CHERRY HILLS VILLAGE
COLORADO

Electrical requirements for plans on all new homes, additions, remodels & Service upgrades

Due to the size and uniqueness of homes built in Cherry Hills Village, a policy has been developed to require information regarding electrical installations on plans that may be different from other jurisdictions. The plans are not required to be drawn by an electrical engineer. The electrical contractor for the project is permitted to develop the plans and include them in the project plans. Much of the information may be able to be provided on the architectural drawings. Cut sheets are not required to be submitted. We are looking for a general idea of the electrical design to confirm that the electrical system will be safe.

To assist the applicant in developing the plans, the following information is required to be included with the City's permit application. The following information includes the basic permit application requirements for a 120/240 volt single phase Electrical Service installed on a single family residential lot.

CAUTION: This handout and the National Electrical Code are not intended as design specifications nor instruction manuals for untrained persons. NEC 90-1(c). The National Electrical Code requires Qualified Persons to design electrical installations.

- Provide a one-line diagram that includes all of the electrical service equipment, all of the conduit and conductor sizes, all of the feeder panels, the entire grounding electrode system, and the grounding electrode conductor sizes, in order to verify compliance with NEC 310.15(B), NEC 250.66 and NEC 250.122. Example diagrams are attached for your information in preparing a Single Line Diagram, if these diagrams meet your needs you can fill in the information for each component or create your own custom one line diagram.

- Provide a floor plan with the location of all of the electrical service equipment, service disconnect(s), and panel(s) in order to verify compliance with NEC 110.26.

- Provide fault current calculations, see attached examples. Provide the short circuit current rating of all of the service equipment and the feeder panel(s), in order to verify compliance with NEC 110.9. A method of calculating fault current is attached for your reference, please consult with the utility company and find out the size of the transformer that will be provided for your project.

- Provide the load calculations for the service, each service disconnect, each feeder panel, and each branch circuit to demonstrate compliance with NEC 220. The standard or optional method may be used. An example of the Optional method is attached. Examples of both methods are located in ANNEX D of the NEC.

- Provide a complete mechanical schedule. The mechanical schedule needs to include a general description of all HVAC equipment, all motors, and all electrical equipment with motors. Provide the anticipated loads for all of the mechanical equipment, the overcurrent protection and conductor sizes. NEC 422 and 430

- Provide the location of all of the electrical outlets and switching devices. The location of each receptacle, luminaire, electrical appliance, switch, fan, and motor shall be identified on the drawings. NEC 210.50, NEC 210.63-70.

- All GFCI protected receptacles and weather-proof receptacles shall be identified on the floor plans. NEC 210.8(A).

- Identify each branch circuit that is AFCI protected on the panel schedules in order to verify compliance with NEC 210.12(A). A sample of a panel schedule is provided, please copy the blank form and fill in the information for every panel that will be installed as part of your project.

TYPICAL FAULT CURRENT VALUES PUBLISHED BY XCEL ENERGY

SINGLE-PHASE PAD MOUNTED TRANSFORMERS

SINGLE-PHASE FAULT CURRENT IN RMS AMPS SYMMETRICAL EXPECTED AT THE SECONDARY TERMINALS OF THE TRANSFORMER. ALL FAULT CURRENTS ARE BASED ON 1%R AND 1%X FOR THE TRANSFORMER IMPEDANCE.

TR	TR	TR	TR	Fault Current	Transformer Protective Device (Bay-O-Net Fuses for NSP, PSCo, and SPS)			
kVA	%R	%X	%Z	240 V Secondary	4 kV	15 kV	25 kV	35 kV
25	1	1	1.4	7,400	25	8	3	3
50	1	1	1.4	14,800	50	15	8	8
100	1	1	1.4	29,600	65	25	15	8
150	1	1	1.4	44,400	100	50	25	15
167	1	1	1.4	49,400	100	50	25	15

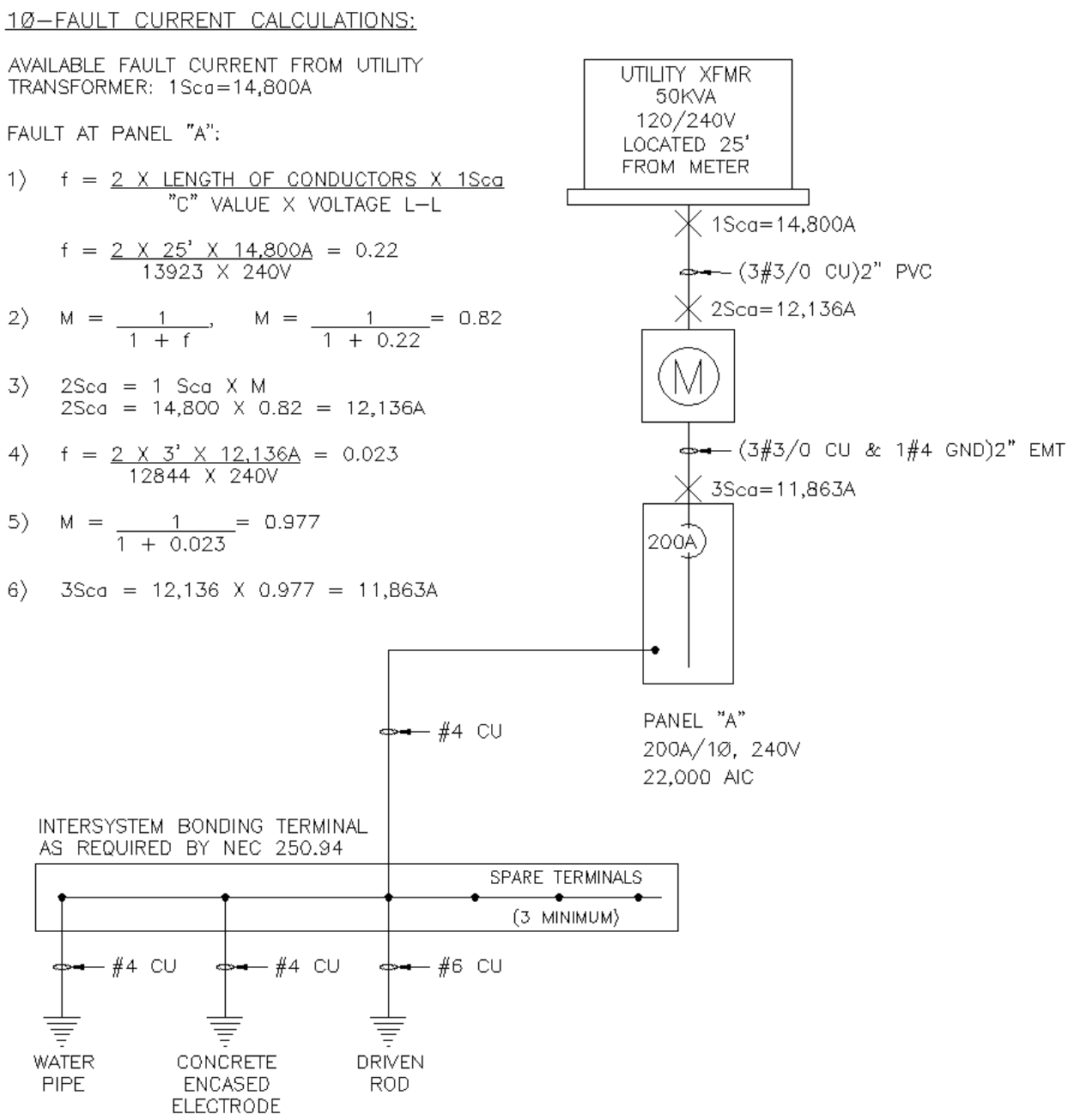
Xcel Energy offers their Standard for Electric Installation and Use (Blue Book) free of charge to all contractors and engineers by download at their webpage (http://www.xcelenergy.com). Please contact your local utility representative for any questions concerning the size of the transformer they will provide for your project, at the builder's call line 1-800-628-2121.

Table 4. "C" Values for Conductors

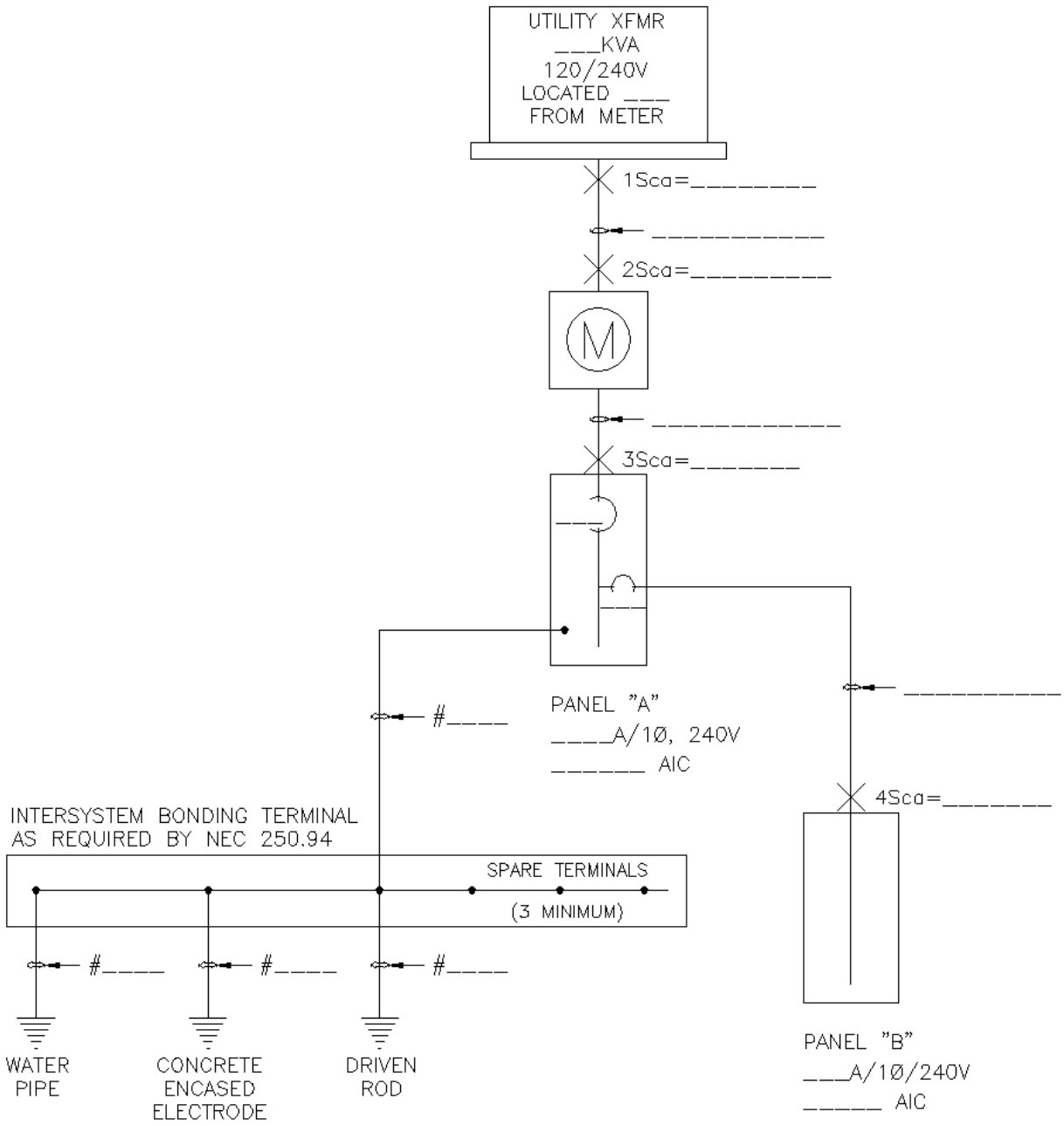
Copper												
AWG or kcmil	Three Single Conductors Conduit						Three-Conductor Cable Conduit					
	Steel			Nonmagnetic			Steel			Nonmagnetic		
	600V	5kV	15kV	600V	5kV	15kV	600V	5kV	15kV	600V	5kV	15kV
14	389	-	-	389	-	-	389	-	-	389	-	-
12	617	-	-	617	-	-	617	-	-	617	-	-
10	981	-	-	982	-	-	982	-	-	982	-	-
8	1557	1551	-	1559	1555	-	1559	1557	-	1560	1558	-
6	2425	2406	2389	2430	2418	2407	2431	2425	2415	2433	2428	2421
4	3806	3751	3696	3826	3789	3753	3830	3812	3779	3838	3823	3798
3	4774	4674	4577	4811	4745	4679	4820	4785	4726	4833	4803	4762
2	5907	5736	5574	6044	5926	5809	5989	5930	5828	6087	6023	5958
1	7293	7029	6759	7493	7307	7109	7454	7365	7189	7579	7507	7364
1/0	8925	8544	7973	9317	9034	8590	9210	9086	8708	9473	9373	9053
2/0	10755	10062	9390	11424	10878	10319	11245	11045	10500	11703	11529	11053
3/0	12844	11804	11022	13923	13048	12360	13656	13333	12613	14410	14119	13462
4/0	15082	13606	12543	16673	15351	14347	16392	15890	14813	17483	17020	16013
250	16483	14925	13644	18594	17121	15866	18311	17851	16466	19779	19352	18001
300	18177	16293	14769	20868	18975	17409	20617	20052	18319	22525	21938	20163
350	19704	17385	15678	22737	20526	18672	22646	21914	19821	24904	24126	21982
400	20566	18235	16366	24297	21786	19731	24253	23372	21042	26916	26044	23518
500	22185	19172	17492	26706	23277	21330	26980	25449	23126	30096	28712	25916
600	22965	20567	17962	28033	25204	22097	28752	27975	24897	32154	31258	27766
750	24137	21387	18889	29735	26453	23408	31051	30024	26933	34605	33315	29735
1,000	25278	22539	19923	31491	28083	24887	33864	32689	29320	37197	35749	31959
Aluminum												
14	237	-	-	237	-	-	237	-	-	237	-	-
12	376	-	-	376	-	-	376	-	-	376	-	-
10	599	-	-	599	-	-	599	-	-	599	-	-
8	951	950	-	952	951	-	952	951	-	952	952	-
6	1481	1476	1472	1482	1479	1476	1482	1480	1478	1482	1481	1479
4	2346	2333	2319	2350	2342	2333	2351	2347	2339	2353	2350	2344
3	2952	2928	2904	2961	2945	2929	2963	2955	2941	2966	2959	2949
2	3713	3670	3626	3730	3702	3673	3734	3719	3693	3740	3725	3709
1	4645	4575	4498	4678	4632	4580	4686	4664	4618	4699	4682	4646
1/0	5777	5670	5493	5838	5766	5646	5852	5820	5717	5876	5852	5771
2/0	7187	6968	6733	7301	7153	6986	7327	7271	7109	7373	7329	7202
3/0	8826	8467	8163	9110	8851	8627	9077	8981	8751	9243	9164	8977
4/0	10741	10167	9700	11174	10749	10387	11185	11022	10642	11409	11277	10969
250	12122	11460	10849	12862	12343	11847	12797	12636	12115	13236	13106	12661
300	13910	13009	12193	14923	14183	13492	14917	14698	13973	15495	15300	14659
350	15484	14280	13288	16813	15858	14955	16795	16490	15541	17635	17352	16501
400	16671	15355	14188	18506	17321	16234	18462	18064	16921	19588	19244	18154
500	18756	16828	15657	21391	19503	18315	21395	20607	19314	23018	22381	20978
600	20093	18428	16484	23451	21718	19635	23633	23196	21349	25708	25244	23295
750	21766	19685	17686	25976	23702	21437	26432	25790	23750	29036	28262	25976
1,000	23478	21235	19006	28779	26109	23482	29865	29049	26608	32938	31920	29135

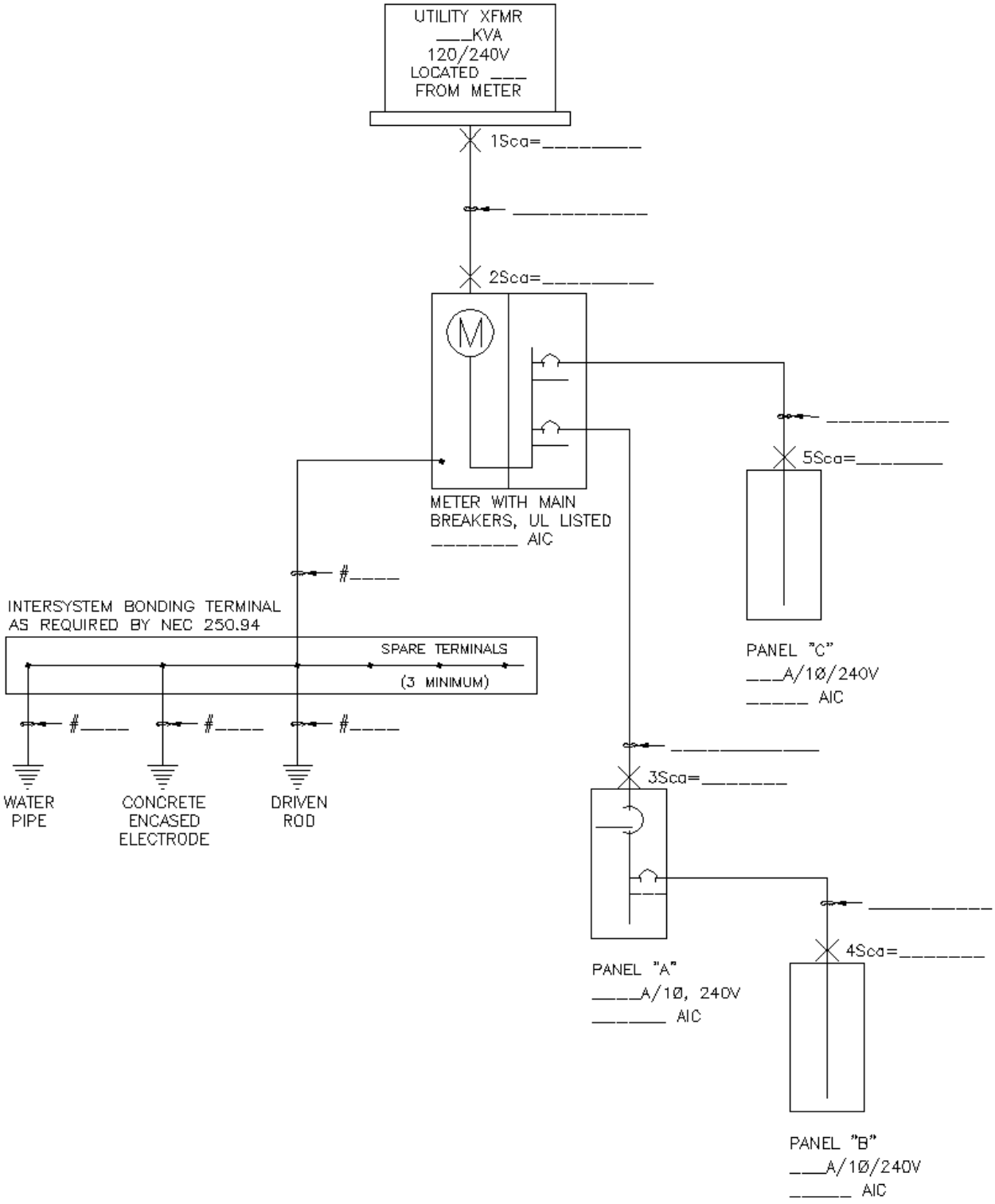
Note: These values are equal to one over the impedance per foot and based upon resistance and reactance values found in IEEE Std 241-1990 (Gray Book), IEEE Recommended Practice for Electric Power Systems in Commerical Buildings & IEEE Std 242-1986 (Buff Book), IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. Where resistance and reactance values differ or are not available, the Buff Book values have been used. The values for reactance in determining the C Value at 5 KV & 15 KV are from the Gray Book only (Values for 14-10 AWG at 5 kV and 14-8 AWG at 15 kV are not available and values for 3 AWG have been approximated).

SAMPLE ONE LINE DIAGRAM WITH FAULT CURRENT CALCULATIONS



This drawing shows typical information required for the one line diagram in order to verify code compliance, if multiple sub-panels are installed expand the one line diagram to include all panels and repeat the fault current calculations steps 1-3 for each panel. The initial fault current value to used for any subsequent calculations will be the available fault current value from the upstream panel and the distance


UTILITY XFMR
___KVA
120/240V
LOCATED ___
FROM METER
1Sca=_____
_____
2Sca=_____
M
_____
3Sca=_____
#____
PANEL "A"
____A/1Ø, 240V
_____ AIC
_____
4Sca=_____
INTERSYSTEM BONDING TERMINAL
AS REQUIRED BY NEC 250.94
SPARE TERMINALS
(3 MINIMUM)
#____
#____
#____
WATER
PIPE
CONCRETE
ENCASED
ELECTRODE
DRIVEN
ROD
PANEL "B"
___A/1Ø/240V
_____ AIC


UTILITY XFMR
___KVA
120/240V
LOCATED ___
FROM METER
1Sca=_____
_____
2Sca=_____
M
METER WITH MAIN
BREAKERS, UL LISTED
_____ AIC
_____
5Sca=_____
PANEL "C"
___A/1Ø/240V
_____ AIC
#_____
INTERSYSTEM BONDING TERMINAL
AS REQUIRED BY NEC 250.94
SPARE TERMINALS
(3 MINIMUM)
#_____
#_____
#_____
WATER
PIPE
CONCRETE
ENCASED
ELECTRODE
DRIVEN
ROD
_____
3Sca=_____
PANEL "A"
____A/1Ø, 240V
_____ AIC
_____
4Sca=_____
PANEL "B"
___A/1Ø/240V
_____ AIC

RESIDENTIAL LOAD CALCULATIONS (NEC 220-30)
OPTIONAL METHOD

SES / PANEL _____

A)	1) _____	SF X 3 VA/SF			=	_____	VA
	2) _____	SMALL APPLIANCE CIRCUITS(MIN. 2) @	1500	VA	=	_____	VA
	3) _____	LAUNDRY CIRCUIT @	1500	VA	=	_____	VA
	4) _____	DISHWASHER @	750	VA	=	_____	VA
	5) _____	RANGE @ 12000VA	12000	VA	=	_____	VA
	6) _____	WATER HEATER @	5000	VA	=	_____	VA
	7) _____	DRYER @	5000	VA	=	_____	VA
	8) _____	MICROWAVE@	1500	VA	=	_____	VA
	9) _____	FORCED AIR UNIT	1500	VA	=	_____	VA
	10) _____		_____	VA	=	_____	VA
	11) _____		_____	VA	=	_____	VA
	12) _____		_____	VA	=	_____	VA
	13) _____		_____	VA	=	_____	VA
	14) _____		_____	VA	=	_____	VA
	15) _____		_____	VA	=	_____	VA
		SUBTOTAL			=	_____	VA
B)		FIRST 10,000VA @ 100%			=	_____	VA
		REMAINING _____ VA @ 40%			=	_____	VA
C)		A/C @ 100%			=	_____	VA
D)		POOL PANEL/EQUIPMENT			=	_____	VA
E)		TOTAL VOLT AMPS			=	_____	VA
F)		TOTAL AMPS (TOTAL VA / 240 VOLTS)			=	_____	AMPS

BUS RATING _____A
VOLTAGE _____V

PANEL

MAIN BREAKER _____A
AIC RATING _____AIC

CKT #	AFCI CB	LOAD DESCRIPTION	LOAD (VA)	CB AMPS	A	B	CB AMPS	LOAD (VA)	LOAD DESCRIPTION	AFCI CB	CKT #
1											2
3											4
5											6
7											8
9											10
11											12
13											14
15											16
17											18
19											20
21											22
23											24
25											26
27											28
29											30
31											32
33											34
35											36
37											38
39											40
41											42

COMPLETE THE PANEL SCHEDULE BASED ON THE LOADS CONNECTED TO EACH CIRCUIT AS SHOWN ON THE FLOOR PLANS

AFCI/CB:
INDICATE IF THE BREAKER WILL HAVE AFCI PROTECTION AS REQUIRED BY NEC 210.12(A).

LOAD DESCRIPTION:
DESCRIBE THE TYPE OF LOAD CONNECTED TO THE CIRCUIT BREAKER PER NEC 408.4.

LOAD (VA):
INDICATE THE LOAD CONNECTED TO THE CIRCUIT TO VERIFY COMPLIANCE WITH NEC 240.

CB AMPS:
INDICATE THE SIZE OF THE CIRCUIT BREAKER SERVING THE LOAD, FOR 2-POLE BREAKERS CONNECT TWO CIRCUIT POSITIONS WITH A LINE AS SHOWN.

CKT #	AFCI CB	LOAD DESCRIPTION	LOAD (VA)	CB AMPS	A	B	CB AMPS	LOAD (VA)	LOAD DESCRIPTION	AFCI CB	CKT #
1	AFCI	MASTER BEDROOM	900	20			50	4000	RANGE WITH OVEN		2
3	AFCI	LIVING ROOM	1020	20			50	4000	RANGE WITH OVEN		4