Complete report

I.T.L. REPORT NO. 82-355-F-1

AMPACITY TEST FOR 600 VOLT POWER CABLES IN AN OPEN TOP CABLE TRAY PROTECTED BY THE THERMO-LAG 330-1 SUBLIMING COATING ENVELOPE SYSTEM

CLIENT: TSI, INC.
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JULY 1982

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CABLE TRAY PROTECTED BY THE

THERMO-LAG 330-1 SUBLIMING COATING ENVELOPE SYSTEM

1.0 PURPOSE OF THE TEST

The purpose of this test was to determine the effect of the application of a 1/2 inch minimum dry thickness of THERMO-LAG 330-1 Subliming Coating Envelope System on the temperature rise and ampacities of 600 volt power cables installed in an open top cable tray. The test was conducted in accordance with methods presented in IPCEA Pub. No. P-54-440 (Second Edition), NEMA Pub. No. WC 51-1975, IPCEA-NEMA Standards Publication entitled: "Ampacities, Cables in Open Top Cable Trays", approved by both the Insulated Power Cable Engineering Association and the National Electrical Manufacturers Association on May 12, 1975.

2.0 TEST SET-UP

The test was conducted at the laboratory facilities of TSI, Inc., 3260 Brannon Avenue, St. Louis, Missouri (63139), on October 21 and October 22, 1981.

For test purposes, the cable tray test assembly was placed on two 2" x 4" wooden blocks within a 4' high by 5' wide by 29½" deep test enclosure constructed of 3/8" plywood. The test enclosure, in turn, was placed on the surface of a laboratory bench.

The desired level of ambient temperature was provided within the test enclosure by means of three heat lamps located in the top of the enclosure, and two hot plates located at the bottom of the enclosure. The entrance and exit openings, for the power cables at one end of the test enclosure, were sealed by means of a 2" shroud of ceramic wool. Likewise, the entire surface of all power cables, entering the test enclosure from the junction with their power supply and the power cables leaving the test enclosure all the way to the energizing variac, were coated with a 2" ceramic wool shroud in the order to minimize heat losses from the ends of the cables outside of the tray which could act as a heat sink for the cables in the tray, giving unconservative test results.

2.1 Cable Tray Test Assembly

The cable tray test assembly was constructed on a single sheet of 20 gage galvanized sheet steel bent in the shape of a "C" and then formed into a "U" shaped cross section. The overall cross sectional dimensions of the cable tray were 14" wide by 4" high. This test assembly was used for both the unprotected and the subliming coating protected cable tray tests.

2.2 Power Cables

Two sizes of 600 volt power cables were used in conducting the unprotected and the subliming coating protected cable tray tests. In both tests, 210 feet of #00 AWG power cable and 2,820 feet of #10 AWG power cable were obtained for installation in the cable tray test assembly.

The insulated #00 AWG power cable was approximately 0.562" in diameter and was made up of 19 strains of 0.837" diameter copper wire. The insulated AWG #10 power cable was about 0.215" in diameter and consisted of 7 strands of 0.0385" diameter copper wire.

2.2.1 #00 AWG Power Cable Circuit

The 210 feet of #00 AWG power cable was cut into 21 ten foot lengths and each of the lengths was connected at its ends with cable clamps to form a series set of 21 cable lines. The series set of 21 cable lines was bent in the shape of a "C" with the vertical dimension being about 28" and the two horizontal dimensions being approximately 46" each. The formed series set of cables then was placed into the "C" shaped cable tray with the cable bundle contacting the tray bottom in the upper horizontal and the vertical portions of the cable tray assembly and hanging below the tray bottom in the lower horizontal portion of the cable tray.

2.2.2 #10 AWG Power Cable Circuit

The 2,820 feet of #10 AWG power cable was folded into 141 loops. The loops then were pulled taut until the cable formed 282 lines of approximately 10 feet in length each. The 282 line cable bundle next was bent in the shape of a "C" with a vertical dimension of about 28" and horizontal dimensions of approximately

46" each. The cable bundle then was placed into the "C" shaped cable tray with its smaller cables lying on top of the previously placed #00 AWG power cables in the upper horizontal and the vertical portions of the cable tray. In the lower horizontal section, the cable bundle was placed with its smaller cables contacting the tray bottom and the #00 AWG power cables lying on top of the smaller cables.

A sketch of the cable tray and the above described cable arrangement is presented in Figure 2.1.

2.3 Power Sources

Separate power sources were used to supply power to the #00 AWG power cable bundle and the #10 AWG continuous power cable. Each of these power cable circuits were independent of the other and were equipped with its own variac. As a result, the amperage of each of the two circuits could be varied in accordance with the test requirements.

A schematic circuit diagram for each of the two power circuits is shown in Figure 2.2.

2.4 Heat Loss Reduction

The two ends of the cable tray together with the cables emerging from the tray ends were wrapped with 2" thick ceramic blanket material. The ceramic blanket wrap then was secured by wrapping it with duct tape. This step was taken to reduce the amount of heat loss from within the cable tray and from the cable lengths that were not located within the tray.

2.5 Instrumentation

The test instruments and devices used during the ampacity test included eighteen (18) thermocouples, two (2) thermocouple temperature recorders, two (2) ammeters, two (2) voltmeters, and a digital readout. All instruments used in the test were calibrated in accordance with TSI's Quality Control Operating Procedures Manual.

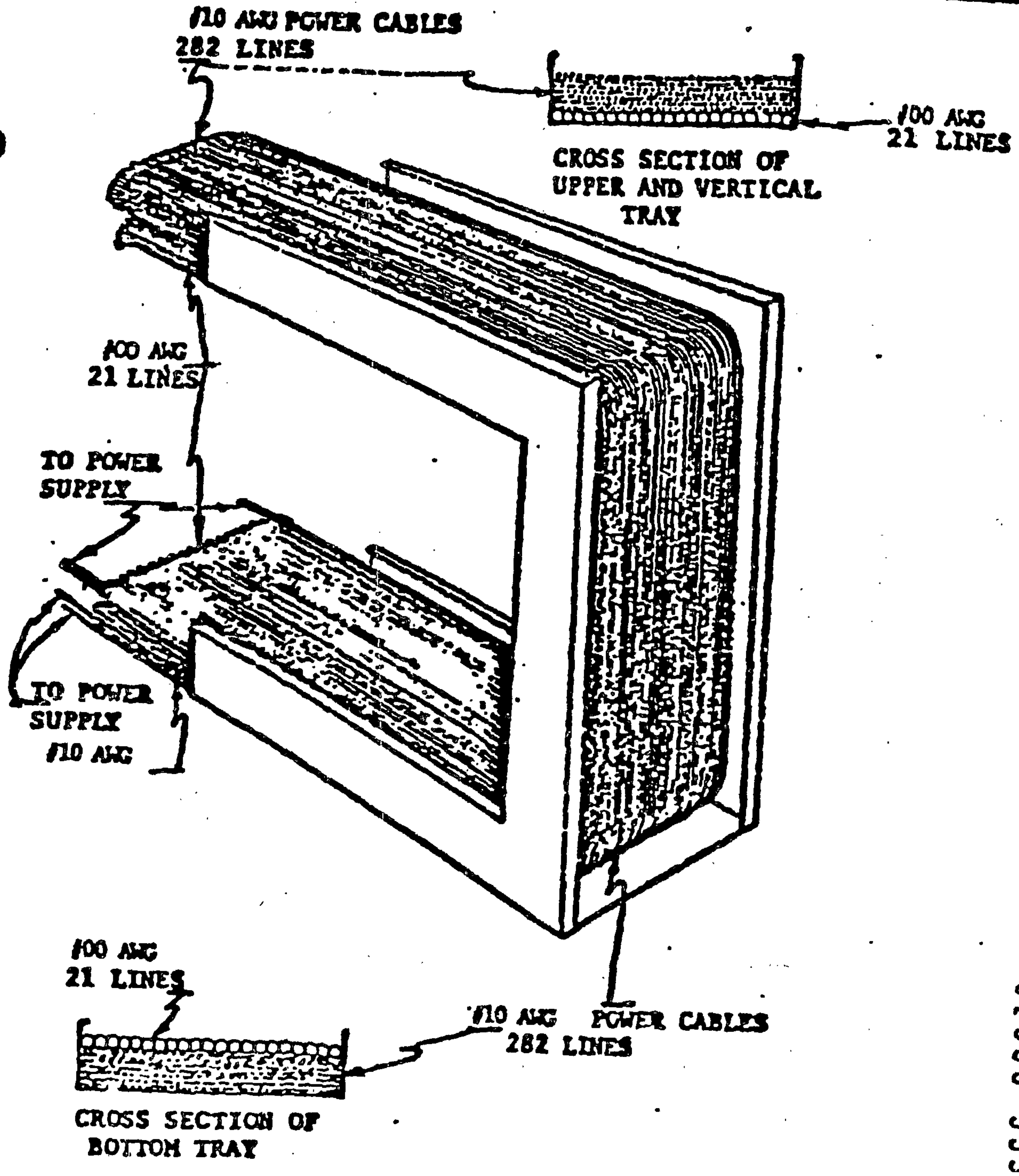

FIGURE 2.1 CABLE ARRANGEMENT IN TRAY

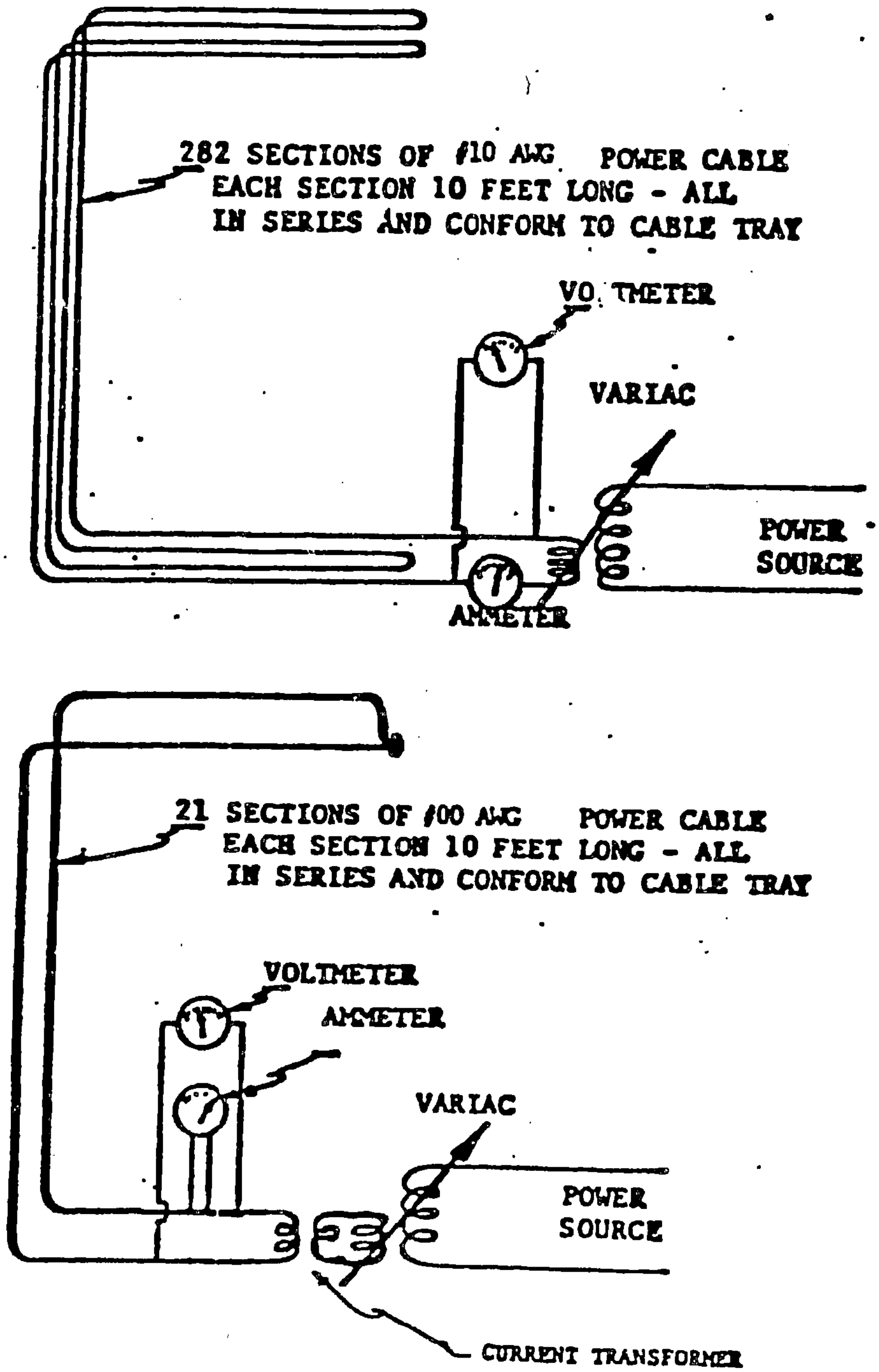

FIGURE 2.2 SCHEMATIC CIRCUIT DIAGRAMS

2.5.1 Thermocouples

The thermocouples were installed at three locations on the cable tray test assembly. The first group was located along the top horizontal section about 5" from the elbow and the second group was located along the top horizontal section approximately 12" from the first group. The third group was located about 12" down the vertical section from the top elbow.

Each of the three groups consisted of six thermocouples with three of the thermocouples being inserted into slits made in the insulation of three #00 AWG power cables and the remaining three being inserted into slits made in the insulation of three #10 AWG power cables.

The location of each of the 18 thermocouple junction are shown in Figure 2.3. Each of these junctions were connected to one of the two thermocouple temperature recorders.

2.5.2 Power Cable Thermocouple Recorders

Two Brown Multipoint Thermocouple Recorders were used to record the temperatures of the power cables at the thermocouple locations previously described. Calibration of each thermocouple was checked against a standard thermometer by comparing the thermocouple readings at room temperature and in boiling water. The deviation was less than 1°C from the known temperature in each case.

2.5.3 Ammeters

Separate ammeters were used to measure the current flow in the #00 AWG power cable circuit and the #10 power cable circuit.

The ammeter used to measure the current in the #00 AWG power cable circuit was placed in series with the power cable and one of the outlines from a current transformer. The ammeter was a General Electric Unit with a readout range from 0-200 amperes. The current transformer was a Westinghouse Unit with a maximum out put of 400 amperes.

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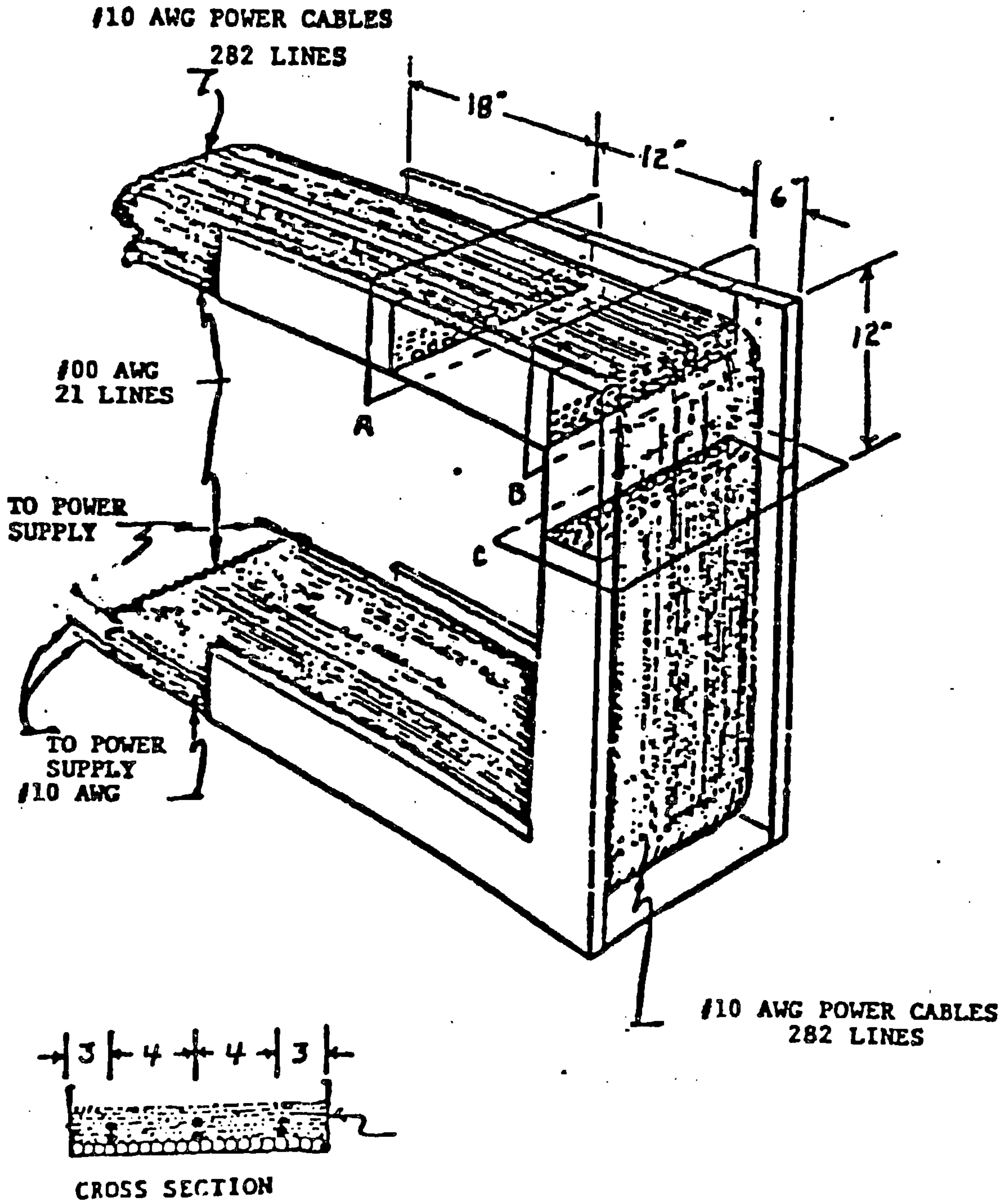

FIGURE 2.3 LOCATION OF THERMOCOUPLES

2.5.4 Voltmeter

Individual voltmeters were provided to measure the voltage in the two different power cable circuits. The voltmeter used in the #00 AWG power cable circuit had a 0-50 volt readout range and the volmeter used in the #10 AWG power cable circuit had a readout range of 0-220 volts.

2.5.5 Ambient Temperature Digital Readout

An Omega Engineering Unit was used to provide a digital readout of the ambient temperature during the test.

3.0 TEST PROCEDURE

The ampacity test was conducted in two separate but interrelated phases. The first test phase consisted of establishing a base line ampacity for the power cables when installed in the open top cable tray test assembly. The second phase consisted of determining the amperage derating which occurs when the open top cable tray test assembly is enclosed by a protective envelope of THERMO-LAG 330-1 Subliming Coating. These two testing phases are described in the following paragraphs.

3.1 Open Top Cable Tray

Prior to the test, the maximum allowable cable amperages were selected from Table 7 of IPCEA Pub. No. P-54-440 (Second Edition), NEMA Pub. No. WC 51-1975, IPCEA Standard Publication entitled: "Ampacities, Cables in Open Top Cable Trays". This involved calculating the depth of the cables in the tray using the formula provided in the publication and then selecting the ampacities for this cable depth and the #00 and #10 conductor sizes from the table. The depth of the cables calculated for the test was 1.405 inches and the maximum allowable amperages were extrapolated from the table to be 109 amperes for the #00 AWG and 11.9 for the #10 AWG power cable circuits.

The base line test was started by energizing the power sources to provide initial amperages of 109 amperes in the #00 AWG power cable circuits and 11.9 in the #10 AWG power cable circuits. The amperage levels were maintained in the power circuits until the hottest spot thermocouple temperatures reached 194°F (90°C). At this point, the current in the power cable circuits were gradually and proportionately reduced, until the thermocouple temperature stabilized within the designated temperature band of 194 ± 3°F (90 ± 2°C). The elapsed time for this pre-test period was circa 4 hours.

Throughout this and the subsequent one hour test phase, the ambient temperature within the test enclosure was maintained at 104 ± 5°F (40 ± 3°C).

Then the one hour base line test was initiated and continued for one hour. During the test, the amperages in the power cables, the cable hot spot thermocouple temperature and the ambient temperature were recorded at 5 minute intervals.

The base line test amperage recorded for the #00 AWG and #10 AWG power cable circuits then were corrected to reflect a 40°C ambient temperature test condition, using the correction tables presented in the IPCEA Pub. No. P-54-440 (Second Edition), NEMA Pub. No. WC 51-1975, IPCEA/NEMA Standard Publication. After correction, the base line amperages for the open top cable tray test assembly became 103.3 amperes for the #00 AWG power cable circuit and 11.2 amperes for the #10 AWG power cable circuit. These values correlate closely with corresponding ampacities presented in the referenced IPCEA/NEMA Standard Publication. The percentage of standard in the case of the #00 AWG power cable was 94.8% and in the case of the #10 AWG power cable was 94.4%.

The base line test amperages and temperatures together with the amperages correlation calculations are shown in Table 1.

3.2 Open Top Cable Tray Protected By Subliming Coating Envelope

Upon completion of the first phase, the open top cable tray was enclosed within a protective envelope of THERMO-LAG 330-1 Subliming Coating. The first step taken in this process was to fabricate the stress skin sections with a 1/2 inch minimum dry film thickness of THERMO-LAG 330-1 Subliming Coating. After the precoated sections had sufficiently cured, they were assembled on the cable tray test assembly using mechanical fastening devices. An exploded view of the subliming coating protection envelope is shown in Figure 2.4.

The test was started with the current flow established at 103 amperes in the #00 AWG power cable circuit and 11.2 amperes in the #10 AWG power cable circuit. These current levels, which were developed in the first test phase, were maintained until the temperature limit of 194°F (90°C) was reached by one of the thermocouples. At this point, the circuit amperes were slowly and proportionately reduced until the hottest spot temperature stabilized within the designated temperature band of 194 ± 3°F (90 ± 2°C).

TABLE 1

OPEN TOP CABLE TRAY TEST DATA

TIME	AVERAGE AMBIENT TEMPERATURE °F	MAXIMUM CABLE TEMPERATURE °F	#10 AWG POWER CABLE AMPERES	#00 AWG POWER CABLE AMPERES
6:19 PM	102	196	11.3	104
6:24 PM	101	195	11.3	104
6:29 PM	102	194	11.3	104
6:34 PM	102	194	11.3	104
6:39 PM	103	194	11.3	104
6:44 PM	103	194	11.3	104
6:49 PM	103	194	11.3	104
6:54 PM	103	194	11.3	104
6:59 PM	103	194	11.3	104
7:04 PM	104	194	11.3	104
7:09 PM	104	194	11.3	104
7:14 PM	104	194	11.3	104
7:19 PM	103	194	11.3	104

Average Ambient Temperature 102.846°F (39.36°C)

Maximum Cable Temperature 194°F (90°C)

Ambient Temperature Correction Factor: $\frac{40.0 - 39.36}{5}(0.05) + 1.00 = 1.0064$

Ampacity Corrections: #10 AWG 11.3/1.0064 = 11.228

#00 AWG 104/1.0064 = 103.39

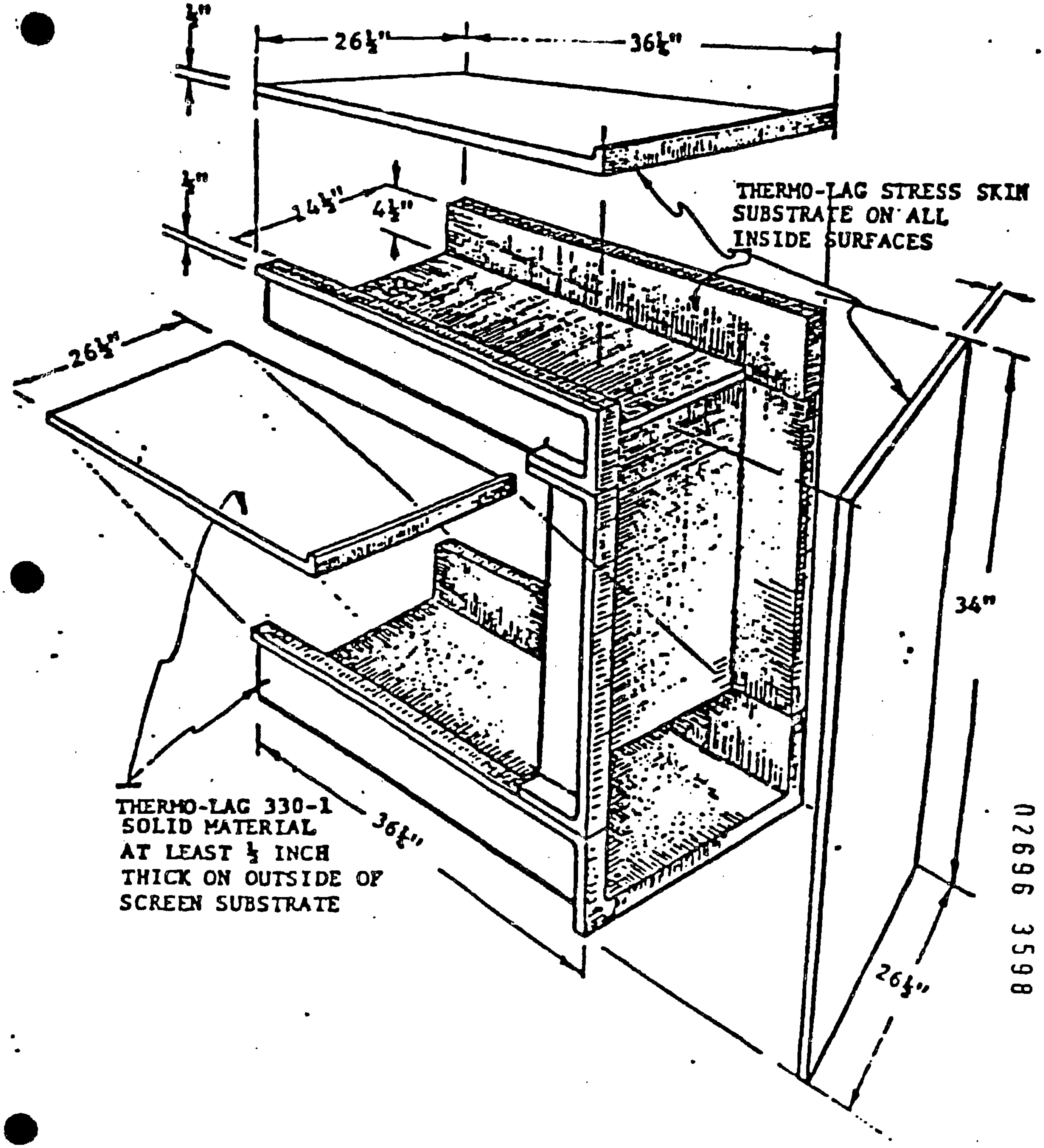

FIGURE 2.4 EXPLODED VIEW OF SUBLIMING COATING ENVELOPE SYSTEM

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After this thermocouple temperature had stabilized within the 194 ± 3°F (90 ± 2°C) limit for one hour, the test run was initiated and continued for another hour. During the test run, the circuit amperages, the hottest spot thermocouple temperature and the ambient temperature were recorded at 5 minute intervals.

The test amperages then were corrected to reflect a 40°C ambient temperature and a 90°C conductor temperature test condition using the correction tables presented in the referenced IPCEA/NEMA Standards Publication. After correction, the test run amperages became 90.432 amperes for the #00 AWG power cable circuit and 9.836 amperes for the #10 AWG power cable circuit. The test amperages and temperatures together with the amperages correction calculations are shown in Table 2.

4.0 ANALYSIS OF TEST RESULTS

The hottest spot thermocouple and ambient temperature together with the power cable amperage readings were recorded at 5 minute intervals during each of the tests. The test results, which are shown in Tables 1 and 2 are analyzed and compared in the following paragraphs.

4.1 Open Top Cable Tray

The hot spot thermocouple temperature readings remained within the 194 ± 3°F (90 ± 2°C) temperature range during the test. The temperatures ranged between 194 and 196°F during the one hour test period.

The #00 AWG power cable current remained constant at 104 amperes and the #10 AWG power cable also held constant at 11.3 amperes throughout the one hour test period. The ambient temperature within the test enclosure averaged 103°F with all temperature readings falling within the prescribed test range of 104 ± 5°F (40 ± 3°C) during the test.

4.2 Open Top Cable Tray Protected By A Subliming Coating Envelope

The hot spot thermocouple temperature for this test rose to 202°F (94.4°C) when the power circuits were energized at the 103 and 11.2 ampere levels established in the first test phase. The temperature readings from this thermocouple then leveled off and remained within a 202 ± 1°F temperature range during the remainder of the one hour test.

The #00 AWG power cable current remained constant at 94.7 amperes and the #10 AWG power cable current also remained unchanged at 10.3 amperes throughout the one hour test period. The ambient temperature within the test enclosure averaged 101°F with all temperature readings falling within the prescribed test range of 104 ± 5°F (40 ± 3°C) during the test.

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TABLE 2

TEST DATA FOR AN OPEN TOP CABLE TRAY PROTECTED WITH A SUBLIMING COATING ENVELOPE

TIME	AVERAGE AMBIENT TEMPERATURE °F	MAXIMUM CABLE TEMPERATURE °F	#10 AWG POWER CABLE AMPERES	#00 AWG POWER CABLE AMPERES
3:45 PM	102	202	10.3	94.7
3:50 PM	102	201	10.3	94.7
3:55 PM	102	201	10.3	94.7
4:00 PM	101	201	10.3	94.7
4:05 PM	101	201	10.3	94.7
4:10 PM	101	202	10.3	94.7
4:15 PM	101	201	10.3	94.7
4:20 PM	101	202	10.3	94.7
4:25 PM	101	201	10.3	94.7
4:30 PM	101	201	10.3	94.7
4:35 PM	101	201	10.3	94.7
4:40 PM	101	201	10.3	94.7
4:45 PM	100	201	10.3	94.7
4:50 PM	100	201	10.3	94.7

Average Ambient Temperature 101.07°F (38.38°C)

Maximum Cable Temperature 202°F (94.44°C)

Ambient Temperature Correction Factor: $\frac{40.0 - 38.37}{5}(0.05) + 1.00 = 1.0163$

Conduit Temperature Correction Factor: $\frac{94.44 - 90.0}{35}(0.05) + 1.00 = 1.0304$

Ampacity Corrections: #00 AWG 94.7/(1.0163)(1.0304) = 90.32

#10 AWG 10.3/(1.0163)(1.0304) = 9.36

4.3 Ampacity Comparison Table

The aforementioned test ampacities corrected for ambient and conductor temperature deviations are presented and compared with application IPCEA/NEMA Standards in the following table:

	OPEN TOP TRAY		ENVELOPE CABLE TRAY		PERCENT CHANGE	
CABLE GAGE	#10 AWG	#00 AWG	#10 AWG	#00 AWG	#10 AWG	#00 AWG
IPCEA/NEMA STANDARDS	11.9	109	N.A.	N.A.	N.A	N.A
TEST	11.228	103.339	9.836	90.432	12.39	12.48

5.0 CONCLUSIONS

The ampacities of 11.2 and 103 amperes established during the open top cable tray base line test correlate very closely with corresponding values presented in the referenced IPCEA/NEMA Standards Publication. The percentage of standard in the case of the #00 AWG power cable was 94.8% and in the case of the #10 AWG power cable was 94.4%.

These base line ampacities constitute a valid standard for determining the derating percentages to be used for power cables installed at a cable depth of 1.405 inches in an open top cable tray protected by a subliming coating envelope. They fall within an acceptable 10% range of comparable open top cable tray values presented in the referenced IPCEA/NEMA Standards Publication. They also maintain the same proportional relationships as is demonstrated in the applicable IPCEA-NEMA Standards.

The derating percentage for the #10 AWG power cable was derived by subtracting the test value of 9.836 amperes from the base line of 11.228 amperes, dividing the resultant number by the base line value of 11.228 amperes, and then multiplying it by 100. The derating percentage for the #00 AWG power cable was calculated on the same basis using the test value of 90.432 amperes and the base line value of 103.339 amperes. As a result, the derating percentage for the #10 AWG power cable was determined to be 12.39% and the percentage for the #00 AWG was determined to be 12.48%, based on the result of this ampacity test. The derating actor of 12.5% shall be used for both the #10 AWG and #00 AWG power cables.

The derating factors apply to the thickness of the THERMO-LAG 330-1 Subliming Coating Envelope System as tested, and tolerances employed in this test program which was 0.625" ± 0.125" dry.

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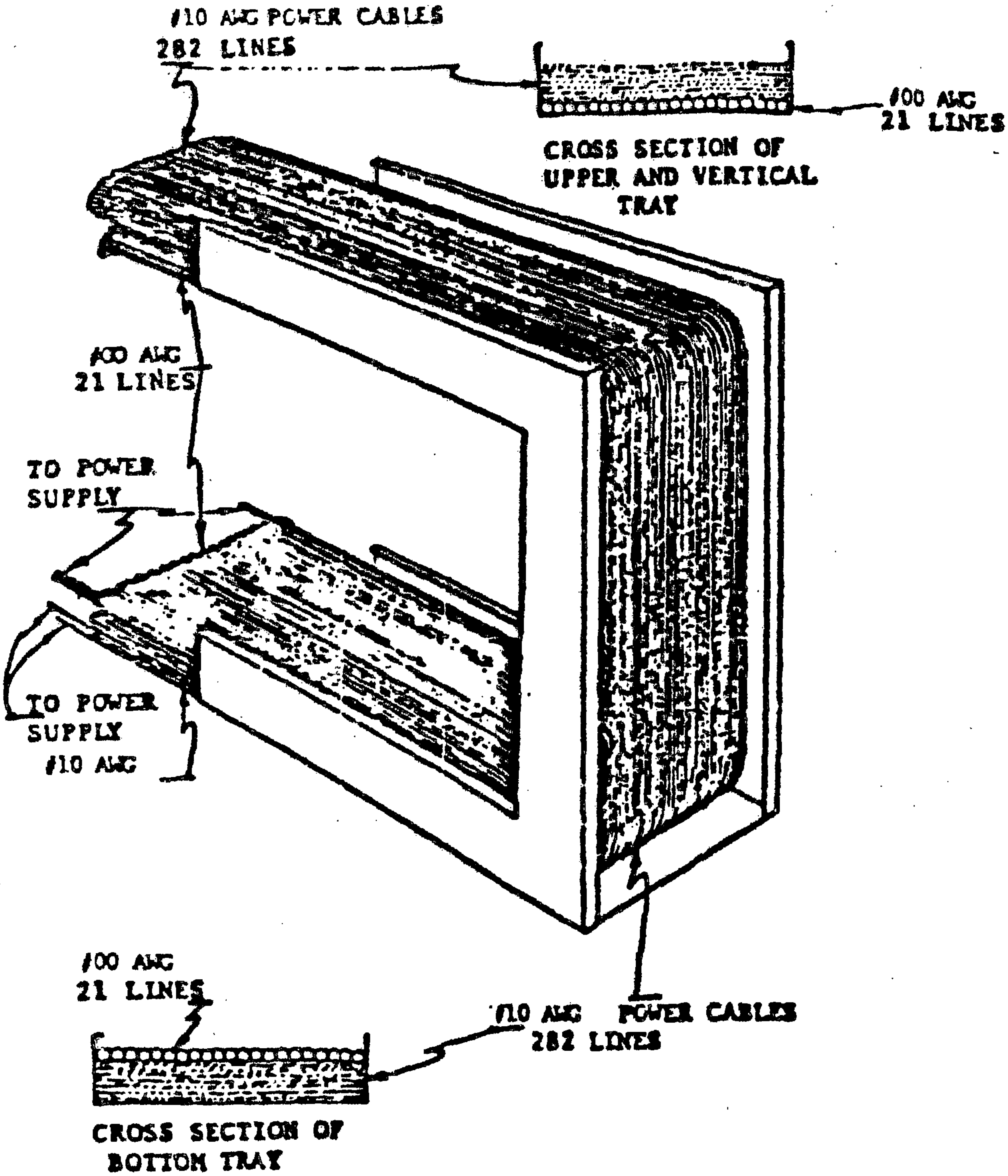

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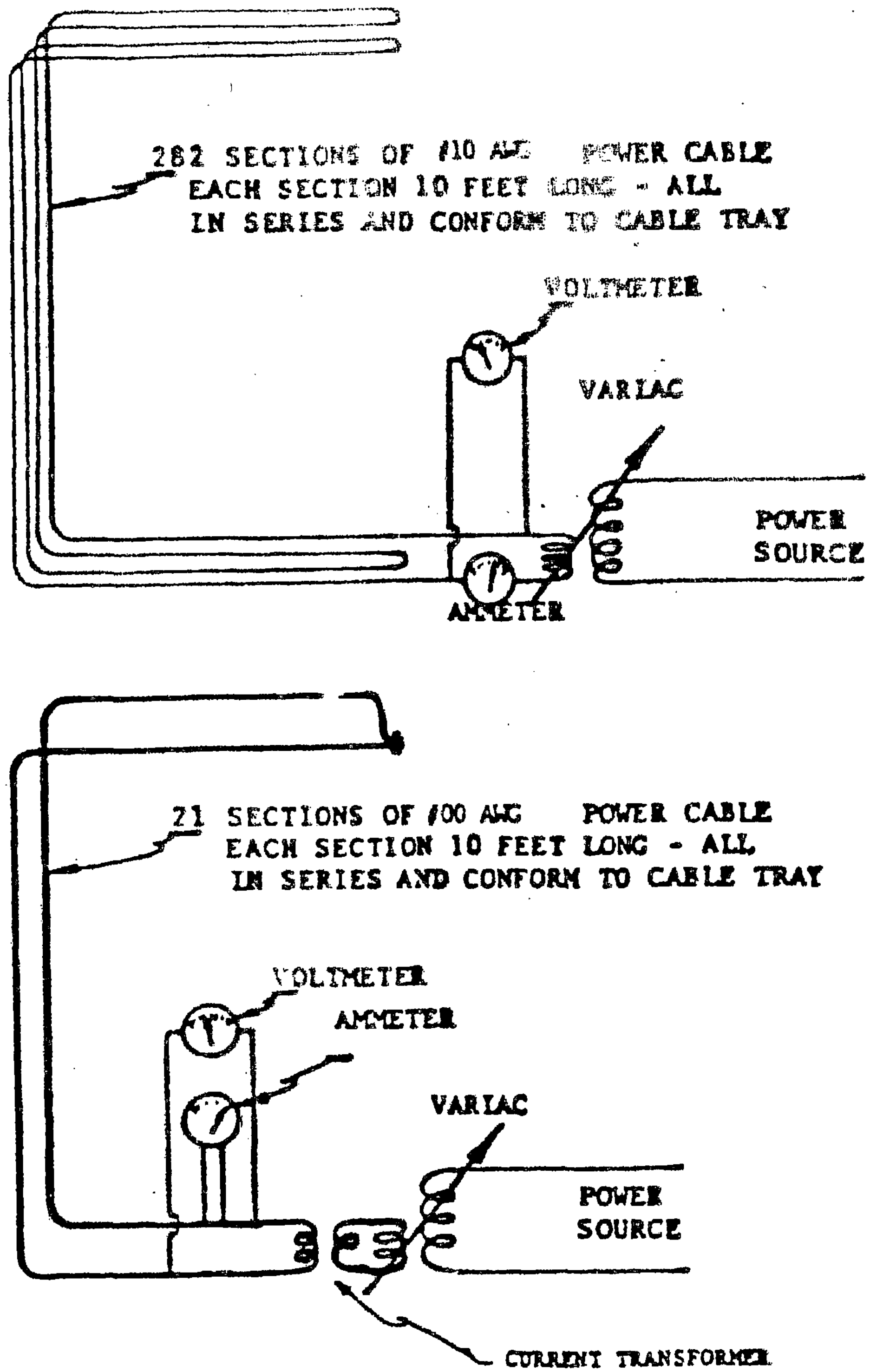

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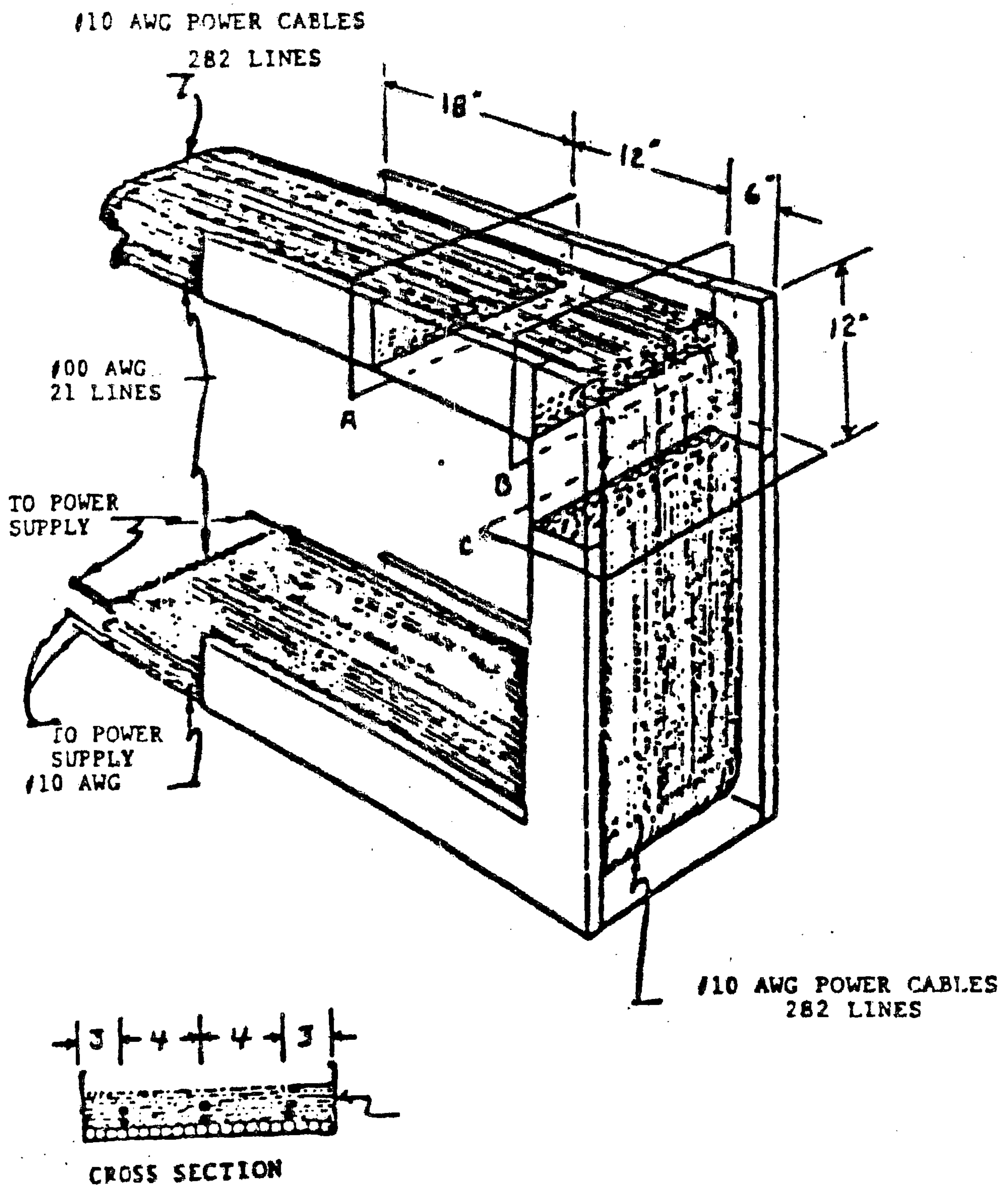

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An Omega Engineering Unit was used to provide a digital readout of the ambient temperature during the test.

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The ampacity test was conducted in two separate but interrelated phases. The first test phase consisted of establishing a base line ampacity for the power cables when installed in the open top cable tray test assembly. The second phase consisted of determining the amperage derating which occurs when the open top cable tray test assembly is enclosed by a protective envelope of THERMO-LAG 330-1 Subliming Coating. These two testing phases are described in the following paragraphs.

3.1 Open Top Cable Tray

Prior to the test, the maximum allowable cable amperages were selected from Table 7 of IPCEA Pub. No. P-54-440 (Second Edition), NEMA Pub. No. WC 51-1975, IPCEA Standard Publication entitled: "Ampacities, Cables in Open Top Cable Trays". This involved calculating the depth of the cables in the tray using the formula provided in the publication and then selecting the ampacities for this cable depth and the #00 and #10 conductor sizes from the table. The depth of the cables calculated for the test was 1.405 inches and the maximum allowable amperages were extrapolated from the table to be 109 amperes for the #00 AWG and 11.9 for the #10 AWG power cable circuits.

The base line test was started by energizing the power sources to provide initial amperages of 109 amperes in the #00 AWG power cable circuits and 11.9 in the #10 AWG power cable circuits. The amperage levels were maintained in the power circuits until the hottest spot thermocouple temperatures reached 194°F (90°C). At this point, the current in the power cable circuits were gradually and proportionately reduced, until the thermocouple temperature stabilized within the designated temperature band of 194 ± 3°F (90 ± 2°C). The elapsed time for this pre-test period was circa 4 hours.

Throughout this and the subsequent one hour test phase, the ambient temperature within the test enclosure was maintained at 104 ± 5°F (40 ± 3°C).

Then the one hour base line test was initiated and continued for one hour. During the test, the amperages in the power cables, the cable hot spot thermocouple temperature and the ambient temperature were recorded at 5 minute intervals.

The base line test amperage recorded for the #00 AWG and #10 AWG power cable circuits then were corrected to reflect a 40°C ambient temperature test condition, using the correction tables presented in the IPCEA Pub. No. P-54-440 (Second Edition), NEMA Pub. No. WC 51-1975, IPCEA/NEMA Standard Publication. After correction, the base line amperages for the open top cable tray test assembly became 103.3 amperes for the #00 AWG power cable circuit and 11.2 amperes for the #10 AWG power cable circuit. These values correlate closely with corresponding ampacities presented in the referenced IPCEA/NEMA Standard Publication. The percentage of standard in the case of the #00 AWG power cable was 94.8% and in the case of the #10 AWG power cable was 94.4%.

The base line test amperages and temperatures together with the amperages correlation calculations are shown in Table 1.

3.2 <u>Open Top Cable Tray Protected By Subliming Coating Envelope</u>

Upon completion of the first phase, the open top cable tray was enclosed within a protective envelope of THERMO-LAC 330-1 Subliming Coating. The first step taken in this process was to fabricate the stress skin sections with a 1/2 inch minimum dry film thickness of THERMO-LAC 330-1 Subliming Coating. After the precoated sections had sufficiently cured, they were assembled on the cable tray test assembly using mechanical fastening devices. An exploded view of the subliming coating protection envelope is shown in Figure 2.4.

The test was started with the current flow established at 103 amperes in the #00 AWG power cable circuit and 11.2 amperes in the #10 AWG power cable circuit. These current levels, which were developed in the first test phase, were maintained until the temperature limit of 194°F (90°C) was reached by one of the thermocouples. At this point, the circuit amperes were slowly and proportionately reduced until the hottest spot temperature stabilized within the designated temperature band of 194 ± 3°F (90 ± 2°C).

TABLE 1

OPEN TOP CABLE TRAY TEST DATA

TIME	AVERAGE AMBIENT TEMPERATURE °F	MAXIMUM CABLE TEMPERATURE °F	#10 AWG POWER CABLE AMPERES	#00 AWG POWER CABLE AMPERES
6:19 PM	102	196	11.3	104
6:24 PM	101	195	11.3	104
6:29 PM	102	194	11.3	104
6:34 PM	102	194	11.3	104
6:39 PM	103	194	11.3	104
6:44 PM	103	194	11.3	104
6:49 PM	103	194	11.3	104
6:54 PM	103	194	11.3	104
6:59 PM	103	194	11.3	104
7:04 PM	104	194	11.3	104
7:09 PM	104	194	11.3	104
7:14 PM	104	194	11.3	104
7:19 PM	103	194	11.3	104

Average Ambient Temperature: 102.846°F (39.36°C)

Maximum Cable Temperature: 194°F (90°C)

Ambient Temperature Correction Factor: $\frac{40.0 - 39.36}{5}(0.05) + 1.00 = 1.0064$

Ampacity Corrections: #10 AWG: 11.3/1.0064 = 11.228

#00 AWG: 104/1.0064 = 103.39

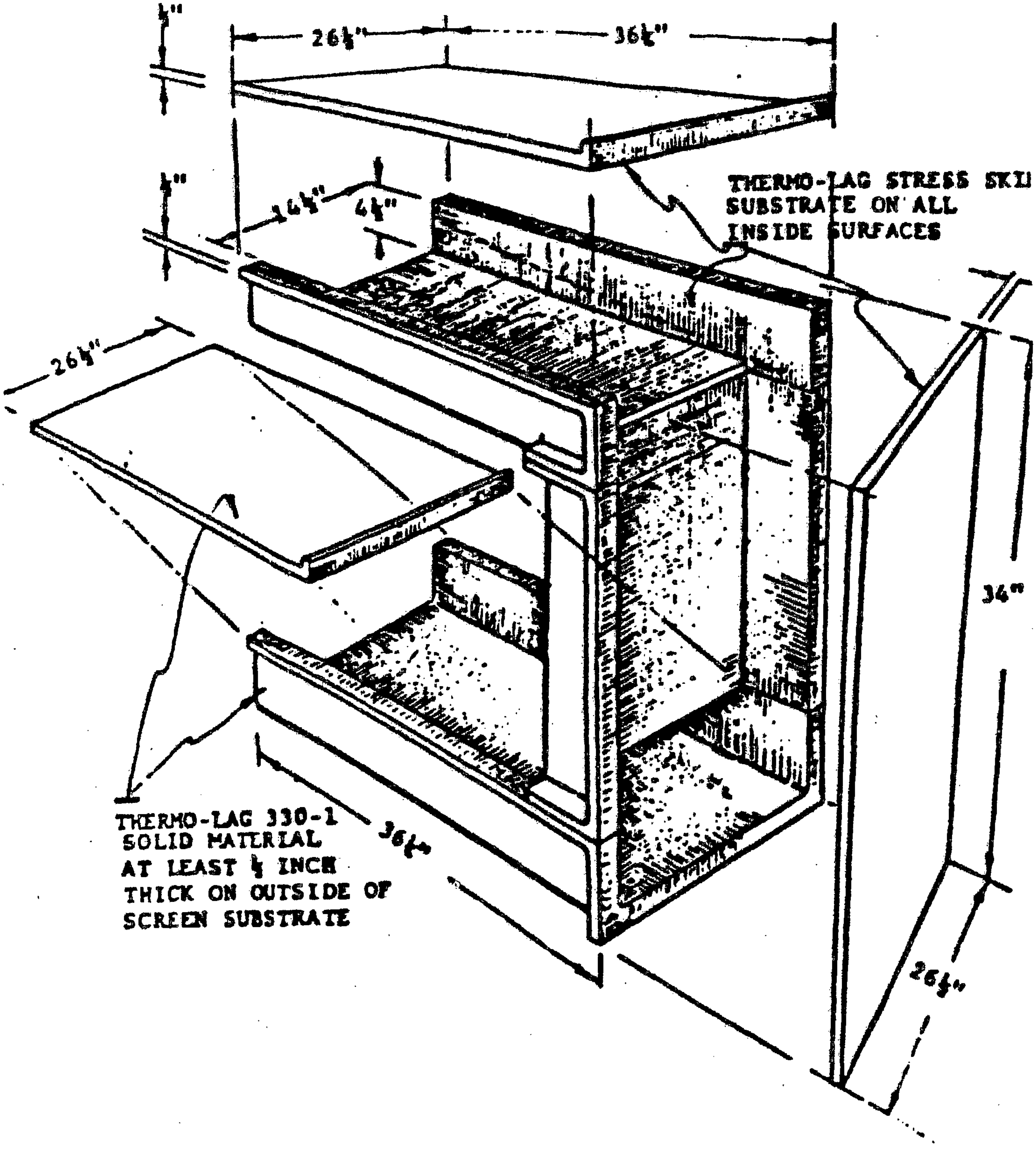

FIGURE 2.4 EXPLODED VIEW OF SUBLIMING COATING ENVELOPE SYSTEM

After this thermocouple temperature had stabilized within the 194 ± 3°F (90 ± 2°C) limit for one hour, the test run was initiated and continued for another hour. During the test run, the circuit amperages, the hottest spot thermocouple temperature and the ambient temperature were recorded at 5 minute intervals.

The test amperages then were corrected to reflect a 40°C ambient temperature and a 90°C conductor temperature test condition using the correction tables presented in the referenced IPCEA/NEMA Standards Publication. After correction, the test run amperages became 90.432 amperes for the #00 AWG power cable circuit and 9.836 amperes for the #10 AWG power cable circuit. The test amperages and temperatures together with the amperages correction calculations are shown in Table 2.

4.0 ANALYSIS OF TEST RESULTS

The hottest spot thermocouple and ambient temperature together with the power cable amperage readings were recorded at 5 minute intervals during each of the tests. The test results, which are shown in Tables 1 and 2 are analyzed and compared in the following paragraphs.

4.1 Open Top Cable Tray

The hot spot thermocouple temperature readings remained within the 194 ± 3°F (90 ± 2°C) temperature range during the test. The temperatures ranged between 194 and 196°F during the one hour test period.

The #00 AWG power cable current remained constant at 104 amperes and the #10 AWG power cable also held constant at 11.3 amperes throughout the one hour test period. The ambient temperature within the test enclosure averaged 103°F with all temperature readings falling within the prescribed test range of 104 ± 5°F (40 ± 3°C) during the test.

4.2 Open Top Cable Tray Protected By A Subliming Coating Envelope

The hot spot thermocouple temperature for this test rose to 202°F (94.4°C) when the power circuits were energized at the 103 and 11.2 ampere levels established in the first test phase. The temperature readings from this thermocouple then leveled off and remained within a 202 ± 1°F temperature range during the remainder of the one hour test.

The #00 AWG power cable current remained constant at 94.7 amperes and the #10 AWG power cable current also remained unchanged at 10.3 amperes throughout the one hour test period. The ambient temperature within the test enclosure averaged 101°F with all temperature readings falling within the prescribed test range of 104 ± 5°F (40 ± 3°C) during the test.

TABLE [illegible]

TEST DATA FOR AN OPEN TOP CABLE TRAY PROTECTED WITH A SUBLIMING COATING ENVELOPE

TIME	AVERAGE AMBIENT TEMPERATURE °F	MAXIMUM CABLE TEMPERATURE °F	#10 AWG POWER CABLE AMPERES	#00 AWG POWER CABLE AMPERES
3:45 PM	102	202	10.3	94.7
3:50 PM	102	201	10.3	94.7
3:55 PM	102	201	10.3	94.7
4:00 PM	101	201	10.3	94.7
4:05 PM	101	201	10.3	94.7
4:10 PM	101	202	10.3	94.7
4:15 PM	101	201	10.3	94.7
4:20 PM	101	[illegible]	10.3	94.7
4:25 PM	101	101	10.3	94.7
4:30 PM	101	201	10.3	94.7
4:35 PM	101	201	10.3	94.7
4:40 PM	101	201	10.3	94.7
4:45 PM	100	201	10.3	94.7
4:50 PM	100	201	10.3	94.7

Average Ambient Temperature: 101.07°F (38.38°C)

Maximum Cable Temperature: 202°F (94.44°C)

Ambient Temperature Correction Factor:

$$\frac{40.0 - 38.37}{5}(0.05) + 1.00 = 1.0163$$

Cable Temperature Correction Factor:

$$\frac{94.44 - 90.0}{35}(0.05) + 1.00 = 1.0304$$

Ampacity Correction:

#00 AWG: $94.7/(1.0163)(1.0304) = 90.432$

#10 AWG: $10.3/(1.0163)(1.0304) = 9.836$

4.3 Ampacity Comparison Table

The aforementioned test ampacities corrected for ambient and conductor temperature deviations are presented and compared with application IPCEA/NEMA Standards in the following table:

	OPEN TOP TRAY		ENVELOPE CABLE TRAY		PERCENT CHANGE	
CABLE GAGE	#10 AWG	#00 AWG	#10 AWG	#00 AWG	#10 AWG	#00 AW
IPCEA/NEMA STANDARDS	11.9	109	N.A.	N.A.	N.A	N.A
TEST	11.228	103.339	9.836	90.432	12.39	12.48

5.0 CONCLUSIONS

The ampacities of 11.2 and 103 amperes established during the open top cable tray base line test correlate very closely with corresponding values presented in the referenced IPCEA/NEMA Standards Publication. The percentage of standard in the case of the #00 AWG power cable was 96.8% and in the case of the #10 AWG power cable was 94.4%.

These base line ampacities constitute a valid standard for determining the derating percentages to be used for power cables installed at a cable depth of 1.405 inches in an open top cable tray protected by a subliming coating envelope. They fall within an acceptable 10% range of comparable open top cable tray values presented in the referenced IPCEA/NEMA Standards Publication. They also maintain the same proportional relationships as is demonstrated in the applicable IPCEA-NEMA Standards.

The derating percentage for the #10 AWG power cable was derived by subtracting the test value of 9.836 amperes from the base line of 11.228 amperes, dividing the resultant number by the base line value of 11.228 amperes, and then multiplying it by 100. The derating percentage for the #00 AWG power cable was calculated on the same basis using the test value of 90.432 amperes and the base line value of 103.339 amperes. As a result, the derating percentage for the #10 AWG power cable was determined to be 12.39% and the percentage for the #00 AWG was determined to be 12.48%, based on the result of this ampacity test. The derating actor of 12.5% shall be used for both the #10 AWG and #00 AWG power cables.

The derating factors apply to the thickness of the THERMO-LAG 330-1 Subliming Coating Envelope System as tested, and tolerances employed in this test program which was 0.625" ± 0.125" dry.