BASS, NIXON & KENNEDY, INC., CONSULTING ENGINEERS
919/851-4422 / 7416 CHAPEL HILL ROAD, RALEIGH, N. C. 27607

November 2, 1982

MEMO:

TO: M. L. Bryant, P. E.
Acquisition Project Management Office
Building N-26
Naval Station
Norfolk, Virginia 23511

FROM: Larry D. Nixon, P. E.

SUBJECT: "Replace Heating Systems in Two-Story Quarters"
Camp Lejeune, North Carolina
Construction Contract: N62470-81-B-1169

Per request from Dennis Phelps of your office contact was made and a meeting was held with Mr. Fred Cone, Mr. Luther Norris and others concerning reported problems with the electrical system (and transformer sizing) on the above project. Information conveyed to me prior to the meeting (as a result of conversations with Bill Face, Van Marshburn, Dennis Phelps, Maxie Bryant and Fred Cone) indicated burned up transformers, "brown-outs", outages and low voltage. The meeting was held on 28 October at 1:00 P.M. at Camp Lejeune.

The following facts were determined inasfar as information was available at the meeting from those attending:

1. Approximately 22 transformers had been added to the 2400 volt system at Paradise Point and approximately six had been increased in size. This work was being performed by the Maintenance Section (Fred Cone).

2. Transformers B, C, J, T, N, DD, and GG were supposed to be changed (by change order to the contract) from 50 KVA to 75 KVA.

3. It was reported that the contract was 85% complete and most units were on line.

4. No problems had been reported for Courthouse Bay (8 residences on 4-37.5 KVA transformers).

5. The Rifle Range residences had been changed to conventional heat pumps since sufficient well water was not available to the water source heat pumps as designed. A problem was experienced with

the five houses on the existing 37.5 KVA transformer (which had not been changed to 50 KVA as scheduled in the contract). A 50 KVA transformer had been added to the 37.5 KVA at the Rifle Range to solve the problem.

6. No problems had been reported at the Naval Hospital area which has 18 residences on a 112.5 KVA transformer bank (at 150% fusing, this is 9.4 KVA per residence.)

7. The first problem reported had been with transformer B, on a Sunday night. This had been scheduled (by change order to the contract) to be a 75 KVA with 150% fusing. It had not been changed and was a 50 KVA with 100% fusing. Thus instead of 112.5 KVA capacity scheduled, only 50 KVA was available. It was reported that the fusing on the 50 KVA was changed to 150% but that the fusing had to be replaced "several" times that night and that the transformer was "hot" the next morning.

8. As a result of the problems with transformer B, the transformer schedule was examined by Maintenance and the decision was made to add the 22 transformers and make the changes noted above.

9. It was reported that the changes at Paradise Point would probably be completed by 1 November 1982.

10. It appears that 100% fusing is being used on many of the existing transformers. LANTDIV specifications call for 150% or higher.

11. The primary feeder fuses serving the 2600 and 2700 block of houses (total of 46) had been changed to 85 amps. (At 2400 volts, this is a capacity of 353.0 KVA or 7.7 KVA per residence.) The demand factor would be approximately 26%. The primary current feeding the existing 3000 KVA transformer bank was reported as a maximum current of 460 amps per leg (280 minimum). Assuming this as of full load, this is a total KVA load of 1910.0 KVA on a 3000 KVA bank. As an average load of 407.0 amps, the load is 1690.0 KVA.

12. The Paradise Point area is served by two 3000 KVA transformer banks at 2400 volts delta.

13. Luther Norris and I were in essential agreement as to the connected load figures for the houses (copies enclosed).

14. Maintenance had reset the outdoor limit thermostat for the compressors. We recommend that these be set at 30°.

The following are my observations, opinions, and/or analysis based on the above:

1. Design calculations (copy enclosed) were submitted as required during design indicating the calculated loads, fusing and demand factors. These are also shown on the contract drawings. No comment was received from Camp Lejeune.

2. The available "hard" data indicate that the scheduled size of a 50 KVA for 9 residences may have been too small. These were increased by change order to the contract to 75 KVA as a result of discussions with LANTDIV and Camp Lejeune.

3. Transformer B which originally gave problems was supposed to be a 75 KVA at 150% fusing but was a 50 KVA at 100% fusing. However, I would not have thought that trouble would be experienced on a Sunday night (no cooking or water heating).

4. Because of all of the changes which have been made, the only installations at Paradise Point with the original sizing are the 50 KVA transformers with 4 residences. It is assumed that 150% fusing is used. It is therefore unknown if the original demand factors are valid. I would recommend that demand readings be taken so that "hard" data can be available for future use.

5. It was suggested that perhaps the "Military" factor was not accounted for since all of the residents are on essentially the same schedule. Perhaps so, but the main table used in the design calculations is from the U. S. Army design manual. What little information is available for the 50 KVA transformers indicated that the particular figure in the table is correct. The Naval Hospital and Courthouse Bay areas also support this conclusion.

6. All primary fusing should be for 150% as an economical sizing for distribution transformers. Manufacturers recommend as high as 200%.

7. The outdoor limits on the heat pumps can be set as low as 20^{o} but 30^{o} is recommended as a practical setting. You may have complaints with heat pumps and "cold" air since heat pump air can drop as low as 85^{o} at the low end of capacity. The KW load at the low end for the compressor is 3.2 KW.

8. As a general comment, I would recommend that a goal be set for eliminating the 2400 volt system entirely.

In summary, I was unable to determine a problem with the transformer

sizing. I am forwarding copies of this memo to those concerned for their comments, additions, corrections and/or rebuttal. I look forward to hearing from you.

cc: W. F. Face, LANTDIV
Dennis Phelps, LANTDIV
Van Marshburn, Camp Lejeune
Luther Norris, Camp Lejeune
Fred Cone, Camp Lejeune

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Contract N62470-81-B-1169

DATE 30 July 1981 JOB NO. _____

JOB Replace Htg. Systems

1 Square = _____ Ft. ELECTRICAL CALCULATIONS

DESIGN CALCULATIONS - ELECTRICAL - L.D. NIXON

REFERENCES; N.E.C. NFPA - 70

"STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS" 10th EDITION

"NAVDOCKS DM-4 - ELECTRICAL ENGINEERING"

"DEPT. OF THE ARMY TM-5-811-1 "ELECTRICAL POWER SUPPLY"

IEEE * JH 2112-1 "PROTECTION FUNDAMENTALS"

EXISTING SERVICES AND TRANSFORMER SIZING - DISCUSSION

RESIDENTIAL LOADS ARE CALCULATED PER N.E.C. SECTION 220-30 FOR THE THREE ESSENTIAL SIZES (COPY ENCLOSED)

EXISTING LOADS TAKEN FROM ON SITE SURVEY AND MEASUREMENTS. THE EXISTING RESIDENCES DO NOT HAVE CENTRAL A/C BUT HAVE SUFFICIENT RECEPTACLES TO COOL THE HOUSES. THE EXISTING SERVICES AND PANELS WERE INSTALLED IN 1978 AND HAVE SUFFICIENT CAPACITY TO SUPPLY WINDOW UNITS OR CENTRAL A/C WITH ELECTRIC HEAT. ALL EXISTING PANELS ARE 200 AMP EXCEPT 18 UNITS AT THE HOSPITAL WHICH ARE 150 AMP. ALL UNITS HAVE UNDERGROUND SERVICES. ON SITE OBSERVATION INDICATES THAT

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DATE ~~30 July 1981~~ JOB NO. _____

JOB _____

1 Square = _____ Ft. Electrical Calculations

MOST UNITS HAVE SUFFICIENT WINDOW UNITS INSTALLED TO COOL THE HOUSES. EXISTING HEAT IS OIL FIRED BOILERS. NEW HEAT WILL BE HEAT-PUMPS WITH ELECTRIC HEAT. IN LIGHT OF THE ABOVE, THE NEW HEATING SYSTEMS WILL NOT INCREASE THE LOAD ON THE EXISTING PANELS OR TRANSFORMERS A SURVEY OF EXISTING TRANSFORMERS WAS TAKEN AND RESULTS ARE SHOWN HEREIN.

THE SCOPE OF THE PROJECT INDICATES THAT $18 000 IS ALLOTTED FOR IMPROVEMENTS TO THE DISTRIBUTION SYSTEM AND DISCUSSIONS WITH ACTIVITY PERSONNEL DETERMINED THAT THIS WAS FOR CHANGING TRANSFORMERS. IN LIGHT OF THE ABOVE DISCUSSION ON LOADING, IT APPEARS THAT THE EXISTING SYSTEM SHOULD BE ADEQUATE. HOWEVER SOME TRANSFORMERS APPEAR TO BE UNDERSIZED EVEN USING THE MOST LIBERAL DEMAND LOADING. THESE ARE NOTED FOR CHANGING. IT IS MY OPINION THAT THE SYSTEM WOULD BE ADEQUATE WITH NO CHANGES, BUT THIS OPINION IS BASED ON OBSERVATION OF THE EXISTING SITUATION. THE CHANGES COULD BE MADE A BID ITEM.

DEMAND FACTORS USED ARE BASED ON N.E.C., DEPT OF THE ARMY DESIGN DATA, AND RECOMMENDED TRANSFORMER LOADING AND FUSING. "STANDARD HANDBOOK" RECOMMENDS MAXIMUM LOADING OF

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

200% FOR 30 MINUTES BEFORE LOSS OF INSULATION LIFE. MOST TRANSFORMER MANUFACTURERS RECOMMEND 180% LOADING. THE LATEST SPEC INDICATE 150% LOADING. THE "DEPT. OF ARMY" DEMAND TABLES SUPPORT THE EXISTING SITUATION AT 150% RISING. OTHER DEMAND FACTORS (N.E.C.) SUPPORT THE 200% LOADING.

RIFLE RANGE

FIVE RESIDENCES ARE SERVED FROM A 37.5 KVA TRANSFORMER (50 KVA @ 150%). TWO 3 HP WELL PUMPS WILL BE ADDED FOR TOTAL DEMAND OF 61 KVA. THIS TRANSFORMER IS RECOMMENDED TO BE CHANGED TO 50 KVA.

NAVAL HOSPITAL

IT SHOULD BE NOTED THAT 18 OF THESE UNITS HAVE 150 AMP SERVICES AND ARE SERVED FROM A 112.5 KVA BANK OF TRANSFORMERS. APPLYING DEMAND FACTORS NOTED ABOVE, THIS IS ADEQUATE WITH NO CHANGE. THREE RESIDENCES ARE SERVED FROM A 200 AMP FEEDER AND WITH THE LOADS AND DEMAND NOTED, THIS IS ADEQUATE.

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

COURTHOUSE BAY

COURTHOUSE BAY IS SERVED BY FOUR 37.5 KVA TRANSFORMERS FOR 8 BUILDINGS. NO CHANGES ARE RECOMMENDED.

PARADISE POINT

LOADING VARIES FROM A MAXIMUM OF 9 BUILDINGS ON A 37.5 KVA TO 2 BUILDINGS ON A 37.5 KVA. RECOMMENDATIONS ARE WEIGHTED BY CONSIDERATION OF THE EXISTING LOADING. IN GENERAL, MOST 37.5 KVA TRANSFORMERS ARE RECOMMENDED TO BE CHANGED TO 50 KVA. THIS IS BASED ON APPARENT OVERLOADING ALTHOUGH THE EXISTING LOADING WOULD INDICATE NO CHANGE IS NECESSARY.

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

RECOMMENDED ABOVE DO NOT INCREASE FAULT CURRENT BEYOND EXISTING CONDITIONS (75 KVA TRANSFORMERS). EXISTING BKRS ARE RATED 10,000 AIC.

USING THE FORMULA:

$$I_{SYM} = \frac{\text{TRANSFORMER KVA} \times 1000}{V_{ST}} \times \frac{100}{Z_{TRANS} + Z_{SYSTEM}}$$

WHERE:

V_{ST} = SECONDARY TERMINAL VOLTAGE

Z_{TRANS} = TRANSFORMER IMPEDANCE IN PER CENT

Z_{SYSTEM} = SYSTEM IMPEDANCE IN PER CENT

FOR A 50 KVA AND $Z_{SYSTEM} = 0$ (INFINITE BUS)

$$I_{SYM} = \frac{50\,(1000)\,100}{240\ (1.6)} = 13,021 \text{ AIC}$$

FROM IEEE TABLES THE IMPEDANCE OF 3-#3/0 IN MAGNETIC DUCT IS 0.88 % PER 100 FEET. AVERAGE SERVICE IS 100 FEET!

$$I_{SYM} = \frac{50(1000)100}{240\,(2.48)} = 8,400 \text{ AIC}$$

WITH INFINITE PRIMARY BUS

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

COURTHOUSE BAY

3 BLDGS X 29.1 KW X 0.5 DEMAND = 43.7 KW DEMAND

37.5 KVA X 150% = 56.3 KVA CAPACITY

NO CHANGE REQUIRED

PARADISE POINT

9 BLDGS. X 29.1 KW X 0.27 DEMAND = 70.7 KW DEMAND

50 KVA X 150% = 75 KVA CAPACITY

NO CHANGE REQUIRED

37.5 X 150% = 56.3 KVA CAPACITY

CHANGE 37.5 KVA TO 50 KVA

SHORT CIRCUIT CALCULATIONS

AS NOTED IN THE 35% SUBMITTAL, THE SERVICE EQUIPMENT IS NEW (1978), NO CHANGES WERE IN THE SCOPE OF THE PROJECT TO ACCOMMODATE INCREASED FAULT CURRENT, AND THE CHANGES

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

DEMAND CALCULATIONS

RIFLE RANGE

5 BLDGS X 29.1 KW X 0.4 DEMAND = 58.2 KW DEMAND

58.2 KW + 3 HP (PUMPS) = 61.2 KW

50 KVA X 150% = 75 KVA

USE 50 KVA (EXISTING IS 37.5 KVA)

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18 BLDGS X 25.8 KW X 0.183 DEMAND = 85.0 KW DEMAND

EXISTING BANK IS 112.5 KVA X 150% =

168.8 KVA CAPACITY

3 BLDGS. X 25.8 X 0.5 DEMAND = 38.7 KW DEMAND

38.7 KW @ 230 V/1φ = 168.3 AMPS

EXISTING 200 AMP FEEDER IS ADEQUATE.

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1 Square = _____ Ft. ELECTRICAL CALCULATIONS

IT IS REASONABLE TO ASSUME THAT ALL 50 KVA TRANSFORMER INSTALLATIONS ARE ADEQUATE.

FOR 75 KVA TRANSFORMERS WITH A 100 FOOT SERVICE

$$I_{sym} = \frac{75(1000)(100)}{240\,(2.48)} = 12{,}600 \text{ AIC}$$

WITH INFINITE BUS

SINCE THE SYSTEM IS 2400 VOLTS PRIMARY, IT IS REASONABLE TO ASSUME THAT AT LEAST TRANSFORMER IMPEDANCE OF 1.6% EXISTS IN THE SYSTEM

$$I_{sym} = \frac{75\,(1000)(100)}{240\,(4.08)} = 7{,}659 \text{ A.I.C.}$$

10,000 AIC BREAKERS ARE ADEQUATE.

DEPT. OF ARMY

1-28 VOLTAGE DROP. Voltage drop should not exceed 2 percent on the primary and secondary circuits, respectively.

1-29 TRANSFORMERS. Transformers should be of the self-cooled type, with rating selected from table I. Where the required size is not listed in the table, the next larger size should be installed unless the next smaller size will provide at least 90 percent of the required rating. Transformers or transformer banks having a capacity in excess of 75 kilovolt-amperes should be installed on two-pole platforms or on concrete mats. Smaller transformers should be pole-mounted. Figures 21, 22, 23, and 24 show typical transformer installations. Wye-wye connected transformers should not be utilized where the primary neutral is not available or within 500 feet of radio stations or navigational aid facilities. All transformers installed outdoors or in fireproof transformer vaults should be of the oil-insulated, self-cooled type. Transformers installed within buildings in which fireproof vaults have not been provided should be of the nonflammable-liquid-cooled type.

Primary connections between transformers installed within buildings and the distribution system should be underground in order to avoid endangering the lives of maintenance personnel while working on the building. Transformer capacities should be selected so that all transformers will be operating as nearly as practicable to the allowable temperature limits during periods of maximum demand. In general, the capacity of transformers should be equal to approximately 60 percent of the connected load, exclusive of family quarters. The transformer capacity for each installation, however, will require special study and will vary from a demand factor of 30 percent for large hospital buildings to a demand factor of 100 percent for isolated power installations. Demand factors for family quarters with or without electric ranges and water heaters are approximately as follows:

Number of quarters	Demand factor per cent	Number of quarters	Demand factor per cent	Number of quarters	Demand factor per cent
1	80.0	19	18.0	37	13.2
2	60.0	20	17.5	38	13.0
3	50.0	21	17.1	39	12.8
4	45.0	22	16.6	40	12.6
5	40.0	23	16.1	41	12.4
6	35.0	24	15.8	42	12.2
7	32.0	25	15.6	43	12.0
8	29.0	26	15.4	44	11.8
9	27.0	27	15.2	45	11.6
10	25.0	28	15.0	46	11.4
11	24.0	29	14.8	47	11.2
12	23.0	30	14.6	48	11.0
13	22.0	31	14.4	49	10.8
14	21.0	32	14.2	50	10.6
15	20.0	33	14.0	51	10.4
16	19.4	34	13.8	52	10.2
17	18.7	35	13.6	53	10.1
* 18	* 18.3	36	13.4	54 and over	10.0

RANGE

Note. Where electricity is used for space heating the total connected heating load should be added to the demands obtained by the use of this table.

GENERAL'S QUARTERS (2000, 2001) EXISTING LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING	-0- KW	
b. AIR COND.: 100 % OF NAMEPLATE RATING	12.0 KW	(6 WINDOW UNITS)
LARGER OF a or b	A. 12.0	

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
3048	SQ. FEET x 3W/ SQ. FEET	9144
2	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED	-0-
	TOTAL OTHER LOAD	36,644
	÷ 1000 W	36.6 KW

FIRST 10 KW at 100 %	B. 10.0 KW
REMAINDER at 40 %	C. 10.6 KW
REQUIRED DEMAND LOAD (A+B+C)	32.6 KW

SERVICE CAPACITY REQUIRED:

KW x 1000 W ÷ 230 V = 141.8 AMPS

EXISTING IS 200 AMPS

GENERAL'S QUARTERS - (2000-2001) NEW LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING 11.4 KW

b. AIR COND.: 100 % OF NAMEPLATE RATING 13.3 KW

LARGER OF a or b A. 13.3

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
3048	SQ. FEET x 3W/ SQ. FEET	9,144
2	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3,000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED.	-0-
	TOTAL OTHER LOAD	36,644
	÷ 1000 W	36.6 KW

FIRST 10 KW at 100 % B. 10.0 KW

REMAINDER at 40 % C. 10.6 KW

REQUIRED DEMAND LOAD (A+B+C) 33.9 KW

SERVICE CAPACITY REQUIRED:

KW x 1000 W ÷ 230 V = 147.4 AMPS

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ELECTRICAL CALCULATIONS

GARAGE, MAID, ENCLOSED PORCH EXISTING LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING -0- KW
b. AIR COND.: 100 % OF NAMEPLATE RATING 8.0 KW (4 WINDOW UNITS)
LARGER OF a or b A. 8.0

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
2592	SQ. FEET x 3W/ SQ. FEET	7776
2	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED	-0-
	TOTAL OTHER LOAD	35,276
	÷ 1000 W	35.3 KW

FIRST 10 KW at 100 % B. 10.0 KW
REMAINDER at 40 % C. 10.2 KW

REQUIRED DEMAND LOAD (A+B+C) 28.2 KW

SERVICE CAPACITY REQUIRED:
KW x 1000 W ÷ 230 V = 122.6 AMPS

EXISTING IS 200 AMPS

GARAGE, MOD D, ENCLOSED PORCH NEW LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING — 8.2 KW

b. AIR COND.: 100 % OF NAMEPLATE RATING — 8.9 KW

LARGER OF a or b — A. 8.9

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
2592	SQ. FEET x 3W/ SQ. FEET	7776
2	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED	

TOTAL OTHER LOAD 35,276

÷ 1000 W 35.3 KW

FIRST 10 KW at 100 % — B. 10.0 KW

REMAINDER at 40 % — C. 10.2 KW

REQUIRED DEMAND LOAD (A+B+C) 29.1 KW

SERVICE CAPACITY REQUIRED:

KW x 1000 W ÷ 230 V = 126.5 AMPS

SMALL UNIT — EXISTING LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING	-0- KW	
b. AIR COND.: 100 % OF NAMEPLATE RATING	6.0 KW	(3 WINDOW UNITS)
LARGER OF a or b	A. 6.0	

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
1690 / 2	SQ. FEET x 3W/ SQ. FEET	5,070
	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3,000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED.	-0-
	TOTAL OTHER LOAD	32,576
	÷ 1000 W	32.6 KW

FIRST 10 KW at 100 %	B.	10.0 KW
REMAINDER at 40 %	C.	9.1 KW
REQUIRED DEMAND LOAD (A+B+C)		25.1 KW

SERVICE CAPACITY REQUIRED:

KW x 1000 W ÷ 230 V = 109.1 AMPS

EXISTING IS 150 AND 200 AMPS.

SMALL UNIT

NEW LOADS

CONNECTED LOAD PER NEC ARTICLE 220-30

SPACE HEATING & AIR COOLING

a. ELECTRICAL HEAT: 65 % OF NAMEPLATE RATING	6.5	KW
b. AIR COND.: 100 % OF NAMEPLATE RATING	6.7	KW
LARGER OF a or b	A. 6.7	

OTHER LOAD

	INDIVIDUALLY CONTROLLED HEATERS	-0-
1690	SQ. FEET x 3W/ SQ. FEET	5070
2	20 AMP APPLIANCE CKT. (S) 1500 W/ CKT.	3,000
1	LAUNDRY CKT. (S) 1500/CKT.	1500
1	HOT WATER HEATER	4500
1	DRYER	5000
1	DISHWASHER	1200
1	DISPOSAL	300
1	RANGE	12,000
-0-	LOADS NOT LISTED.	-0-
	TOTAL OTHER LOAD	32570
	÷ 1000 W	32.6 KW

FIRST 10 KW at 100 %	B. 10.0	KW
REMAINDER at 40 %	C. 9.1	KW
REQUIRED DEMAND LOAD (A+B+C)	25.8	KW

SERVICE CAPACITY REQUIRED:

KW x 1000 W ÷ 230 V = 112.2 AMPS