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NORTHERN STATES POWER COMPANY
PRAIRIE ISLAND NUCLEAR GENERATING PLANT
FIRE PROTECTION PER APPENDIX R REQUIREMENTS
AMPACITY STUDY

September 16, 1983

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FIRE PROTECTION PER APPENDIX R REQUIREMENTS
AMPACITY STUDY

for
Northern States Power Company
Prairie Island Nuclear Generating Plant
Units 1 & 2

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September 16, 1983

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1.0 INTRODUCTION AND PURPOSE

At the request of Northern States Power Company (NSP), Stone & Webster Engineering Corporation (SWEC) has performed a study of cable ampacity in fire protected cable trays.

The purpose of this study is to examine the effect on cable ampacity when a 10CFR50 Appendix R fire barrier is installed on safety-related cable trays. Appendix R fire barriers are required by the Nuclear Regulatory Commission (NRC) to be installed on Class IE circuits which do not meet a 20 foot combustible separation criteria between redundant trains. This work is required to be completed by February 1984.

There are presently no industry standards that can directly applied for sizing cable under these specific conditions. This study uses a simple heat transfer model to determine the temperature rise across the fire barrier. At this point, industry guidelines are then applied in the conventional manner. The emphasis of the study is on the B&W Kaowool fire barrier presently in use at Prairie Island Nuclear Generating Plant (PINGP). However, several other materials are also evaluated. The results of a limited test program on existing trays wrapped with the B&W Kaowool fire barrier are included.

A brief economic and technical comparison of the various materials considered is also presented.

PINGP presently has approximately 10% of the cable trays identified to be protected in accordance with Appendix R wrapped with 2-1" layers of B&W Kaowool (1-hour fire barrier). A schematic of the proposed protection for the remaining trays is shown in Figure 1. This figure differs from the existing tray wraps in that no marinite board was installed in the first phase. Instead, voids between cables were filled with Kaowool.

NSP provided SWEC with a listing of trays identified to be covered. SWEC did not verify the applicability of these trays to the requirements of Appendix R nor did we confirm that the system and trays selected by NSP meet the requirements of Appendix R. Appendix R states that a three-hour fire barrier is required between circuits of redundant trains when separation between the trains is less than 20 feet horizontally or there are intervening combustibles or fire hazards. Appendix R allows a one hour barrier to be installed if the area has fire detectors and an automatic fire suppression system.

2.0 SUMMARY

This study indirectly applies the industry standards for sizing cable by determining a temperature rise across the fire barrier and adding this temperature rise to the original design ambient temperature of the cable to determine a new ambient temperature. Industry standards are then applied to the new ambient temperature to determine the permissable ampacity.

The temperature rise across the fire barrier is a function of the heat generated inside the barrier and the ability of the barrier to dissipate the heat. The heat generated inside the barrier can be accurately determined, since the cable resistance and total amperage are known. The ability of the barrier to dissipate heat is approximated by using a heat transfer model.

The ampacity derating factors presented here are considered to be the minimum factors that must be applied if the cable is to operate under the specified temperature conditions. Additional derating may be required to account for the different modes of heat transfer between a cable in an open ventilated cable tray and a cable in an enclosed unventilated cable tray.

The following materials are investigated in this study:

- B&W Kaowool one-hour fire barrier
- TSI Thermo Lag 330-1 one-hour fire barrier
- TSI Thermo Lag 330-1 three-hour fire barrier
- 3M M20A one-hour fire barrier
- 3M M20R one-hour fire barrier
- 3M M20R three-hour fire barrier

The theoretical results of the study indicate that for the one-hour (2 in) B&W Kaowool Fire Barrier (similar to that presently installed at PINGP), substantial ampacity derating is required for most power cables. Cables serving motor operated valves and cables that are oversized to begin with appear to have sufficient margin even when operated inside the fire barrier. In general, oversized cables are those cables which were selected based on a minimum cable size for mechanical strength rather than on a minimum cable size for ampacity considerations.

The derating multipliers for the other materials considered were substantially lower.

Derating factors for a specific barrier varied greatly. Aside from the fire barrier material, the derating of a specific cable within a specific tray depends on the physical tray dimensions, other cables in the tray, the amperage loading of each cable, the duty factor of each cable, and the size of each cable. The study concludes that no single derating factor should be applied for cables installed in a specific type of fire barrier.

The results of the study indicate that a combination of several different materials may result in the most cost-effective installation with minimum impact on the ampacity and loading criteria of the existing installation.

3.0 CABLE AMPACITY CONSIDERATIONS

3.1 Cable Sizing Criteria

Proper sizing of cables to service electrical loads is critical to assure safe, reliable, and continous operation of the cable and the load for the design life of the installation. Proper size and selection of a specific electric cable should include the following criteria:

- Voltage drop during normal operation
- Voltage drop during startup operation
- Ampacity during continous operation
- Ampacity during a short circuit

The application of the voltage drop criteria assures adequate voltage at the terminals of the load so that it will start and operate continously at the rated load. The required voltage under these conditions is a function of the design of the load. On the other hand, the ampacity criteria is applied to an electric cable in order to avoid operating the cable at a temperature higher than the design limits.

The limiting operating temperature of a cable is generally determined by the design temperature of the cable insulation. The insulation on the cables installed at PINGP is rated for the following temperatures:

- Normal continuous operating temperature - 90°C for 40 years
- Emergency operating temperature - 130°C for 100 hours per year (maximum of five such periods)
- Short circuit operating temperature - 250°C

These limits apply to any surface in contact with the cable insulation. Since the copper (or aluminum) conductor generates heat in the process of carrying current, the conductor temperature must be limited to the operating temperatures discussed above. Therefore, the normal continous ampacity of the cable must be limited to a point where the heat generated in the conductor can be transmitted through the cable insulation and jacket materials and dissipated to the environment without the conductor temperature exceeding 90°C.

The ability of the cable to reject heat to the environment is a function of the ambient temperature of the environment and the method of heat transfer (conduction, radiation, or convection).

The industry standard for determining the maximum permissable ampacity for a cable is IPCEA Standard P-46-426 (1966). This standard lists ampacities for numerous combinations of cable insulation temperature ratings and application conditions (in air, in conduit, in duct banks, in cable tray, voltage rating, etc.). It does not address ampacity for cables in enclosed trays or trays wrapped with a fire barrier or any other material.

The applicable section of this standard for the power cables installed at PINGP lists allowable ampacities for 3/c-copper cables at 1kv and 8kv (600v, 5000v levels at PINGP) with 90°C conductor temperature, 40°C ambient air temperature, isolated in air. This allowable ampacity is then adjusted for conditions other than those stated above. The resulting derated ampacity must then exceed the expected design ampacity of the load serviced.

For a typical motor load, the design ampacity should include a 15 percent margin for motor service factor and a 10 percent margin for low voltage operation (down to 90 percent of nameplate volts). For these reasons, the cable design ampacity for motor loads should be at least 125 percent of the motor nameplate amperage. For cables installed in a single layer in cable tray with 1/4 to 1 diameter spacing, a .82 derating factor is applied. Table 1 summarizes the ampacities per the industry standards for cables and conditions at PINGP.

3.2 Method For Derating Power Cables In a Wrapped Tray

After the cable trays are wrapped, the design ampacity of the cables must be reexamined, since the environment in which the cables are installed has changed from the design conditions. Specifically, the ambient temperature which the cables are exposed is expected to be higher and the predominant cable cooling process is no longer convection.

The industry standards do not specifically address the application of cables under these conditions. However, it seems obvious that the minimum derating factor that should be applied is one which accounts for the cables new ambient temperature (i.e., the temperature inside the wrapped tray). This new ambient temperature will be the sum of the old ambient temperature plus the temperature rise across the fire barrier.

To estimate the temperature rise across the fire barrier, the fire wrap is modeled using the conventional heat transfer formula:

$Q = UxA x \Delta T$

Q = Heat Flow
U = Thermal Conductivity
A = Surface Area
ΔT = Temperature Rise

or solving for the temperature rise

$\Delta T = UxA/Q$

For the purpose of this study the geometry of fire barrier analyzed will be similar to that shown in Figure 1. For all materials considered, the model assumes no temperature gradient across the interior of the covered tray. For the B&W Kaowool the effects of the Marinite board shown in Figure 1 are neglected.

Also for this study, all quantities will be discussed on a running or linear foot basis since this will make the calculations independent of tray length. No additional consideration will be given to short tray lengths or tray ends that may receive additional cooling by the convection process. Special coverings such as foil or Zetex are neglected.

The surface area (A) of the fire wrap per running foot of tray is determined by summing twice the tray depth (4 inches assumed for all trays) and twice the tray width.

The thermal conductivity of the fire wrap is determined by first summing the resistances of each layer of the barrier and then inverting the result. A thermal resistance factor is included in the sum for the inner and outer surface-to-air boundries. This surface factor is derived by averaging the ASHRAE (1977) horizontal up and horizontal down surface resistance for nonreflective (emittance E = .90) surfaces in still air. The resistance used at each surface-to-air boundary is

$$R = .765(HOURxFT^2x^\circ F/Btu)$$

In addition to the surface-to-air boundary thermal resistance, the resistance of the fire barrier material itself must be considered. This information is obtained from published data by the manufacturers. The resistances of the various fire barriers considered is as follows:

Material	Thickness	Thermal Resistivity $HRxFT^2x^\circ F/Btu$
One-hour B&W Kaowool	2"	4.0
One-hour TSI 330-1	1/2"	0.417
Three-hour TSI 330-1	1"	0.833
One-hour 3M M20A	1"	0.641
One-hour 3M M20R	3/4"	0.333
Three-hour 3M M20R	1 1/2"	0.666

In each case, the thermal conductivity of the system is then determined by taking the reciprocal of the sum of the two surface resistivities and material thermal resistivities. The surface area per linear foot (A), the thermal conductivity (U), and the product (AxU) are listed in Table 2 for the various fire barriers considered.

The only remaining variable in the equation for temperature rise is Q. To determine the total heat generated (Q) by the cables inside the wrapped trays, the following formula is applied to each cable in the enclosure:

$$W = I^2xRxN$$

W = Watts
I = Phase Amps
R = Conductor Resistance
N = Number of Conductors
(N = 3 for 3 phase power cables
N = 2 for DC power cables)

The cable resistance used in the study is the resistance of a single conductor adjusted for operation at 90°C and adjusted for AC or DC. (Note that as temperature increases, conductor resistance increases) Table 3 lists these quantities for the cable types installed at PINGP.

The current (I) for each load is the full load amperes (nameplate amperes) as determined from the PINGP motor list (1983), the plant one-lines, or by estimation. These values of amperage are listed in Table 4 for the various cables routed through the power cable trays which were identified to be wrapped. Along with the cable ID and amperage, the service, the NSP cable type, equivalent cable resistance (RxN), and watts generated per linear foot (I^2xRxN) are also listed.

The total heat generated (Q) in each tray is then determined by adding the individual contributions of each cable (I^2R) routed in that tray. For the purpose of this study, all cables are assumed to be operating at full load amperes. No additional margin is included for low voltage operation or operation into the service factor range. Table 5 demonstrates the details of this procedure for the one-hour B&W Kaowool fire barrier for all power trays identified to be wrapped. Tables 6A, B, C, D, E, and F summarize the results of this procedure for power trays for the Kaowool as well as the other materials considered.

Next an approximation to the air temperature in which the cable is operating is determined by adding the design ambient temperature in which the tray is located to the temperature rise across the fire protection boundary. SWEC recommends that a design ambient temperature of 40°C be used for this purpose since 40°C is the design temperature in the auxiliary building at PINGP.

If the cables were originally designed to operate at a design ambient temperature of 40°C, then it is logical that the minimum temperature derating factor that must be applied is for the temperature rise across the fire barrier.

Table 7 lists the industry standard derating factors (Ref. 1) that must be applied to cables operating above an ambient temperature of 40°C. By adding the recommended 40°C design ambient temperature to the calculated temperature rises for specific trays in Tables 6A, B, C, D, E, and F, a total temperature is obtained. The minimum derating multiplier for cables in a specific tray can then be determined from Table 7 by reading the corresponding I'/I value for the corresponding value of total temperature.

The calculated derating factors are given in Tables 6A, B, C, D, E, and F for the trays and materials considered. Additional derating may also be required since the mode of heat transfer for the open tray is different than for the covered tray. For this study, these additional derating factors are not investigated.

Derating of a specific cable is then accomplished by listing all protected cable trays through which the cable is routed and then applying the derating factor of the tray with the largest predicted temperature rise to the specific cable. This derating factor is applied to the industry standard ampacity (Table 1). The resulting ampacity then may be compared to the nameplate current of the load. If the derated ampacity is larger than the load current, than the cable is sufficiently sized. If not, additional evaluation of the cable is required as will be discussed later.

This final step is not taken in this study as it is dependent on the materials ultimately selected for the fire protection. Note that these derating factors apply only to cables operating at the estimated temperature. The cables will only reach the estimated temperature when operating at rated load amperes, if the cable's ampacity is derated to less than rated load amperes, the heat generated by the cable will be reduced and the estimated operating temperature will also decrease. Thus additional iterations of this procedure could be performed to zero in on a specific ampacity limit for a specific cable under these conditions. This iterative procedure is not addressed in this study since for the cables considered, any ampacity derating beyond the required ampacity of the load is unacceptable.

3.3 Method for Derating Control Cables in a Wrapped Tray

Control cable tray 1AM-TA9 was examined to predict the temperature rise in this type tray when wrapped in 2 in of B&W Kaowool (one-hour barrier).

The ability of the tray to dissipate heat is determined in the same way as discussed in Section 3.2 of this study for power trays. Tray 1AM-TA9 can dissipate .305 watts/°C per linear foot of tray.

The heat generated inside the tray is then estimated by examining the function of each of the cables. Tray 1AM-TA9 contains 66 multiconductor cables or 442 conductors. Most conductors are #12 AWG.

The resistance of each conductor is calculated to be .00206 OHMS/ft at 90°C for AC or DC applications.

The associated circuit for each cable was examined for current consuming devices and total current consumption was calculated for each circuit. The following power consumptions were allowed for each current consuming device:

ITEM	POWER CONSUMPTION	ALLOWED AMPERAGE
Solenoid Operated Valve	20W	.2A
Indicating Lights	10W	.1A
Motor Starters	100W	1.0A
Alarm Drops	2W	.02A
Misc. Auxiliary Relays	20W	.4A
Transmitters	20W	.2A
Duplex Outlets	500W	5A

The total current consumption in each circuit was then applied to each conductor in cables serving that circuit. This approximation resulted in a very conservative average conductor current of .79 amps.

The .79 amps is then squared, multiplied by the number of conductors, and multiplied by the conductor resistance to determine the total heat gain in the tray (watts = I^2xRxN). For tray 1AM-TA9 this resulted in .57 watts/ft. This translates into a 3.4°F temperature rise.

Since 1AM-TA9 is only 74 percent full with 442 conductors, SWEC assumed 100 percent fill would result in about 600 conductors. For this case allowing .79 amps per conductor the heat generated increases to .71 watts and the temperature rise increases to 4.2°F.

An extrapolation of this data indicates that control cable derating does not become a problem until each of the 600 conductors is operating at more than 2.5 amps.

For control cables installed in a random lay open top cable tray, IPCEA 54-440 (1979) allows six amps per conductor at 90°C conductor temperature, 40°C ambient temperature, 600V insulation level, and three conductor cable construction. For this study, this value of six amps is assumed to be valid for all multiconductor cables.

In most cases, control and instrument cables are selected on the basis of mechanical strength rather than ampacity; this estimate seems to confirm this fact. The study also indicates that the current in each conductor must be increased more than three times from the already conservative estimate of .79 amps used in the study before derating becomes a concern.

Derating requirements for other fire barrier materials are not addressed for control trays since the B&W Kaowool (2 in 1-hour barrier), appears acceptable.

4.0 FIELD TEST RESULTS

In order to add confidence to the results of the predicted temperature rise calculations discussed in the previous section, a limited temperature survey of cable trays covered with a one-hour B&W Kaowool fire barrier was made. This survey consisted of monitoring covered, uncovered, and ambient temperatures in five power cable trays and three control cable trays. SWEC selected the power trays which contained feeders to safeguards equipment likely to be operating during normal plant operation. NSP selected the control trays based on fill criteria. Within the limits of experimental accuracy, the results compared favorably with the calculations.

4.1 General Description Of The Test Setup

For the survey, several power cables installed in wrapped cable trays that operate during normal plant operation were identified. Since the fire barrier is installed only on safety-related cable trays, most cables in these trays are not normally or continuously in service. Of the remaining cables that are in service during normal operation, the charging pump cables and associated trays were selected since one charging pump is operational at all times and since the pumps are relatively large loads (approximately 140 amps). The surveyed trays associated with the charging pumps are as follows:

Tray	Width	Predominant Load
1AG - LA30	12"	#12 Charging Pump
2AG - LB5	30"	#21 Charging Pump
2AG - LB8	24"	#21 Charging Pump

In addition to the three power trays identified above, two power trays containing the diesel generator D2 feeder cable were identified. These trays were selected since the survey could be coordinated with the bi-weekly diesel generator load test. The load current of the generator nameplate voltage and power factor is 479 amps. These trays are as follows:

Tray	Width	Predominant Load
1AM-LB23	9"	Diesel Generator D2
1AM-LB27	18"	Diesel Generator D2

Three control trays were also identified to be monitored. These trays were selected by NSP since they were close to the main control room and were appproaching the fill limit. These trays are:

Tray	Width	%Fill	#Cables
1AM-TA8	18"	94%	87
1AM-TA9	18"	74%	66
1AM-TA10	18"	58%	45

Based on the availability of strip chart recorders and the relative locations of the points to be monitored, three central monitoring points were selected. As listed in Tables 8, 9, and 10, 27 thermocouples and three recorders were installed. Thermocouples installed in the wrapped section of power cable trays were inserted alongside the predominant cable in that tray (charging pump feeder or diesel generator feeder). Thermocouples installed in the unwrapped sections of power cable trays were installed alongside and strapped to the predominant cable in that tray. Ambient thermocouples were installed in air in the general vicinity of the trays being monitored. Thermocouples installed in control trays were inserted approximately into the center of the cable bundle. In several cases, a thermocouple was inserted into a covered section (metal tray cover) of control trays as well as the wrapped and unwrapped tray sections. The recorders on elevations 695' and 715' in the auxiliary building were started on August 10, 1983 and continued to run at a chart speed of 1 inch per hour until August 24, 1983. The recorder in the relay room was started August 22, 1983 and ran at 1 inch per hour until August 24, 1983 (in conjunction with the diesel testing). During the test period, the operation of the charging pumps and diesel generator was monitored periodically.

Thermocouples were fabricated by twisting together and crimping the two conductors of the thermocouple extension wire. The limits of error for the type "T" thermocouples is $\pm$ 1.8°F, and $\pm$ 4°F for the type "K" thermocouples. Recorder operation and calibration was checked by the PINGP instrument shop prior to the survey.

4.2 Charging Pump Feeder Tray Test Results

As stated before, three cable trays serving two charging pumps were instrumented for the temperature survey. All three trays are located on elevation 695 of the auxiliary building. Tray 1AB-LA30 services Unit 1 charging pump #12, and trays 2AG-LB5 and 2AG-LB8 service Unit 2 charging pump #21. A list of thermocouples installed on these trays is contained in Table 8.

All thermocouples were connected to a type "K" multipoint recorder located at G-12 on elevation 695.

Figure 2 is a sample of the strip chart record from this test. The temperature data recorded for this test are relatively constant for the duration of the test. Exceptions to the consistency appeared on August 11, 1983 when the #21 charging pump was started, and on August 23, 1983 when #21 charging pump was reduced to minimum speed.

During the course of the test, both charging pumps normally operated between 65 percent and 70 percent of full speed. For both pumps, 70 percent speed corresponded to 88 amps load current as measured by the PINGP electrical shop on August 10, 1983. The speed of the pumps was read several times during the survey at the charging pump speed manual/auto control station on the main control board.

Typical steady state temperatures recorded were as follows:

T/C#	Description	Measured Temperature
Average 3 & 4	#12 charging pump feeder in wrapped tray 1AG-LA30	120°F
9	#12 charging pump feeder in unwrapped tray 1AG-LA30	96°F
1	Ambient near 1AG-LA30	85°F
Average 5 & 6	#21 charging pump feeder in wrapped tray 2AG-LB5	111°F
Average 7 & 8	#21 charging pump feeder in wrapped tray 2AG-LB8	108°F
10	#21 charging pump feeder in unwrapped tray	91°F
2	Ambient near 2AG-LB5 & 8	85°F

This information indicates a temperature rise across the B&W Kaowool of 35°F for the #12 charging pump feeder in tray 1AG-LA30, a 26°F rise for #21 charging pump feeder in tray 2AG-LB5, and a 23°F rise for #21 charging pump feeder in tray 2AG-LB8.

In order to compare measured values to the predicted values, the predicted values must be adjusted to the conditions existing in the tray at the time of the survey. First, all other feeders in the trays being studied are assumed to be out of service. This assumption is valid since the other feeders service safeguards loads such as motor operated valves, RHR pumps, safety injection pumps, and containment spray pumps. The second modification to the predicted temperature rise is to adjust the heat generated in the cable to account for operation of the charging pumps at less than nameplate current. Since the heat gain (and thus the temperature rise) is directly proportional to the square of the current, the temperature rise in tray 1AG-LA30 is reduced to 43 percent of the predicted value (the square of the measured current of 88 amps divided by the Unit 1 charging pump nameplate current of 134 amps). Similarly, for the #21 charging pump feedars in trays 2AG-LB8, and 2AG-LB8 the temperature rise is reduced to 34 percent of the predicted value [(88 amps/152 amps)^2].

These adjusted temperature rises compare to the measured rises as follows:

Condition	Tray	ΔT
Calculated temperature rise in tray with all cables at nameplate load:	1AG-LA30	91°F
	2AG-LB5	115°F
	2AG-LB8	77°F
Calculated temperature rise in tray with only charging pump at 70 percent speed (88 amps)	1AG-LA30	39°F
	2AG-LB5	38°F
	2AG-LB8	26°F
Measured temperature rise in tray with only charging pump operating at 70 percent speed (88 amps)	1AG-LA30	35°F
	2AG-LB5	26°F
	2AG-LB8	23°F

The error limits on type "K" thermocouples is ± 4°F. Thus, all measured temperatures seem to correspond reasonably close to the predicted values.

4.3 Diesel Generator Feeder Tray Test Results

Two cable trays containing the D2 Diesel Generator Feeder were instrumented for the temperature survey. The first tray (1AM-LB23) is located in the relay room on elevation 715, and the second tray (1AM-LB27) is located outside the relay room over access control in the auxiliary building on elevation 715. The instrumentation installed is given Tables 9 and 10.

The thermocouples monitoring tray 1AM-LB23 were connected to a type "T" two point recorder located in the relay room. The thermocouples monitoring tray 1AM-LB27 were connected to a type "T" multipoint recorder located at H-7 on elevation 715' in the auxiliary building.

Since the diesel generator is not normally in service, the temperature survey of these trays was coordinated with the bi-weekly diesel generator load test.

The diesel generator is rated for continous operation at 2750 kw @ 0.8PF. At the nameplate voltage (4.16kv), this translates to 479 amps per phase at full load. During the test on August 23, 1983, the diesel was run for 15 hours at 400 amps.

Due to the thermal mass of the cable (conductor, insulation, jacket, and armor), the cable tray, and the fire barrier, SWEC predicted that at rated load the temperature rise for these trays will be about 7°F per hour. This implies that tray 1AM-LB23 will reach a steady state temperature in about 30 hours and tray 1AM-LB27 will reach steady state temperature in about 18 hours.

At rated load (479A), the predicted temperature rise across the fire barrier is 207°F for tray 1AM-LB23 (9" wide) and 122°F for tray 1AM-LB27 (18" wide).

However, since the diesel generator was operated at less than full load current, the total temperature will drop as the square of the ratio of the currents or 70 percent of its predicted value [(400 amps/479 amps)^2]. The revised temperature rise in the trays is then 144°F for tray 1AM-LB23 and 84°F for tray 1AM-LB27. The rate of temperature rise is also reduced to 70 percent or 5°F per hour. The time to equilibrium should remain about the same.

A summary of the test results is as follows:

	1AM-LB23			1AM-LB27		
Time (Hours)	Inside 1AM-LB23	Ambient 1AM-LB23	Temp. Rise	Inside 1AMLB27	Ambient 1AM-2B27	Temp. Rise
0	80°F	80°F	0°F	89°F	89°F	0°F
2	88°F	81°F	7°F	95°F	89°F	6°F
4	95°F	82°F	14°F	100°F	89°F	11°F
6	105°F	82°F	23°F	105°F	89°F	16°F
8	116°F	82°F	34°F	110°F	89°F	21°F
10	123°F	82°F	41°F	115°F	89°F	26°F
12	128°F	82°F	46°F	120°F	89°F	31°F
14	132°F	82°F	50°F	125°F	89°F	38°F
15	135°F	82°F	53°F	127°F	89°F	38°F

For both trays, the temperature increases seem to react slower than the rate of rise prediction indicates. Note that the rate of rise is not a critical factor in the derating determination only an estimate of the thermal mass of the cable, tray, and fire wrap. For both trays, there was no indication of reaching a steady state temperature lower than predicted. The diesel was stopped at 15 hours into the test since it was evident at that point that ampacity derating was required regardless of the final steady state temperature..

Working backwards from a 53°F temperature rise after 15 hours at 83 percent load current implies a 75°F (42°C) rise at rated load (479A) after 15 hours. Adding the 42°C rise to the 40°C ambient results in a total internal tray temperature of 82°C. According to the industry standard (summarized in Table 7), this cable should be derated to 40 percent of its original ampacity after 15 hours and additional derating is required until the temperature stabilizes. From Table 1, a 1000 MCM cable installed in tray with no allowance for undervoltage or service factors can carry 630 amps. Forty percent of this is 252 amps; comparing this to the required current of 479 amps indicates that this cable is undersized for this application.

4.4 Control Tray Test Results

Three cable trays containing control cable were instrumented for the temperature survey. The trays were 1AM-TA8, 9, and 10.

All three trays are heavily filled and are located near the relay room on elevation 715' in the auxiliary building.

Nine type "T" thermocouples were installed to measure representative temperatures inside the cable bundles of the trays for three conditions. 1) cable tray unwrapped and without a cover, 2) cable tray unwrapped and with a cover, 3) cable tray wrapped and with a cover. A thermocouple was also installed to measure the ambient temperature in the general vicinity of the trays. All thermocouples were connected to a type "T" multipoint recorder installed on elevation 715' of the auxiliary building. The instrumentation for these trays is lised in Table 9.

The resulting temperatures were then recorded from August 10, 1983 through August 24, 1983. Figure 3 is a sample of the strip chart record. During this period, all temperatures remained within a 5°F window. Although specific points cannot be distinguished on this record, the window agrees favorably with the predicted temperature rise in trays 1AM-TA9 and 1AM-TA10 of 3.4°F.

5.0 MATERIAL COMPARISON

5.1 General

In addition to ampacity, the materials from three companies (B&W, TSI, and 3M) were investigated from a technical and economic standpoint. Most of the fire barrier systems have successfully passed the applicable ASTM-E119 fire testing and have received American Nuclear Insurer's (ANI) and Underwriter Laboratory's (UL) approval. However, because the list of available qualified products is so limited, some additional materials from these manufacturers have been included for comparison and future reference. Presently, these materials show every indication of passing ASTM-E119 and gaining the appropriate approvals.

All of the systems investigated are of a passive nature, and all vary greatly in their method of fire protection. The B&W Kaowool system is a non-conductive barrier system which insulates the tray or conduit from the fire. The Kaowool is unaffected after the fire. The TSI system is a chemical compound that absorbs the heat of the fire as it sublimates, thus protecting the enclosed tray or conduit. The TSI product will be consumed during a fire. The 3M system is installed as a dense mat, and when exposed to heat, expands and forms a char with a high thermal resistance (intumescent). The 3M system must also be replaced after a fire. The three-hour systems presented are basically made by increasing the thickness of the specific companies' one-hour systems.

Each system presented has physical, technical, or economic advantages or disadvantages. Therefore, factors such as cost, weight, ease of installation and repair, re-entry capability, and ampacity derating are presented in this section to more effectively evaluate each material's overall capability.

The system weights, material costs, and labor required to completely install each system are given in "per linear foot" quantities. Weight measurements are based on 30 in x 6 in tray sections, while labor costs are all based on $20.00/hour to facilitate economic comparison. Both of these measurements can be readily adjusted to reflect different tray sizes or labor rates. Manhour estimates are based on manufacturer and/or client data at other nuclear facilities and include, site prep and cleanup, and scaffold assembly/disassembly.

TSI, Inc. manufactures the only three-hour fire barrier presently qualified for use on cable tray and conduit at nuclear facilities. Their system Thermo-Lag 330-1 with Stress Skin 330-69 has successfully passed the ASTM-E119 three-hour test and has also gained ANI approval.

3M is developing a new fire barrier material, M20R, which is presently in testing and has successfully passed the one-hour test. 3M feels very confident that this same material will also pass the three-hour fire tests, and they are proceeding with this testing. Based on this information and the fact that 3M feels that this new material should be qualified, approved, and in production by November 1983, the developmental information is included for comparison and future reference.

A summary of the economic, technical, and ampacity considerations for the three-hour barriers is presented in Table 11.

Three qualified manufacturers of one-hour rated fire barriers were investigated, B&W, TSI, and 3M. 3M is presently testing a new material, M20R, which will compete directly with its existing M20A system. B&W has also modified their existing system by recommending the inclusion of an outer protective wrap Zetex-800. This alters their system cost and is included as a separate system for comparison. In general, the one-hour rated systems and materials are the basis for other multiple hour fire ratings offered by these respective companies. All barriers including the new 3M (M20R) system have passed ASTM-E119 fire testing and all except M20R have UL, ANI, and NRC approval for use on IE class Electrical circuits as stipulated in 10CFR50 Appendix R section G.2.C.

A summary of the economic, technical, and ampacity considerations for the one-hour barriers is presented in Table 12.

5.2 B&W Kaowool Ceramic Blanket Materials

5.2.1 General

Kaowool is a ceramic blanket used as a passive reflective fire barrier. This material has successfully passed the ASTM-E119 fire test and is ANI, UL, and NRC approved for use on IE class electrical circuits.

Kaowool is subject to physical and liquid damage; therefore, B&W now recommends the use of a protective wrapping.

5.2.2 Kaowool One-Hour Barrier

Two 1 in wraps of Kaowool held in place by stainless steel bands are required for the one-hour rating. Based on manufacturer's installation data at other nuclear facilities, 5.25 hours per linear foot is required for a complete installation or approximately $105.00 per linear foot. Material costs for the basic Kaowool Blanket are approximately $21.00 per linear foot resulting in an estimated total cost of $126.00 per linear foot.

The installation of a one-hour Kaowool wrap results in a system weight of 9.5 lb per linear foot. Although this figure is relatively low, it should still be considered in tray siesmic and loading analysis. SWEC cable derating calculations for this material installed on power trays indicates excessive derating in many trays (Table 6A). This level of deration can be considered severe; and based on this data, special consideration should be given when selecting trays for protection with this material.

5.2.3 Kaowool One-Hour Barrier with Zetex 800

The Kaowool ceramic blanket material is subject to physical abuse, abrading, and liquid (wicking) damage. Therefore, B&W now recommends wrapping basic Kaowool systems with a Zetex-800 E-glass cloth blanket to protect against inadvertant liquid sprays and physical abuse. Zetex - 800 has no fire protective capability but will withstand approximately 1000°F before disintegration. This material is supplied with or without aluminum

5.3.2 Thermolag 330-1 One Hour-Barrier

Prefab panels 1/2-in thick are used to meet the requirements of the one-hour fire rating system. Weight is approximately 21 lb per linear foot. The weight should be considered in seismic and tray loading calculations. Present data issued by the manufacturer states that cable derating for this one-hour system is approximately 12 percent. SWEC calculations for this material, based on manufacturer's data, reflect a minimum derating of between 0 and 27 percent (Table 6B).

Materials costs are approximately $186.00 per linear foot. Labor costs are estimated to be 8.25 hours per linear foot or $165.00 resulting in total costs of $351.00 per foot.

5.3.3 Thermolag 330-1 Three-Hour Barrier

Prefab panels one in thick are required to meet the requirements of a three-hour barrier.

Installation figures based on manufacturer's data and installations at other nuclear facilities indicate approximately 8.25 hours per linear foot is required to completely install this system, resulting in labor charges of $165.00 per linear foot. Material charges are approximately $372.00 per linear foot, resulting in an estimated total cost of $537.00 per linear foot.

Manufacturer's data gives the weight of an installed system to be approximately 42 lb per linear foot. Although the manufacturer's data also states that other facilities have not experienced difficulty in adding this amount of additional loading to existing tray systems, consideration should be given to this area.

Present data issued by TSI Inc. states that cable derating for a three-hour system is in the 17 to 20 percent range. For the power cable trays identified to be protected at PINGP SWEC estimates, derating between 0 and 35 percent would be required (Table 6C).

5.4 3M - M20 Materials

5.4.1 General

M20 is an intumescent (heat expanding) passive mat which can be wrapped around conduit and cable tray while being secured with stainless steel bands. When engulfed in flame, this material will expand in one direction and char.

5.4.2 M20A One-Hour Barrier

M20A is a ceramic intumescent (heat expanding) neoprene rubber mat with an aluminum foil backing. Four 1/4-in wraps are needed to produce the required one-hour fire rating. The entire wrap is secured to either conduit or cable tray with stainless steel bands.

This system requires approximately 5.50 hours per linear foot to completely install resulting in labor charges of approximately $110.00 per linear foot. Materials are approximately $162.00 per linear foot. This results in an estimated total cost of $272.00 per linear foot.

The resulting system weight is approximately 16 lbs. per linear foot and should be considered in siesmic and tray loading calculations.

This material has successfully passed the ASTM-E119 one-hour fire test and has gained UL approval. ANI approval is still pending and should be available by October 1983. Calculations by the manufacturer show derating of cables to be in the 34 to 38 percent range. Alternate calculations by SWEC based on manufacturer's data show cable minimum derating from 0 to 31 percent (Table 6D).

5.4.3 M20R One-Hour Barrier

M20R is an intumescent (heat expanding) passive material produced in 1/4-in rubber mats with aluminum foil backing. Three wraps are anticipated to produce the one-hour rating. This material is presently still in testing and is presented here for comparison and future reference.

This new material is expected to be priced similar to the M20A mat. However, because only three wraps will be required, the following reduced charges are projected: labor, 5.40 hours per linear foot or $108.00 per linear foot; material estimated at $122.00 per linear foot, bringing the estimated total cost to $230.00 per linear foot. This projects a moderate economic savings over the M20A material.

This material has presently passed the ASTM-E119 one-hour fire rating. Certification, ANI and UL approval, and production are anticipated by November 1983.

The estimated system weight of 15 lb per linear foot should be considered in siesmic and tray loading calculations. SWEC estimates cable derating between 0 and 26 percent (Table 6E).

5.4.4 M20R Three-Hour Barrier

M20R is an intuscent (heat expanding) passive material produced in 1/4 in rubber mats with aluminum foil backing. Six wraps are anticipated to produce the three-hour rating. This material is presently still in testing and is referenced here for comparison and future reference.

This new material is expected to be priced similar to the (M20A) mat presently used in the 3M one-hour rated system. Due to six wraps of material being required a projected installation time of 7.5 hours per linear foot or $150.00 per linear foot is anticipated. Material costs are estimated at $243.00 per linear foot. This results in an estimated total cost of $393.00 per linear foot.

Six 1/4-in wraps result in an estimated system weight of 30 lb per linear foot. Consideration should be given when adding this level of loading to existing tray. Present data calculated by 3M indicates cable derating will be in the 35 to 40 percent range, which is consistent with their presently available M20A mat. The study confirms these derating estimates. For the trays to be covered at PINGP, SWEC estimates minimum deratings between 0 and 32 percent (Table 6F).

6.0 CONCLUSIONS & RECOMMENDATIONS

The study indicates that for most cable trays identified to be provided with an Appendix R fire barrier, the ampacity of the enclosed cables will be substantially affected. The degree of ampacity derating required is dependent on the fire barrier material, the heat load generated within the fire barrier, and the external surface area of the fire barriers.

For the various materials examined, the insulating fire barrier materials such as B&W Kaowool require the greatest ampacity derating factors for normal operation. The state or phase change materials such as the 3M intumescent barrier or the TSI subliming barrier require less derating than the insulating type. However, in many cases, the predicted cable derating for any of the materials considered exceeds the available design margin of the existing cables.

Cables that are not seriously affected by the addition of a fire barrier are those cables that were sized and selected on the basis of minimum requirements for mechanical integrity rather than on the basis minimum ampacity requirements. The study and associated test program also indicated that the time constants involved in reaching a steady state temperature are quite long (18 to 30 hours), resulting in little or no derating for cables serving low duty factor loads such as motor-operated valves. In general, cables that may be seriously affected are cables serving large loads that are required to operate continously for extended periods of time.

The basis of the derating factors determined in this study is a relatively simple heat transfer model that predicts the temperature rise across the fire barrier. This temperature rise is then added to the design ambient temperature of the environment to determine a new ambient temperature to which the cable is exposed. The cable is then derated in accordance with industry standards for the new ambient temperature.

The industry standards for sizing (ampacity) of power and control cables do not specifically address use of cables in wrapped trays. The methods used in this study attempt to reduce the use of cables under these conditions to a point where the industry standards can be applied. Prior to proceeding, SWEC recommends that the cable manufacturers used at PINGP be contacted and asked for their input to this particular application.

Specific derating factors for each cable affected are not determined in this study, but derating factors for various tray sections with the different fire barrier systems are addressed. Once the fire barrier system for each tray section has been determined, then individual cable derating will be accomplished by applying the derating factor associated with the worst case tray through which the cable is routed (highest temperature rise) to the ampacity for the specific cable.

The study indicates that the most cost-efficient means of conformance with Appendix R may be an installation combining several fire barrier materials. For example, a B&W Kaowool fire barrier could be installed on most control trays and some power trays that contain oversized or low-duty

factor cables. A state change material such as TSI thermo-lag or 3M M20 Mat could then be installed on the remaining trays. This study indicates that some of the cables installed in the remaining trays will still require derating beyond the available design margin of the cable.

Since most of the cables and trays under consideration service safety-related equipment, a service life for these cables of less than 40 years may be realistic. The cable manufacturers may also be consulted regarding a higher operating temperature for a shorter service life.

Other alternatives to prevent the potential problem include rerouting selected cables or adding parallel feeders to selected loads to reduce the ampacity loading in the problem cables. Investigation of actual motor full load amperes versus nameplate full load amperes may also result in additional ampacity margin for problem cables.

It should be noted that besides the initial heat generation and ampacity derating calculations performed before the fire barrier installation, every time a new cable is added to the tray, the calcuations should be redone to determine the effect of the cable addition.

In addition, SWEC recommends that the design loading and seismic analysis of the affected cable tray systems should be re-evaluated regardless of the fire barrier material ultimately selected.

REFERENCES

1. IPCEA* S-135-1966 (also IEEE S-135), Power Cable Ampacities for Copper and Aluminum Conductors

2. Ashrae Fundamentals - 1977

3. Prairie Island Nuclear Generating Station Electric Motor Load List dated February 10, 1983.

4. IPCEA* P-54-440-1979 (also NEMA WC-51), Ampacities for Cables in Open-Top Cable Trays

* IPCEA (Insulated Power Cable Engineers Association) has recently changed their name to ICEA(Insulated Cable Engineers Association)

TABLE 2

WRAPPED CABLE TRAY HEAT TRANSFER COEFFICIENTS

TRAY SIZE (IN)	AREA (A) SQFT PER LIN FT OF TRAY	UxA for B&W Kaowool One-Hour (U=.05532) WATTS/C PER LIN FT	UxA for TSI Therma-Lag Three-Hour (U=.2232) WATTS/C PER LIN FT	UxA for TSI Therma Lag One-Hour (U=.271) WATTS/C PER LIN FT	UxA for 3M M20A One-Hour (U=.243) WATTS/C PER LIN FT	UxA for 3M M20R Threp-Hour (U=.283) WATTS/C PER LIN FT	UxA for 3M M20R One-Hour (U=.24) WATTS/C PER LIN FT
6	1.5	.08	.33	.41	.36	.42	.36
9	2	.11	.45	.54	.48	.57	.48
12	2.5	.14	.56	.68	.60	.71	.6
18	3.5	.19	.78	.95	.85	.99	.84
24	4.5	.25	1.00	1.22	1.09	1.27	1.08
30	5.5	.30	1.23	1.49	1.34	1.56	1.32

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TABLE 11

THREE-HOUR FIRE BARRIER SUMMARY

COMPANY	PRODUCT TYPE	APPROVAL	MAT COST $/FT.	WEIGHT LBS. LB/FT.	EST. TIME INSTALLATION HRS/FT.	PER LIN. FT. LABOR COST EST. @ $20.00/HR.	EST. TOTAL COST $/FT.	COMMENTS
TSI Inc.	Thermo-Lag. 330-1 & Stress Skin 330-69 (Subliming) Prefab Panels	ANI & NRC (at some Nuclear Stations)	$372.00	42	8.25	$165.00	$537.00	1) Fabrication shop needed 2) Installers recommended 3) Delivery & schedule problems likely. 4) Very Heavy 5) Ampacity Derating per study 0 to 35 percent
3M	M20R (Intumescent) Mat Wrap	Still in Testing	$243.00	30	7.50	$150.00	$393.00	1) Not available until Nov. 83 2) Speculative on passing 3HR tests. 3) Heavy 4) Data based on Mfg. projections 5) Ampacity Derating per study 0 to 32 percent

TABLE 12

ONE-HOUR FIRE BARRIER SUMMARY

COMPANY	PRODUCT TYPE	APPROVAL	MAT COST $/FT.	WEIGHT LB/FT.	EST. TIME INSTALLATION HRS/FT.	PER LIN. FT. LABOR COST EST. @ $20.00/HR.	EST. TOTAL COST $/FT.	COMMENTS
TSI Inc.	Thermo-Lag. 330-1 with Stress Skin 330-69 (Subliming) Prefab Panels	ANI & NRC (at some Nuclear Stations)	$186.00	21	8.25	$165.00	$351.00	1) Fabrication shop needed 2) Installers recommended 3) Delivery & schedule problems likely. 4) Med. Heavy 5) Repair material (liquid) 6 mo. life 6) Ampacity Derating per study 0 to 27 percent
3M	M20A (Intumescent) Mat Wrap	ANI Pending on Wrap Design	$162.00	16	5.50	$110.00	$272.00	1) Requires ANI & NRC approval 2) New product may be available in Nov. 83 3) Med. Heavy 4) Ampacity Derating per study 0 to 31 percent
3M	M20R (Intumescent) Mat Wrap	Still in testing	$122.00	15	5.40	$108.00	$230.00	1) Not available until Nov. 83 2) Should pass 1 hr. test 3) Med. Heavy 4) Data based on Mfg. projections 5) Ampacity Derating per study 0 to 27 percent

Continued next page

TABLE 12 (cont.)

ONE-HOUR FIRE BARRIER SUMMARY

COMPANY	PRODUCT TYPE	APPROVAL	MAT COST $/FT.	WEIGHT LB/FT.	EST. TIME INSTALLATION HRS/FT.	PER LIN. FT. LABOR COST EST. @ $20.00/HR.	EST. TOTAL COST $/FT.	COMMENTS
B&W	Kaowool (ceramic blanket) wrap w/o Zetex	ANI & NRC (at some Nuclear Stations)	$21.00	9.5	5.25	$105.00	$126.00	1) B&W now recommends Zetex coat to protect against inadvertent damage. 2) Medium 3) Ampacity Derating per study 0 to 100%
B&W	Kaowool (ceramic blanket) wrap with Zetex coat	Same	$47.00	10.5	5.35	$107.00	$154.00	1) Requires ANI & NRC approval 2) New product may be availiable in Nov. 83 3) Med. 4) Ampacity Derating per study 0 to 100%

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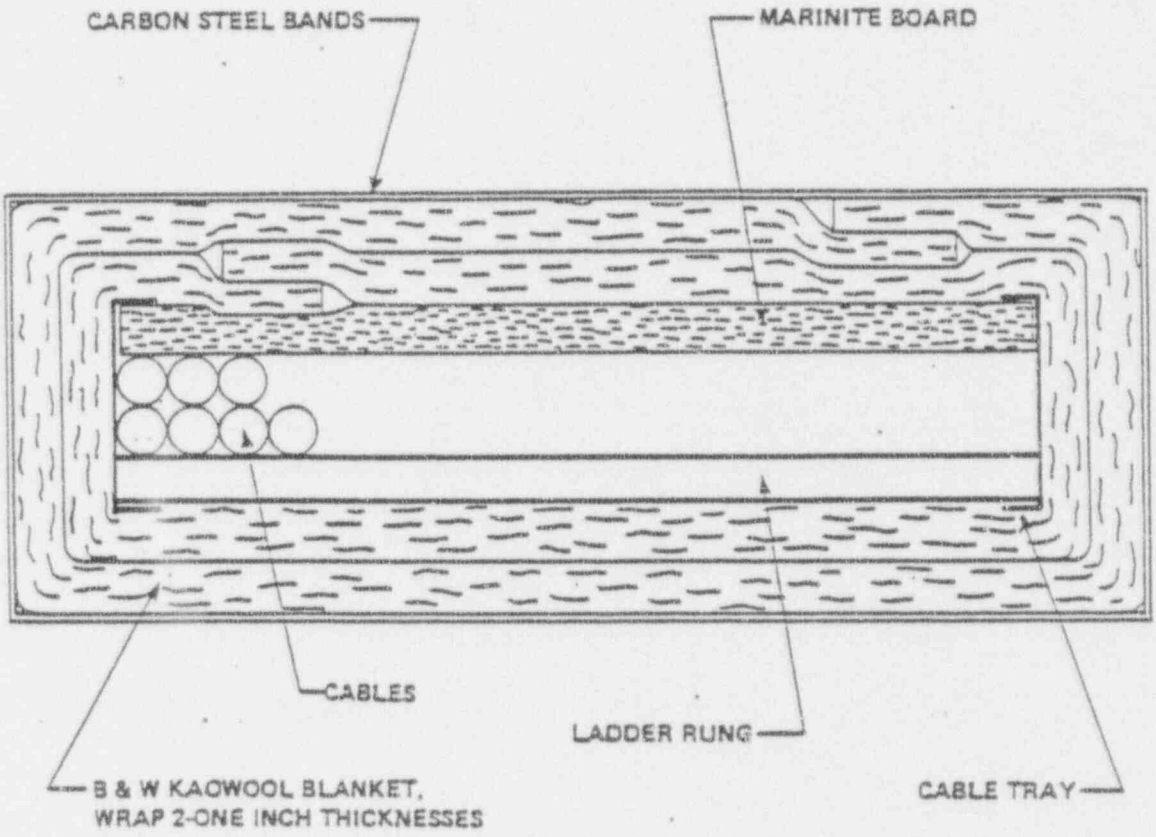

FIGURE 1

PROPOSED B & W KAOWOOL TRAY COVER

FIGURE 2

SAMPLE OF CHARGING PUMP TRAY
TEST STRIP CHART RECORD

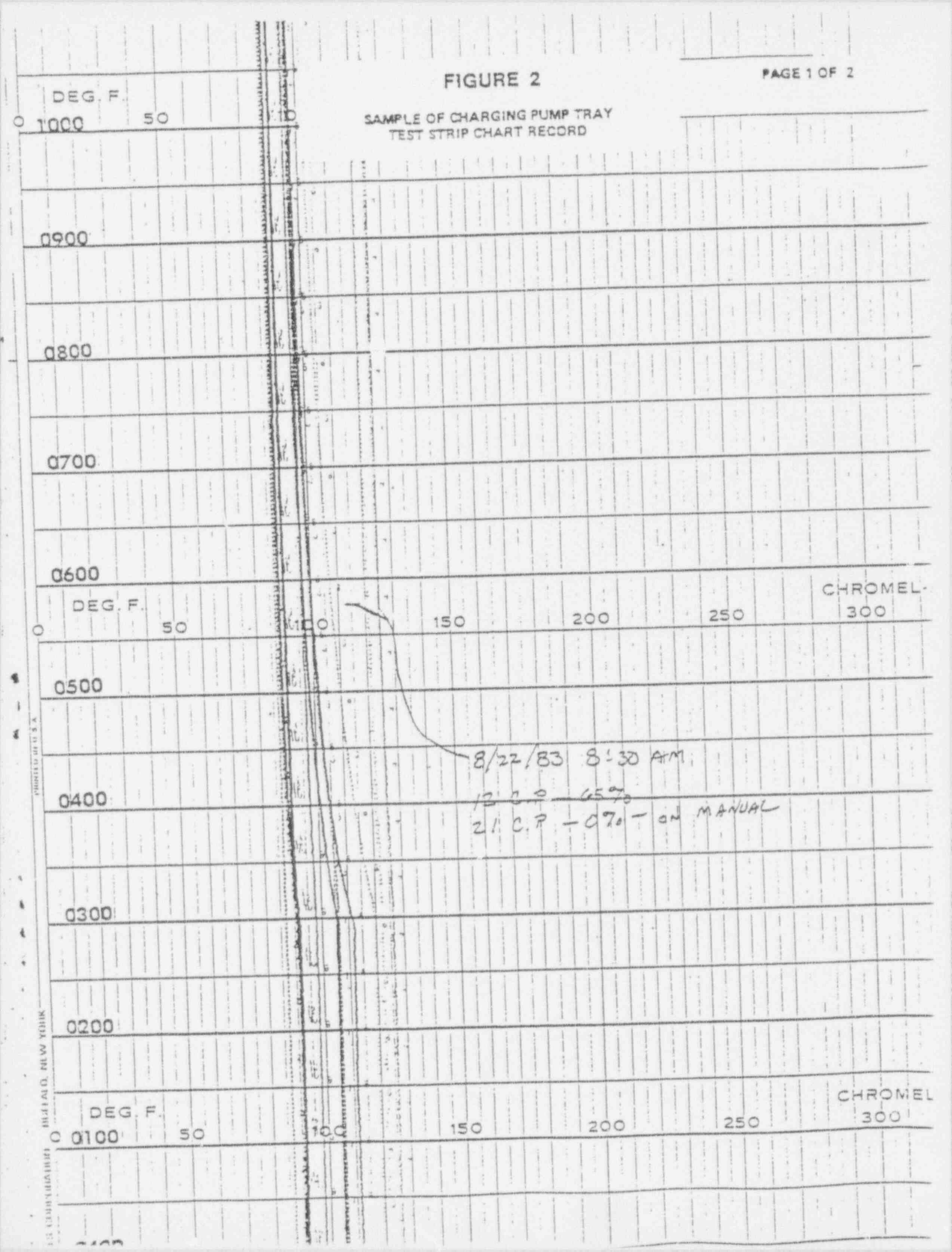

FIGURE 2

SAMPLE OF CHARGING PUMP TRAY
TEST STRIP CHART RECORD

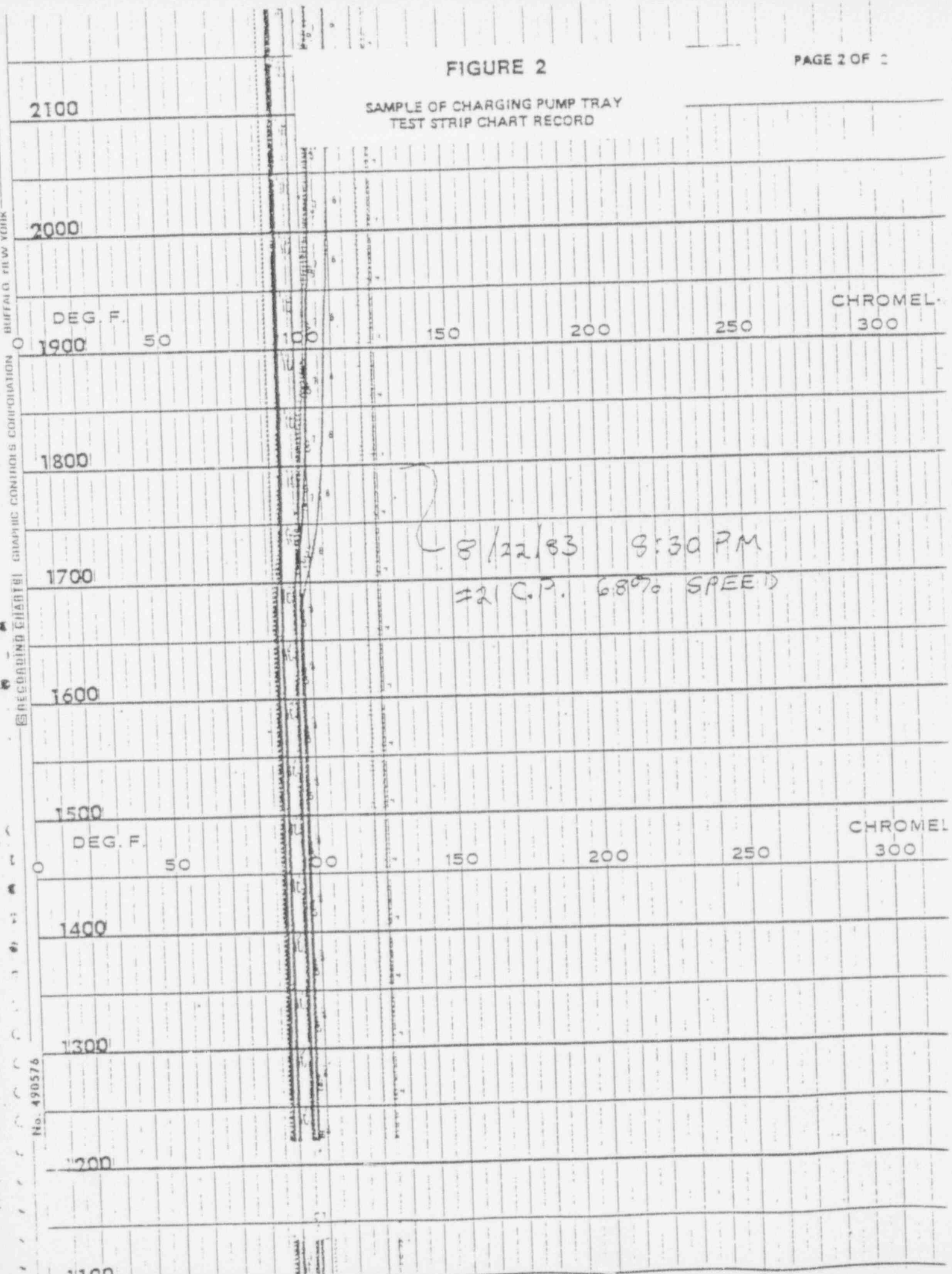

FIGURE 3

SAMPLE OF CONTROL TRAY
TEST STRIP CHART RECORD

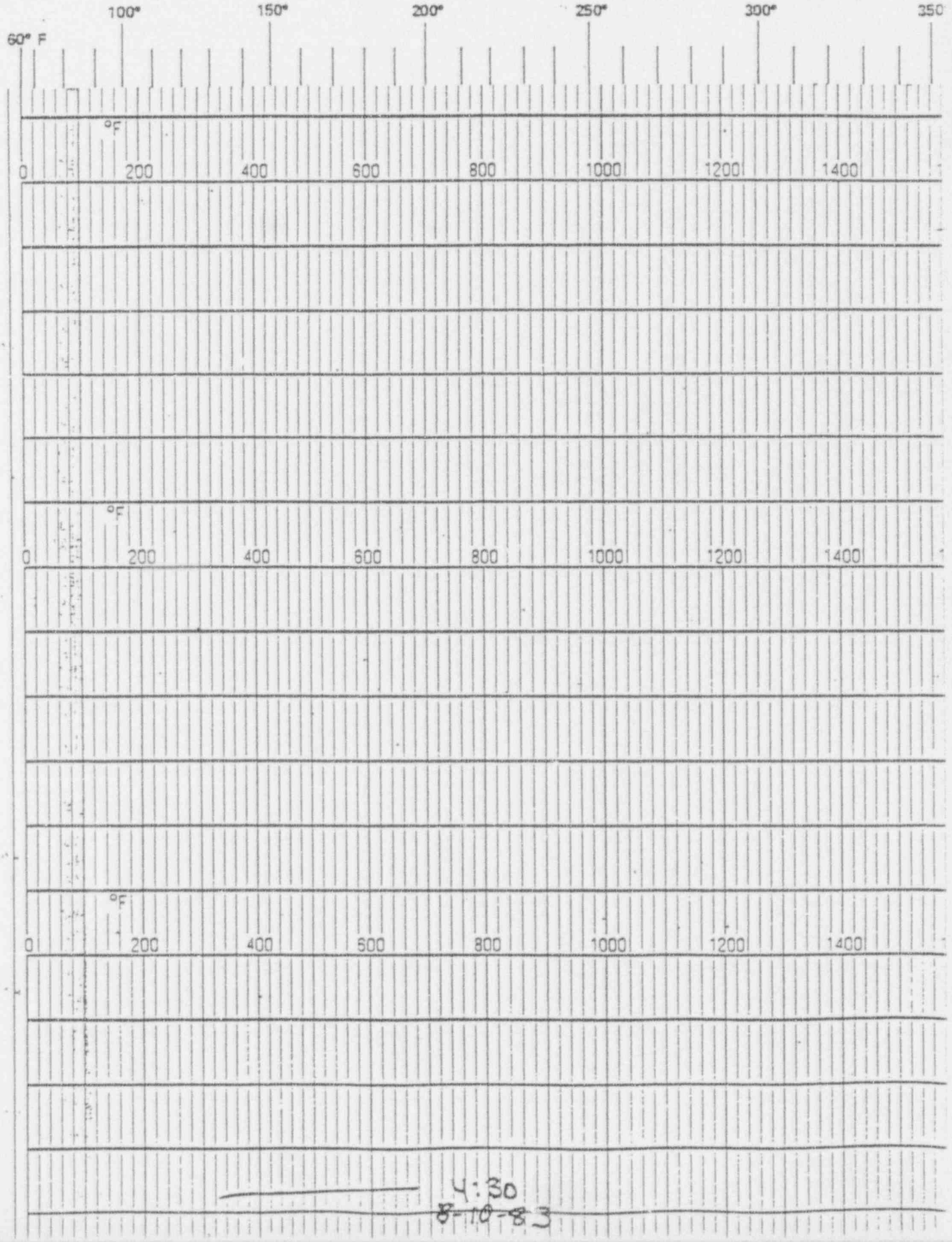

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TABLE 1

CABLE AMPACITY FOR COPPER CABLES INSTALLED IN ACCORDANCE WITH ICEA P-46-426

CABLE SIZE	VOLTS	NSP TYPE	(A) AMPS	(B) (A)*.82 AMPS	(C) (B)*1.25 AMPS
3/C-#10	600	28			
3/C-#8	600	27	59	48	39
3/C-#6	5000	7	93	76	61
3/C-#4	600	31	104	85	68
3/C-#2	600	24	138	113	91
3/C-#2	5000	6	159	130	104
3/C-#1/0	600	23,221	186	153	122
3/C-#4/0	600	22	287	235	188
3/C-#4/0	5000	5	321	263	211
3/C-350	600	21	394	323	258
3/C-500	600	20	487	399	319
3/C-750	5000	2	669	549	439
3/C-1000	5000	1	768	630	504

(A) AMPS AT 90C CONDUCTOR TEMP., 40C AMBIENT TEMP., 3/C-COPPER CABLE ISOLATED IN AIR.

(B) AMPS FOR THE SAME CONDITIONS AS (A) ADJUSTED FOR INSTALLATION ON LADDER SUPPORTS, WITH 1/4 TO 1 DIAMETER SPACING, AND NOT MORE THAN 6 CABLES HORIZONTALLY.

(C) AMPS FOR THE SAME CONDITIONS AS (A)&(B) ADJUSTED FOR LOAD SERVICE FACTOR AND UNDER VOLTAGE OPERATION (10% BELOW NAMEPLATE). THIS COLUMN CAN BE COMPARED WITH THE LOADS NAMEPLATE FULL LOAD CURRENT AT RATED VOLTAGE.

NOTE: SHORT CIRCUIT CURRENT LIMITS AND VOLTAGE DROP DURING NORMAL OPERATION AND STARTING SHOULD ALSO BE CONSIDERED IN SIZING A SPECIFIC CABLE.

TABLE 3

CONDUCTOR AND CABLE RESISANCE AT PINGP

AC CABLES

TYPE CABLE	(4) CABLE SIZE	(5) COND OHMS/FT @25C	(6) COND OHMS/FT @90C (5)*1.25	(7) AC/DC RATIO	(8) COND AC OHMS /FT@90C (6)*(7)	(9) OHMS / 3PH-FT 3*(7)
29	3/C-#10	.00104	.0013	1.00	.0013	.0039
27	3/C-#8	.000654	.0008175	1.00	.0008175	.0024525
7	3/C-#6	.00041	.0005125	1.00	.0005125	.0015375
31	3/C-#4	.000259	3.238E-4	1.00	3.238E-4	9.713E-4
6,24	3/C-#2	.000162	.0002025	1.01	2.045E-4	6.136E-4
23,221	3/C-#1/0	.000102	.0001275	1.02	1.301E-4	3.902E-4
5,22	3/C-#4/0	.0000509	6.363E-5	1.04	6.617E-5	1.985E-4
21	3/C-350	.0000308	.0000385	1.08	4.158E-5	1.247E-4
20	3/C-500	.0000216	.000027	1.13	3.051E-5	9.153E-5
2	3/C-750	.0000144	.000018	1.21	2.178E-5	6.534E-5
1	3/C-1000	.0000108	.0000135	1.28	1.728E-5	5.184E-5

DC CABLES

TYPE CABLE	(4) CABLE SIZE	(5) COND OHMS/FT. @25C	(6) COND OHMS/FT @90C	(9) OHMS/ LIN-FT 2*(6)
44	2/C-10	.00104	.0013	.0026
49	2/C-6	.00041	.0005125	.001025

TABLE 4

SUMMARY OF AFFECTED POWER CABLES

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-2	DSL GEN	49	30	.001025	.9225000.
1DCB-3	SWGR 120	49	30	.001025	.9225000
1DCB-31	CONT. DC	44	15	.0026	.5850000
1HVB-1	CLG.FANS	28	3	.0039	.0351000.
1HVB-9	CLG.FANS	28	3	.0039	.0351000
1HVB-13	CLG.FANS	28	8	.0039	.2496000
1HVB-17	CLG.FANS	28	2.5	.0039	.0243750
1HVB-74	CLG.FANS	28	2.5	.0039	.0243750
1HVB-86	CLG.FANS	28	2.5	.0039	.0243750
1HVB-90	CLG.FANS	28	2.5	.0039	.0243750
1K1-3	MV-32061	28	0	.0039	0
1K1-4	MV-32120	28	0	.0039	0
1K1-11	MV-32115	28	0	.0039	0
1K1-14	MV-32060	28	0	.0039	0
1K1-21	CHARG PP	23	134	3.902E-4	7.005533
1K1-26	MV-32322	28	0	.0039	0
1K1-33	MV-32266	28	0	.0039	0
1K2-1	MCC 1KA2	24	20	6.136E-4	.2454300
1K2-2	RHR SMP P	28	3.8	.0039	.0563160
1K2-4	MV-32085	28	0	.0039	0
1K2-5	MV-32084	28	0	.0039	0
1K2-6	CHARG PP	23	134	3.902E-4	7.005533
1K2-7	CHARG PP	23	134	3.902E-4	7.005533
1K2-8	MV-32146	28	0	.0039	0
1K2-9	MV-32159	28	0	.0039	0
1K2-18	PNL 135	24	15	6.136E-4	.1380544
1K2-20	MV-32267	28	0	.0039	0
1K2-22	MV-32115	28	0	.0039	0
1KA2-1	MV-32097	28	0	.0039	0
1KA2-2	MV-32099	28	0	.0039	0
1KA2-3	MV-32105	28	0	.0039	0
1KA2-4	MV-32102	28	0	.0039	0
1KA2-5	MV-32076	28	0	.0039	0
1KA2-6	MV-32078	28	0	.0039	0
1KA2-7	MV-32121	28	0	.0039	0
1KA2-8	MV-32201	28	0	.0039	0
1KA2-9	MV-32203	28	0	.0039	0
1KA2-10	MV-32080	28	0	.0039	0
1KA2-11	MV-32082	28	0	.0039	0
1KA2-12	MV-32207	28	0	.0039	0
1KA2-13	MV-32163	28	0	.0039	0
1KA2-15	MV-32040	28	0	.0039	0
1LA2-1	MV-32065	28	0	.0039	0
1LA2-2	MV-32204	28	0	.0039	0
1LA2-3	MV-32072	28	0	.0039	0
1LA2-4	MV-32230	28	0	.0039	0

TABLE 4

SUMMARY OF AFFECTED POWER CABLES

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1LA2-9	MV-32068	28	0	.0039	0
1LA2-10	MV-32069	28	0	.0039	0
1LA2-11	MV-32231	28	0	.0039	0
1LA2-12	MV-32196	28	0	.0039	0
1LA2-13	MV-32135	28	0	.0039	0
1LA2-14	MV-32141	28	0	.0039	0
1LA2-21	MV-32243	28	0	.0039	0
1LA2-27	MV-32047	28	0	.0039	0
1L2-4	BA XFR PP	28	18	.0039	1.263600
1L2-5	BA XFR PP	28	0	.0039	0
1L2-14	MV-32074	28	0	.0039	0
1L2-16	WST GAS C	27	30	.0024525	2.207250
1L2-20	MV-32199	28	0	.0039	0
1M2-7	MV-32273	28	0	.0039	0
1M2-9	MV-32276	28	0	.0039	0
1X2-1	FAN COIL	23	85	3.902E-4	2.818834
1X2-2	FAN COIL	23	85	3.902E-4	2.818834
122-1	MCC 1A2	2	390	6.534E-5	9.938214
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142
126-1	MCC 1L2	21	250	1.247E-4	7.796250
126-2	MCC 1M2	21	85	1.247E-4	.9012465
126-3	MCC 1MA	22	200	1.985E-4	7.940400
127-1	MCC 1X2	21	180	1.247E-4	4.041576
128-1	C RM CHLR	21	192	1.247E-4	4.598415
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16402-1	US 120	5	140	1.985E-4	3.890796
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1	SI PUMP	6	100	6.136E-4	6.13575
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-16	US 220 DC	49	30	.001025	.9225000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-2	CLG.FANS	28	2.5	.0039	.0243750
2HVB-10	CLG.FANS	28	3	.0039	.0351000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-23	CLG.FANS	28	2.5	.0039	.0243750
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2HVB-39	CLG.FANS	28	8	.0039	.2496000
2KA2-3	MV-32212	28	0	.0039	0
2KA2-8	MV-32116	28	0	.0039	0
2KA2-9	MV-32109	28	0	.0039	0
2KA2-10	MV-32111	28	0	.0039	0
2KA2-13	MV-32185	28	0	.0039	0
2KA2-14	MV-32183	28	0	.0039	0
2KA2-15	MV-32191	28	0	.0039	0
2KA2-16	MV-32204	28	0	.0039	0

TABLE 4

SUMMARY OF AFFECTED POWER CABLES

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2KA2-17	MV-32181	28	0	.0039	0
2KA2-18	MV-32209	28	0	.0039	0
2KA2-20	MV-32205	28	0	.0039	0
2KA2-23	MV-32029	28	0	.0039	0
2KA2-25	MV-32051	28	0	.0039	0
2KA2-26	MV-32059	28	0	.0039	0
2K2-1	MV-32117	28	0	.0039	0
2K2-2	MV-32117	28	0	.0039	0
2K2-4	CHARG PP	221	152	3.902E-4	9.014026
2K2-6	MV-32334	28	0	.0039	0
2K2-7	MV-32161	28	0	.0039	0
2K2-8	MCC 2KA2	24	20	6.136E-4	.2454300
2K2-9	RHR SMP P	28	0	.0039	0
2K2-10	MV-32189	28	0	.0039	0
2K2-11	MV-32268	28	0	.0039	0
2LA2-16	MV-32249	28	0	.0039	0
2LA2-31	MV-32168	28	0	.0039	0
2L2-1	MV-32374	28	0	.0039	0
2L2-2	MV-32126	28	0	.0039	0
2L2-3	MV-32127	28	0	.0039	0
2L2-5	MV-32189	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39
2L2-14	MV-32387	28	0	.0039	0
2L2-29	MV-32177	28	0	.0039	0
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
2X2-1	FAN COIL	23	85	3.902E-4	2.818834
2X2-4	FAN COIL	23	85	3.902E-4	2.818834
2X2-7	FAN COIL	221	0	3.902E-4	0
2X2-8	FAN COIL	221	0	3.902E-4	0
222-1	MCC 2A2	20	200	9.153E-5	3.661200
223-1	MCC 2K2	20	246	9.153E-5	5.539029
226-2	MCC 2L2	21	90	1.247E-4	1.010394
25402-1	US 220	5	140	1.985E-4	3.890796
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25404-1	RHR PUMP	7	25	.0015375	.9609375
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25406-1	DSL FEED	1	479	5.184E-5	11.89422
25409-1	CS PUMP	7	32.8	.0015375	1.654104
1L2-1	MCC 1LA2	24	20	6.136E-4	.2454300
1L2-6	MV-32086	28	0	.0039	0

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LA30 TRAY WID= 12 TRAY LEN= 36.5 TRY LOSS= .1384

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1K1-3	MV-32061	28	0	.0039	0
1K1-4	MV-32120	28	0	.0039	0
1K1-11	MV-32115	28	0	.0039	0
1K1-14	MV-32060	28	0	.0039	0
1K1-21	CHARG PP	23	134	3.902E-4	7.005533
1K1-26	MV-32322	28	0	.0039	0
1K1-33	MV-32266	28	0	.0039	0

TOT AMPS= 134 TOT W/FT= 7.005533 DELTA T= 50.61902

TRAY ID= 1AG-LB1 TRAY WID= 30 TRAY LEN= 7.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-1	CLG.FANS	28	3	.0039	.0351000
1HVB-9	CLG.FANS	28	3	.0039	.0351000
1HVB-13	CLG.FANS	28	8	.0039	.2496000
1HVB-74	CLG.FANS	28	2.5	.0039	.0243750
1HVB-86	CLG.FANS	28	2.5	.0039	.0243750
1HVB-90	CLG.FANS	28	2.5	.0039	.0243750
1KA2-7	MV-32121	28	0	.0039	0
1K2-1	MCC 1KA2	24	20	6.136E-4	.2454300
1K2-2	RHR SMP P	28	3.8	.0039	.0563160
1K2-4	MV-32085	28	0	.0039	0
1K2-9	MV-32159	28	0	.0039	0
1K2-20	MV-32267	28	0	.0039	0
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142
16404-1	RHR PUMP	7	25	.0015375	.9609375

TOT AMPS= 412.3 TOT W/FT= 9.065328 DELTA T= 29.77315

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LB2 TRAY WID= 30 TRAY LEN= 11 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-1	CLG.FANS	28	3	.0039	.0351000
1HVB-9	CLG.FANS	28	3	.0039	.0351000
1HVB-13	CLG.FANS	28	8	.0039	.2496000
1HVB-74	CLG.FANS	28	2.5	.0039	.0243750
1HVB-86	CLG.FANS	28	2.5	.0039	.0243750
1HVB-90	CLG.FANS	28	2.5	.0039	.0243750
1KA2-7	MV-32121	28	0	.0039	0
1K2-1	MCC 1KA2	24	20	6.136E-4	.2454300
1K2-4	MV-32085	28	0	.0039	0
1K2-2	RHR SMP P	28	3.8	.0039	.0563160
1K2-9	MV-32159	28	0	.0039	0
1K2-20	MV-32267	28	0	.0039	0
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142

TOT AMPS= 387.3 TOT W/FT= 8.104391 DELTA T= 26.61715

TRAY ID= 1AG-LB3 TRAY WID= 30 TRAY LEN= 8 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-17	CLG.FANS	28	2.5	.0039	.0243750
1KA2-7	MV-32121	28	0	.0039	0
1K2-1	MCC 1KA2	24	20	6.136E-4	.2454300
1K2-2	RHR SMP P	28	3.8	.0039	.0563160
1K2-4	MV-32085	28	0	.0039	0
1K2-5	MV-32084	28	0	.0039	0
1K2-9	MV-32159	28	0	.0039	0
1K2-18	PNL 135	24	15	6.136E-4	.1380544
1K2-20	MV-32267	28	0	.0039	0
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142

TOT AMPS= 383.3 TOT W/FT= 7.873895 DELTA T= 25.86014

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LB12 TRAY WID= 30 TRAY LEN= 9.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1KA2-4	MV-32102	28	0	.0039	0
1KA2-7	MV-32121	28	0	.0039	0
1KA2-8	MV-32201	28	0	.0039	0
1K2-1	MCC 1KA2	24	20	6.136E-4	.2454300

TOT AMPS= 20 TOT W/FT= .2454300 DELTA T= .8060628

TRAY ID= 1AG-LB14 TRAY WID= 18 TRAY LEN= 31 TRY LOSS= .19376

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-1	CLG.FANS	28	3	.0039	.0331000
1KA2-4	MV-32102	28	0	.0039	0
1KA2-8	MV-32201	28	0	.0039	0
1K2-9	MV-32159	28	0	.0039	0
1K2-20	MV-32267	28	0	.0039	0
1L2-4	BA XFR PP	28	18	.0039	1.263600
1L2-5	BA XFR PP	28	0	.0039	0
1L2-16	WST GAS C	27	30	.0024525	2.207250
16403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 83.2 TOT W/FT= 5.100091 DELTA T= 26.32169

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LB15 TRAY WID= 18 TRAY LEN= 54.5 TRY LOSS= .19376

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-1	CLG.FANS	28	3	.0039	.0351000
1KA2-4	MV-32102	28	0	.0039	0
1KA2-8	MV-32201	28	0	.0039	0
1K2-9	MV-32159	28	0	.0039	0
1L2-4	BA XFR PP	28	18	.0039	1.263600
1L2-5	BA XFR PP	28	0	.0039	0
1L2-16	WST GAS C	27	30	.0024525	2.207250
16403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 83.2 TOT W/FT= 5.100091 DELTA T= 26.32169

TRAY ID= 1AG-LB19 TRAY WID= 12 TRAY LEN= 31 TRY LOSS= .1384

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-1	CLG.FANS	28	3	.0039	.0351000
1L2-16	WST GAS C	27	30	.0024525	2.207250

TOT AMPS= 33 TOT W/FT= 2.242350 DELTA T= 16.20195

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LB23 TRAY WID= 30 TRAY LEN= 13.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1KA2-1	MV-32097	28	0	.0039	0
1KA2-2	MV-32099	28	0	.0039	0
1KA2-3	MV-32105	28	0	.0039	0
1KA2-5	MV-32076	28	0	.0039	0
1KA2-6	MV-32078	28	0	.0039	0
1KA2-9	MV-32203	28	0	.0039	0
1KA2-10	MV-32080	28	0	.0039	0
1KA2-11	MV-32082	28	0	.0039	0
1KA2-12	MV-32207	28	0	.0039	0
1KA2-13	MV-32163	28	0	.0039	0
1KA2-15	MV-32040	28	0	.0039	0

TOT AMPS= 0 TOT W/FT= 0 DELTA T= 0

TRAY ID= 1AG-LB24 TRAY WID= 30 TRAY LEN= 18.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-9	CLG.FANS	28	3	.0039	.0351000
1HVB-13	CLG.FANS	28	8	.0039	.2496000
1KA2-1	MV-32097	28	0	.0039	0
1KA2-2	MV-32099	28	0	.0039	0
1KA2-3	MV-32105	28	0	.0039	0
1KA2-5	MV-32076	28	0	.0039	0
1KA2-6	MV-32078	28	0	.0039	0
1KA2-9	MV-32203	28	0	.0039	0
1KA2-10	MV-32080	28	0	.0039	0
1KA2-11	MV-32082	28	0	.0039	0
1KA2-12	MV-32207	28	0	.0039	0
1KA2-13	MV-32163	28	0	.0039	0
1K2-2	RHR SMP P	28	3.8	.0039	.0563160
1K2-4	MV-32085	28	0	.0039	0
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 147.6 TOT W/FT= 8.130870 DELTA T= 26.70412

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AG-LB25 TRAY WID= 18 TRAY LEN= 17.5 TRY LOSS= .19376

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-13	CLG.FANS	29	8	.0039	.2496000
1KA2-5	MV-32076	29	0	.0039	0
1KA2-6	MV-32078	29	0	.0039	0
1KA2-9	MV-32203	29	0	.0039	0
1KA2-10	MV-32080	29	0	.0039	0
1KA2-11	MV-32082	29	0	.0039	0
1KA2-12	MV-32207	29	0	.0039	0
1KA2-13	MV-32163	29	0	.0039	0
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 108 TOT W/FT= 6.385350 DELTA T= 32.95494

TRAY ID= 1AG-LB26 TRAY WID= 12 TRAY LEN= 52 TRY LOSS= .1384

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1HVB-13	CLG.FANS	29	8	.0039	.2496000
1KA2-9	MV-32203	28	0	.0039	0
1KA2-10	MV-32080	28	0	.0039	0
1KA2-11	MV-32082	28	0	.0039	0
1KA2-12	MV-32207	28	0	.0039	0
1KA2-13	MV-32163	28	0	.0039	0
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 108 TOT W/FT= 6.385350 DELTA T= 46.13692

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB1 TRAY WID= 24 TRAY LEN= 71.5 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-3	SWGR 120	49	30	.001025	.9225000
1DCB-31	CONT. DC	44	15	.0026	.5850000
122-1	MCC 1A2	2	390	6.534E-5	9.938214
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16402-1	US 120	5	140	1.985E-4	3.890796
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 765 TOT W/FT= 25.68144 DELTA T= 103.0886

TRAY ID= 1AM-LB2 TRAY WID= 30 TRAY LEN= 17.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-3	SWGR 120	49	30	.001025	.9225000
1DCB-31	CONT. DC	44	15	.0026	.5850000
122-1	MCC 1A2	2	390	6.534E-5	9.938214
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16402-1	US 120	5	140	1.985E-4	3.890796
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1.	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 765 TOT W/FT= 25.68144 DELTA T= 84.34525

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB3 TRAY WID= 30 TRAY LEN= 10 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-3	SWGR 120	49	30	.001025	.9225000
1DCB-31	CONT. DC	44	15	.0026	.5850006
122-1	MCC 1A2	2	390	6.534E-5	9.938214
123-1	MCC 1K2	20	277	9.153E-5	7.023005
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16402-1	US 120	5	140	1.985E-4	3.890796
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 1042 TOT W/FT= 32.70445 DELTA T= 107.4108

TRAY ID= 1AM-LB4 TRAY WID= 30 TRAY LEN= 19.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-3	SWGR 120	49	30	.001025	.9225000
123-1	MCC 1K2	20	277	9.153E-5	7.023005
126-2	MCC 1M2	21	85	1.247E-4	.9012465
126-3	MCC 1MA	22	200	1.985E-4	7.940400
122-1	MCC 1A2	2	390	6.534E-5	9.938214
16402-1	US 120	5	140	1.985E-4	3.890796

TOT AMPS= 1122 TOT W/FT= 30.61616 DELTA T= 100.5523

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB5 TRAY WID= 30 TRAY LEN= 10 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-31	CONT. DC	44	15	.0026	.5850000
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142
126-2	MCC 1M2	21	85	1.247E-4	.9012465
126-3	MCC 1MA	22	200	1.985E-4	7.940400
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 832 TOT W/FT= 27.18130 DELTA T= 89.27121

TRAY ID= 1AM-LB6 TRAY WID= 30 TRAY LEN= 16 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-31	CONT. DC	44	15	.0026	.5850000
1HVB-74	CLG.FANS	28	2.5	.0039	.0243750
1M2-7	MV-32273	28	0	.0039	0
1M2-9	MV-32276	28	0	.0039	0
123-1	MCC 1K2	20	277	9.153E-5	7.023005
123-2	MCC 1T2	20	65	9.153E-5	.3867142
164001-1	CS PUMP	7	32.8	.0015375	1.654104
16403-1	CC PUMP	7	32.2	.0015375	1.594141
16404-1	RHR PUMP	7	25	.0015375	.9609375
16405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 549.5 TOT W/FT= 18.36403 DELTA T= 60.31275

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB14 TRAY WID= 24 TRAY LEN= 17 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
126-1	MCC 1L2	21	250	1.247E-4	7.796250
127-1	MCC 1X2	21	180	1.247E-4	4.041576
128-1	C RM CHLR	21	192	1.247E-4	4.598415

TOT AMPS= 622 TOT W/FT= 16.43624 DELTA T= 65.97721

TRAY ID= 1AM-LB15 TRAY WID= 24 TRAY LEN= 6.5 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
126-1	MCC 1L2	21	250	1.247E-4	7.796250
127-1	MCC 1X2	21	180	1.247E-4	4.041576
128-1	C RM CHLR	21	192	1.247E-4	4.598415

TOT AMPS= 622 TOT W/FT= 16.43624 DELTA T= 65.97721

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB16 TRAY WID= 24 TRAY LEN= 6.5 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1LA2-27	MV-32047	28	0	.0039	0
1L2-1	MCC 1LA2	24	20	6.136E-4	.2454300
1L2-6	MV-32086	28	0	.0039	0
126-1	MCC 1L2	21	250	1.247E-4	7.796250
127-1	MCC 1X2	21	180	1.247E-4	4.041576

TOT AMPS= 450 TOT W/FT= 12.08326 DELTA T= 48.50376

TRAY ID= 1AM-LB19 TRAY WID= 18 TRAY LEN= 6.5 TRY LOSS= .19376

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1LA2-1	MV-32065	28	0	.0039	0
1LA2-2	MV-32234	28	0	.0039	0
1LA2-3	MV-32072	28	0	.0039	0
1LA2-4	MV-32230	28	0	.0039	0
1LA2-9	MV-32068	28	0	.0039	0
1LA2-10	MV-32069	28	0	.0039	0
1LA2-11	MV-32231	28	0	.0039	0.
1LA2-12	MV-32196	28	0	.0039	0
1LA2-13	MV-32135	28	0	.0039	0
1LA2-14	MV-32141	28	0	.0039	0
1LA2-21	MV-32243	28	0	.0039	0

TOT AMPS= 0 TOT W/FT= 0 DELTA T= 0

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB21 TRAY WID= 24 TRAY LEN= 14 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1LA2-1	MV-32065	28	0	.0039	0
1LA2-2	MV-32234	28	0	.0039	0
1LA2-3	MV-32072	28	0	.0039	0
1LA2-4	MV-32230	28	0	.0039	0
1LA2-9	MV-32068	28	0	.0039	0
1LA2-10	MV-32069	28	0	.0039	0
1LA2-11	MV-32231	28	0	.0039	0
1LA2-12	MV-32196	28	0	.0039	0
1LA2-13	MV-32135	28	0	.0039	0
1LA2-14	MV-32141	28	0	.0039	0
1L2-14	MV-32074	28	0	.0039	0
1L2-20	MV-32199	28	0	.0039	0
1X2-1	FAN COIL	23	85	3.902E-4	2.818834
1X2-2	FAN COIL	23	85	3.902E-4	2.818834

TOT AMPS= 170 TOT W/FT= 5.637667 DELTA T= 22.63033

TRAY ID= 1AM-LB22 TRAY WID= 24 TRAY LEN= 34.5 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1LA2-1	MV-32065	28	0	.0039	0
1LA2-2	MV-32234	28	0	.0039	0
1LA2-3	MV-32072	28	0	.0039	0
1LA2-4	MV-32230	28	0	.0039	0
1LA2-9	MV-32068	28	0	.0039	0
1LA2-10	MV-32069	28	0	.0039	0
1LA2-11	MV-32231	28	0	.0039	0
1LA2-12	MV-32196	28	0	.0039	0
1LA2-13	MV-32135	28	0	.0039	0
1LA2-14	MV-32141	28	0	.0039	0
1L2-14	MV-32074	28	0	.0039	0
1L2-20	MV-32199	28	0	.0039	0
1X2-1	FAN COIL	23	85	3.902E-4	2.818834
1X2-2	FAN COIL	23	85	3.902E-4	2.818834

TOT AMPS= 170 TOT W/FT= 5.637667 DELTA T= 22.63033

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 1AM-LB23 TRAY WID= 9 TRAY LEN= 54.5 TRY LOSS= .11072

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-2	DSL GEN	49	30	.001025	.9225000
25406-1	DSL FEED	1	479	5.184E-5	11.89422

TOT AMPS= 509 TOT W/FT= 12.81672 DELTA T= 115.7580

TRAY ID= 1AM-LB27 TRAY WID= 18 TRAY LEN= 62 TRY LOSS= .19376

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
1DCB-2	DSL GEN	49	30	.001025	.9225000
123-2	MCC 1T2	20	65	9.153E-5	.3867142
25406-1	DSL FEED	1	479	5.184E-5	11.89422

TOT AMPS= 574 TOT W/FT= 13.20344 DELTA T= 68.14325

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB2 TRAY WID= 24 TRAY LEN= 12 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2KA2-3	MV-32212	28	0	.0039	0
2K2-7	MV-32161	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 36.2 TOT W/FT= 1.635741 DELTA T= 6.566079

TRAY ID= 2AG-LB5 TRAY WID= 30 TRAY LEN= 38 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2KA2-3	MV-32212	28	0	.0039	0
2K2-1	MV-32117	28	0	.0039	0
2K2-2	MV-32117	28	0	.0039	0
2K2-4	CHARG PP	221	152	3.902E-4	9.014026
2K2-6	MV-32334	28	0	.0039	0
2K2-7	MV-32161	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25404-1	RHR PUMP	7	25	.0015375	.9609375
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 351.5 TOT W/FT= 19.46003 DELTA T= 63.91235

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB8 TRAY WID= 24 TRAY LEN= 9 TRY LOSS= .24911

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2KA2-3	MV-32212	28	0	.0039	0
2K2-2	MV-32117	28	0	.0039	0
2K2-4	CHARG PP	221	152	3.902E-4	9.014026
2K2-7	MV-32161	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 193.7 TOT W/FT= 10.70924 DELTA T= 42.98829

TRAY ID= 2AG-LB9 TRAY WID= 30 TRAY LEN= 5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2KA2-3	MV-32212	28	0	.0039	0
2K2-1	MV-32117	28	0	.0039	0
2K2-2	MV-32117	28	0	.0039	0
2K2-4	CHARG PP	221	152	3.902E-4	9.014026
2K2-6	MV-32334	28	0	.0039	0
2K2-7	MV-32161	28	0	.0039	0
2K2-9	RHR SMP P	28	0	.0039	0
2K2-11	MV-32268	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 326.5 TOT W/FT= 18.49910 DELTA T= 60.75636

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB10 TRAY WID= 30 TRAY LEN= 5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2KA2-3	MV-32212	28	0	.0039	0
2K2-2	MV-32117	28	0	.0039	0
2K2-7	MV-32161	28	0	.0039	0
2K2-8	MCC 2KA2	24	20	6.136E-4	.2454300
2K2-9	RHR SMP P	28	0	.0039	0
2K2-10	MV-32188	28	0	.0039	0
2K2-11	MV-32268	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 194.5 TOT W/FT= 9.730500 DELTA T= 31.95777

TRAY ID= 2AG-LB11 TRAY WID= 30 TRAY LEN= 10 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2KA2-3	MV-32212	28	0	.0039	0
2K2-8	MCC 2KA2	24	20	6.136E-4	.2454300
2K2-9	RHR SMP P	28	0	.0039	0
2K2-10	MV-32188	28	0	.0039	0
2K2-11	MV-32268	28	0	.0039	0
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 194.5 TOT W/FT= 9.730500 DELTA T= 31.95777

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB12 TRAY WID= 30 TRAY LEN= 14 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2HVB-18	CLG.FANS	28	3	.0039	.0351000
2HVB-33	CLG.FANS	28	2.5	.0039	.0243750
2HVB-39	CLG.FANS	28	8	.0039	.2496000
2KA2-3	MV-32212	28	0	.0039	0
2K2-8	MCC 2KA2	24	20	6.136E-4	.2454300
2K2-9	RHR SMP P	28	0	.0039	0
2K2-10	MV-32188	28	0	.0039	0
2K2-11	MV-32268	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 194.3 TOT W/FT= 9.997959 DELTA T= 32.83618

TRAY ID= 2AG-LB13 TRAY WID= 30 TRAY LEN= 11 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2KA2-3	MV-32212	28	0	.0039	0
2KA2-8	MV-32116	28	0	.0039	0
2KA2-9	MV-32109	28	0	.0039	0
2KA2-10	MV-32111	28	0	.0039	0
2KA2-13	MV-32185	28	0	.0039	0
2KA2-14	MV-32183	28	0	.0039	0
2KA2-15	MV-32191	28	0	.0039	0
2KA2-16	MV-32204	28	0	.0039	0
2KA2-17	MV-32181	28	0	.0039	0
2KA2-18	MV-32209	28	0	.0039	0
2KA2-20	MV-32205	28	0	.0039	0
2K2-8	MCC 2KA2	24	20	6.136E-4	.2454300
2K2-11	MV-32268	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39

TOT AMPS= 48 TOT W/FT= 1.899030 DELTA T= 6.236961

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB17 TRAY WID= 30 TRAY LEN= 30 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2HVB-10	CLG.FANS	28	3	.0039	.0351000
2HVB-39	CLG.FANS	28	8	.0039	.2496000
2KA2-8	MV-32116	28	0	.0039	0
2KA2-9	MV-32109	28	0	.0039	0
2KA2-10	MV-32111	28	0	.0039	0
2KA2-13	MV-32185	28	0	.0039	0
2KA2-14	MV-32183	28	0	.0039	0
2KA2-15	MV-32191	28	0	.0039	0
2KA2-16	MV-32204	28	0	.0039	0
2KA2-17	MV-32181	28	0	.0039	0
2KA2-18	MV-32209	28	0	.0039	0
2KA2-20	MV-32205	28	0	.0039	0
2K2-9	RHR SMP P	28	0	.0039	0
2K2-10	MV-32188	28	0	.0039	0
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 143.8 TOT W/FT= 8.074554 DELTA T= 26.51916

TRAY ID= 2AG-LB18 TRAY WID= 30 TRAY LEN= 11 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2HVB-10	CLG.FANS	28	3	.0039	.0351000
2HVB-39	CLG.FANS	28	8	.0039	.2496000
2KA2-8	MV-32116	28	0	.0039	0
2KA2-9	MV-32109	28	0	.0039	0
2KA2-10	MV-32111	28	0	.0039	0
2KA2-13	MV-32185	28	0	.0039	0
2KA2-14	MV-32183	28	0	.0039	0
2KA2-15	MV-32191	28	0	.0039	0
2KA2-16	MV-32204	28	0	.0039	0
2KA2-17	MV-32181	28	0	.0039	0
2KA2-18	MV-32209	28	0	.0039	0
2KA2-20	MV-32205	28	0	.0039	0
25405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 111 TOT W/FT= 6.420450 DELTA T= 21.08661

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AG-LB19 TRAY WID= 12 TRAY LEN= 44 TRY LOSS= .1384

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2HVB-10	CLG.FANS	28	3	.0039	.0351000
2HVB-39	CLG.FANS	28	8	.0039	.2496000
2KA2-13	MV-32185	28	0	.0039	0
2KA2-14	MV-32183	28	0	.0039	0
2KA2-15	MV-32191	28	0	.0039	0
2KA2-18	MV-32209	28	0	.0039	0
2S405-1	SI PUMP	6	100	6.136E-4	6.13575

TOT AMPS= 111 TOT W/FT= 6.420450 DELTA T= 46.39053

TRAY ID= 2AG-LB29 TRAY WID= 12 TRAY LEN= 48 TRY LOSS= .1384

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2HVB-2	CLG.FANS	28	2.5	.0039	.0243750
2K2-1	MV-32117	28	0	.0039	0
2S404-1	RHR PUMP	7	25	.0015375	.9609375

TOT AMPS= 27.5 TOT W/FT= .9853125 DELTA T= 7.119310

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB1 TRAY WID= 24 TRAY LEN= 55 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-16	US 220 DC	49	30	.001025	.9225000
222-1	MCC 2A2	20	200	9.153E-5	3.661200
25402-1	US 220	5	140	1.985E-4	3.890796
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25404-1	RHR PUMP	7	25	.0015375	.9609375
25405-1	SI PUMP	6	100	6.136E-4	6.13575
25409-1	CS PUMP	7	32.8	.0015375	1.654104

TOT AMPS= 590 TOT W/FT= 19.98943 DELTA T= 80.24016

TRAY ID= 2AM-LB2 TRAY WID= 30 TRAY LEN= 16 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-16	US 220 DC	49	30	.001025	.9225000
222-1	MCC 2A2	20	200	9.153E-5	3.661200
25402-1	US 220	5	140	1.985E-4	3.890796
25403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 432.2 TOT W/FT= 11.23864 DELTA T= 36.91092

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB3 TRAY WID= 30 TRAY LEN= 11 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-16	US 220 DC	49	30	.001025	.9225000
222-1	MCC 2A2	20	200	9.153E-5	3.661200
25402-1	US 220	5	140	1.985E-4	3.890796
25403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 432.2 TOT W/FT= 11.23864 DELTA T= 36.91092

TRAY ID= 2AM-LB4 TRAY WID= 30 TRAY LEN= 20 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-16	US 220 DC	49	30	.001025	.9225000
222-1	MCC 2A2	20	200	9.153E-5	3.661200
223-1	MCC 2K2	20	246	9.153E-5	5.539029
226-1	MCC-2M2	21	50	1.247E-4	.3118500
25402-1	US 220	5	140	1.985E-4	3.890796

TOT AMPS= 666 TOT W/FT= 14.32538 DELTA T= 47.04866

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB5 TRAY WID= 30 TRAY LEN= 11 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
223-1	MCC 2K2	20	246	9.153E-5	5.539029
226-1	MCC-2M2	21	50	1.247E-4	.3118500
2540J-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 358.2 TOT W/FT= 8.615021 DELTA T= 28.29421

TRAY ID= 2AM-LB6 TRAY WID= 30 TRAY LEN= 16.5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2HVB-23	CLG.FANS	28	2.5	.0039	.0243750
2L2-5	MV-32189	28	0	.0039	0
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
223-1	MCC 2K2	20	246	9.153E-5	5.539029
2540J-1	CC PUMP	7	32.2	.0015375	1.594141
2LA2-16	MV-32249	28	0	.0039	0

TOT AMPS= 310.7 TOT W/FT= 8.327546 DELTA T= 27.35006

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB7 TRAY WID= 30 TRAY LEN= 16 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2HVB-23	CLG.FANS	28	2.5	.0039	.0243750
2KA2-23	MV-32029	28	0	.0039	0
2KA2-25	MV-32051	28	0	.0039	0
2KA2-26	MV-32059	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39
223-1	MCC 2K2	20	246	9.153E-5	5.539029
25403-1	CC PUMP	7	32.2	.0015375	1.594141
25404-1	RHR PUMP	7	25	.0015375	.9609375

TOT AMPS= 337.7 TOT W/FT= 9.813683 DELTA T= 32.23096

TRAY ID= 2AM-LB8 TRAY WID= 30 TRAY LEN= 21 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2KA2-23	MV-32029	28	0	.0039	0
2KA2-25	MV-32051	28	0	.0039	0
2KA2-26	MV-32059	28	0	.0039	0
2LA2-16	MV-32249	28	0	.0039	0
2L2-5	MV-32189	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0

TOT AMPS= 62 TOT W/FT= 2.865200 DELTA T= 9.410142

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB9 TRAY WID= 24 TRAY LEN= 6 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2L2-1	MV-32374	28	0	.0039	0
2L2-14	MV-32387	28	0	.0039	0
2L2-29	MV-32177	28	0	.0039	0
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
2X2-1	FAN COIL	23	85	3.902E-4	2.818834
2X2-4	FAN COIL	23	85	3.902E-4	2.818834
2X2-7	FAN COIL	221	0	3.902E-4	0
2X2-8	FAN COIL	221	0	3.902E-4	0

TOT AMPS= 204 TOT W/FT= 6.849267 DELTA T= 27.49385

TRAY ID= 2AM-LB10 TRAY WID= 24 TRAY LEN= 25 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2L2-1	MV-32374	28	0	.0039	0
2L2-14	MV-32387	28	0	.0039	0
2LA2-31	MV-32168	28	0	.0039	0
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
2X2-1	FAN COIL	23	85	3.902E-4	2.818834
2X2-4	FAN COIL	23	85	3.902E-4	2.818834
2X2-7	FAN COIL	221	0	3.902E-4	0
2X2-8	FAN COIL	221	0	3.902E-4	0

TOT AMPS= 204 TOT W/FT= 6.849267 DELTA T= 27.49385

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-LB20 TRAY WID= 30 TRAY LEN= 5 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2KA2-23	MV-32029	28	0	.0039	0
2KA2-25	MV-32051	28	0	.0039	0
2KA2-26	MV-32059	28	0	.0039	0
2LA2-16	MV-32249	28	0	.0039	0
2L2-5	MV-32189	28	0	.0039	0
2L2-6	BA XFR PP	28	18	.0039	1.263600
2L2-7	BA XFR PP	28	0	.0039	0
2L2-8	BA TK HTR	28	10	.0039	.39
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
2X2-1	FAN COIL	23	85	3.902E-4	2.818834
2X2-7	FAN COIL	221	0	3.902E-4	0

TOT AMPS= 147 TOT W/FT= 5.684034 DELTA T= 18.66800

TRAY ID= 2AM-LB21 TRAY WID= 30 TRAY LEN= 4 TRY LOSS= .30448

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-34	2-SOV'S	44	4	.0026	.0416000
2L2-1	MV-32374	28	0	.0039	0
2L2-2	MV-32126	28	0	.0039	0
2L2-3	MV-32127	28	0	.0039	0
2L2-29	MV-32177	28	0	.0039	0
2M2-10	HYD CONT	28	0	.0039	0
2M2-12	MV-32295	28	0	.0039	0
2X2-1	FAN COIL	23	85	3.902E-4	2.818834
2X2-4	FAN COIL	23	85	3.902E-4	2.818834
2X2-7	FAN COIL	221	0	3.902E-4	0
2X2-8	FAN COIL	221	0	3.902E-4	0

TOT AMPS= 204 TOT W/FT= 6.849267 DELTA T= 22.49497

TABLE 5

DETAILED TABULATION FOR POWER TRAYS WRAPPED WITH KAOWOOL

TRAY ID= 2AM-30 TRAY WID= 24 TRAY LEN= 24 TRY LOSS= .24912

CABLE ID	SERVICE	TYPE	AMP	OHMS/FT	W/FT
2DCB-7	PNL 261	44	15	.0026	.5850000
2DCB-12	CONT DC	44	15	.0026	.5850000
2DCB-16	US 220 DC	49	30	.001025	.9225000
222-1	MCC 2A2	20	200	9.153E-5	3.661200
25402-1	US 220	5	140	1.985E-4	3.890796
25403-1	CC PUMP	7	32.2	.0015375	1.594141

TOT AMPS= 432.2 TOT W/FT= 11.23864 DELTA T= 45.11335

TABLE 6A

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR B & W KAOWOOL

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	51	ERROR
1AG-LB1	30	7.5	9	31	30	0.64
1AG-LB2	30	11	8	28	27	0.68
1AG-LB3	30	8	8	27	26	0.69
1AG-LB4	30	7	22	75	72	ERROR
1AG-LB6	24	12	7	24	28	0.66
1AG-LB7	9	42	7	24	63	ERROR
1AG-LB8	9	9.5	1	3	9	0.91
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	18	0.81
1AG-LB12	30	9.5	0	1	1	0.99
1AG-LB14	18	31	5	17	26	0.69
1AG-LB15	18	54.5	5	17	26	0.69
1AG-LB19	12	31	2	8	16	0.82
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	27	0.68
1AG-LB25	18	17.5	6	22	33	0.58
1AG-LB26	12	52	6	22	46	0.28
1AM-LB1	24	71.5	26	88	103	ERROR
1AM-LB2	30	17.5	26	88	84	ERROR
1AM-LB3	30	10	33	112	107	ERROR
1AM-LB4	30	19.5	31	104	101	ERROR
1AM-LB5	30	10	27	93	89	ERROR
1AM-LB6	30	16	18	63	60	ERROR
1AM-LB14	24	17	16	56	66	ERROR
1AM-LB15	24	6.5	16	56	66	ERROR
1AM-LB16	24	6.5	12	41	49	0.17
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	23	0.74
1AM-LB22	24	34.5	6	19	23	0.74
1AM-LB23	9	54.5	13	44	116	ERROR
1AM-LB27	18	62	13	45	68	ERROR

TRAY DERATING MULTIPLIERS NOTED WITH "ERROR" INDICATE TRAYS WHERE PREDICTED TEMPERATURES ARE HIGHER THAN 90 C.

TABLE 6A

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR B & W KAOWOOL

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	7	0.93
2AG-LB5	30	38	19	66	64	ERROR
2AG-LB8	24	9	11	37	43	0.37
2AG-LB9	30	5	18	63	61	ERROR
2AG-LB10	30	5	10	33	32	0.60
2AG-LB11	30	10	10	33	32	0.60
2AG-LB12	30	14	10	34	33	0.59
2AG-LB13	30	11	2	6	6	0.94
2AG-LB17	30	30	8	28	27	0.69
2AG-LB18	30	11	6	22	21	0.76
2AG-LB19	12	44	6	22	46	0.27
2AG-LB29	12	48	1	3	7	0.93
2AM-LB1	24	55	20	68	80	ERROR
2AM-LB2	30	16	11	38	37	0.51
2AM-LB3	30	11	11	38	37	0.51
2AM-LB4	30	20	14	49	47	0.24
2AM-LB5	30	11	9	29	28	0.66
2AM-LB6	30	16.5	8	28	27	0.67
2AM-LB7	30	16	10	33	32	0.60
2AM-LB8	30	21	3	10	9	0.90
2AM-LB9	24	6	7	23	27	0.67
2AM-LB10	24	25	7	23	27	0.67
2AM-LB20	30	5	6	19	19	0.79
2AM-LB21	30	4	7	23	22	0.74
2AM-LB30	24	24	11	38	45	0.31

TRAY DERATING MULTIPLIERS NOTED WITH "ERROR" INDICATE TRAYS WHERE PREDICTED TEMPERATURES ARE HIGHER THAN 90 C.

TABLE 6B

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR TSI THERMO-LAG

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	10	0.89
1AG-LB1	30	7.5	9	31	6	0.94
1AG-LB2	30	11	8	28	5	0.94
1AG-LB3	30	8	8	27	5	0.95
1AG-LB4	30	7	22	75	15	0.84
1AG-LB6	24	12	7	24	6	0.94
1AG-LB7	9	42	7	24	13	0.86
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	4	0.96
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	5	0.94
1AG-LB15	18	54.5	5	17	5	0.94
1AG-LB19	12	31	2	8	3	0.97
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	5	0.94
1AG-LB25	18	17.5	6	22	7	0.93
1AG-LB26	12	52	6	22	9	0.90
1AM-LB1	24	71.5	26	88	21	0.76
1AM-LB2	30	17.5	26	88	17	0.81
1AM-LB3	30	10	33	112	22	0.75
1AM-LB4	30	19.5	31	104	21	0.77
1AM-LB5	30	10	27	93	18	0.80
1AM-LB6	30	16	18	63	12	0.87
1AM-LB14	24	17	16	56	13	0.85
1AM-LB15	24	6.5	16	56	13	0.85
1AM-LB16	24	6.5	12	41	10	0.90
1AM-LB19	12	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	5	0.95
1AM-LB22	24	34.5	6	19	5	0.95
1AM-LB23	9	54.5	13	44	24	0.73
1AM-LB27	18	62	13	45	14	0.85

TABLE 6B

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR TSI THERMO-LAG

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	1	0.99
2AG-LB5	30	38	19	66	13	0.86
2AG-LB8	24	9	11	37	9	0.91
2AG-LB9	30	5	18	63	12	0.87
2AG-LB10	30	5	10	33	7	0.93
2AG-LB11	30	10	10	33	7	0.93
2AG-LB12	30	14	10	34	7	0.93
2AG-LB13	30	11	2	6	1	0.99
2AG-LB17	30	30	8	28	5	0.94
2AG-LB18	30	11	6	22	4	0.96
2AG-LB19	12	44	6	22	9	0.90
2AG-LB29	12	48	1	3	1	0.99
2AM-LB1	24	55	20	68	16	0.82
2AM-LB2	30	16	11	38	8	0.92
2AM-LB3	30	11	11	38	8	0.92
2AM-LB4	30	20	14	49	10	0.90
2AM-LB5	30	11	9	29	6	0.94
2AM-LB6	30	16.5	8	28	6	0.94
2AM-LB7	30	16	10	33	7	0.93
2AM-LB8	30	21	3	10	2	0.98
2AM-LB9	24	6	7	23	6	0.94
2AM-LB10	24	25	7	23	6	0.94
2AM-LB20	30	5	6	19	4	0.96
2AM-LB21	30	4	7	23	5	0.95
2AM-LB30	24	24	11	38	9	0.90

TABLE 6C

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR THREE HOUR TSI THERMO-LAG

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	13	0.87
1AG-LB1	30	7.5	9	31	7	0.92
1AG-LB2	30	11	8	28	7	0.93
1AG-LB3	30	8	8	27	6	0.93
1AG-LB4	30	7	22	75	18	0.80
1AG-LB6	24	12	7	24	7	0.93
1AG-LB7	9	42	7	24	16	0.83
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	4	0.96
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	7	0.93
1AG-LB15	18	54.5	5	17	7	0.93
1AG-LB19	12	31	2	8	4	0.96
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	7	0.93
1AG-LB25	18	17.5	6	22	8	0.91
1AG-LB26	12	52	6	22	11	0.88
1AM-LB1	24	71.5	26	88	26	0.70
1AM-LB2	30	17.5	26	88	21	0.76
1AM-LB3	30	10	33	112	27	0.68
1AM-LB4	30	19.5	31	104	25	0.71
1AM-LB5	30	10	27	93	22	0.75
1AM-LB6	30	16	18	63	15	0.84
1AM-LB14	24	17	16	56	16	0.82
1AM-LB15	24	6.5	16	56	16	0.82
1AM-LB16	24	6.5	12	41	12	0.87
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	6	0.94
1AM-LB22	24	34.5	6	19	6	0.94
1AM-LB23	9	54.5	13	44	29	0.65
1AM-LB27	18	62	13	45	17	0.81

TABLE 6C

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR THREE HOUR TSI THERMO-LAG

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	2	0.98
2AG-LB5	30	38	19	66	16	0.83
2AG-LB8	24	9	11	37	11	0.89
2AG-LB9	30	5	18	63	15	0.84
2AG-LB10	30	5	10	33	8	0.92
2AG-LB11	30	10	10	33	8	0.92
2AG-LB12	30	14	10	34	8	0.91
2AG-LB13	30	11	2	6	2	0.98
2AG-LB17	30	30	8	28	7	0.93
2AG-LB18	30	11	6	23	5	0.95
2AG-LB19	12	44	6	22	12	0.88
2AG-LB29	12	48	1	3	2	0.98
2AM-LB1	24	55	20	68	20	0.78
2AM-LB2	30	16	11	38	9	0.90
2AM-LB3	30	11	11	38	9	0.90
2AM-LB4	30	20	14	49	12	0.88
2AM-LB5	30	11	9	29	7	0.93
2AM-LB6	30	16.5	8	28	7	0.93
2AM-LB7	30	16	10	33	8	0.92
2AM-LB8	30	21	3	10	2	0.98
2AM-LB9	24	6	7	23	7	0.93
2AM-LB10	24	25	7	23	7	0.93
2AM-LB20	30	5	6	19	5	0.95
2AM-LB21	30	4	7	23	6	0.94
2AM-LB30	24	24	11	38	11	0.88

TABLE 6D

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR 3M M20A

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	12	0.88
1AG-LB1	30	7.5	9	31	7	0.93
1AG-LB2	30	11	8	28	6	0.94
1AG-LB3	30	8	8	27	6	0.94
1AG-LB4	30	7	22	75	16	0.82
1AG-LB6	24	12	7	24	6	0.93
1AG-LB7	9	42	7	24	14	0.84
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	4	0.96
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	6	0.94
1AG-LB15	18	54.5	5	17	6	0.94
1AG-LB19	12	31	2	8	4	0.96
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	6	0.94
1AG-LB25	18	17.5	6	22	8	0.92
1AG-LB26	12	52	6	22	11	0.89
1AM-LB1	24	71.5	26	88	23	0.73
1AM-LB2	30	17.5	26	88	19	0.78
1AM-LB3	30	10	33	112	24	0.71
1AM-LB4	30	19.5	31	104	23	0.74
1AM-LB5	30	10	27	93	20	0.77
1AM-LB6	30	16	18	63	14	0.85
1AM-LB14	24	17	16	56	15	0.84
1AM-LB15	24	6.5	16	56	15	0.84
1AM-LB16	24	6.5	12	41	11	0.88
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	5	0.95
1AM-LB22	24	34.5	6	19	5	0.95
1AM-LB23	9	54.5	13	44	26	0.69
1AM-LB27	18	62	13	45	16	0.83

TABLE 6D

SUMMARY OF POWER TRAY TEMPERATURE RISES FOR ONE HOUR 3M M20A

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	HEAT GENERATED PER LIN FOOT (BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	1	0.98
2AG-LB5	30	38	19	66	15	0.84
2AG-LB8	24	9	11	37	10	0.90
2AG-LB9	30	5	18	63	14	0.85
2AG-LB10	30	5	10	33	7	0.92
2AG-LB11	30	10	10	33	7	0.92
2AG-LB12	30	14	10	34	7	0.92
2AG-LB13	30	11	2	6	1	0.99
2AG-LB17	30	30	8	28	6	0.94
2AG-LB18	30	11	6	22	5	0.95
2AG-LB19	12	44	6	22	11	0.89
2AG-LB29	12	48	1	3	2	0.98
2AM-LB1	24	55	20	68	18	0.80
2AM-LB2	30	16	11	38	8	0.91
2AM-LB3	30	11	11	38	8	0.91
2AM-LB4	30	20	14	49	11	0.89
2AM-LB5	30	11	9	29	6	0.93
2AM-LB6	30	16.5	8	28	6	0.94
2AM-LB7	30	16	10	33	7	0.92
2AM-LB8	30	21	3	10	2	0.98
2AM-LB9	24	6	7	23	6	0.94
2AM-LB10	24	25	7	23	6	0.94
2AM-LB20	30	5	6	19	4	0.96
2AM-LB21	30	4	7	23	5	0.95
2AM-LB30	24	24	11	38	10	0.89

TABLE 6E

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR THREE HOUR 3M M20R

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	12	0.88
1AG-LB1	30	7.5	9	31	7	0.93
1AG-LB2	30	11	8	28	6	0.94
1AG-LB3	30	8	8	27	6	0.94
1AG-LB4	30	7	22	75	17	0.82
1AG-LB6	24	12	7	24	7	0.93
1AG-LB7	9	42	7	24	15	0.84
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	4	0.96
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	6	0.94
1AG-LB15	18	54.5	5	17	6	0.94
1AG-LB19	12	31	2	8	4	0.96
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	6	0.94
1AG-LB25	18	17.5	6	22	8	0.92
1AG-LB26	12	52	6	22	11	0.89
1AM-LB1	24	71.5	26	88	24	0.72
1AM-LB2	30	17.5	26	88	19	0.78
1AM-LB3	30	10	33	112	25	0.71
1AM-LB4	30	19.5	31	104	23	0.73
1AM-LB5	30	10	27	93	21	0.77
1AM-LB6	30	16	18	63	14	0.85
1AM-LB14	24	17	16	56	15	0.83
1AM-LB15	24	6.5	16	56	15	0.83
1AM-LB16	24	6.5	12	41	11	0.88
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	5	0.95
1AM-LB22	24	34.5	6	19	5	0.95
1AM-LB23	9	54.5	13	44	27	0.68
1AM-LB27	18	62	13	45	16	0.83

TABLE 6E

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR THREE HOUR 3M M20R

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	12	0.88
1AG-LB1	30	7.5	9	31	7	0.93
1AG-LB2	30	11	8	28	6	0.94
1AG-LB3	30	8	8	27	6	0.94
1AG-LB4	30	7	22	75	17	0.82
1AG-LB6	24	12	7	24	7	0.93
1AG-LB7	9	42	7	24	15	0.84
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	4	0.96
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	6	0.94
1AG-LB15	18	54.5	5	17	6	0.94
1AG-LB19	12	31	2	8	4	0.96
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	6	0.94
1AG-LB25	18	17.5	6	22	8	0.92
1AG-LB26	12	52	6	22	11	0.89
1AM-LB1	24	71.5	26	88	24	0.72
1AM-LB2	30	17.5	26	88	19	0.78
1AM-LB3	30	10	33	112	25	0.71
1AM-LB4	30	19.5	31	104	23	0.73
1AM-LB5	30	10	27	93	21	0.77
1AM-LB6	30	16	18	63	14	0.85
1AM-LB14	24	17	16	56	15	0.83
1AM-LB15	24	6.5	16	56	15	0.83
1AM-LB16	24	6.5	12	41	11	0.88
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	5	0.95
1AM-LB22	24	34.5	6	19	5	0.95
1AM-LB23	9	54.5	13	44	27	0.68
1AM-LB27	18	62	13	45	16	0.83

TABLE 6E

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR THREE HOUR 3M M20R

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	2	0.98
2AG-LB5	30	38	19	66	15	0.84
2AG-LB8	24	9	11	37	10	0.90
2AG-LB9	30	5	18	63	14	0.85
2AG-LB10	30	5	10	33	7	0.92
2AG-LB11	30	10	10	33	7	0.92
2AG-LB12	30	14	10	34	8	0.92
2AG-LB13	30	11	2	6	1	0.99
2AG-LB17	30	30	8	28	6	0.94
2AG-LB18	30	11	6	22	5	0.95
2AG-LB19	12	44	6	22	11	0.89
2AG-LB29	12	48	1	3	2	0.98
2AM-LB1	24	55	20	68	19	0.79
2AM-LB2	30	16	11	38	9	0.91
2AM-LB3	30	11	11	38	9	0.91
2AM-LB4	30	20	14	49	11	0.88
2AM-LB5	30	11	9	29	7	0.93
2AM-LB6	30	16.5	8	28	6	0.93
2AM-LB7	30	16	10	33	7	0.92
2AM-LB8	30	21	3	10	2	0.98
2AM-LB9	24	6	7	23	6	0.93
2AM-LB10	24	25	7	23	6	0.93
2AM-LB20	30	5	6	19	4	0.96
2AM-LB21	30	4	7	23	5	0.95
2AM-LB30	24	24	11	38	10	0.89

TABLE 6F

SUMMARY OF POWER TRAY TEMPERATURE RISES
FOR ONE HOUR 3M M20R

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
1AG-LA30	12	36.5	7	24	10	0.90
1AG-LB1	30	7.5	9	31	6	0.94
1AG-LB2	30	11	8	28	5	0.95
1AG-LB3	30	8	8	27	5	0.95
1AG-LB4	30	7	22	75	14	0.85
1AG-LB6	24	12	7	24	6	0.94
1AG-LB7	9	42	7	24	12	0.87
1AG-LB8	9	9.5	1	3	2	0.98
1AG-LB10	9	17	0	0	0	1.00
1AG-LB11	30	14.5	5	18	3	0.97
1AG-LB12	30	9.5	0	1	0	1.00
1AG-LB14	18	31	5	17	5	0.95
1AG-LB15	18	54.5	5	17	5	0.95
1AG-LB19	12	31	2	8	3	0.97
1AG-LB23	30	13.5	0	0	0	1.00
1AG-LB24	30	18.5	8	28	5	0.95
1AG-LB25	18	17.5	6	22	6	0.93
1AG-LB26	12	52	6	22	9	0.91
1AM-LB1	24	71.5	26	88	20	0.77
1AM-LB2	30	17.5	26	88	16	0.82
1AM-LB3	30	10	33	112	21	0.76
1AM-LB4	30	19.5	31	104	20	0.78
1AM-LB5	30	10	27	93	17	0.81
1AM-LB6	30	16	18	63	12	0.87
1AM-LB14	24	17	16	56	13	0.86
1AM-LB15	24	6.5	16	56	13	0.86
1AM-LB16	24	6.5	12	41	9	0.90
1AM-LB19	18	6.5	0	0	0	1.00
1AM-LB21	24	14	6	19	4	0.95
1AM-LB22	24	34.5	6	19	4	0.95
1AM-LB23	9	54.5	13	44	23	0.74
1AM-LB27	18	62	13	45	13	0.86

TABLE 6F

SUMMARY OF POWER TRAY TEMPERATURE RISES FOR ONE HOUR 3M M20R

TRAY ID#	WIDTH (IN)	LENGTH (FT)	HEAT GENERATED PER LIN FOOT (WATT)	(BTU/H)	DELTA T (DEG C)	TRAY DERATING MULTIPLIER
2AG-LB2	24	12	2	6	1	0.99
2AG-LB5	30	38	19	66	13	0.87
2AG-LB8	24	9	11	37	8	0.91
2AG-LB9	30	5	18	63	12	0.87
2AG-LB10	30	5	10	33	6	0.94
2AG-LB11	30	10	10	33	6	0.94
2AG-LB12	30	14	10	34	6	0.93
2AG-LB13	30	11	2	6	1	0.99
2AG-LB17	30	30	8	28	5	0.95
2AG-LB18	30	11	6	22	4	0.96
2AG-LB19	12	44	6	22	9	0.90
2AG-LB29	12	48	1	3	1	0.99
2AM-LB1	24	55	20	68	16	0.83
2AM-LB2	30	16	11	38	7	0.92
2AM-LB3	30	11	11	38	7	0.92
2AM-LB4	30	20	14	49	9	0.90
2AM-LB5	30	11	9	29	6	0.94
2AM-LB6	30	16.5	8	28	5	0.94
2AM-LB7	30	16	10	33	6	0.93
2AM-LB8	30	21	3	10	2	0.98
2AM-LB9	24	6	7	23	5	0.94
2AM-LB10	24	25	7	23	5	0.94
2AM-LB20	30	5	6	19	4	0.96
2AM-LB21	30	4	7	23	4	0.95
2AM-LB30	24	24	11	38	9	0.91

TABLE 7

AMPACITY DERATING SCHEDULE
PER IPCEA P-46-426 (1975)

Ta AMBIENT TEMP	Tc CONDUCTOR TEMP	I'/I DERATING FACTOR
40	90	1.00
41	90	0.99
42	90	0.98
43	90	0.97
44	90	0.96
45	90	0.95
46	90	0.94
47	90	0.93
48	90	0.92
49	90	0.91
50	90	0.89
51	90	0.88
52	90	0.87
53	90	0.86
54	90	0.85
55	90	0.84
56	90	0.82
57	90	0.81
58	90	0.80
59	90	0.79
60	90	0.77
61	90	0.76
62	90	0.75
63	90	0.73
64	90	0.72
65	90	0.71
66	90	0.69
67	90	0.68
68	90	0.66
69	90	0.65
70	90	0.63
71	90	0.62
72	90	0.60
73	90	0.58
74	90	0.57
75	90	0.55
76	90	0.53
77	90	0.51
78	90	0.49
79	90	0.47
80	90	0.45
81	90	0.42
82	[illegible]	0.40
83	[illegible]	0.37
84	[illegible]	0.35
85	[illegible]	0.32
86	[illegible]	0.28
87	[illegible]	0.24
88	[illegible]	0.20
89	90	0.14
90	90	0.00

TABLE 7

AMPACITY DERATING SCHEDULE
PER IPCEA P-46-426 (1975)

Ta AMBIENT TEMP	Tc CONDUCTOR TEMP	I'/I DERATING FACTOR
40	90	1.00
41	90	0.99
42	90	0.98
43	90	0.97
44	90	0.96
45	90	0.95
46	90	0.94
47	90	0.93
48	90	0.92
49	90	0.91
50	90	0.89
51	90	0.88
52	90	0.87
53	90	0.86
54	90	0.85
55	90	0.84
56	90	0.82
57	90	0.81
58	90	0.80
59	90	0.79
60	90	0.77
61	90	0.76
62	90	0.75
63	90	0.73
64	90	0.72
65	90	0.71
66	90	0.69
67	90	0.68
68	90	0.66
69	90	0.65
70	90	0.63
71	90	0.62
72	90	0.60
73	90	0.58
74	90	0.57
75	90	0.55
76	90	0.53
77	90	0.51
78	90	0.49
79	90	0.47
80	90	0.45
81	90	0.42
82	90	0.40
83	90	0.37
84	90	0.35
85	90	0.32
86	90	0.28
87	90	0.24
88	90	0.20
89	90	0.14
90	90	0.00

TABLE 9

THERMOCOUPLE LIST FOR TEMPERATURE SURVEY
EL 715

The following is a list of Type T thermocouples installed on Elev. 715' in the auxiliary building and connected to the 14 point Type T recorder.

TC1 - Ambient Temperature Near 1AM-TA10

TC2 - Open secion of 1AM-TA10

TC3 - Covered Section of 1AM-TA10

TC4 - Covered and Wrapped Section of 1AM-TA10

TC5 - Open Section of 1AM-TA8

TC6 - Covered Section of 1AM-TA8

TC7 - Covered and Wrapped Section of 1AM-TA8

TC8 - Covered and Wrapped Section of 1AM-TA9

TC9 - Wrapped Section of 1AM-LB27*

TC10- Unwrapped Section of 1AM-LB27*

TC11- Ambient Temperature Near 1AM-LB27

TC12- Wrapped Section of 1AM-TA10 (Back up TC)

TC13- Wrapped Section of 1AM-TA8 (Back up TC)

TC14- Wrapped Section of 1AM-LB27 (Back up TC)*

* Thermocouple installed on the diesel generator feeder.

TABLE 10

THERMOCOUPLE LIST FOR TEMPERATURE SURVEY
RELAY ROOM

The following is a list of Type T thermocouples installed in the relay room Elev. 715'.

TC1 - Ambient Temperature Near 1AM-LB23

TC2 - Wrapped Section of 1AM-LB23*

TC3 - Wrapped Section of 1AM-LB23 (Back up)*

*Thermocouple installed on the diesel generator feeder.