College Station Utilities

Reliable, Affordable, Community Owned

Design and Operating Spreadsheets

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Assistant Director

Spreadsheet for Dispatch Control of Power Factor

CHART FOR DETERMINING WHEN TO SWITCH ON CAPACITOR BANK WHEN THERE IS A LAGGING SYSTEM POWER FACTOR (>5000 KVAR) AND WHEN SYSTEM LOAD IS INCREASING

TRC/121508

KW	KVAR	P.F.	LEADING OR LAGGING	CAPACITOR KVAR TO TURN ON	NEW KVAR	NEW POWER FACTOR	LEADING OR LAGGING
1000	997	0.7082	LAGGING	1200	-203	0.9800	LEADING
1500	895	0.8586	LAGGING	1200	-305	0.9800	LEADING
2000	915	0.9093	LAGGING	1200	-285	0.9900	LEADING
2500	949	0.9349	LAGGING	1200	-251	0.9950	LEADING
3000	899	0.9579	LAGGING	1200	-301	0.9950	LEADING
3500	849	0.9718	LAGGING	1200	-351	0.9950	LEADING
4000	798	0.9807	LAGGING	1200	-402	0.9950	LEADING
4500	748	0.9865	LAGGING	1200	-452	0.9950	LEADING
5000	698	0.9904	LAGGING	1200	-502	0.9950	LEADING
5500	648	0.9931	LAGGING	1200	-552	0.9950	LEADING
6000	734	0.9926	LAGGING	1200	-466	0.9970	LEADING
6500	695	0.9943	LAGGING	1200	-505	0.9970	LEADING
7000	657	0.9956	LAGGING	1200	-543	0.9970	LEADING
7500	618	0.9966	LAGGING	1200	-582	0.9970	LEADING
8000	579	0.9974	LAGGING	1200	-621	0.9970	LEADING
8500	540	0.9980	LAGGING	1200	-660	0.9970	LEADING
9000	501	0.9985	LAGGING	1200	-699	0.9970	LEADING
9500	462	0.9988	LAGGING	1200	-738	0.9970	LEADING
10000	424	0.9991	LAGGING	1200	-776	0.9970	LEADING

KW	KVAR	P.F.	LEADING OR LAGGING	CAPACITOR KVAR TO TURN ON	NEW KVAR	NEW POWER FACTOR	LEADING OR LAGGING
1000	458	0.9093	LAGGING	600	-142	0.9900	LEADING
1500	386	0.9684	LAGGING	600	-214	0.9900	LEADING
2000	399	0.9807	LAGGING	600	-201	0.9950	LEADING
2500	349	0.9904	LAGGING	600	-251	0.9950	LEADING
3000	299	0.9951	LAGGING	600	-301	0.9950	LEADING
3500	328	0.9956	LAGGING	600	-272	0.9970	LEADING
4000	347	0.9963	LAGGING	600	-253	0.9980	LEADING
4500	315	0.9976	LAGGING	600	-285	0.9980	LEADING
5000	376	0.9972	LAGGING	600	-224	0.9990	LEADING
5500	354	0.9979	LAGGING	600	-246	0.9990	LEADING
6000	331	0.9985	LAGGING	600	-269	0.9990	LEADING
6500	309	0.9989	LAGGING	600	-291	0.9990	LEADING
7000	287	0.9992	LAGGING	600	-313	0.9990	LEADING
7500	264	0.9994	LAGGING	600	-336	0.9990	LEADING
8000	242	0.9995	LAGGING	600	-358	0.9990	LEADING
8500	331	0.9992	LAGGING	600	-269	0.9995	LEADING
9000	315	0.9994	LAGGING	600	-285	0.9995	LEADING
9500	299	0.9995	LAGGING	600	-301	0.9995	LEADING
10000	284	0.9996	LAGGING	600	-316	0.9995	LEADING

OPERATING GUIDELINES:

1. DURING THE SUMMER, TURN ON 1200 KVAR SWITCHED BANKS BEFORE UTILIZING 600 KVAR SWITCHED BANKS.
2. DURING THE WINTER, UTILIZE 1200 AND 600 KVAR SWITCHED BANKS AS NEEDED TO CONTROL POWER FACTOR.
3. DOCUMENT ANY FEEDER THAT NEEDS ADDITIONAL CAPACITORS OR SWITCHED BANKS AND FORWARD THESE RECOMMENDATIONS TO ENGINEERING ALONG WITH SCREEN PRINTS FROM THE CAPACITOR SCREEN.

CHART FOR DETERMINING WHEN TO SWITCH OFF CAPACITOR BANK WHEN SYSTEM LOAD IS DECREASING

KW	KVAR	P.F.	LEADING OR LAGGING	CAPACITOR KVAR TO TURN OFF	NEW KVAR	NEW POWER FACTOR	LEADING OR LAGGING
1000	-251	0.9700	LEADING	1200	949	0.7252	LAGGING
1500	-376	0.9700	LEADING	1200	824	0.8764	LAGGING
2000	-350	0.9850	LEADING	1200	850	0.9204	LAGGING
2500	-438	0.9850	LEADING	1200	762	0.9565	LAGGING
3000	-526	0.9850	LEADING	1200	674	0.9756	LAGGING
3500	-613	0.9850	LEADING	1200	587	0.9862	LAGGING
4000	-570	0.9900	LEADING	1200	630	0.9878	LAGGING
4500	-641	0.9900	LEADING	1200	559	0.9924	LAGGING
5000	-712	0.9900	LEADING	1200	488	0.9953	LAGGING
5500	-784	0.9900	LEADING	1200	416	0.9971	LAGGING
6000	-855	0.9900	LEADING	1200	345	0.9984	LAGGING
6500	-801	0.9925	LEADING	1200	399	0.9981	LAGGING
7000	-862	0.9925	LEADING	1200	338	0.9988	LAGGING
7500	-924	0.9925	LEADING	1200	276	0.9993	LAGGING
8000	-985	0.9925	LEADING	1200	215	0.9996	LAGGING
8500	-935	0.9940	LEADING	1200	265	0.9995	LAGGING
9000	-990	0.9940	LEADING	1200	210	0.9997	LAGGING
9500	-1045	0.9940	LEADING	1200	155	0.9999	LAGGING
10000	-1100	0.9940	LEADING	1200	100	1.0000	LAGGING

KW	KVAR	P.F.	LEADING OR LAGGING	CAPACITOR KVAR TO TURN OFF	NEW KVAR	NEW POWER FACTOR	LEADING OR LAGGING
1000	-251	0.9700	LEADING	600	349	0.9440	LAGGING
1500	-305	0.9800	LEADING	600	295	0.9812	LAGGING
2000	-246	0.9925	LEADING	600	354	0.9847	LAGGING
2500	-308	0.9925	LEADING	600	292	0.9932	LAGGING
3000	-301	0.9950	LEADING	600	299	0.9951	LAGGING
3500	-351	0.9950	LEADING	600	249	0.9975	LAGGING
4000	-283	0.9975	LEADING	600	317	0.9969	LAGGING
4500	-319	0.9975	LEADING	600	281	0.9981	LAGGING
5000	-224	0.9990	LEADING	600	376	0.9972	LAGGING
5500	-246	0.9990	LEADING	600	354	0.9979	LAGGING
6000	-269	0.9990	LEADING	600	331	0.9985	LAGGING
6500	-291	0.9990	LEADING	600	309	0.9989	LAGGING
7000	-221	0.9995	LEADING	600	379	0.9985	LAGGING
7500	-237	0.9995	LEADING	600	363	0.9988	LAGGING
8000	-253	0.9995	LEADING	600	347	0.9991	LAGGING
8500	-269	0.9995	LEADING	600	331	0.9992	LAGGING
9000	-180	0.9998	LEADING	600	420	0.9989	LAGGING
9500	-190	0.9998	LEADING	600	410	0.9991	LAGGING
10000	-200	0.9998	LEADING	600	400	0.9992	LAGGING

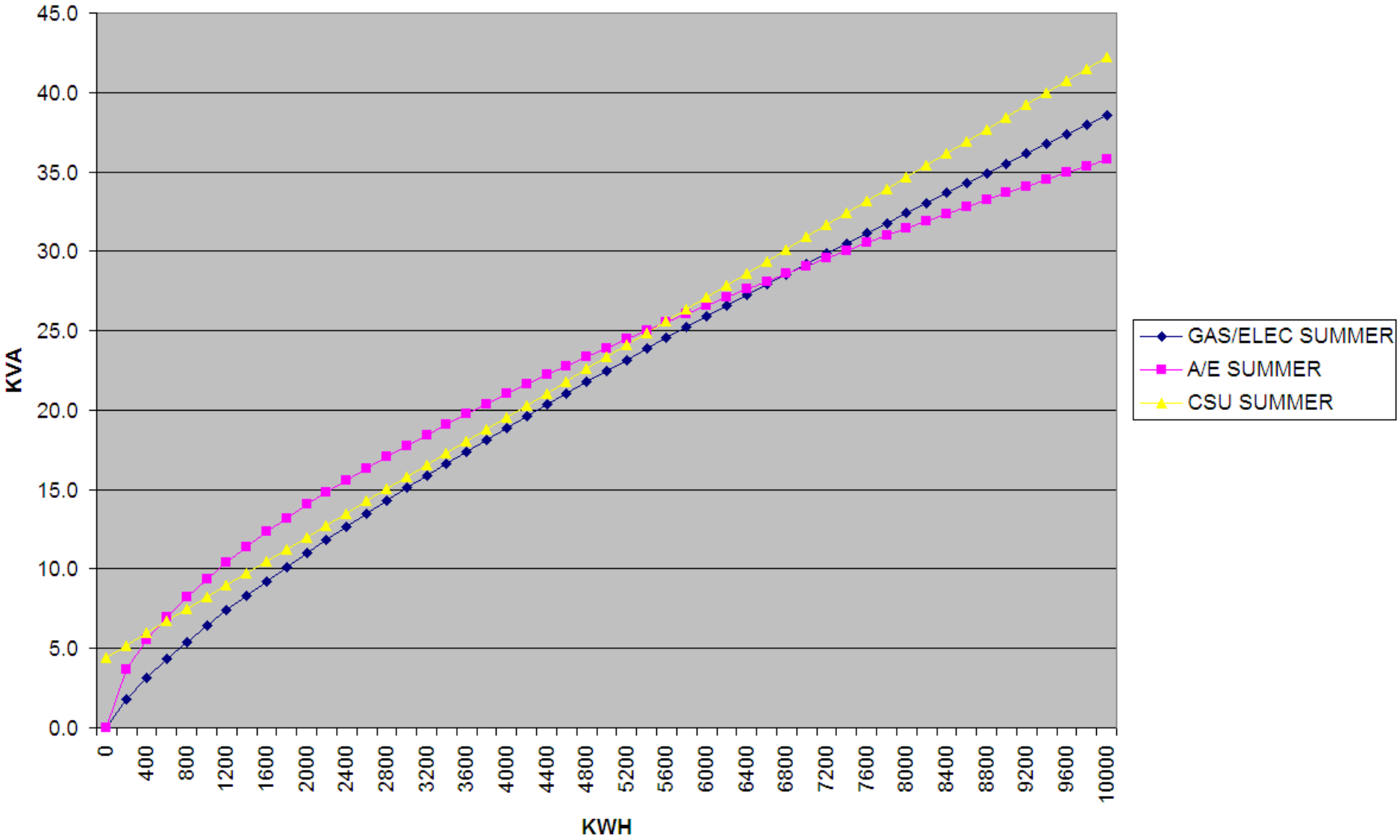
OPERATING GUIDELINES:

1. IF REQUIRED TO MAINTAIN A LAGGING SYSTEM POWER FACTOR, CAPACITORS CAN BE TURNED OFF OUTSIDE THE GUIDELINES DESIGNATED IN THIS CHART.
2. WHEN LOADS ARE DECREASING IN THE SUMMER, TURN OFF 600 KVAR CAPACITOR BANKS FIRST.
3. WHEN LOADS ARE DECREASING IN THE WINTER, MONITOR WHETHER TO TURN OFF THE 1200 KVAR BANKS FIRST TO ADJUST THE POWER FACTOR AT MINIMUM LOAD FOR THE FEEDER.
4. DOCUMENT ANY FEEDER THAT NEEDS CAPACITOR CHANGES AT MINIMUM LOADING AND FORWARD THESE RECOMMENDATIONS TO ENGINEERING ALONG WITH SCREEN PRINTS FROM THE CAPACITOR SCREEN.

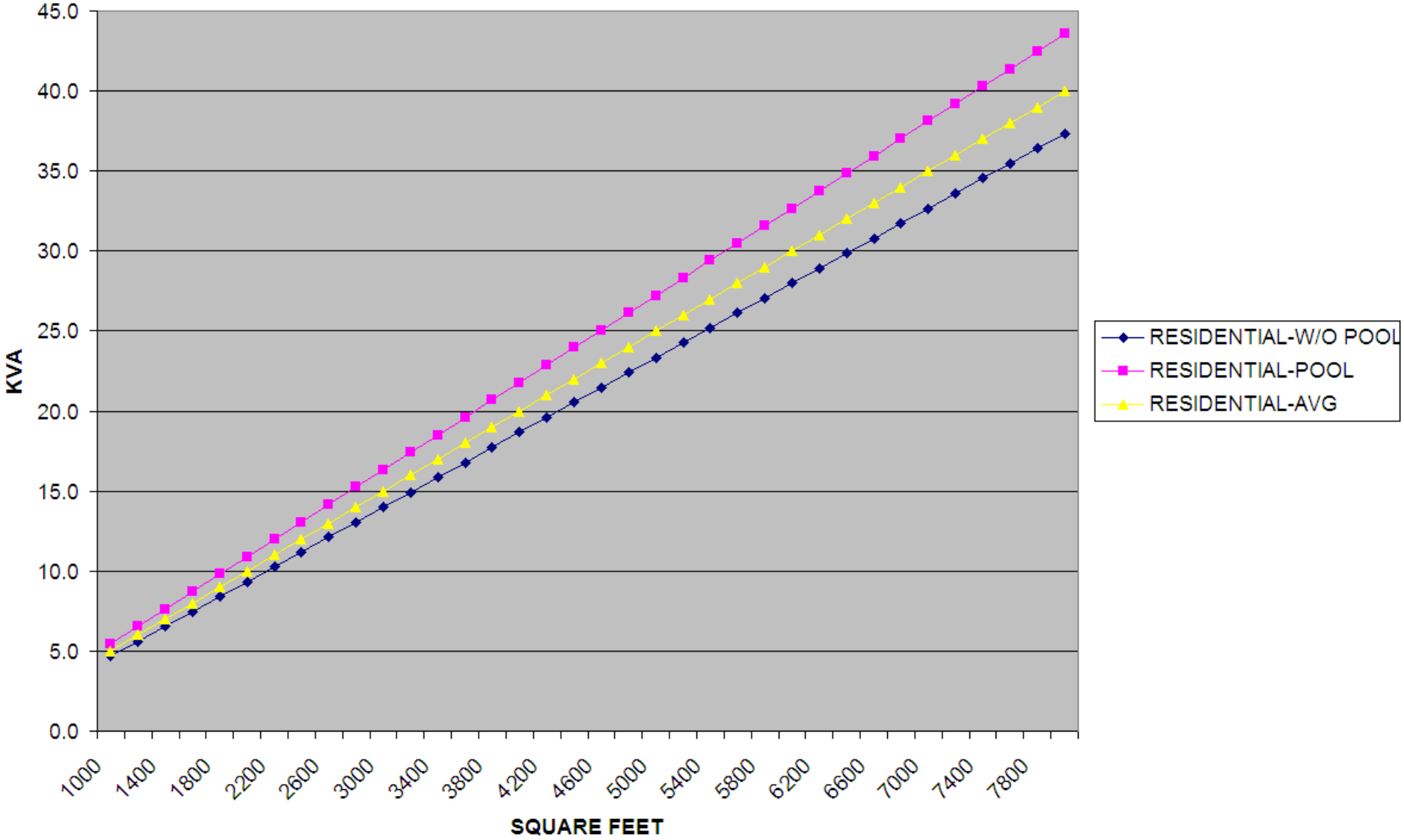
Infinite Bus Fault Current Calculation

	A	B	C	D	E	F	G
1	**INFINITE BUS FAULT CURRENT CALCULATION**						
2							TRC/82858
3	**PROJECT NAME:**						
4	**DATE:**	9/25/2009					
5	**PROJECT COORDINATOR:**						
6							
7	**REQUIRED DATA:**						
8	THREE PHASE TRANSFORMER KVA:		(IN KVA)				
9	TRANSFORMER PERCENT IMPEDANCE:						
10	SECONDARY LINE-TO-LINE VOLTAGE (ELL):		(IN VOLTS)				
11							
12	**CALCULATIONS:**						
13	I (FULL LOAD AMPS)	I(FLA)=(KVA*1000)/(ELL*1.73)					
14	SCA(SECONDARY) OR SHORT CIRCUIT AMPS AT SECONDARY BUS	SCA(SECONDARY)=I(FLA)*100/PERCENT IMPEDANCE					
15							
16	**RESULTS:**						
17	I (FULL LOAD AMPS)	#DIV/0!					
18	INFINITE BUS FAULT CURRENT	#DIV/0!					
19							

RESIDENTIAL KWH TO KVA COMPARISON



RESIDENTIAL: SUMMER KVA BASED ON SQUARE FOOTAGE OF HOUSE



Transformer Sizing Template

CLEAR FORM BUTTON

CALCULATION FOR SIZING TRANSFORMER FOR EXISTING RESIDENTIAL CUSTOMERS

ADDRESS:
WO#:
DATE: 9/25/2009

CUSTOMER ID	AUGUST			SEPTEMBER			JANUARY			FEBRUARY		
	KVH FROM AS400	KVA	DIVERSIFIED	KVH FROM AS400	KVA	DIVERSIFIED	KVH FROM AS400	KVA	DIVERSIFIED	KVH FROM AS400	KVA	DIVERSIFIED
		0	0.0		0	0.0		0	0.0		0	0.0
		min xfmr:	0.0		min xfmr:	0.0		min xfmr:	0.0		min xfmr:	0.0

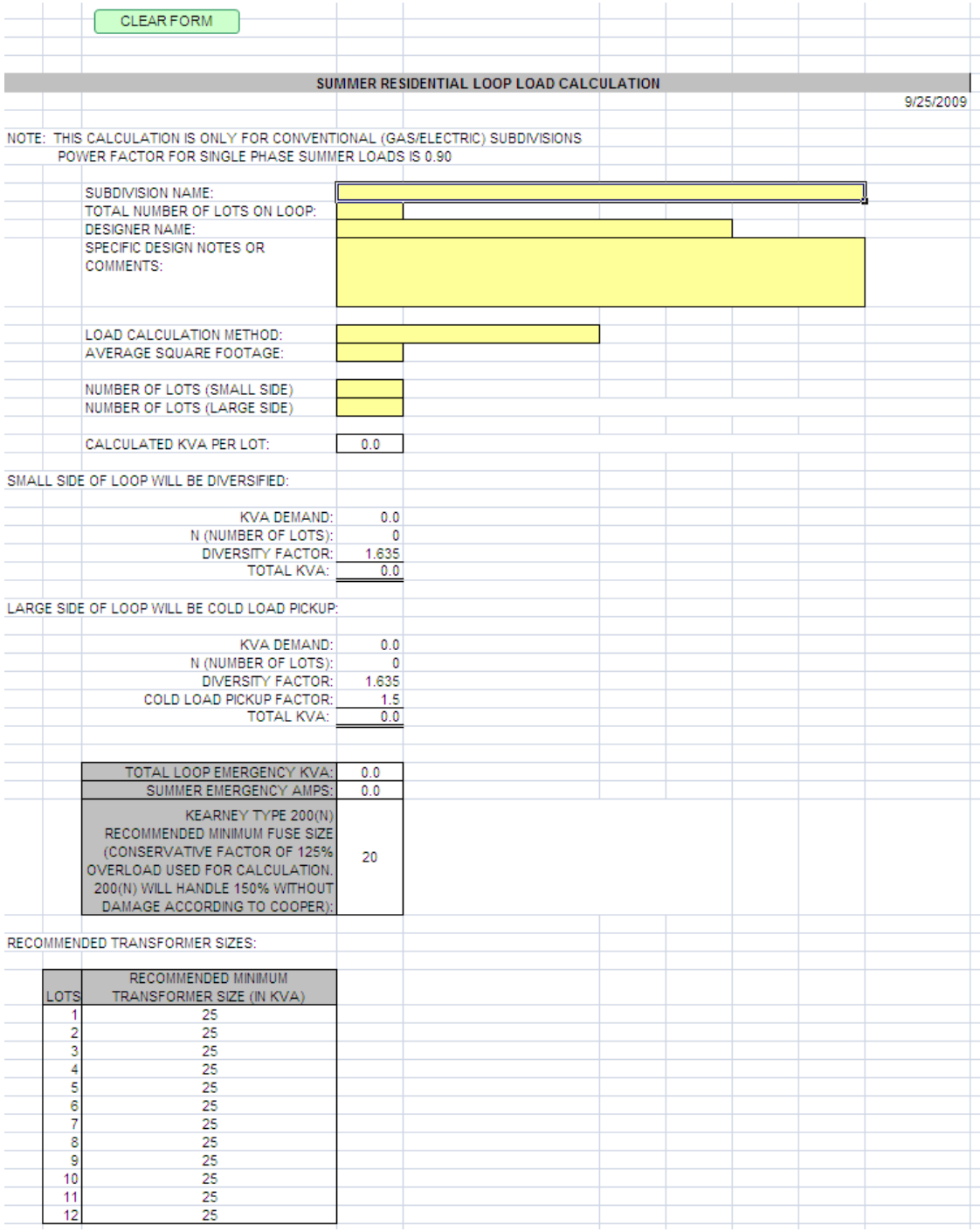
CALCULATED MINIMUM SIZE XFMR KVA: 0
RECOMMENDED MINIMUM XFMR KVA SIZE: 0

AVAILABLE TRANFORMER KVA SIZES

OH	URD
10	25
15	37.5
25	50
37.5	75
50	100
75	167
100	250

RECOMMENDATION:

Subdivision Design (gas/electric subdivision)



CLEAR FORM

SUMMER RESIDENTIAL LOOP LOAD CALCULATION

9/25/2009

NOTE: THIS CALCULATION IS ONLY FOR CONVENTIONAL (GAS/ELECTRIC) SUBDIVISIONS
POWER FACTOR FOR SINGLE PHASE SUMMER LOADS IS 0.90

SUBDIVISION NAME:	
TOTAL NUMBER OF LOTS ON LOOP:	
DESIGNER NAME:	
SPECIFIC DESIGN NOTES OR COMMENTS:	
LOAD CALCULATION METHOD:	
AVERAGE SQUARE FOOTAGE:	
NUMBER OF LOTS (SMALL SIDE)	
NUMBER OF LOTS (LARGE SIDE)	
CALCULATED KVA PER LOT:	0.0

SMALL SIDE OF LOOP WILL BE DIVERSIFIED:

KVA DEMAND:	0.0
N (NUMBER OF LOTS):	0
DIVERSITY FACTOR:	1.635
TOTAL KVA:	0.0

LARGE SIDE OF LOOP WILL BE COLD LOAD PICKUP:

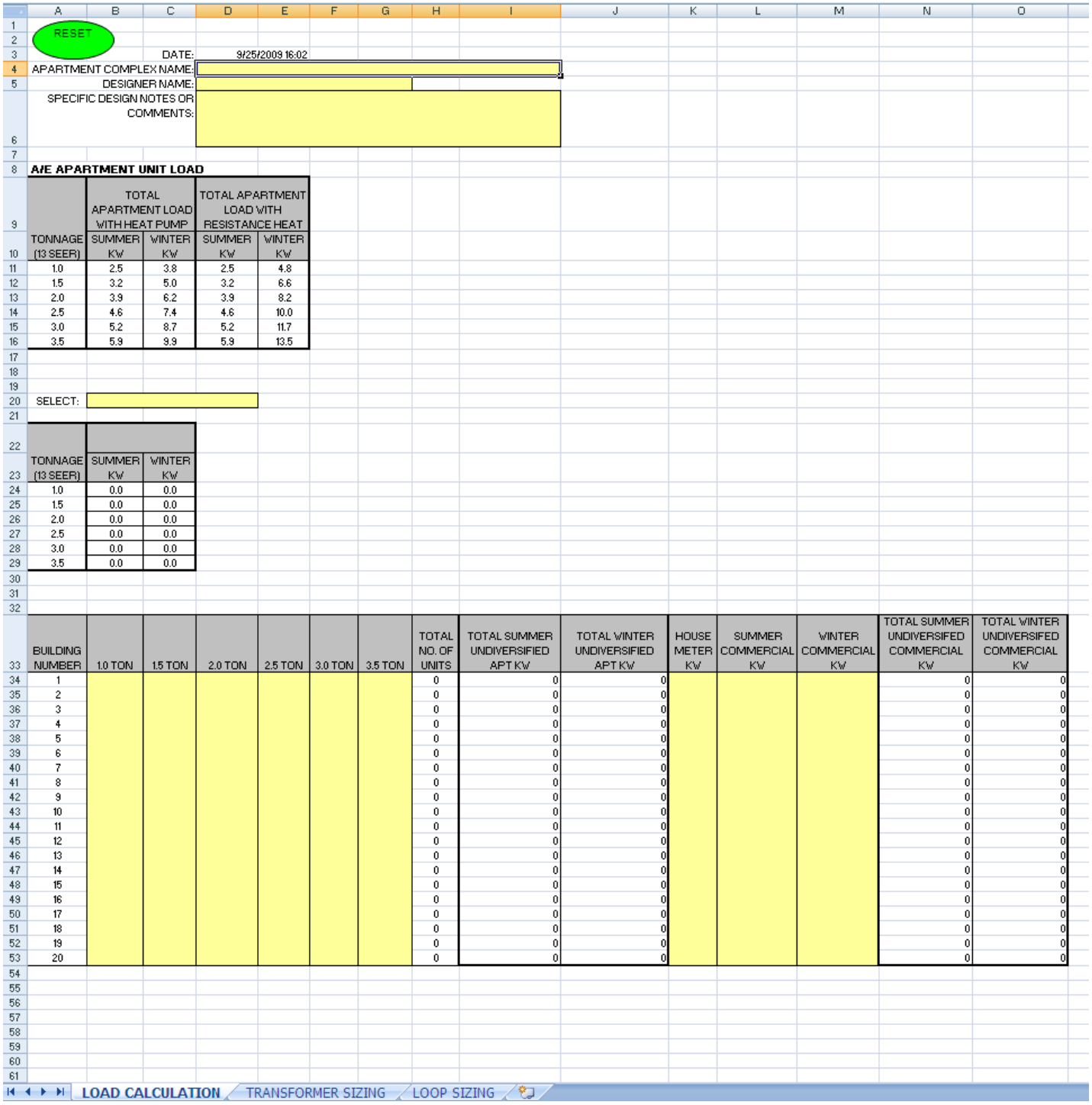
KVA DEMAND:	0.0
N (NUMBER OF LOTS):	0
DIVERSITY FACTOR:	1.635
COLD LOAD PICKUP FACTOR:	1.5
TOTAL KVA:	0.0

TOTAL LOOP EMERGENCY KVA:	0.0
SUMMER EMERGENCY AMPS:	0.0
KEARNEY TYPE 200(N) RECOMMENDED MINIMUM FUSE SIZE (CONSERVATIVE FACTOR OF 125% OVERLOAD USED FOR CALCULATION. 200(N) WILL HANDLE 150% WITHOUT DAMAGE ACCORDING TO COOPER):	20

RECOMMENDED TRANSFORMER SIZES:

LOTS	RECOMMENDED MINIMUM TRANSFORMER SIZE (IN KVA)
1	25
2	25
3	25
4	25
5	25
6	25
7	25
8	25
9	25
10	25
11	25
12	25

Apartment Complex Design (3 sheets)



RESET

DATE: 9/25/2009 16:02

APARTMENT COMPLEX NAME:

DESIGNER NAME:

SPECIFIC DESIGN NOTES OR COMMENTS:

A/E APARTMENT UNIT LOAD

TONNAGE (13 SEER)	TOTAL APARTMENT LOAD WITH HEAT PUMP SUMMER KW	TOTAL APARTMENT LOAD WITH HEAT PUMP WINTER KW	TOTAL APARTMENT LOAD WITH RESISTANCE HEAT SUMMER KW	TOTAL APARTMENT LOAD WITH RESISTANCE HEAT WINTER KW
1.0	2.5	3.8	2.5	4.8
1.5	3.2	5.0	3.2	6.6
2.0	3.9	6.2	3.9	8.2
2.5	4.6	7.4	4.6	10.0
3.0	5.2	8.7	5.2	11.7
3.5	5.9	9.9	5.9	13.5

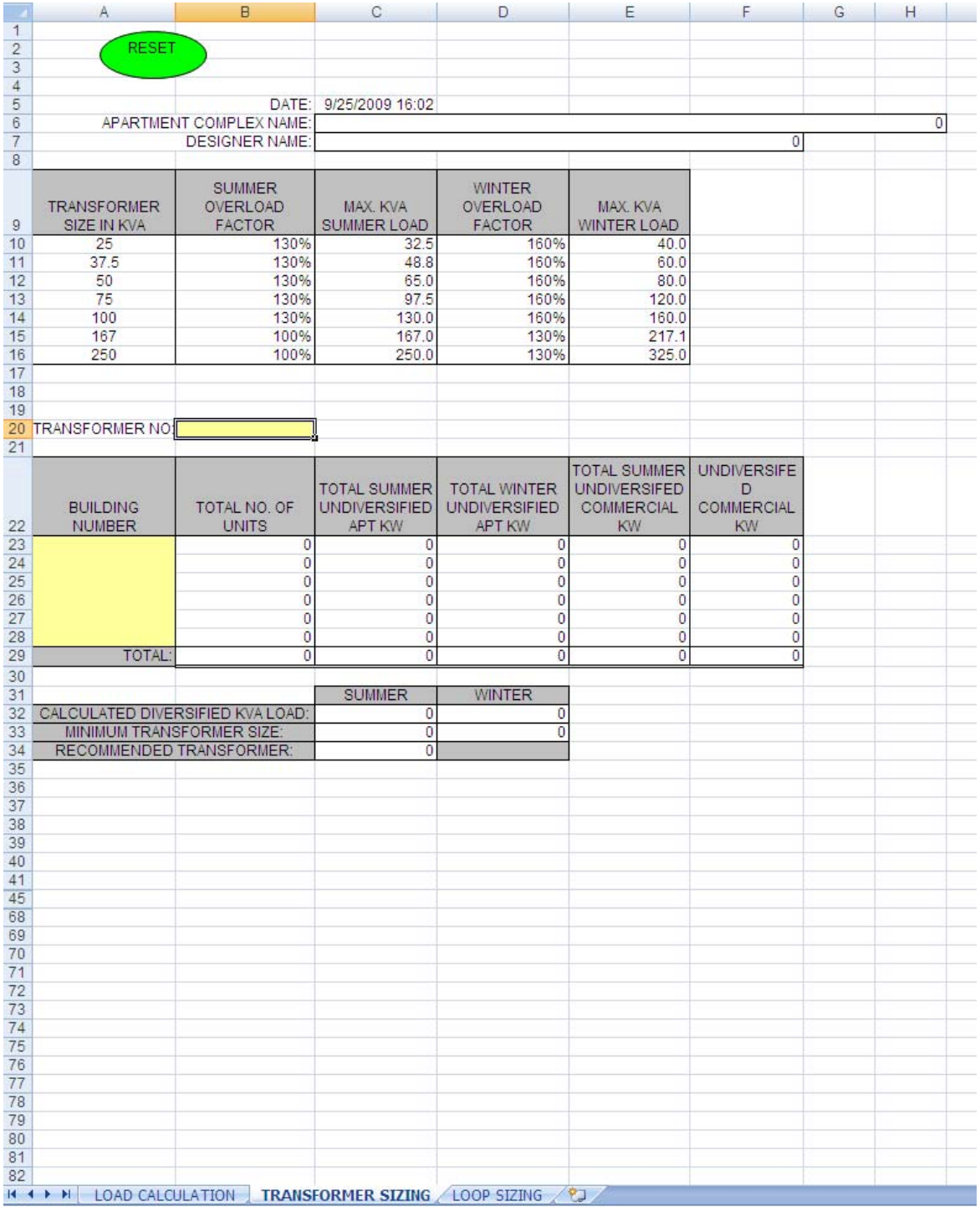
SELECT:

TONNAGE (13 SEER)	SUMMER KW	WINTER KW
1.0	0.0	0.0
1.5	0.0	0.0
2.0	0.0	0.0
2.5	0.0	0.0
3.0	0.0	0.0
3.5	0.0	0.0

BUILDING NUMBER	1.0 TON	1.5 TON	2.0 TON	2.5 TON	3.0 TON	3.5 TON	TOTAL NO. OF UNITS	TOTAL SUMMER UNDIVERSIFIED APT KW	TOTAL WINTER UNDIVERSIFIED APT KW	HOUSE METER KW	SUMMER COMMERCIAL KW	WINTER COMMERCIAL KW	TOTAL SUMMER UNDIVERSIFED COMMERCIAL KW	TOTAL WINTER UNDIVERSIFED COMMERCIAL KW
1							0	0	0				0	0
2							0	0	0				0	0
3							0	0	0				0	0
4							0	0	0				0	0
5							0	0	0				0	0
6							0	0	0				0	0
7							0	0	0				0	0
8							0	0	0				0	0
9							0	0	0				0	0
10							0	0	0				0	0
11							0	0	0				0	0
12							0	0	0				0	0
13							0	0	0				0	0
14							0	0	0				0	0
15							0	0	0				0	0
16							0	0	0				0	0
17							0	0	0				0	0
18							0	0	0				0	0
19							0	0	0				0	0
20							0	0	0				0	0

LOAD CALCULATION | TRANSFORMER SIZING | LOOP SIZING

Apartment Complex (continued)



RESET

DATE: 9/25/2009 16:02

APARTMENT COMPLEX NAME: 0

DESIGNER NAME: 0

TRANSFORMER SIZE IN KVA	SUMMER OVERLOAD FACTOR	MAX. KVA SUMMER LOAD	WINTER OVERLOAD FACTOR	MAX. KVA WINTER LOAD
25	130%	32.5	160%	40.0
37.5	130%	48.8	160%	60.0
50	130%	65.0	160%	80.0
75	130%	97.5	160%	120.0
100	130%	130.0	160%	160.0
167	100%	167.0	130%	217.1
250	100%	250.0	130%	325.0

TRANSFORMER NO:

BUILDING NUMBER	TOTAL NO. OF UNITS	TOTAL SUMMER UNDIVERSIFIED APT KW	TOTAL WINTER UNDIVERSIFIED APT KW	TOTAL SUMMER UNDIVERSIFED COMMERCIAL KW	UNDIVERSIFED COMMERCIAL KW
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
TOTAL:	0	0	0	0	0

	SUMMER	WINTER
CALCULATED DIVERSIFIED KVA LOAD:	0	0
MINIMUM TRANSFORMER SIZE:	0	0
RECOMMENDED TRANSFORMER:	0	

LOAD CALCULATION | TRANSFORMER SIZING | LOOP SIZING

Apartment Complex (continued)

RESET SHEET

APARTMENT COMPLEX NAME:	0
DESIGNER NAME:	0

LOOP NUMBER:

SIDE 1: BUILDING NUMBER	TOTAL NO. OF UNITS	TOTAL SUMMER UNDIVERSIFIED APT KW	TOTAL WINTER UNDIVERSIFIED APT KW	TOTAL SUMMER UNDIVERSIFED COMMERCIAL KW	TOTAL WINTER UNDIVERSIFED COMMERCIAL KW
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
TOTAL:	0	0	0	0	0

	APARTMENT UNITS		COMMERCIAL		TOTAL		
	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	
CALCULATED DIVERSIFIED UNIT KVA LOAD:	0	0	0	0	0	0	
DIVERSIFIED AMPS	0.0	0.0	0.0	0.0	0.0	0.0	WINTER: MULT BY 1.7 FOR COLD LOAD PICKUP
COLD LOAD AMPS	0.0	0.0	0.0	0.0	0.0	0.0	SUMMER: LEAVE COMMERCIAL AT 100% FOR COLD LOAD

SIDE 2: BUILDING NUMBER	TOTAL NO. OF UNITS	TOTAL SUMMER UNDIVERSIFIED APT KW	TOTAL WINTER UNDIVERSIFIED APT KW	TOTAL SUMMER UNDIVERSIFED COMMERCIAL KW	TOTAL WINTER UNDIVERSIFED COMMERCIAL KW
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
TOTAL:	0	0	0	0	0

	APARTMENT UNITS		COMMERCIAL		TOTAL	
	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER
CALCULATED DIVERSIFIED UNIT KVA LOAD:	0	0	0	0	0	0
DIVERSIFIED AMPS	0.0	0.0	0.0	0.0	0.0	0.0
COLD LOAD AMPS	0.0	0.0	0.0	0.0	0.0	0.0

SCENARIO 1:	0.0	0.0
SCENARIO 2:	0.0	0.0

	SUMMER	WINTER
COLD LOAD AMPS:	0.0	0.0
CALCULATED SUMMER AND WINTER FUSE SIZE	0	0
RECOMMENDED FUSE SIZE:	0	

LOAD CALCULATION | TRANSFORMER SIZING | LOOP SIZING

Questions?