TVA CONTRACT 78K50-823558

EXAMINATION OF THE EFFECT OF VIMASCO CABLE COATING No. 2-B ON AMPACITY IN CABLE TRAYS

for

VIMASCO CORPORATION
P. O. BOX 516
NITRO, WEST VIRGINIA 25143

J.I. 0F0Q5.AF
(CONTRACT)

DECEMBER 19, 1980

Factory Mutual Research
1151 Boston-Providence Turnpike
Norwood, Massachusetts 02062

Factory Mutual System

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I INTRODUCTION

1.1 Vimasco Corporation requested tests to determine the effect of their No. 2-B Cable Coating on the ampacity rating of both No. 4/0 AWG 1 conductor power cables and No. 12 AWG 7 conductor control cables. The test procedure used was taken from Test Plan No. F-C4715 which was obtained from Vimasco. This test plan basically outlines procedures to determine the amperage required to obtain 167°F (75°C) and 194°F (90°C) steady state conductor temperature using no coating, 1/8 in. (3.18 mm) coating, and 1/4 in. (6.35 mm) coating.

II TEST SETUP (See Appendix)

2.1 Two 8 ft (2.4 m) long x 18 in. (45.7 mm) wide cable trays were modified by using a length of angle iron and C-clamps to reduce the width to 12 in. (305 mm). One tray was set up with No. 12 AWG 7/C Type PXMJ copper stranded control cable having a 0.662 in. (16.8 mm) diameter. Fifty-seven runs (which resulted in 3 layers) of this PVC jacketed cable were used resulting in a cable tray loading of 41%. The percent loading is calculated by the number of runs times the diameter divided by the cable tray cross sectional area. The remaining tray was set up with No. 4/0 AWG 1/C PVC coated copper stranded power cable (Type PXJ). Forty-eight runs were used which resulted in a 43% loading (3 layers).

2.2 Type K Iron Constantan 28 gauge thermocouples were installed as shown in Figs. 1, 2 and 3 by cutting a slit in the PVC cable jacket and placing the electrically insulated thermocouple directly on the conducting wire. The thermocouples were electrically insulated to prevent any spurious signals from affecting the readings.

2.3 Temperatures were measured using a Fluke Model 2190A and Y2001 digital thermometer on the No. 12 AWG cable tray and a Fluke Model 2160A on the No. 4 AWG cable tray. A Fluke voltmeter Model 8000A with a 0-10 ampere shunt was used to measure current on the No. 12 AWG tray. A Bell Model No. 1776 clamp on ammeter was used with the No. 4/0 AWG tray. Calibration of the instruments was performed before and after each test.

2.4 The cables were energized with a 60 Hz current load by using a General Radio Co. Type W500M autotransformer on the No. 12 AWG tray. This cable was wired such that the current would pass through each conductor (series). The No. 4/0 AWG tray was energized by a Multi-Amp Electronic Corp. Model CR-225 current transformer.

III TEST PROCEDURE

3.1 The cables were installed in the trays with resulting cable loadings as specified in Paragraph 2.1.

3.2 The cable trays were energized. Current draw and temperatures were monitored while the current was gradually raised so that a 75°C conductor temperature was obtained. This current was maintained for 1 hour, then gradually raised to obtain 90°C for the 1 hour steady.

3.3 Following the above tests, representatives from Vimasco Corporation applied a 1/8 in. (3.2 mm) layer of cable coating on both trays. The trays were energized for approximately 24 hours following which temperature tests were performed as in Paragraph 3.2.

3.4 Following this test, Vimasco representatives applied an additional 1/8 in. (3.2 mm) coating. The trays were energized and allowed to cure, followed by the last series of temperature tests. A summary of the test results are outlined in Figs. 6 and 7.

IV TEST RESULTS

Two plots of the log of temperature rise vs. current draw are presented in Figs. 4 and 5. These plots allow a comparison of ampacities even though the room ambient temperature varied during the tests. Taking data from a 23°C ambient condition (reading the graph at 126°F [52°C] and 152°F [67°C]) resulted in loss of ampacities between 2-4% as a result of 1/8 in. (3.2 mm) of Vimasco cable coating.

TESTS BY: W. F. Pelrine and R. Rozenas

ATTACHMENTS: Figs. 1, 2, 3, 4, 5, 6 & 7

APPENDIX: Four Photographs

EXAMINATION OF DATA AND REPORT BY:

R. Rozenas
Engineer/Fuels Section

REVIEWED BY:

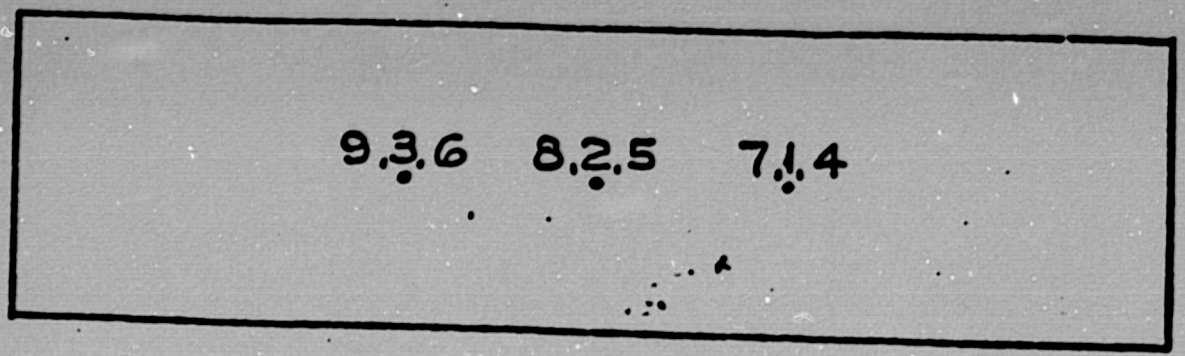
D. R. Knight
Manager/Fuels Section

RR/jm

ORIGINAL DATA: Test Notebook No. 2053

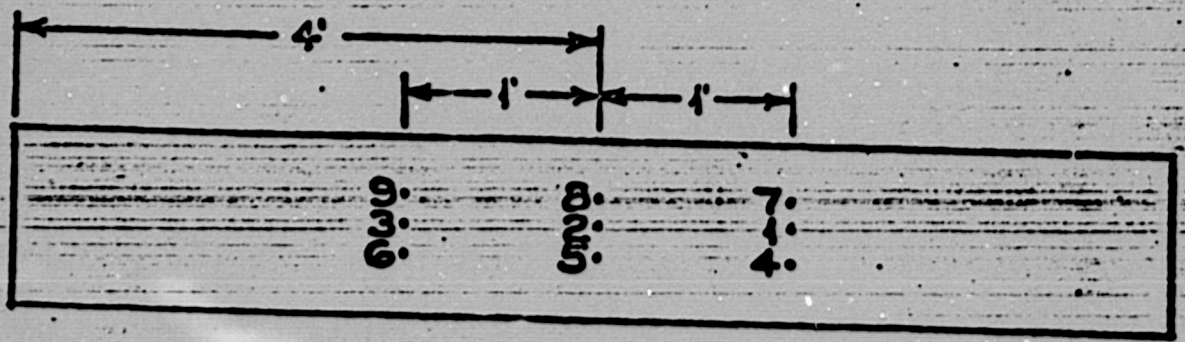
Thermocouple Map

Fig. 1



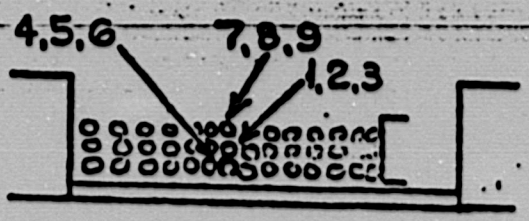
Top View

Fig. 2



Side View

Fig. 3



End View

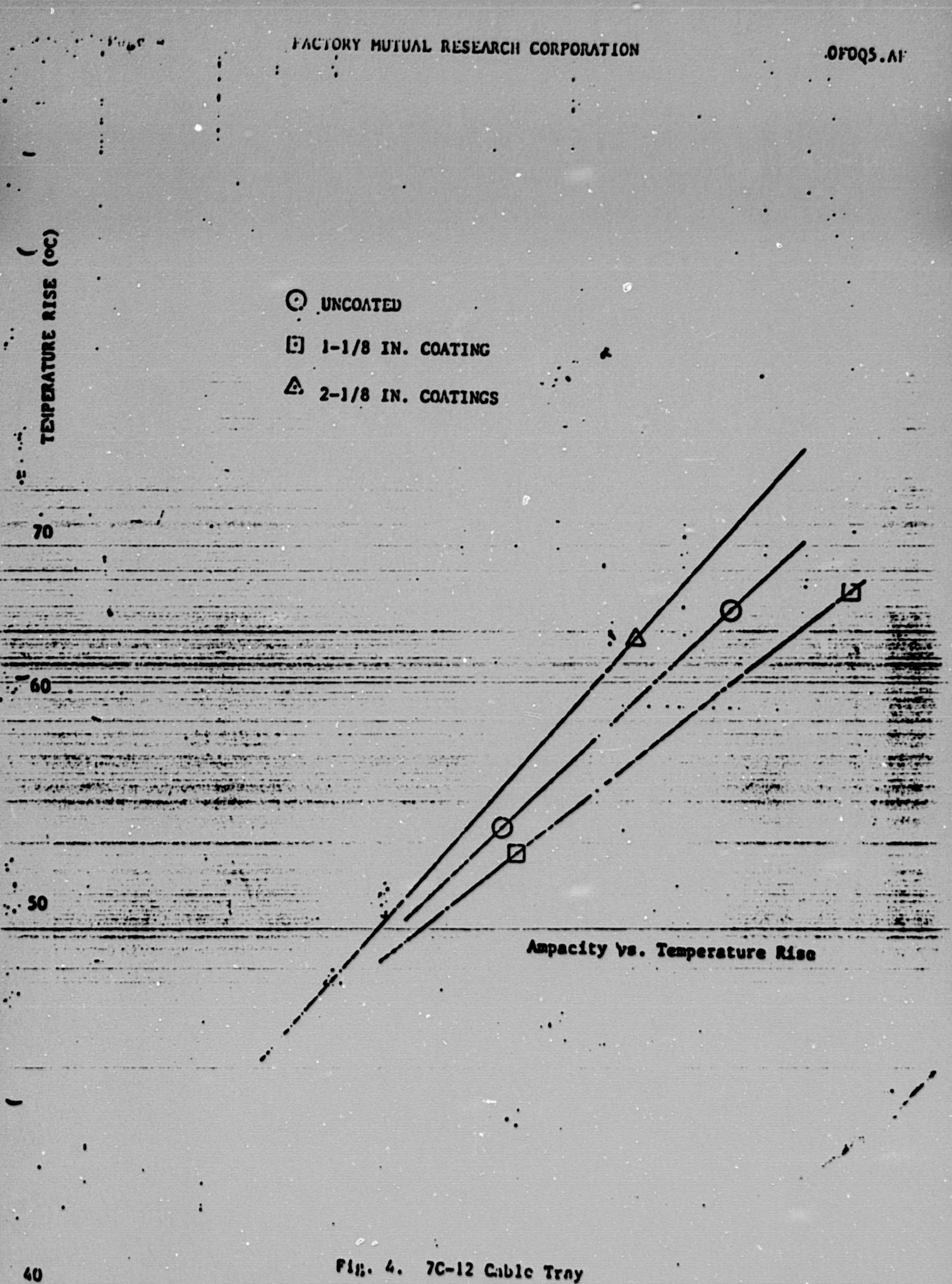


Fig. 4. 7C-12 Cable Tray

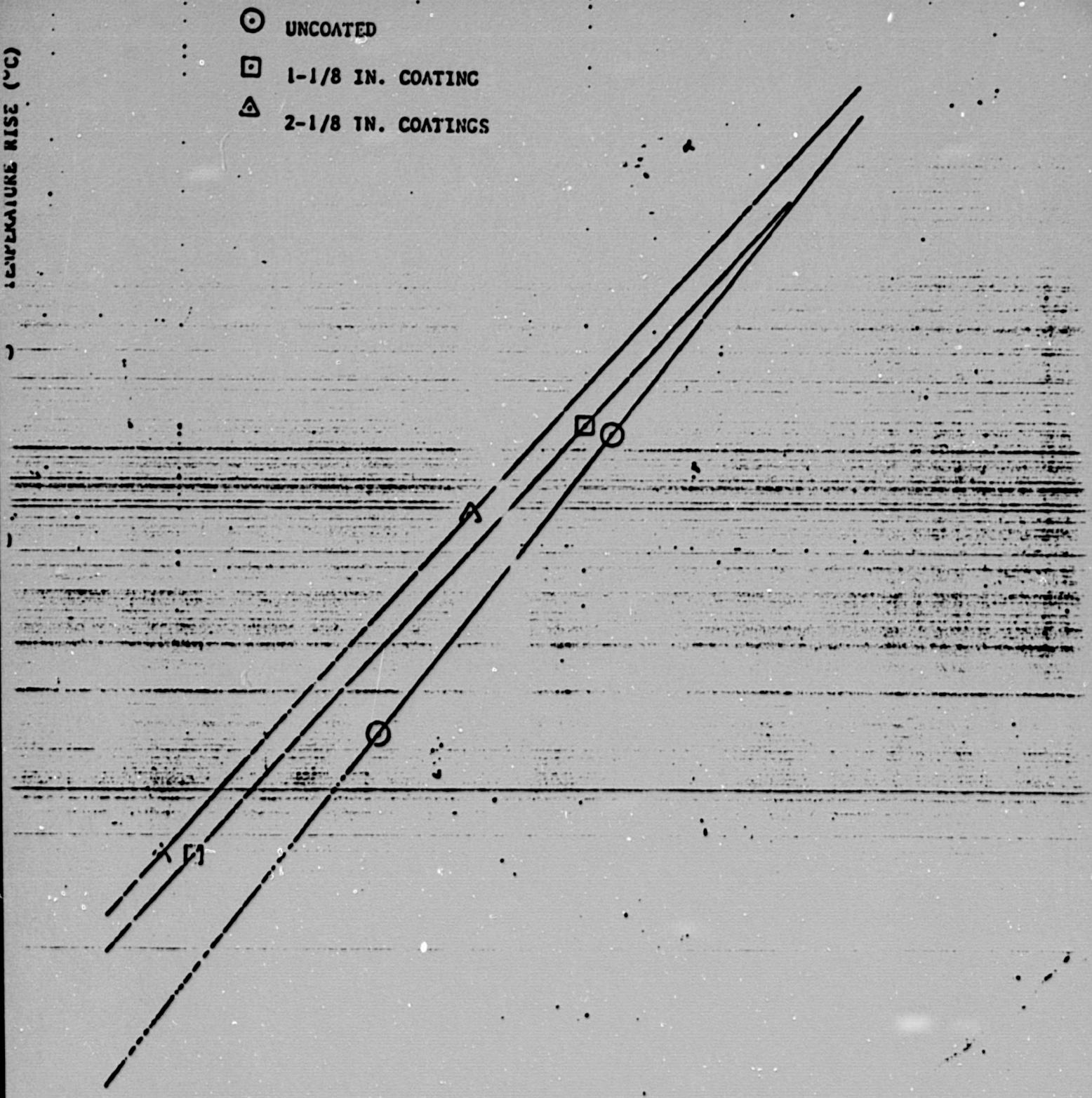


Fig. 5. 1C-4/0 Cable Tray

Fig. 6

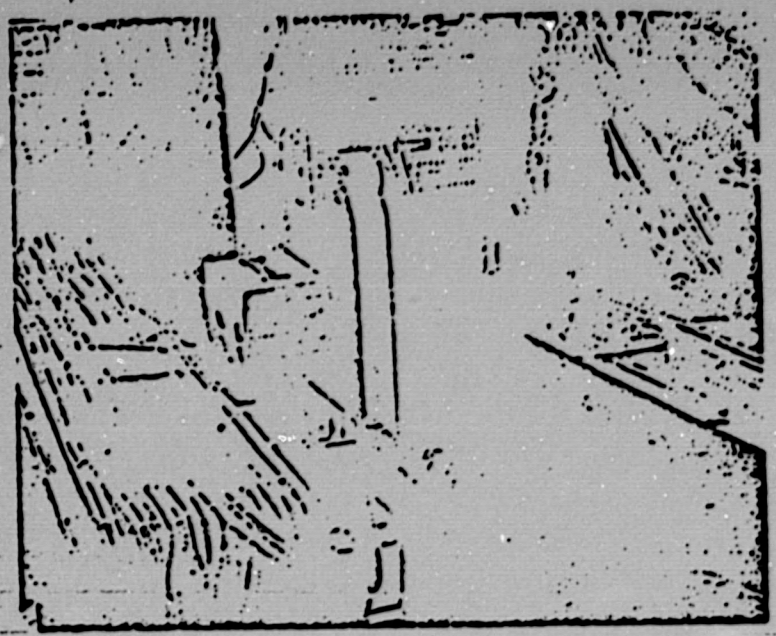
NO. 12 AWG 7 CONDUCTOR RESULTS

Approx. Cable Temp.	Coating Thickness	Average Conductor Internal Temp. °F	(°C)	Current (Amps)	Room Temp. °F	(°C)	Temp. Rise °F	(°C)
157°F (75°C)	No Coating	169.0	(76.1)	9.9	73.8	(23.2)	127.2	(52.9)
	1/8 in.	170.0	(76.7)	9.7	73.4	(23)	128.7	(53.7)
	1/4 in.	166.8	(74.8)	9.1	80.8	(27.1)	118.0	(47.8)
194°F (90°C)	No Coating	194.4	(90.2)	11.2	71.6	(22)	154.7	(68.2)
	1/8 in.	197.9	(92.2)	10.7	77.4	(25.2)	152.6	(57)
	1/4 in.	194.	(90.4)	10.3	78.4	(25.8)	148.3	(64.6)

Fig. 7

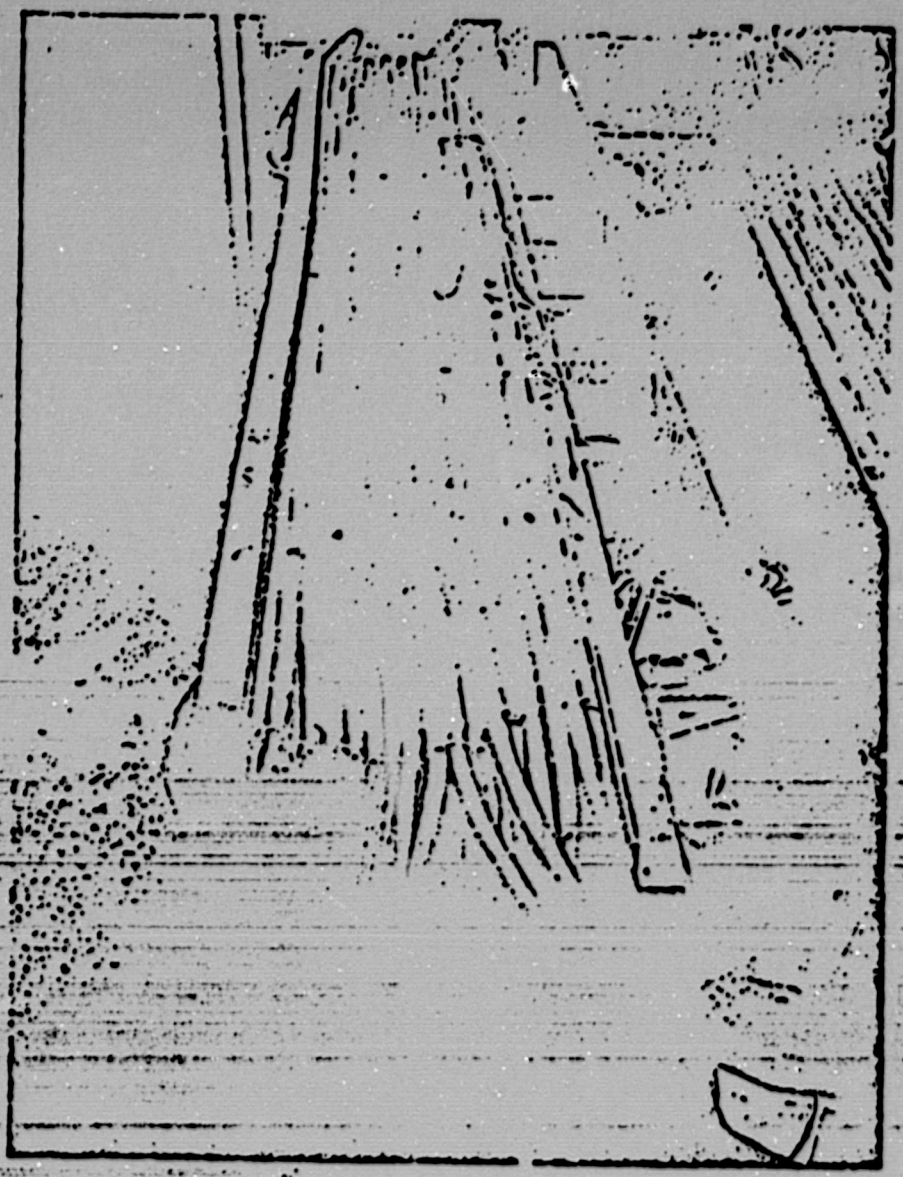
NO. 4/0 AWG 1 CONDUCTOR RESULTS

Approx. Cable Temp.	Coating Thickness	Average Conductor Internal Temp. °F	(°C)	Current (Amps)	Room Temp. °F	(°C)	Temp. Rise °F	(°C)
167°F (75°C)	No Coating	167	(75)	175	73.5	(23)	125.6	(52)
	1/8 in.	167.9	(75.5)	165	77.5	(25.3)	122.4	(50.2)
	1/4 in.	167.4	(75.2)	162	78.8	(26)	120.6	(49.2)
194°F (90°C)	No Coating	194	(90)	192	73.4	(23)	152.6	(67)
	1/8 in.	194	(90)	190	73	(22.8)	153	(67.2)
	1/4 in.	197.4	(91.9)	189	74.8	(23.8)	154.6	(68.1)

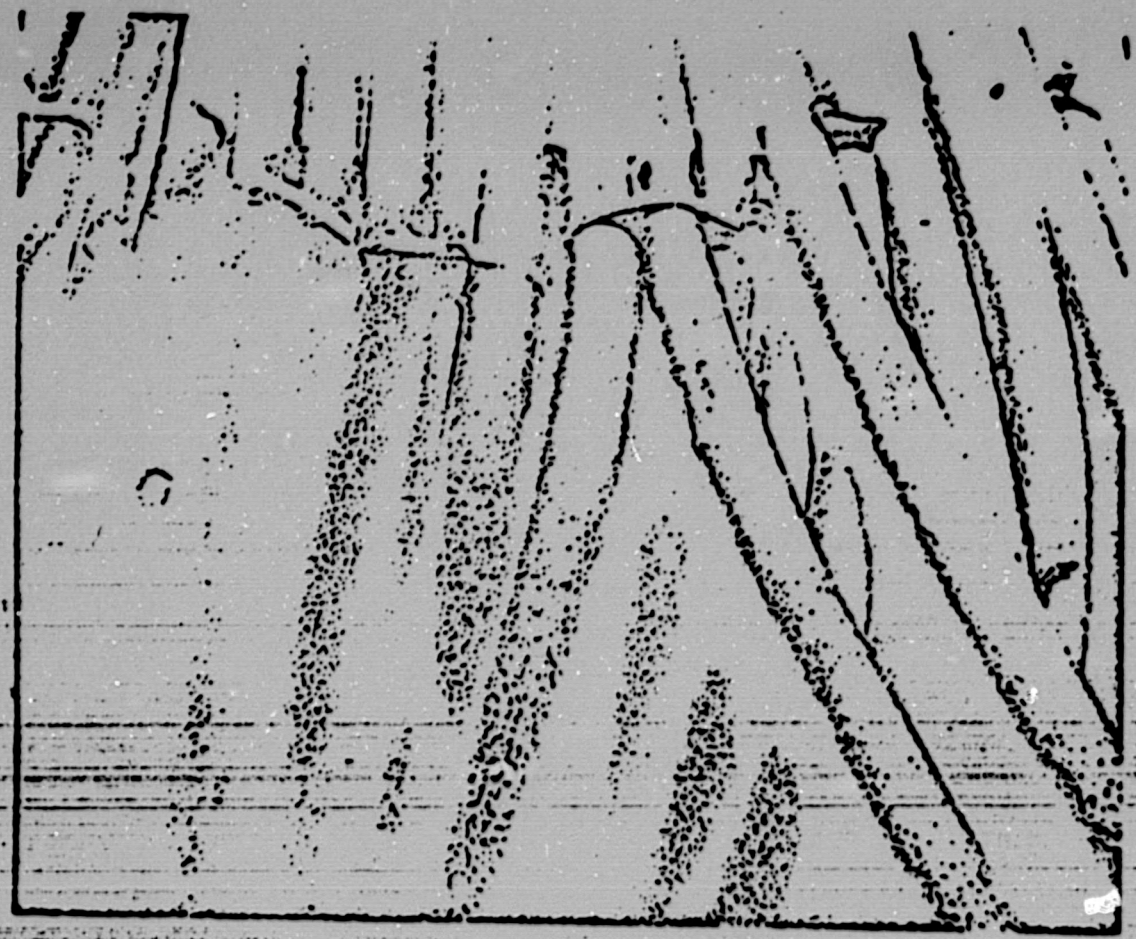


TEST SETUP

1/8 INCH COATING



1/4 INCH COATING



CLOSE-UP OF 1/4 INCH COATING