90–120	3/0	12(f)
120	130–150	3/0	12(n)
130	80–110	3/0	12(f)
130	120–150	3/0	12(n)
140	80–100	3/0	12(f)
140	110–150	3/0	12(n)
150	80	3/0	12(f)
150	90–150	3/0	12(n)

6kW Electric Heater(EH)

Sec Ft	Serv Ft	S1–S2	# Cust
75kVA			
60	80–110	3/0–3/0	20
60	120–150	3/0–3/0	20(e)
70	80	3/0–3/0	20
70	90–100	3/0–3/0	20(e)
70	110	1/0	12
80	80–100	3/0–3/0	20(e)
80	110 .	1/0	12
50kVA			
70	120–150	1/0	12
80	120–140	1/0	12
80	150	1/0	12(f)
90	80–120	1/0	12
90	130–150	1/0	12(f)
100	80–110	1/0	12
100	120–150	1/0	12(f)
110	80	1/0	12
110	90–150	1/0	12(f)
120	80–120	1/0	12
120	130–150	3/0	12(f)
130	80	1/0	12(f)
130	90–140	3/0	12
130	150	3/0	12(f)
140	80–120	3/0	12
140	130–150	3/0	12(f)
150	80–110	3/0	12
150	120–150	3/0	12(f)

4.5kW A/C Option

Sec Ft	Serv Ft	S1–S2–S3	# Cust
75kVA			
60	80–110	3/0–1/0	20(e)
60	110–150	3/0–3/0	20(a)
70	80–90	3/0–3/0	20(e)
70	100–150	3/0–3/0	20(a)
80	80	3/0–3/0	20(e)
80	90–130	3/0–1/0	20(a)
80	140–150	350–3/0	20(a)
90	80	3/0–3/0	20(a)
90	90–120	3/0–3/0	20(a)#
90	130–150	350–3/0	20(a)
100	110	3/0–3/0	20(a)#
100	120–130	350–3/0	20(a)
110	100–110	350–3/0	20(a)(n)
50kVA			
100	80–100	3/0	12(e)
100	140–150	3/0	12(n)
110	80–90	3/0	12(e)
110	120–150	3/0	12(n)
120	80–90	3/0	12(e)
120	100–150	3/0	12(n)
130	80–90	3/0	12(e)
130	100–140	3/0	12(n)
130	150	350	8(r)
140	80–120	3/0	12(n)
140	130–150	350	8(r)
150	80–110	3/0	12(n)#
150	120	350	8(f)
150	130–150	350	8(r)

H2–H5 SHORT=1/0–1/0
H1–H4 SHORT=1/0–1/0

a)H2=1/0, b)H3=1/0, c)H1=1/0, d)H4=1/0, e)H2–H5=1/0–1/0, f)H1–H4=1/0–1/0, g)H2–H4=1/0–1/0
h)H3–H6=1/0–1/0, i)H3–H5=1/0–1/0, j)H2=3/0, l)H3–H5=3/0–1/0, m)H2–H4=1/0–3/0, n)H1–H4=3/0–3/0
o)H2–H5=3/0–3/0, p)H2–H4=3/0–3/0, q)H1–H2–H4=1/0–1/0–1/0, r)H1=3/0
s)S4=#2, t)S4–1/0, u)S4–S5=1/0–#2, v)S4–S5=1/0–1/0, w)S2–S4=3/0–1/0, x)S4=3/0

TABLE OF CONTENTS

REV	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
C						F					
B	FORMATTING	JIK	-	-	02/21/2020	E					
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SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SINGLE FAMILY RESIDENTIAL SECONDARY SYSTEMS

FMO DM5223.6

H6 — S6 — H5 — S5 — H4 — S4 — T — S1 — H1 — S2 — H2 — S3 — H3

Sq. Ft.: 0-1299

SINGLE-SIDED

6.5kW EH & EWH

Sec Ft	Serv Ft	S1-S2-S3	# Cust
50kVA			
60	20	3/0-3/0-1/0	14
60	30-50	1/0-1/0	10
70	20-50	1/0-1/0	10
80	20	3/0-1/0	10
25kVA			
80	30-50	#2	6
90-110	20-50	#2	6
120-150	20-50	1/0	6

6kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
50kVA			
60-70	20-50	1/0-1/0	10
80	20-50	1/0-1/0	10(e)
90	20	3/0-1/0	10
90	30-50	3/0-1/0	10(e)
100	20	3/0-3/0	10
100	30-50	3/0-3/0	10(e)
110	20-50	3/0-3/0	10(e)
120	20-40	3/0-3/0	8(t)
120	50	3/0-3/0	8(a)
25kVA			
130	20-40	1/0	6
130	50	1/0	6
140-150	20-40	1/0	6
140-150	50	1/0	6(f)

Sq. Ft.: 1300-1999

SINGLE-SIDED

7.5kW EH & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
50kVA			
60	20-30	1/0-1/0	10
60	40-50	1/0-1/0	10(e)
70	20-50	3/0-1/0	10
80-90	20-50	3/0-3/0	10
100	20	3/0-3/0	10
100	30-50	3/0-3/0	10(e)
110	20-40	3/0-3/0	10(e)
110	50	3/0-3/0	8(j)(t)
120-150	20-50	1/0	6

7kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	20-40	3/0-1/0	10
60	50	3/0-1/0	10(e)
70	20-50	3/0-3/0	10
80	20-40	3/0-3/0	10
80	50	3/0-3/0	10(e)
90	20-30	3/0-3/0	10
90	40	3/0-3/0	10(e)
90	50	3/0-3/0	10(a)
100	20	3/0-3/0	10
100	30-40	3/0-3/0	10(e)
100	50	3/0-3/0	10(e)
50kVA			
110	20-40	1/0	6
110	50	3/0	6
120	20-30	1/0	6
120	40	1/0	6(f)
120	50	3/0	6
130	20-30	1/0	6
130	40	1/0	6(f)
130	50	3/0	6
140	20-30	1/0	6
140	40-50	3/0	6
150	20-40	3/0	6
150	50	3/0	6(f)

H1-H4 SHORT=1/0-1/0

Sq. Ft.: 2000-2999

SINGLE-SIDED

8kW EH & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
50kVA			
60	20	1/0-1/0	10
60	30-50	1/0-1/0	10(e)
70	20-50	3/0-1/0	10
80	20-50	3/0-3/0	10
90	20	3/0-3/0	10
90	30-50	3/0-3/0	10(e)
100	20	3/0-3/0	10
100	30	3/0-3/0	8(a)(t)
100	40-50	3/0-3/0	8(t)(j)
110-150	20-50	1/0	6

8kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	20-40	3/0-1/0	10
60	50	3/0-1/0	10(e)
70	20-30	3/0-1/0	10
70	40-50	3/0-1/0	10(e)
80	20-40	3/0-3/0	10
80	50	3/0-3/0	10(e)
90	20-30	3/0-3/0	10
90	40	3/0-3/0	10(e)
90	50	3/0-3/0	10(a)
100	20	3/0-3/0	10
100	30	3/0-3/0	10(e)
100	50	3/0-3/0	10(a)
50kVA			
100	40	1/0	6
110	20-30	1/0	6
110	40-50	1/0	6(f)
120	20-30	1/0	6
120	40-50	1/0	6(f)
130	20	1/0	6
130	30-40	1/0	6(f)
130	50	3/0	6
140	20	1/0	6
140	30	1/0	6(f)
140	40-50	3/0	6
150	20	1/0	6(f)
150	30-40	3/0	6(f)
150	50	3/0	6(f)

a)H2=1/0, b)H3=1/0, c)H1=1/0, d)H4=1/0, e)H2-H5=1/0-1/0, f)H1-H4=1/0-1/0, g)H2-H4=1/0-1/0
h)H3-H6=1/0-1/0, i)H3-H5=1/0-1/0, j)H2=3/0, l)H3-H5=3/0-1/0, m)H2-H4=1/0-3/0, n)H1-H4=3/0-3/0
o)H2-H5=3/0-3/0, p)H2-H4=3/0-3/0, q)H1-H2-H4=1/0-1/0-1/0, r)H1=3/0
s)S4=#2, t)S4-1/0, u)S4-S5=1/0-#2, v)S4-S5=1/0-1/0, w)S2-S4=3/0-1/0, x)S4=3/0

DOUBLE-SIDED

6.5kW EH & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	80-90	3/0-3/0	20
60	100-150	3/0-3/0	20(e)
70	80-100	3/0-3/0	20(e)
50kVA			
70	110-150	1/0	12
80	80-110	1/0	12
80	120-150	1/0	12(f)
90	80-100	1/0	12
90	110-150	1/0	12(f)
100	80	1/0	12
100	90-150	1/0	12(f)
110	80-110	1/0	12(f)
110	120-140	3/0	12
110	150	3/0	12(f)
120	80-110	3/0	12
120	120-150	3/0	12(f)
130	80-110	3/0	12
130	120-150	3/0	12(f)
140	80-100	3/0	12
140	100-150	3/0	12(f)
150	80-90	3/0	12
150	100-150	3/0	12(f)

6kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	80-100	3/0-3/0	16(a)(t)
60	110-150	3/0-3/0	16(g)(t)
70	80-100	1/0	12
70	110-150	350-3/0	16(g)(t)
80	80-90	1/0	12
80	100-130	350-3/0	16(g)(t)
80	140-150	3/0	12(f)
90	80-90	1/0	12
90	100-150	1/0	12(f)
100	80	1/0	12
100	90-130	1/0	12(f)
100	140-150	3/0	12(f)
110	80-130	1/0	12(f)
110	140-150	3/0	12(f)
120	80-110	1/0	12(f)
120	120-140	3/0	12(f)
120	150	3/0	12(n)
130	80-90	3/0	12
130	100-130	3/0	12(f)
130	140-150	3/0	12(n)
140	80-100	3/0	12
140	100-130	3/0	12(f)
140	140-150	3/0	12(n)
150	80-90	3/0	12
150	100-120	3/0	12(f)
150	130-150	3/0	12(n)

7.5kW EH & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	80-100	3/0-3/0	16(t)(a)
60	100-120	3/0-3/0	16(t)(j)
60	130-150	3/0-3/0	16(t)(k)
70	80	3/0-3/0	16(t)(j)
70	90	350-3/0	16(t)
70	100-150	350-3/0	16(t)(a)
80	80-110	350-3/0	16(t)(g)
80	120-140	350-3/0	16(t)(k)
50kVA			
80	150	3/0	12(f)
90	80-90	3/0	12
90	100	3/0	12(f)
90	110-150	3/0	12(f)
100	80-100	3/0	12
100	110-150	3/0	12(f)
110	80-130	3/0	12(f)
110	140-150	3/0	8(c)
120	80-110	3/0	12(f)
120	120-150	3/0	8(c)
130	80	3/0	12(n)
130	90	3/0	12(f)
130	100-130	3/0	8(c)
130	140-150	3/0	12(n)
140	80	3/0	12(n)
140	90-110	3/0	8(c)
140	120	3/0	12(n)
140	130-150	3/0	9(r)

7kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
100kVA			
60	150	350-3/0	16(x)(a)
70	150	350-3/0	16(x)(p)
80	150	350-350	16(x)(a)
75kVA			
60	80-120	1/0	12(f)
60	130-140	3/0	12(f)
70	80	3/0	12
70	90-140	3/0	12(f)
80	80	3/0	12
80	90-130	3/0	12(f)
80	140	3/0	12(n)
90	80	3/0	12
90	90-120	3/0	12(f)
90	130-150	3/0	12(n)
100	80-120	3/0	12(f)
100	130-150	3/0	12(n)
110	80-110	3/0	12(f)
110	120-150	3/0	12(n)
120	80-100	3/0	12(f)
120	110-150	3/0	12(n)
130	80-100	3/0	12(f)
130	110-150	3/0	12(n)
140	80-90	3/0	12(f)
140	100-140	3/0	12(n)
140	150	350	12(n)
150	80-90	3/0	12(f)
150	100-140	3/0	12(n)
		350	8(r)

8kW EH & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	80-100	3/0-3/0	16(t)(j)
60	110	3/0-3/0	16(t)(r)
60	120-140	350-3/0	16(t)(g)
60	150	350-3/0	16(t)(q)
70	80	350-3/0	16(t)(a)
70	90-120	350-3/0	16(t)(g)
70	130-140	350-3/0	16(t)(k)
50kVA			
70	150	3/0	12(f)
80	80-100	3/0	12
80	110-150	3/0	12(f)
90	80-90	3/0	12
90	100-140	3/0	12(f)
90	150	3/0	8(c)
100	80	3/0	12
100	90-140	3/0	12(f)
100	150	3/0	8(c)
110	80-110	3/0	12(f)
110	120	3/0	12(n)
110	130-150	3/0	8(c)
120	80-90	3/0	12(f)
120	100	3/0	8(c)
120	110-140	3/0	12(n)
120	150	3/0	8(r)
130	80-120	3/0	12(n)
130	130-150	3/0	8(r)
140	80	3/0	12(n)
140	90-150	3/0	8(r)
150	80-100	3/0	8(r)
150	110-150	350	12(f)

8kW A/C & EWH

Sec Ft	Serv Ft	S1-S2	# Cust
75kVA			
60	80-90	3/0	12
60	100-140	3/0	12(f)
60	150	350-3/0	20(a)
70	80	3/0	12
70	90-140	3/0	12(f)
70	150	3/0	12(n)
80	80	3/0	12
80	90-130	3/0	12(f)
80	140-150	3/0	12(n)
90	80	3/0	12
90	90-120	3/0	12(f)
90	130-150	3/0	12(n)
100	80-120	3/0	12(f)
100	130-150	3/0	12(n)
110	80-110	3/0	12(f)
110	120-150	3/0	12(n)
120	80-100	3/0	12(f)
120	110-150	3/0	12(n)
130	80	350	12
130	90-140	350	12(f)
140	80	350	12
140	90-130	350	12(f)
140	140	350	12(n)
150	80	350	12
150	90-130	350	12(f)
50kVA			
130	150	350	12(n)
140	150	350	12(n)
150	140-150	350	8(r)

REV	CHANGE	BY	DSGN	APPV	DATE	REV	CHANGE	BY	DSGN	APPV	DATE
C						F					
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X Indicates Latest Revision | Completely Revised | New Page | Information Removed

SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SINGLE FAMILY RESIDENTIAL SECONDARY SYSTEMS

5300
DEMAND ESTIMATING

5300
DEMAND ESTIMATING

5300 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5400
VOLTAGE DROP

5400
VOLTAGE DROP

5400 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5500
CONDUCTOR AMPACITIES

5500
CONDUCTOR
AMPACITIES

5500 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5600
TRANSFORMERS

5600
TRANSFORMERS

5600 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5700
PADS &
SUBSTRUCTURES

5700
PADS &
SUBSTRUCTURES

5700 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5800
CAPACITORS

5800
CAPACITORS

5800 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

5900

WIRE & SUPPORTS

5900
WIRE & SUPPORTS

5900 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

6000
SUBSTATION
LOAD FORCASTING

6000
SUBSTATION
LOAD FORCASTING

6000 - No FMO standards for this section.

MAIN TABLE OF CONTENTS

6100
SECTIONALIZING & PROTECTION

6100
SECTIONALIZING
& PROTECTION

MAIN TABLE OF CONTENTS

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	6114 MOVED TO FMO	JIK	MAK	FRC	KRG	09/16/2024	D						

Indicates Latest Revision | Completely Revised | X New Page | Information Removed

SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

SHEET 1 OF 1

TABLE OF CONTENTS
SECTIONALIZING AND PROTECTION

FMO DM6101

TABLE OF CONTENTS

DM6114 FIELD MAINTENANCE ONLY

ALL VERSIONS LISTED IN FMO ARE SUPERSEDED BY THEIR CURRENT VERSION FOUND INSIDE THE ELECTRIC DISTRIBUTION DESIGN MANUAL.

REVISION HISTORY:

09/16/2024: MOVED TO FMO

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	6114 MOVED TO FMO	JIK	MAK	FRC	KRG	09/16/2024	D						

	Indicates Latest Revision		Completely Revised	X	New Page		Information Removed

SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FIELD MAINTENANCE ONLY

UNDERGROUND SERVICE RESTORER

SCOPE

This document provides criteria for the selection and application of 12KV feeder sectionalizing devices on selected high–risk circuits.

PURPOSE

Application of automatic sectionalizing devices for underground circuits (pad–mounted service restorer and PME3 with SCADA) can be beneficial in reducing the number of customers affected by service interruptions. These devices are also helpful in reducing the projected SAIDI by minimzing the impact of a failure of the unfused high molecular polyethylene (HMWPE or PECN in GFMS or unjacketed cross–linked polyethylene (XLPE) cable.

CRITERIA

A. Circuits chosen for study should meet one or more of the following:

1. A high amount of unfused type HMWPE of XLPE cable as defined by
   a. Total cable length exceeding one mile or
   b. Exceeding 20 percent of the total underground cable length
2. Underground outage history exceeding three feeder outages over the last three years regardless of cause.

B. In addition to the above, the application must be prioritized based on the cost–to–benefit (C/B) ratio analysis in Design Manual section 6145. The projected value (the inverse of the C/B ratio) must be greater than one to justify the additional sectionalizing devices. Alternate methods of project methods of project justification may be allowed by Electric Distribution Planning.

APPLICATION

The circuit under consideration must be examined to ensure that it will meet the switching provisions of Design Manual section 6111 after modification. Service restorers are the preferred device because of the automatic operation and the fact that they can immediately reduce the number of customers affected by an outage. If a service restorer is already in use on a circuit, the PME3 with SCADA should be used where substation SCADA is available or will be available within two years. In cases where the frequency is not as critical, the PME3 with SCADA may be the most economical choice.

1. 600A Padmounted Service Restorer

a. Consideration must be made regarding the location and length of the un–fused cable segments when locating the service restorer. As a general guide, locate the service to maximize the amount of load on the line side of the device and to maximize the circuit length on load side. The service restorer should be located to protect at least one half of the circuit load. If this is not practical, locate to maximize the isolation of the unfused cable sections.

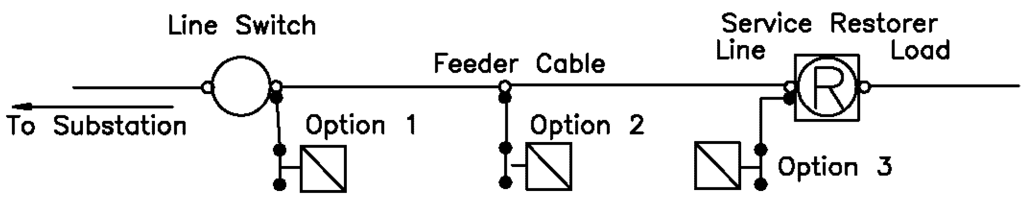
b. A line switch is required immediately ahead of the service restorer for maintenance. This may be an overhead gang operated or hookstick switch, a padmount switch, a handhole switch (On–Off),or a manhole switch (group/On–Off). Manhole switches are acceptable for this application but they are not preferred.

FOR FIELD MAINTENANCE ONLY

TABLE OF CONTENTS

APPLICATION (continued)

c. No load should be connected between the service restorer and the line switch immediately ahead. An exception to this rule would be the placement of a single phase transformer that would only provide secondary service for the actuator device within the service restorer. This single phase transformer may tap the feeder at either the switch, the service restorer or in between. Following is an illustrative one-line diagram for the three optional hookups.



Special Note: DM 6121.3.d.1 requires that a fuse request be submitted and approved prior to installation of un-fused transformer stations.

d. If the service restorer is located so as to protect a purely underground section it shall be set for one test reclosing 5 seconds after the fault, then lockout. Distribution Planning will determine the number of test reclosings for circuits with overhead spans on the load side of the service restorer.

e. Distribution Planning must be contacted to obtain settings for all protective devices on the circuit.

2. PME3 with SCADA or SCADA Overhead Switch

The PME3 with SCADA should be applied in cases where: 1) A feeder has an existing service restorer and protection (fuse) coordination is not possible. 2) The less expensive SCADA switch will provide adequate protection for the circuit being studied.

a. If existing subsurface or padmount switchgear is strategically placed for service restoration contact Electric Distribution Standards about SCADA actuator retro-fit. This option can be more economical than other options.

b. Install SCADA type switches at the midpoint, one-quarter and three-quarter points on the feeder in that order of preference. These may be the new PME3 SCADA switch, SCADA overhead switch, or an existing underground switch retro-fitted with SCADA.

c. SCADA operated devices may be installed on feeders from current non-SCADA substations where SCADA is not planned within two years. Substations where SCADA is not planned within two years will limit options to automatic protection devices.

d. Consideration should be given to converting strong tie switches to SCADA.

FOR FIELD MAINTENANCE ONLY

TABLE OF CONTENTS

6200
SYSTEM
ENGINEERING

6200
SYSTEM
ENGINEERING

MAIN TABLE OF CONTENTS

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	6222 MOVED TO FMO	JIK	FRC	FRC	KRG	09/16/2024	D						

Indicates Latest Revision | Completely Revised | New Page | X Information Removed

SDG&E ELECTRIC DISTRIBUTION DESIGN MANUAL FOR FIELD MAINTENANCE ONLY

SHEET 1 OF 1

TABLE OF CONTENTS
SYSTEM ENGINEERING

FMO
DM6201.1

TABLE OF CONTENTS

DM6222 FIELD MAINTENANCE ONLY

ALL VERSIONS LISTED IN FMO ARE SUPERSEDED BY THEIR CURRENT VERSION FOUND INSIDE THE ELECTRIC DISTRIBUTION DESIGN MANUAL.

REVISION HISTORY:

09/16/2024: MOVED TO FMO

REV	CHANGE	DR	BY	DSN	APV	DATE	REV	CHANGE	DR	BY	DSN	APV	DATE
C							F						
B							E						
A	6114 MOVED TO FMO	JIK	FRC	FRC	KRG	09/16/2024	D						

	Indicates Latest Revision		Completely Revised	X	New Page		Information Removed

TABLE OF CONTENTS

SCOPE

This criteria shall be used for the application of grounding banks. Grounding banks provide a grounded neutral source that is required by load additions which are served by 6.9kV transformers.

DEFINITIONS

A grounding bank installation consists of three−phase transformers connected grounded wye−delta and is used to provide a ground source for the primary neutral wire. The primary voltage rating of the transformers used can be 12 or 6.9kV. The secondary voltage shall be rated 480 volts or higher (see O.H. Standards page 1195).

APPLICATION OF GROUNDING BANKS

A. Why Grounding Banks?

A grounding bank may be installed to serve single−phase load additions using 6.9kV transformers when there are two or fewer grounding banks on a circuit and:

1. Extension of an existing neutral wire, beyond the proper location for a grounding bank, is double the cost of a new grounding bank installation.

2. A neutral connected to an existing grounding bank is available, but additional single−phase load will exceed the recommended kVA limit on the existing grounding bank (see paragraph B.5).

B. Design Considerations

The following lists several design considerations related to the application of grounding banks.

1. The available short−circuit current sensed by a protective device is reduced approximately 100 amps for each grounding bank between the fault location and the substation. To prevent desensitization of the substation ground relays, the number of grounding banks on a circuit is limited to three installations.

2. A grounding bank should be installed at a central location to enable future loads to take advantage of this neutral source. Since there will normally be a maximum of three grounding banks per circuit, each grounding bank should be located to cover one third of the area served by the circuit.

3. The recommended location for a grounding bank is on the unfused portion of a circuit, preferably on the feeder because the load on the grounding bank will be served by an energized neutral source except during times when the circuit is interrupted or the grounding bank has failed.

4. Neutrals established by grounding banks should only be used to serve transformers fed from the same circuit.

5. The following are approved grounding bank installations, allowable connected kVA unbalance between phases and maximum connected kVA loading.

Grounding Bank Installation	Allowable Connected kVA unbalance Between Phases	Maximum Connected kVA Loading (a)
3 – 50 kVA's	150 kVA	1500 kVA
3 – 75 kVA's	225 kVA	2250 kVA

(a) The maximum connected kVA allowed was set at 10 times the unbalance which a grounding bank may tolerate because the load unbalance on the average circuit is 10 percent.

b. For more information on overhead grounding banks, refer to O.H. Standards Page 1195.

6. Single–phase loads served from a grounding bank should be divided equally among the three phases to balance the total load as much as possible.

If the amount of unbalance cannot be kept within the limits set above, one of the following must be done:

a. Extend the neutral from the substation and remove the grounding bank. This alternative is recommended if there is significant load growth potential in the area.

b. Serve part of the load with 12kV single–phase transformers. Use enough 12kV transformers to reduce the amount of 6.9kV connected kVA below the recommended limit.

c. Extend the neutral from another grounding bank, either new or existing, and transfer some 6.9kV load to this neutral. These neutrals are not to be connected to each other.

6300
SUBSTATION ENGINEERING

6300
SUBSTATION ENGINEERING

6300 - No FMO standards for this section.