

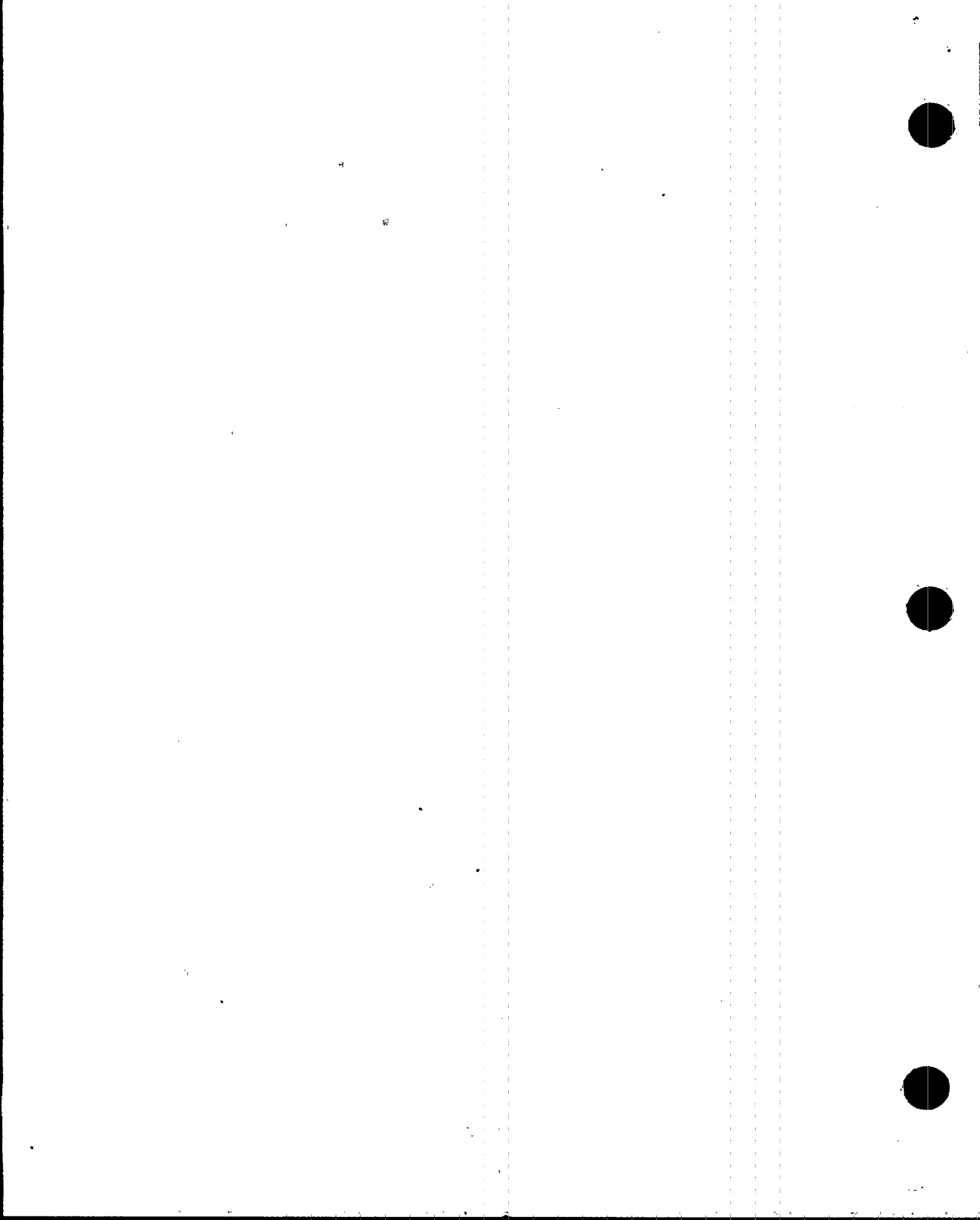
CALCULATION COVER SHEET

Calculation No: PTN - BESE--96 - 006

Title: AMPACITY DERATING FOR CABLES in RACEWAYS and BOXES WITH THERMO-LAG 330
and with THERMO-LAG 330 W/LAYER OF THERMO-LAG 770 FIRE BARRIER COATING

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No.	Description						
REVISIONS							

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LIST OF EFFECTIVE PAGESCalculation No: PTN - BFSE - 96 - 006REV. 0

Title: AMPACITY DERATING FOR CABLES in RACEWAYS and BOXES WITH THERMO-LAG 330
and with THERMO-LAG 330 W/LAYER OF THERMO-LAG 770 FIRE BARRIER COATING

Page	Section	Rev.	Page	Section	Rev.
i	Cover Sheet	0			
ii	List of Effective Pages	0			
iii	Table of Contents	0			
4	1.0 Purpose	0			
4	2.0 References	0			
5	2.0 References	0			
6	2.0 References	0			
7	2.0 References	0			
7	3.0 Methodology	0			
7	4.0 Assumptions/Bases	0			
8	4.0 Assumptions/Bases	0			
8	5.0 Calculation	0			
9	5.0 Calculation	0			
10	5.0 Calculation	0			
11	5.0 Calculation	0			
	5.0 Calculation	0			
	5.0 Calculation	0			
	5.0 Calculation	0			
15	6.0 Results	0			
16	6.0 Results	0			
17	6.0 Results	0			
18	6.0 Results	0			
19	6.0 Results	0			
20	6.0 Results	0			
21	6.0 Results	0			

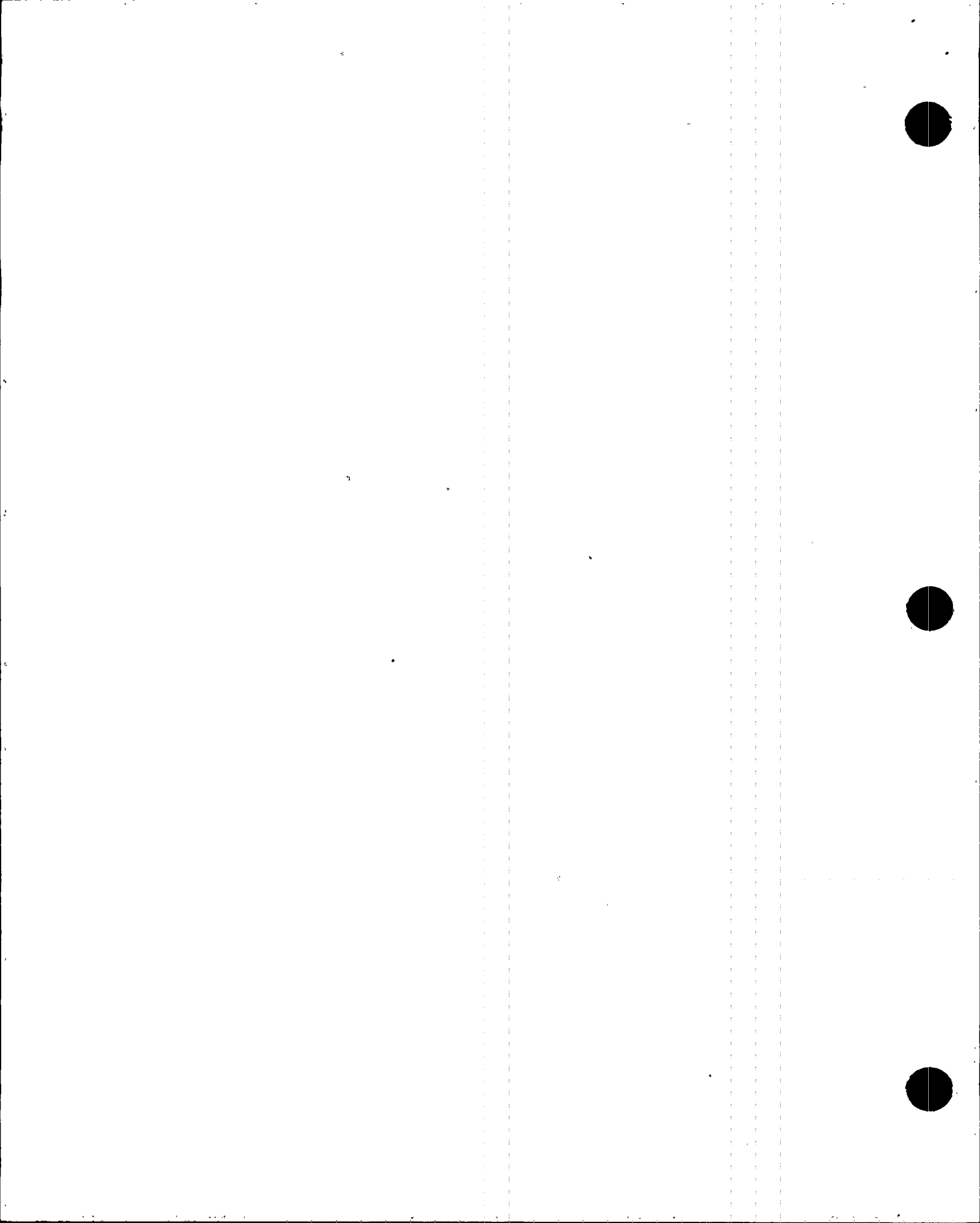


TABLE OF CONTENTSCALCULATION NUMBER PTN - BFSE - 96 - 006 REV. 0

<u>SECTION</u>	<u>TITLE</u>	<u>PAGES</u>
--	Cover Sheet	i
--	List of Effective Pages	ii
--	Table of Contents	iii
1.0	Purpose	4
2.0	References	4 - 7
3.0	Methodology	7
4.0	Assumptions/Bases	7 - 8
5.0	Calculation	8 - 14
6.0	Results	15 - 21

<u>ATTACHMENT NO.</u>	<u>TITLE</u>	<u>PAGES</u>
1	LISTING OF RACEWAYS AND INTERVENER/ INTERFERING CONDUITS THERMO-LAG 330-1, 3 HOUR UPGRADE	3

REF.

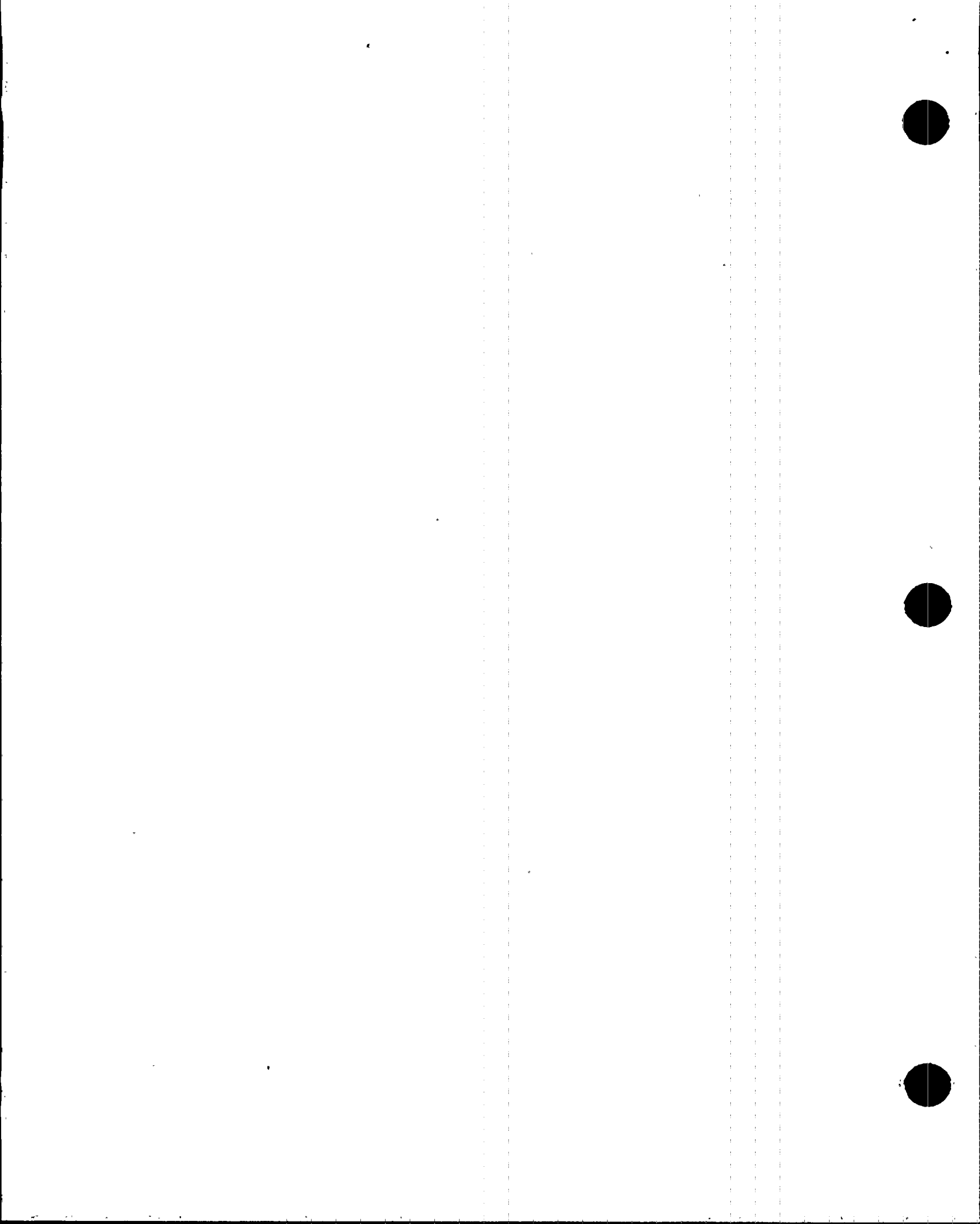
1.0. PURPOSE

The purpose of this calculation is to show that the addition of a fire protective coating (Thermo-Lag 330-1 (for 1hr) and Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr)) to the conduits, boxes and cable trays for those cables requiring fire protection in a plant area does not reduce the allowable ampacity to a level lower than the actual ampacity of each cable. In addition, this calculation also shows that the addition of a fire protective coating (Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1) to intervening conduits does not reduce the allowable ampacity to a level lower than the actual ampacity of each cable. The addition of the new fire protective coating is required to address the NRC generic letter 92-08, "Thermo-Lag 330-1 Fire Barriers".

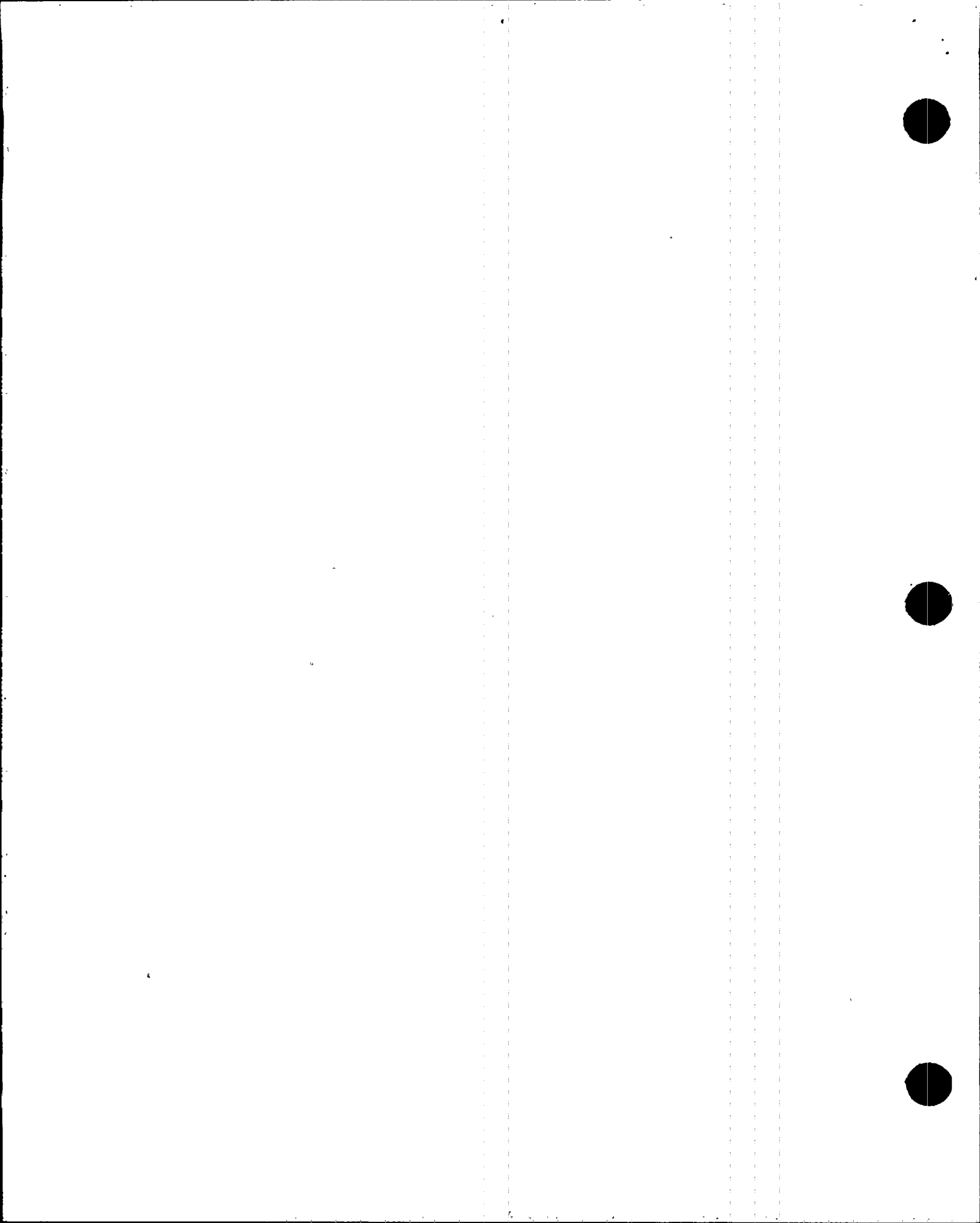
2.0. REFERENCES

- 2.1 Calculation JPN-PTN-BFJM-96-005, Rev. 0, Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier
- 2.2 Calculation PTN-BFJE-93-001, Rev. 0, Ampacity Derating Response to NRC GL 92-08 for Cables Routed in Conduit and Tray with Thermo-Lag 330-1 Fire Barrier System Coating
- 2.3 FPL Document 5610-E-2000, Turkey Point Plant - Units 3 & 4, Appendix R Essential Cable List, Revision 10, Dated July 1996
- 2.4 Turkey Point Units 3 and 4, Updated Final Safety Analysis Report (UFSAR) Revision 13, dated October 1996
- 2.5 Omega Point Lab Test Reports # 12340-94583, 95165, 95168, 95246, Electrical Test to Determine the Ampacity Derating of a Protective Envelope for Class 1E Electrical Conduits
- 2.6 NRC Generic Letter 92-08, Thermo-Lag 330-1 Fire Barriers, Dated 12/17/92
- 2.7 Turkey Point Units 3 and 4, Technical Specifications, Amendments 191/185, effective September 26, 1996
- 2.8 5610-E-305, Rev. 44, Cable and Raceway Schedule
- 2.9 Calculation EC-096, Rev. 1, Cable Ampacity and Voltage Drop Calculation
- 2.10 Calculation 5177-BF-01, Rev. 2, Cable Ampacity in Duct Bank, Maintained Space Tray, Conduit and Free Air
- 2.11 Calculation 5177-BF-15, Rev. 1, Cable Ampacity Verifications for Cables Installed in 1 Hour Thermo-Lag 330-1 Covered Conduits (Unit 4 and Common)

REF.	
	<ul style="list-style-type: none">2.12 FPL Letter JPNS-PTN-92-0882, T. P. Heisterman to A. T. Zielonka, Thermo-Lag 330 Inspection/Walkdown, dated 8/14/922.13 5613-E-417, Revision 1, Penetrations T3C11, T3C21, T3C312.14 Vendor Manual AAS50, Rev. 3, Instruction & Operating Manual - 400 Amp Battery Charger2.15 5613-E-675, Rev. 3, Vital Inverter Loadings2.16 Standard IEEE/ICRA S-135-1-62/P-46-426, Power Cable Ampacities - Copper Conductors, 19622.17 Bechtel Calculation 5177-EF-09, Revision 1, Dated November 10, 19892.18 Calculation EC-138, Rev. 4, Switchgear, Load Center and MCC Load Study2.19 Calculation EC-136, Rev. 4, Existing Stationary Battery Cell Sizing and Voltage Drop Calculation2.20 Calculation IC-TP.0011, Rev. 0, EDG 125 VDC Load Calculation2.21 Thermal Science, Incorporated (TSI) Technical Note 11781, Rev. 52.22 Industrial Testing Laboratories (ITL) Report No. 84-10-5, Dated October 19842.23 Bechtel Calculation 5177-265-EF-25, Rev. 1, Dated November 10, 19892.24 Calculation 5177-462-E-03, Rev. 1, Station Batteries Loading Study2.25 5613-E-11, Sh. 1, Rev. 9, Single Line Diagram Electrical 125V DC and 120V Instrument AC2.26 5613-E-12, Rev. 4, Single Line Diagram Electrical 125V DC and 120V Instrument AC2.27 5614-E-11, Sh. 1, Rev. 5, Single Line Diagram Electrical 125V DC and 120V Instrument AC2.28 5614-E-12, Rev. 5, Single Line Diagram Electrical 125V DC and 120V Instrument AC2.29 MN-3.21 Specification, Rev. 5, Installation and Inspection Guidelines for Thermo-Lag Fire Barrier Material2.30 Engineering Evaluation JPN-PTN-SEEP-96-011, Rev. 0, Engineering Evaluation for Review of Ampacity Ratings for Power Cables in Conduits and Trays with Thermo-Lag 330-1 covering



REF.	
	<p>2.31 OMEGA POINT LAB Test Reports #11960-97337 & 97338, Ampacity Derating of Cables Enclosed in Conduit with Thermo-Lag 330-1/770-1 Upgrade Electrical Raceway Fire Barrier System (ERFBS)</p> <p>2.32 Calculation PTN-BFJM-96-028, Rev. 0, Fire Barrier Ampacity Correction Factors for T-Lag 330-1/770-1 Assemblies</p> <p>2.33 FPL Letter L-95-301, "Additional Information - Generic Letter 92-08, Thermo-Lag 330-1 Fire Barriers", dated November 16, 1995</p> <p>2.34 5610-E-303, Sh. 120, Rev. 2, Panel Schedule</p> <p>2.35 5610-E-56A, Rev. 1, Raceway Protection Wrap El. 18'-0" Area 20</p> <p>2.36 5610-E-61A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 18</p> <p>2.37 5610-E-67A, Rev. 1, Raceway Protection Wrap El. 10'-0" & Below Area 9 & 10</p> <p>2.38 5610-E-100A, Rev. 2, Raceway Protection Wrap El. 14'-0" Area 5</p> <p>2.39 5610-E-101A, Rev. 3, Raceway Protection Wrap El. 30'-6" Area 5</p> <p>2.40 5610-E-107A, Rev. 1, Raceway Protection Wrap El. 14'-0" Area 11</p> <p>2.41 5610-E-108A, Rev. 1, Raceway Protection Wrap El. 30'-6" Area 11</p> <p>2.42 5610-E-110A, Rev. 1, Raceway Protection Wrap El. 14'-0" Area 12</p> <p>2.43 5610-E-119A, Rev. 5, Raceway Protection Wrap El. 18'-0" Area 8</p> <p>2.44 5610-E-124A, Rev. 2, Raceway Protection Wrap El. 18'-0" Area 14</p> <p>2.45 5610-E-127A, Rev. 3, Raceway Protection Wrap El. 18'-0" Area 10</p> <p>2.46 5610-E-128A, Rev. 2, Raceway Protection Wrap El. 30'-0" Area 16</p> <p>2.47 5610-E-131A, Rev. 3, Raceway Protection Wrap All Elev. Area 24</p> <p>2.48 5610-E-133A, Rev. 6, Raceway Protection Wrap All Elev. Area 17</p> <p>2.49 5610-E-135A, Rev. 4, Raceway Protection Wrap El. 42'-0" Area 8</p> <p>2.50 5610-E-150A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 1</p> <p>2.51 5610-E-151A, Rev. 3, Raceway Protection Wrap El. 30'-0" & 31'-0" Area 1</p> <p>2.52 5610-E-154A, Rev. 3, Raceway Protection Wrap El. 30'-0" Area 2</p> <p>2.53 5610-E-160A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 3</p> <p>2.54 5610-E-161A, Rev. 4, Raceway Protection Wrap El. 30'-0" Area 3</p>



REF.

- 2.55 5610-E-183A, Rev. 1, Raceway Protection Wrap Intake Struct. Area 23
- 2.56 5610-E-626A, Rev. 0, Raceway Protection Wrap North of U3 Turb. Bldg.
- 2.57 5610-E-629A, Rev. 0, Raceway Protection Wrap North of U3 Turb. Bldg. Auxiliary Power Upgrade
- 2.58 5610-E-791A, Rev. 2, Raceway Protection Wrap Area 16 Above El. 58'-0"
- 2.59 PC/M 96-014, Rev. 0, Thermo-Lag Overlay Upgrades for Indoor Fire Zones

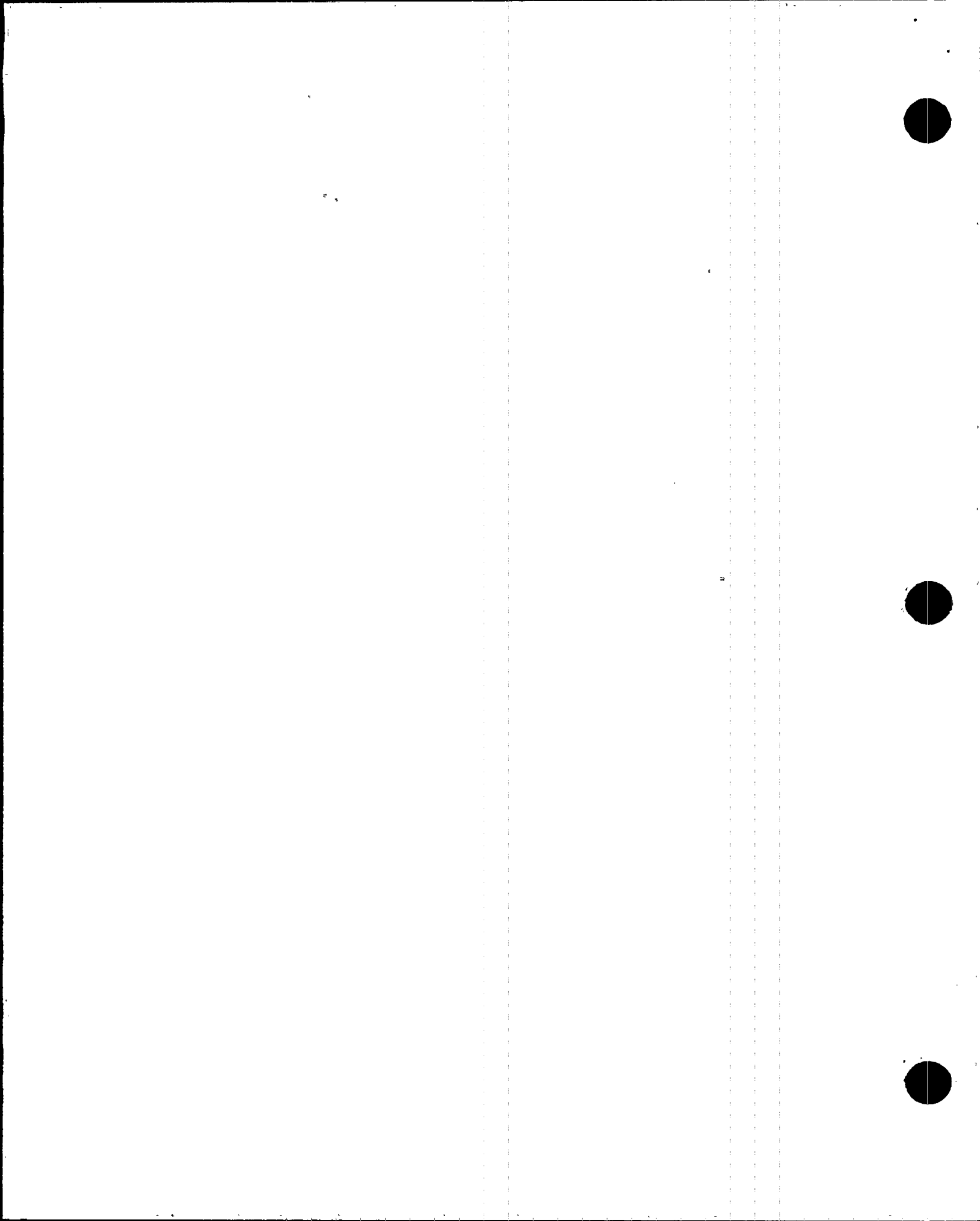
3.0. METHODOLOGY

This calculation is prepared to evaluate the ampacity rating of power cables in conduits, boxes and cable trays with Thermo-Lag 330-1 (for 1hr) and with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) fire barrier coverings. The population of power cables to be evaluated was determined from an engineering walkdown (Attachment 1) of electrical raceway components required to be protected from the effects of a design basis fire event and a review of layout drawings (Ref. 2.35-2.58). In addition the engineering walkdown also identified intervening raceways (Attachment 1) which required to be wrapped (only for portions of raceway) due to plant conditions which impacted the implementation of the required fire barrier material installation in accordance with specification MN-3.21 (Ref. 2.29).

Ampacity correction factors for 1 hour and 3 hour Thermo-Lag as determined in Calculations PTN-BFJM-96-005 (Ref. 2.1) and PTN-BFJM-96-028 (Ref. 2.32) will be used in this calculation. The Ampacity correction factors determined in Calculations PTN-BFJM-96-005 and PTN-BFJM-96-028 are based on testing of Thermo-Lag wrapped raceways performed at Omega Point Laboratories for Texas Utilities Comanche Peak Plant (Ref. 2.5) and for Tennessee Valley Authority Nuclear Plants (Ref. 2.31).

4.0 ASSUMPTIONS/BASES

- 4.1 Fire protection coatings used for circuits included in this calculation are the Thermo Science, Inc. (TSI) Thermo-Lag 330-1 (for 1hr) and Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) Fire Barrier System (fire wrap).
- 4.2 The scope of this calculation applies to conduit, boxes and tray sections inside and outside containment. For cables inside containment, the ambient air temperature is assumed to be 50 °C. Outside containment, the ambient temperature is assumed to be 40 °C.
- 4.3 Control and Instrumentation cables are not included in this evaluation because ampacity derating is not of concern for these types of service.



REF.

4.4 This calculation does not size any new cables. Evaluations performed within this calculation use data and tables from the referenced calculations as noted.

4.5 Note that for cable sizing purposes, ampacity is only one factor, along with circuit voltage drop at normal and degraded grid voltage and cable short circuit fault withstand capability. Additionally, cable sizing used 'standard' cable sizes which were cables that were already available on site that were as large or larger than the designed cable required.

4.6 Note where conduits are fire wrapped in a banked configuration, it is assumed that the spacing of the conduits is such that the cable ampacity must be corrected for conduit grouping.

5.0. CALCULATION

5.1. Ampacity Rating for Cables in Wrapped Conduit

Table 1 lists all Thermo-Lag 330-1 (for 1hr) wrapped conduits, identified in Attachment 1, containing power cables. Table 2 lists all Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) wrapped conduits, identified in Attachment 1, containing power cables. Table 3 lists all Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3Hr) intervening conduits, identified in Attachment 1, containing power cables. The population of power cables to be evaluated is based on electrical raceways and intervening raceways required to be wrapped per Attachment 1. Power cables included in the raceways were determined by review of the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 2.8). The installed power cables, cable conductor sizes and the number of conductors per cable were determined from CARS. Conductor resistances were determined from Calculation EC-096, Section 7.2.2 (Ref. 2.9). Load currents were determined from the listed references in Tables 1, 2 & 3.

Operating heat loads (watts per foot) for the cables were calculated as follows:

$$\text{Watts/ft} = (\# \text{ of Conductors}) (\Omega \text{ per } 1000 \text{ ft}) (\text{Load Current})^2 / 1000$$

The ampacities for 90°C rated cables were determined from Calculations 5177-EF-01 (Ref. 2.10) "Cable Ampacity in Duct Bank, Maintained Space Tray, Conduit and Free Air" and EC-096 (Ref. 2.9) "Cable Ampacity and Voltage Drop Calculations." Power cables procured to Specifications 5610-E-11 and 5610-E-13 have a maximum rated conductor temperature of 85°C. The ampacities for these cables were adjusted for rated temperature using the following formula from IEEE/ICEA Standard S-135-1-62/P-46-426 (Ref. 2.16):

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REF.

$$I' = I \left[\frac{T_c' - T_a' - \text{DELTA TD}'}{T_c - T_a - \text{DELTA TD}} \times \frac{234.5 + T_c}{234.5 + T_c'} \right]^{1/2} \text{ amperes}$$

Where:

I	=	The 90°C cable ampacity (Ref. 2.10)
T _c	=	90°C
T _a	=	40°C
DELTA TD	=	0.15°C, (4/0 AWG, 8KV Cable)
	=	0°C, (350 MCM, 600V Cable)
	=	0°C, (750 MCM, 600V Cable)
I'	=	The 85°C cable ampacity
T _c '	=	85°C
T _a '	=	40°C
DELTA TD'	=	0.15°C, (4/0 AWG, 8KV Cable)
	=	0°C, (350 MCM, 600V Cable)
	=	0°C, (750 MCM, 600V Cable)

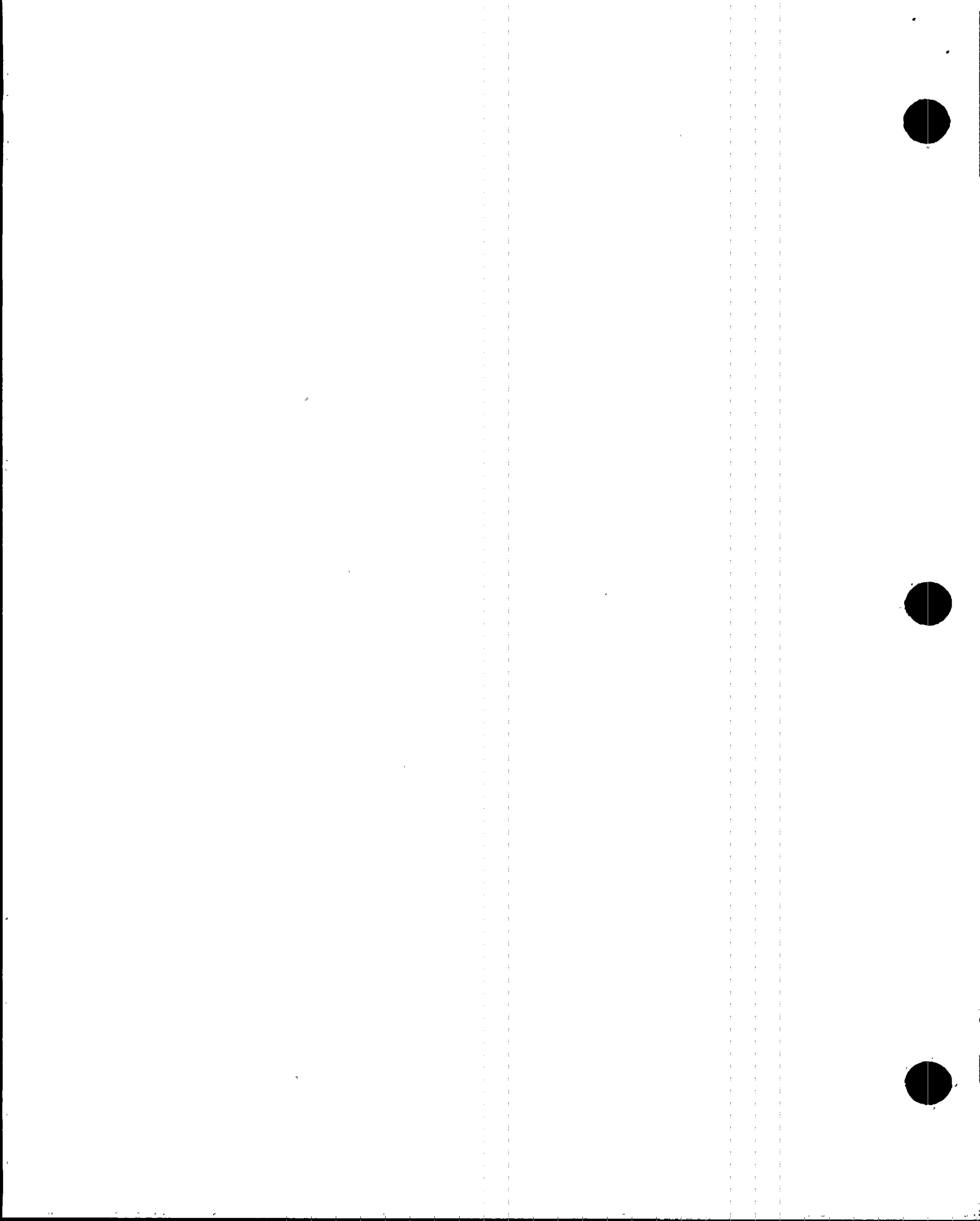
Therefore, the conductor temperature rating correction factors for 85°C cables are as follow:

0.956 (4/0 AWG Cable)
 0.956 (350 MCM Cable)
 0.956 (750 MCM Cable)

Cable ampacities were derated when the number of conductors in the conduit exceeded three. The following ampacity correction factors were taken from Attachment 5 of Calculation 5177-EF-15 (Ref. 2.11) "Ampacity Verification for Cables Installed in 1 Hour Thermo-lag 330-1 covered conduits (Unit 4 and Common):"

<u>Total Number of Conductors</u>	<u>Ampacity Correction Factor</u>
3	1.00
4 - 6	0.80
7 - 9	0.70
10 - 24	0.70

Where conduits are fire wrapped in a banked configuration, it is assumed that the spacing of the conduits is such that the cable ampacity must be corrected for conduit grouping. Conduit sections which are not wrapped in a banked configuration are not considered to be grouped. Banked conduit section configurations were identified by field walkdowns (Ref. 2.12). The following ampacity correction factors were taken from Attachment 5 of Calculation 5177-EF-15 (Ref. 2.11) "Ampacity Verification for Cables Installed in 1 Hour Thermo-lag 330-1 covered conduits (Unit 4 and Common):"



REF.

Number of Conduits in Group with <u>Power Cables</u>	<u>Ampacity</u> <u>Correction Factor</u>
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2	0.94
3	0.91
4	0.88
5	0.87
6	0.86

Electrical raceways (3J1920, 4J1760 and 4J2096) sections protected with 1-1/4" (Nominal) thickness Thermo-Lag 330-1 material and designated as requiring a 1 hour rated fire barrier will receive an additional wire mesh stress for support, per Fire Protection Evaluation Records attached to PC/M 96-014 (Ref. 2.59). The ampacity correction factor for the above fire barrier assembly was conservatively selected by using the correction factor for the conduits wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 in a banked configuration from Calculation PTN-BFJM-96-028 (Ref. 2.32) "Fire Barrier Ampacity Correction Factors for T-Lag 330-1/770-1 Assemblies:"

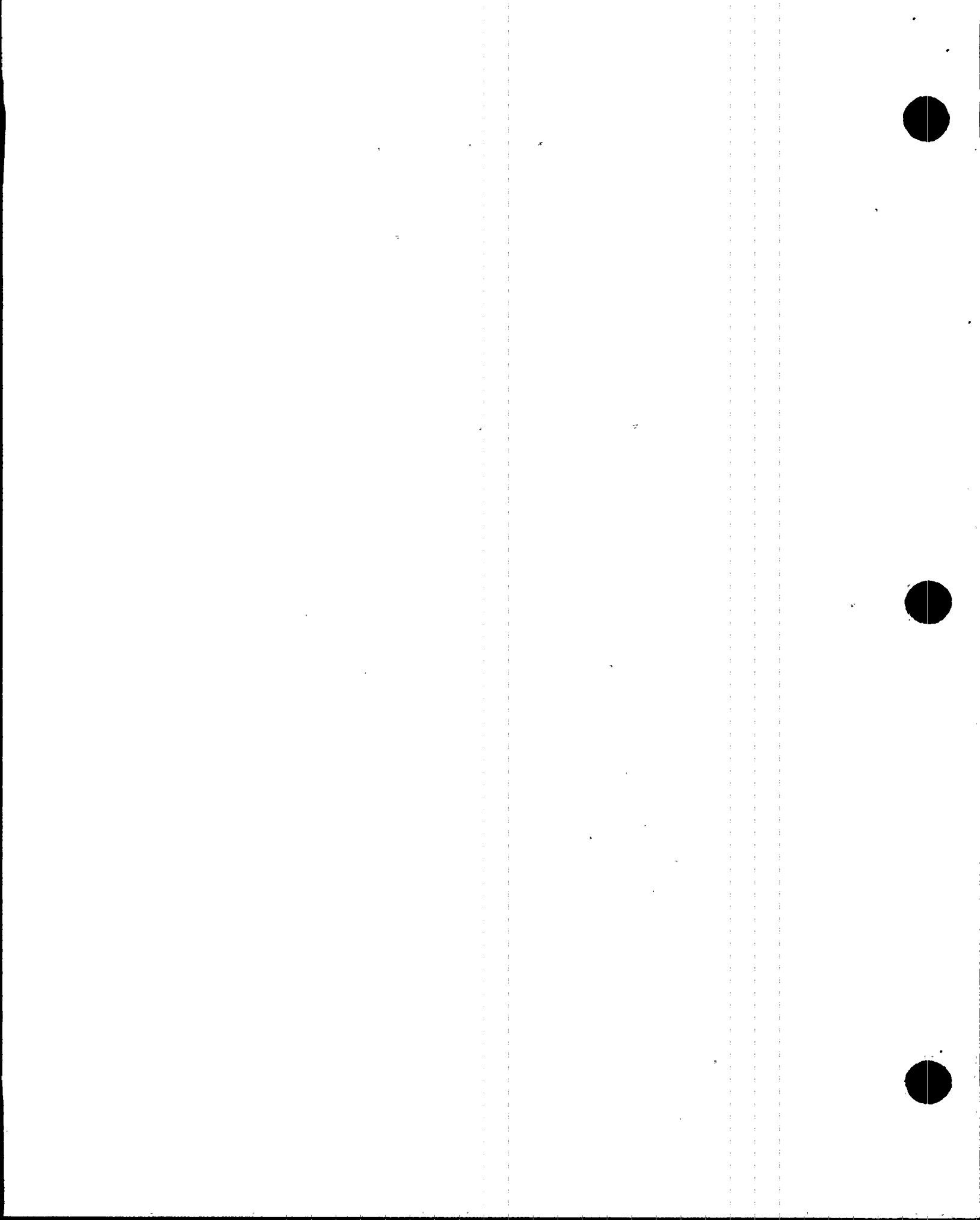
<u>Wrapped</u> <u>Configuration</u>	<u>Ampacity</u> <u>Correction Factor</u>
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1 Hr Wrapped (1-1/4" Thickness) Single Conduit	0.74
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Electrical raceways (3J1712 and 3J1777) sections protected with 5/8" (Nominal) thickness Thermo-Lag 330-1 material and designated as requiring a 1 hour rated fire barrier will receive an additional 3/8" (Nominal) thickness Thermo-Lag 330-1 material overlay along conduit runs, per Fire Protection Evaluation Records attached to PC/M 96-014 (Ref. 2.59). The ampacity correction factor for the above fire barrier assembly was conservatively selected by using the correction factor for the conduits wrapped with 1-1/4" (Nominal) Thermo-Lag 330-1 in a single conduit configuration from Calculation PTN-BFJM-96-005 (Ref. 2.1) "Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier:"

<u>Wrapped</u> <u>Configuration</u>	<u>Ampacity</u> <u>Correction Factor</u>
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1 Hr Wrapped (5/8" Thickness) Single Conduit	0.80
--	------



REF.

Rated cable ampacities in conduit were calculated as follows:

Rated Amps = (Cable Amp.) (Temp. Corr. Fact.) (# of Cond. Corr. Fact.) (Conduit Group. Corr. Fact.) (T-Lag Corr. Fact.)

Maximum heat loads (watts per foot) for the cables were calculated as follows:

Watts/ft = (# of Conductors) (Ω per 1000 ft) (Rated Current)²/1000

The percentage cable loading between rated ampacity and actual load current was calculated as follows:

% Cable Loading = 100 (Load Current) / (Rated Ampacity)

The ampacities of cables in conduits wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) fire barrier material were corrected using the following factors taken from Calculation PTN-BFJM-96-028 (Ref. 2.32) "Fire Barrier Ampacity Correction Factors for T-Lag 330-1/770-1 Assemblies:"

<u>Wrapped Configuration.</u>	<u>Ampacity Correction Factor</u>
3 Hr Wrapped Single Conduit ($\leq 4"$)	0.82
3 Hr Wrapped Banked Conduit	0.74

Rated cable ampacities in conduit were calculated as follows:

Rated Amps = (Cable Amp.) (Temp. Corr. Fact.) (# of Cond. Corr. Fact.) (Conduit Group. Corr. Fact.) (T-Lag Corr. Fact.)

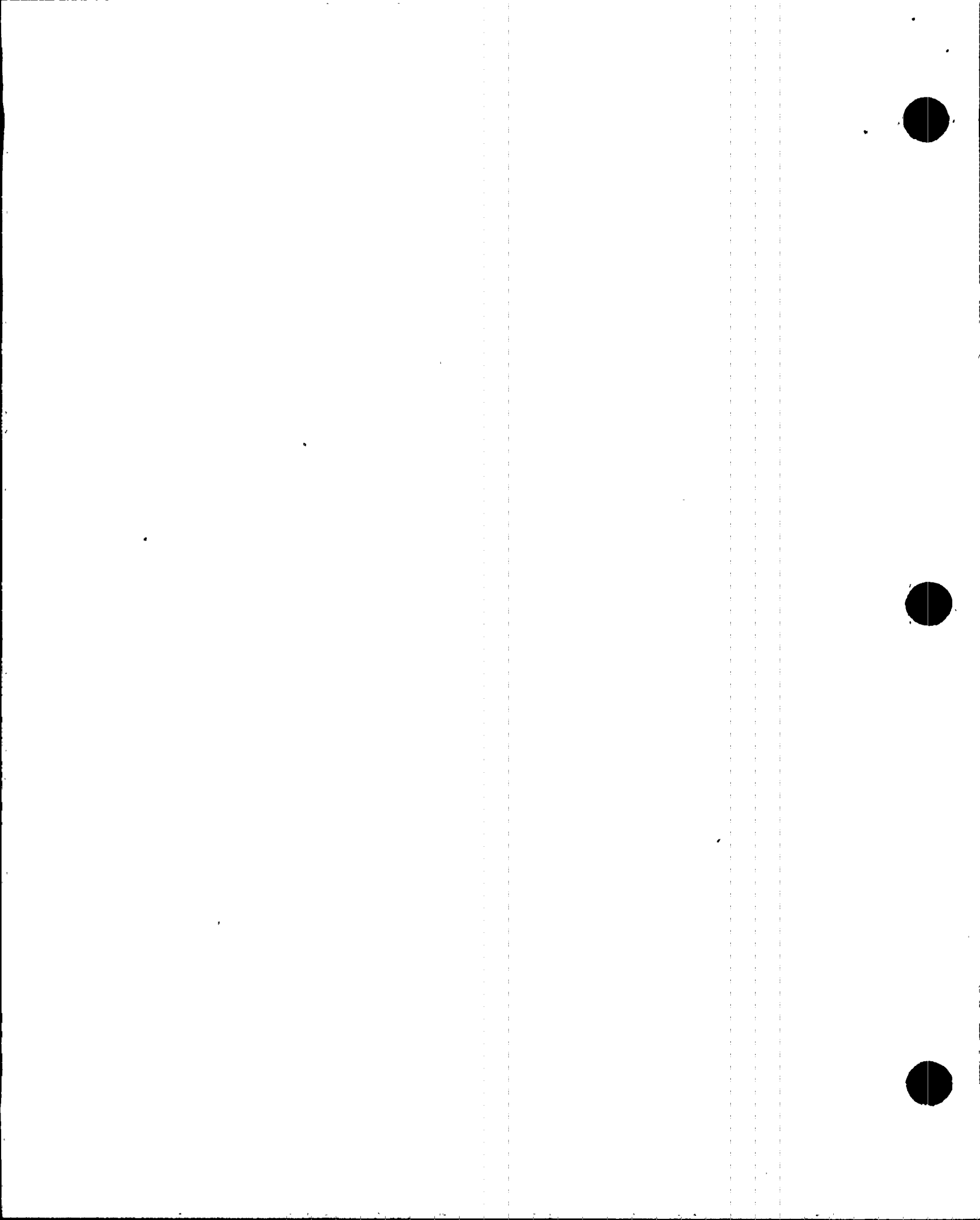
Maximum heat loads (watts per foot) for the cables were calculated as follows:

Watts/ft = (# of Conductors) (Ω per 1000 ft) (Rated Current)²/1000

The percentage cable loading between rated ampacity and actual load current was calculated as follows:

% Cable Loading = 100 (Load Current) / (Rated Ampacity)

The following conduits which were listed in Attachment 1 contain control, indication, instrumentation and spare cables:



REF.

CONDUITS

3A1096

84-857

3/4" EMT

3/4" to Alarm 1-1

3F1328

3K1818

3K1286

3K1285

3J1644

3J-753

3A1171

CONDUITS

3K1284

3K1814

3J1330

3J1336

3K1787

3K1810

4F1326

4F1098

4K1451

4J1781

4F1382

CONDUITS

4J1648

4J1649

4F1366

4J1482

4J1507

4J1669

3F1376

3/4" Control

1-1/2" CNTL(4J1702)

1" CNTL(4F1003)

3/4" Light

In addition, conduit 3J1611 is embedded in wall and therefore the cables in this conduit are not required to be derated.

A review of the Cable and Raceway Schedule(CARS) 5610-E-305(Ref. 2.8) determined that all of the cables routed in the above listed conduits are either control, indication, instrumentation, space heater or spare cables which do not need to be evaluated for derating(Section 4.3).

5.2 Ampacity Rating Methodology for Cables in Wrapped Tray

The population of power cables to be evaluated was determined from an engineering walkdown(Attachment 1) of electrical raceway components required to be protected from the effects of a design basis fire event. In addition the engineering walkdown also identified intervening raceways(Attachment 1) which required to be wrapped(only for portions of raceway) due to plant conditions which impacted the implementation of the required fire barrier material installation in accordance with specification MN-3.21(Ref. 2.29). This walkdown only identified one tray section 3KFT10(West Penetration Room) which required to be wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1(for 3Hr). A review of the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 2.8) determined that all of the cables in this tray were either control, indication or instrumentation cables which have a negligible effect and are not included.

The ampacities of cables in trays wrapped with Thermo-Lag 330-1(for 1 Hr) fire barrier material were corrected using the following factors taken from Calculation PTN-BFJM-96-005 (Ref. 2.1) "Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier:"

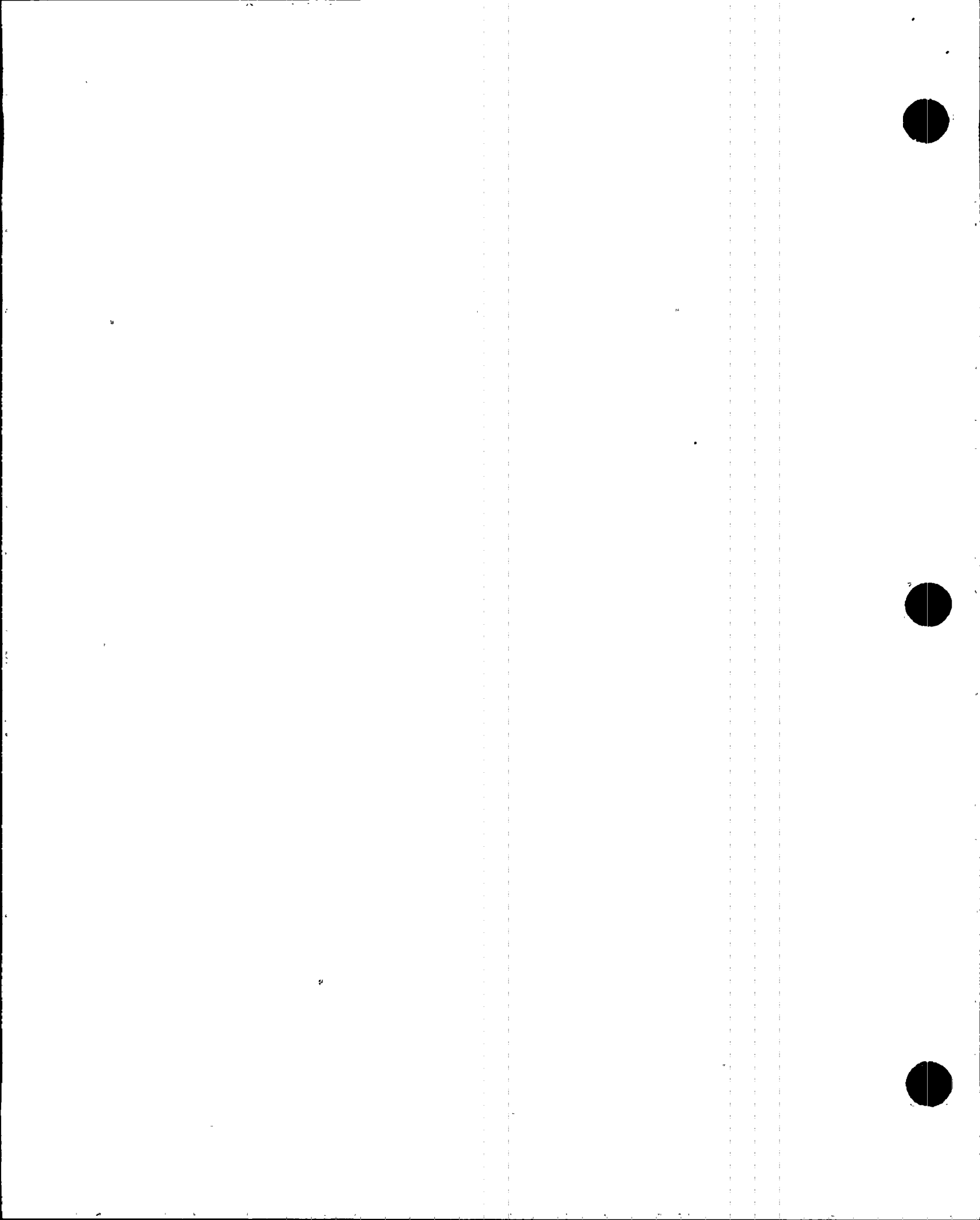
Wrapped
Configuration

Ampacity
Correction Factor

1 Hr Wrapped
Cable Tray

0.69

The ampacities of cables in trays wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1(for 3 Hr) fire barrier material were corrected using the



REF.

following factors taken from Calculation PTN-BFJM-96-028 (Ref. 2.32) "Fire Barrier Ampacity Correction Factors for T-Lag 330-1/770-1 Assemblies:"

<u>Wrapped Configuration</u>	<u>Ampacity Correction Factor</u>
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3 Hr Wrapped Cable Tray	0.52
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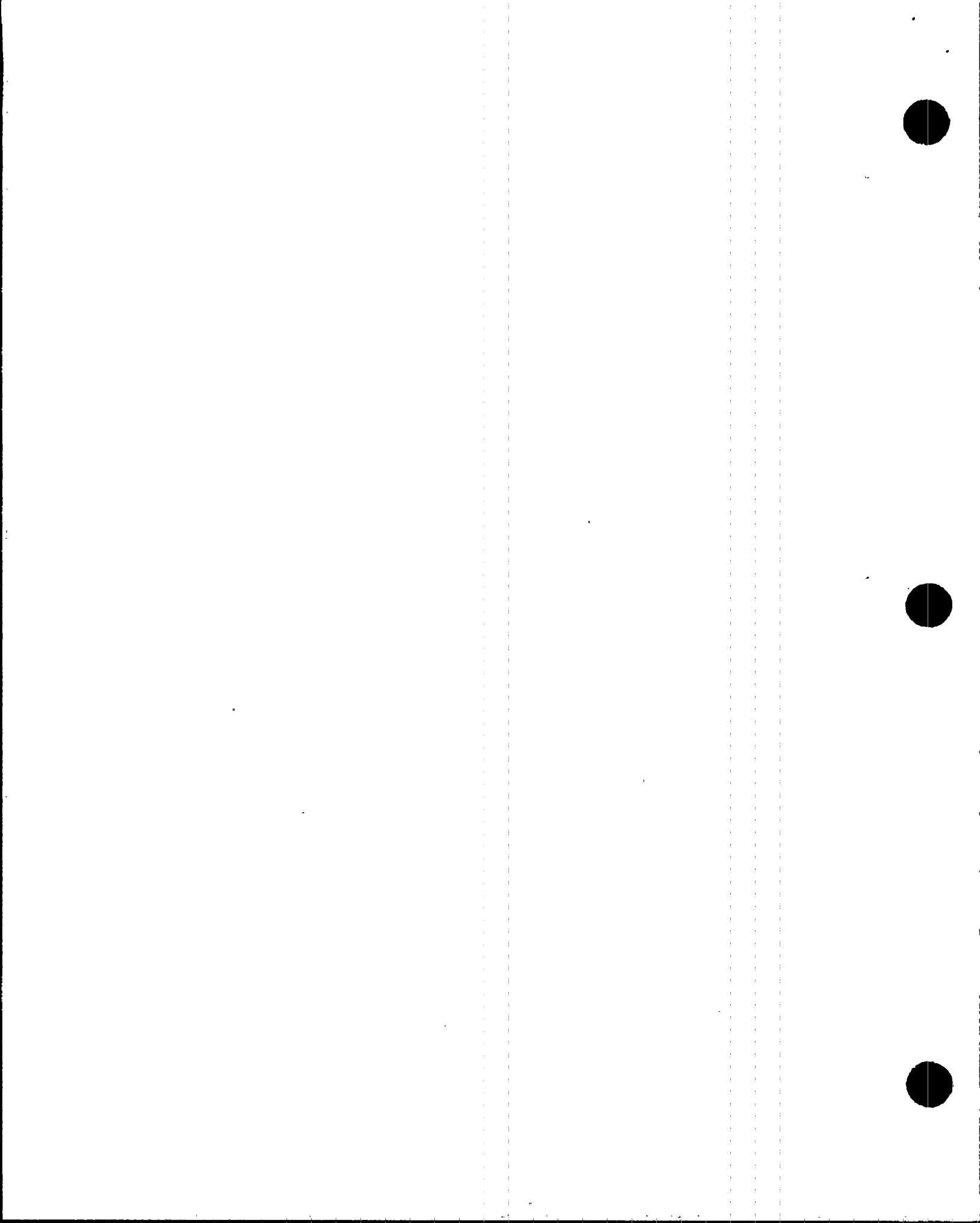
Maximum watts per foot and percent cable loading were calculated as previously discussed above for conduits.

5.3 Ampacity Rating Methodology for Cables in Wrapped Boxes

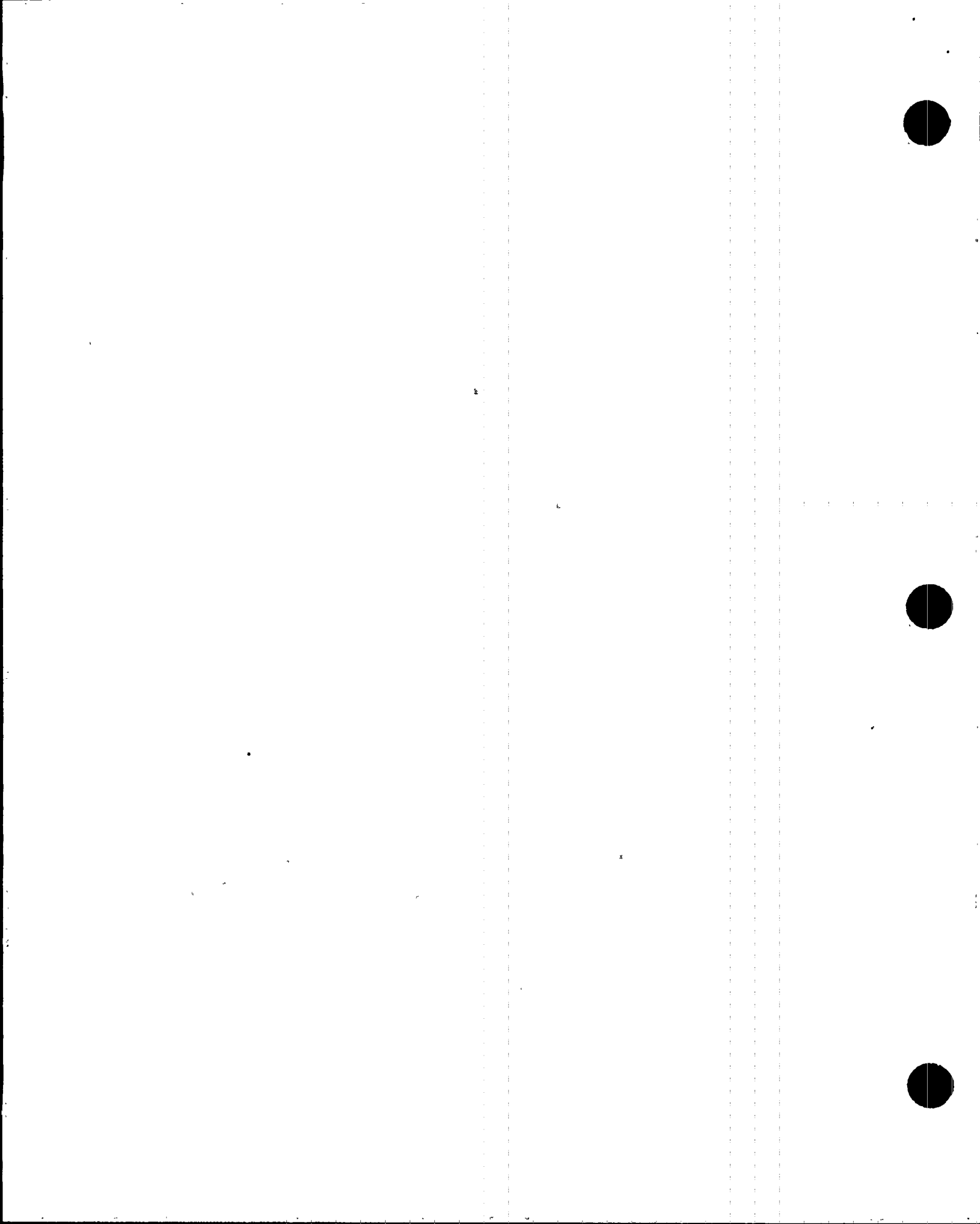
Table 4 lists all Thermo-Lag 330-1 (for 1hr) and Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) wrapped pull boxes, terminal boxes and junction boxes, identified in Attachment 1, containing power cables. The population of power cables to be evaluated was determined from an engineering walkdown (Attachment 1) of electrical raceway components required to be protected from the effects of a design basis fire event. Power cables located in the conduits were determined by review of the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 2.8). The installed power cables, cable conductor sizes and the number of conductors per cable were determined from CARS. Control cables and spares have a negligible effect and are not included. Conductor resistances were determined from Calculation EC-096 (Ref. 2.9). Load currents were determined from the listed references in Table 4.

The ampacities for 90°C rated cables were determined from Calculations 5177-EF-01 (Ref. 2.10) "Cable Ampacity in Duct Bank, Maintained Space Tray, Conduit and Free Air" and EC-096 (Ref. 2.9) "Cable Ampacity and Voltage Drop Calculations." Power cables procured to Bechtel Specifications 5610-E-11 and 5610-E-13 have a maximum rated conductor temperature of 85°C. Boxes were not included in the above calculations, therefore the ampacity for cable tray are applied to the wrapped boxes. The application of the cable tray ampacity to boxes has been determined to be valid based on the geometric similarity. Boxes are not expected to be as heavily loaded as the tested cable tray due to the shape of the boxes and the spacing between cables.

The ampacities of cables in boxes wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3 Hr) fire barrier material were corrected using the following factors taken from Calculation PTN-BFJM-96-028 (Ref. 2.32) "Fire Barrier Ampacity Correction Factors for T-Lag 330-1/770-1 Assemblies:"



REF.					
	<table><tr><th data-bbox="381 327 599 389"><u>Wrapped Configuration</u></th><th data-bbox="774 327 1053 389"><u>Ampacity Correction Factor</u></th></tr><tr><td data-bbox="381 420 583 482">3 Hr Wrapped Boxes</td><td data-bbox="774 420 842 451">0.70</td></tr></table> <p data-bbox="381 513 1554 576">The following boxes which were listed in Attachment 1 contain control, indication, instrumentation and spare cables:</p> <p data-bbox="477 607 566 638"><u>BOXES</u></p> <p data-bbox="477 638 579 658">PB3711</p> <p data-bbox="477 669 579 689">PB3836</p> <p data-bbox="477 700 579 721">TB3117</p> <p data-bbox="381 762 1554 886">A review of the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 2.8) determined that all of the cables routed in the above listed boxes were either control, indication, instrumentation or spare cables which have a negligible effect and are not included in this calculation.</p> <p data-bbox="381 917 1062 948">5.4 <u>Individual Case Study Calculations</u></p> <p data-bbox="381 980 1554 1073">The following circuits have not been specifically identified in previous calculations but will affect essential equipment in the PTN Safe Shutdown Analysis.</p> <p data-bbox="381 1104 1554 1777">5.4.1. The Engineering walkdown (Attachment 1) of electrical raceway components required to be protected from the effects of a design basis fire event identified conduit 3K1814, located in the West Penetration Room, as requiring to be wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr). The safe shutdown cable (3V455C/G) in conduit 3K1814 exits the conduit and is routed in free air to Penetration T3C11. In order to protect this cable in this area from the effects of a design basis fire and because of space limitations around the penetration T3C11 (cable congestion) it was determined that a box will be mounted around the penetration T3C11 and will be wrapped with Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1. This wrap will also include portions of cable tray 3KFT10 which runs directly below the Penetration T3C11. The cables for cable tray 3KFT10 were reviewed in Section 5.2 of this calculation. A review of the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 2.8) and drawing 5613-E-417, "Penetrations T3C11, T3C21, T3C31", (Ref. 2.13) determined that all of the cables connected to Penetration T3C11 were either control or instrumentation cables which have a negligible effect and are not included.</p>	<u>Wrapped Configuration</u>	<u>Ampacity Correction Factor</u>	3 Hr Wrapped Boxes	0.70
<u>Wrapped Configuration</u>	<u>Ampacity Correction Factor</u>				
3 Hr Wrapped Boxes	0.70				



REF.

6.0. RESULTS

The following tables include the results of the individual calculations prepared in Sections 5.1, 5.2, and 5.3 above.

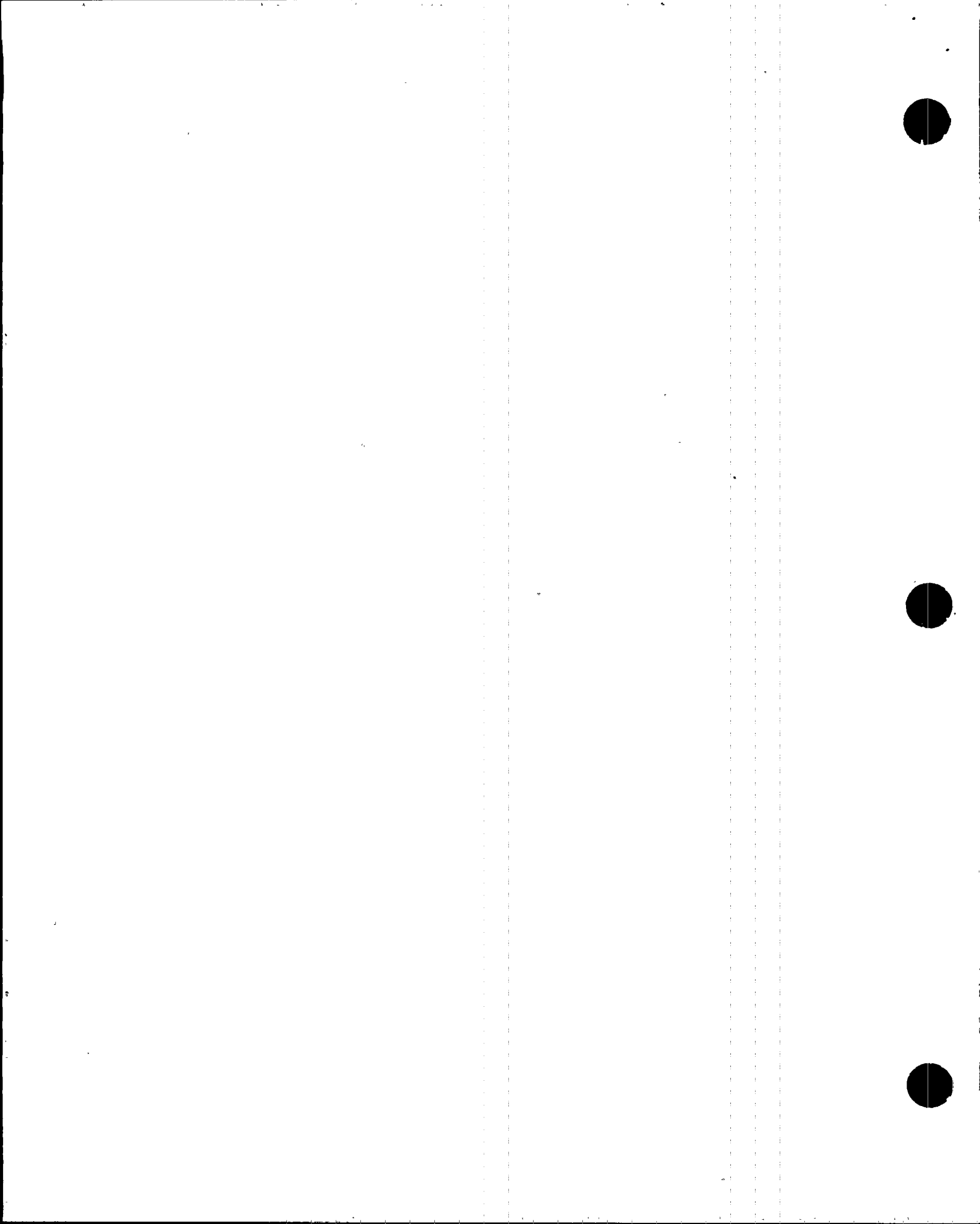


TABLE 1
SHEET NO. 18

CABLE		RACEWAY		COND. SIZE	CABLE		CABLE res/1000'	LOAD AMPS	LOAD Source	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	COND. C. F.	GRPING C. F.	T-LAG C. F.	RATED AMPS	MAX. W/FT	% CABLE LOADING
SCH	SUB	NUM	WP		# COND	SIZE												
300104	P	3J1712	1	3	2-1/C	2	0.2110	23.50	4	0.2330	130	1	.7	1	0.80	72.80	2.24	32.28
300131	Q	3J1712	1	3	2-1/C	4	0.3380	1.00	2	0.0007	97	1	.7	1	0.80	54.32	1.98	1.84
300147	P	3J1712	1	3	2-1/C	0	0.1330	15.40	4	0.0631	179	1	.7	1	0.80	100.24	2.67	15.38
300147	Q	3J1712	1	3	2-1/C	0	0.1330	15.40	4	0.0631	179	1	.7	1	0.80	100.24	2.67	15.38
3Y01	A	3J1777	1	3	2-1/C	0	0.1380	82.50	3	1.0625	179	1	.8	1	0.80	114.56	3.57	54.58
3Y01	P	3J1777	1	3	2-1/C	0000	0.0689	97.00	2	1.2968	278	1	.8	1	0.80	177.92	4.38	54.52
302328	R	3J1820	1	3	2/C	00	0.1100	3.00	1	0.0020	204	1	.7	1	0.74	105.87	2.48	2.84
302328	S	3J1820	1	3	2/C	00	0.1100	3.00	1	0.0020	204	1	.7	1	0.74	105.87	2.48	2.84
302328	P	3J1820	1	3	2-1/C	0	0.1330	14.15	4	0.0533	179	1	.7	1	0.74	92.72	2.29	15.26
302328	RAL	3J1820	1	3	2/C	00	0.1100	3.00	1	0.0020	204	1	.7	1	0.74	105.87	2.48	2.84
302328	P	4J1780	1	3	2-1/C	0	0.1330	14.15	4	0.0533	179	1	.8	1	0.74	105.97	2.99	13.35
302328	RAL	4J1780	1	3	2-1/C	0	0.1330	14.15	4	0.0533	179	1	.8	1	0.74	105.97	2.99	13.35
400104	Q	4J1780	1	3	2-1/C	8	0.5340	24.00	4	0.8152	75	1	.8	1	0.74	44.40	2.11	54.05
400104	R	4J2088	1	3	2/C	4	0.3380	24.00	4	0.3971	130	1	1	1	0.74	98.20	6.22	24.95

LOAD AMPS SOURCE

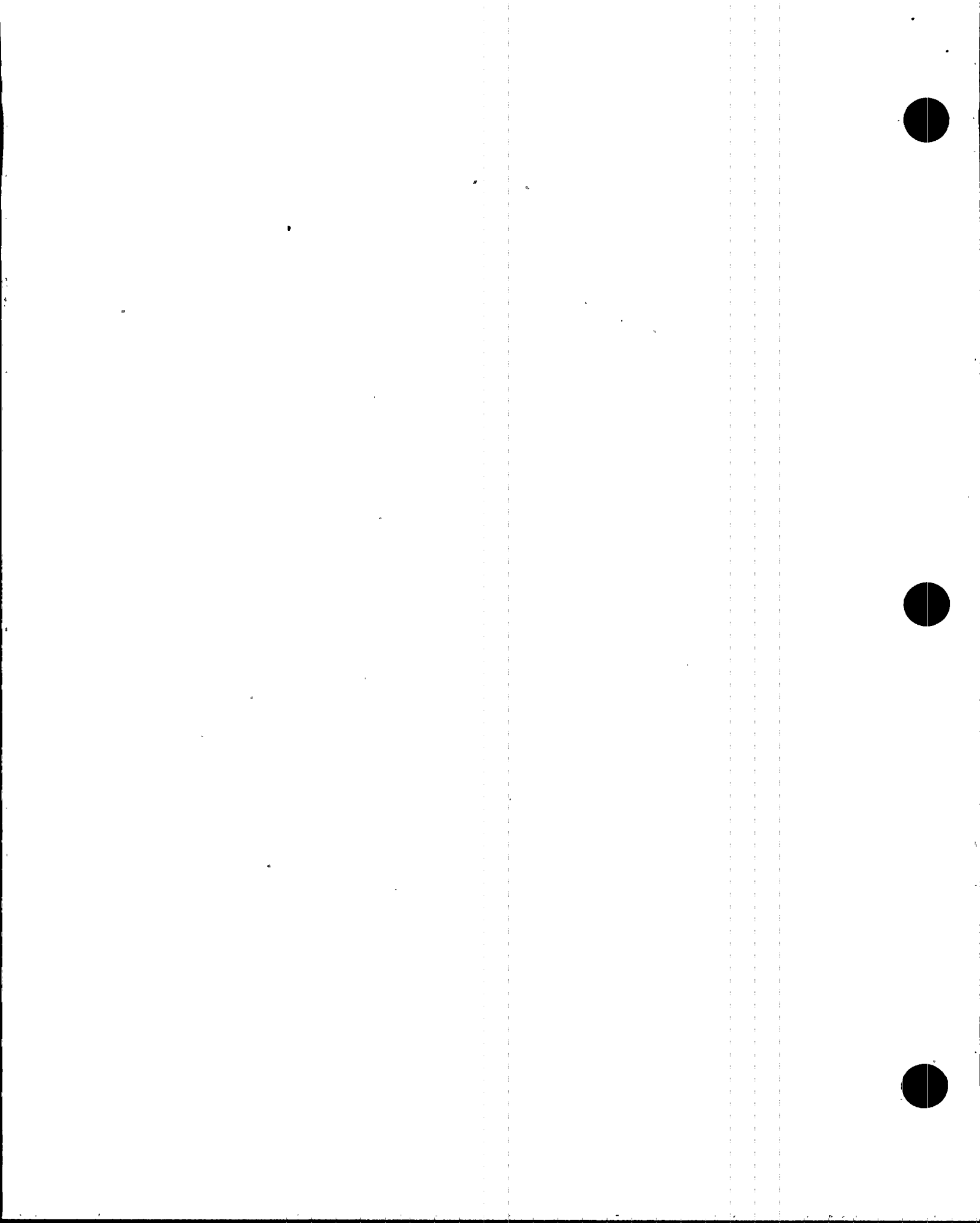
- 1) IC-TP-0011, REV. 0 (REFERENCE 2.20)
2) 5177-482-E-03, REV. 1 (REFERENCE 2.24)
3) 5813-E-11, SH. 1, REV. 0; 1 - 7.5KV/12KV - 62.5A (REFERENCE 2.25)
4) PTH-BFJE-83-001, REV. 0 (REFERENCE 2.2)



CABLE		RACEWAY		COND.	CABLE		CABLE	LOAD	LOAD	OPER.	CABLE	TEMP.	COND.	GRPING	T-LAG	RATED	MAX.	% CABLE
SCH	SUB	NUM	WP	SIZE	# COND	SIZE	res/1000'	AMPS	Source	W/FT	AMPACITY	C.F.	C.F.	C.F.	C.F.	AMPS	W/FT	LOADING
380112	1	3A451	3	4	3-1/C	750	0.0224	200.00	5	2.8880	588	.958	1	.84	.74	397.87	10.83	50.28
380112	2	3A452	3	4	3-1/C	750	0.0224	200.00	5	2.8880	588	.958	1	.84	.74	397.87	10.83	50.28
3Y02	A	3J1810	3	3	2-1/C	0	0.1380	82.50	1	1.0825	178	1	.8	.88	.74	83.25	2.37	87.02
3Y05	A	3J1810	3	3	2-1/C	0	0.1380	82.50	2	1.0825	178	1	.8	.88	.74	83.25	2.37	87.02
4Y02	A	4F1331	3	3	2-1/C	0	0.1380	82.50	3	1.0825	178	1	.8	1	.74	105.97	3.05	58.88
4Y05	A	4F1331	3	3	2-1/C	0	0.1380	82.50	4	1.0825	178	1	.8	1	.74	105.97	3.05	58.88
300108	A	4F1380	3	2	2-1/C	0	0.1330	1.00	5	0.0003	178	1	.8	1	.82	117.42	3.87	0.85
300108	A	4F1380	3	2	2-1/C	0	0.1330	1.00	5	0.0003	178	1	.8	1	.82	117.42	3.87	0.85
4Y02	0A	4J1807	3	3	2-1/C	0	0.1380	82.50	3	1.0825	178	1	.7	.84	.74	87.18	2.07	71.71
4Y05	A	4J1807	3	3	2-1/C	0	0.1380	82.50	4	1.0825	178	1	.7	.84	.74	87.18	2.07	71.71
480814	A	4J1788	3	4	3-1/C	0000	0.0888	104.50	5	2.2572	278	1	.7	1	.82	159.57	5.28	85.48
400108	P	4J1788	3	4	2-1/C	0	0.1330	1.00	5	0.0003	178	1	.7	1	.82	102.75	2.81	0.87
400108	P	4J1788	3	4	2-1/C	0	0.1330	17.78	5	0.0842	178	1	.7	1	.82	102.75	2.81	17.31
400112	P	4J1788	3	4	2-1/C	2	0.2110	2.00	5	0.0017	130	1	.7	1	.82	74.82	2.35	2.88
400128	R	4J1788	3	4	2-1/C	2	0.2110	50.00	5	1.0550	130	1	.7	1	.82	74.82	2.35	87.01
480814	A	4J1788	3	4	3-1/C	0000	0.0888	104.50	5	2.2572	278	1	.7	1	.82	159.57	5.28	85.48
480824	P	4J1788	3	4	1-3/C	10	1.4040	2.83	5	0.0281	38	1	.7	1	.82	20.88	1.80	12.73
480838	P	4J1788	3	4	1-3/C	10	1.4040	3.00	5	0.0378	38	1	.7	1	.82	20.88	1.80	14.52
400108	P	4J1788	3	4	2-1/C	0	0.1330	1.00	5	0.0003	178	1	.7	1	.82	102.75	2.81	0.87
400108	P	4J1788	3	4	2-1/C	0	0.1330	17.78	5	0.0842	178	1	.7	1	.82	102.75	2.81	17.31
400112	P	4J1788	3	4	2-1/C	2	0.2110	2.00	5	0.0017	130	1	.7	1	.82	74.82	2.35	2.88
400128	R	4J1788	3	4	2-1/C	2	0.2110	50.00	5	1.0550	130	1	.7	1	.82	74.82	2.35	87.01

LOAD AMPS SOURCE

- 1) 5813-E-11, SH. 1, REV. 0; 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.25)
- 2) 5813-E-12, REV. 4; 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.28)
- 3) 5814-E-11, SH. 1, REV. 5; 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.27)
- 4) 5814-E-12, REV. 5; 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.28)
- 5) PTM-BFJE-93-001, REV. 0(REFERENCE 2.2)



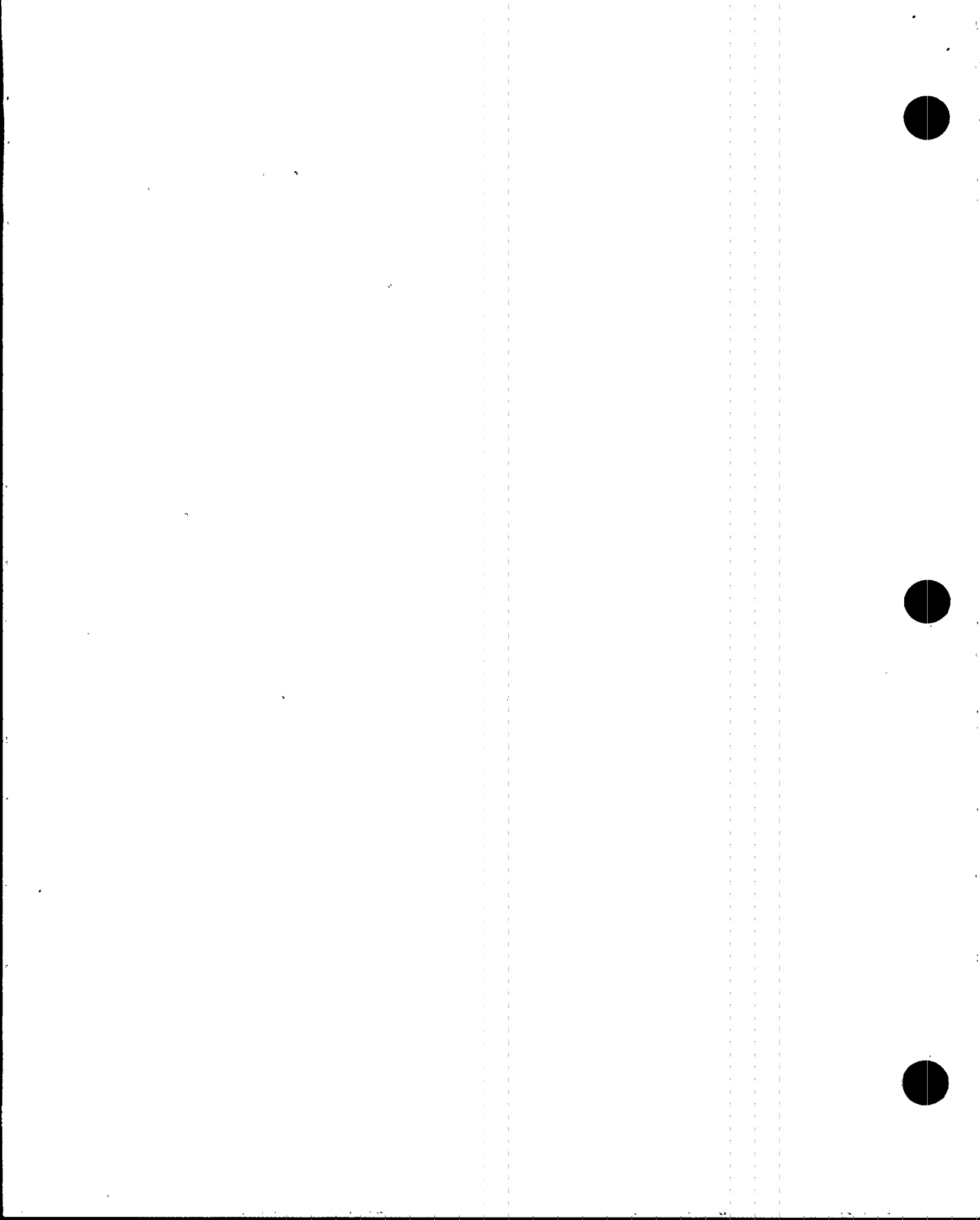
AMPACITY DERATING FOR CABLES ROUTED IN INTERVENING CONDUIT WRAPPED WITH THERMO-LAG 330-1 W/LAYER THERMO-LAG 770-1

PTM-BFSE-88-000, REV. 0

TABLE 3

SHEET NO. 10

CABLE		RACEWAY		COND. SIZE	CABLE		CABLE res/1000'	LOAD AMPS	LOAD Source	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	COND. C. F.	GRPING C. F.	T-LAG C. F.	RATED AMPS	MAX. W/FT	% CABLE LOADING
SCH	SUB	NUM	WP		# COND	SIZE												
385418	P	3A1835	3	3	1-3/C	10	1.4040	3.58	2	0.0543	38	1	1	1	0.82	29.52	3.87	12.18
385417	P	3A1835	3	3	1-3/C	10	1.4040	5.98	1	0.1508	38	1	.7	1	0.82	20.68	1.80	28.84
385417	P	3A1836	3	3	1-3/C	10	1.4040	5.98	1	0.1508	38	1	1	1	0.82	29.52	3.87	20.28
380112	1	3A451	3	4	3-1/C	750	0.0224	200.00	8	2.8880	598	.958	1	.94	0.74	397.87	10.83	50.28
380112	2	3A452	3	4	3-1/C	750	0.0224	200.00	8	2.8880	598	.958	1	.94	0.74	397.87	10.83	50.28
3Y02	E	3F1331	3	3	2-1/C	0000	0.0889	83.30	14	0.9582	278	1	.8	.88	0.74	144.83	2.89	57.52
4Y02	E	3F1331	3	3	2-1/C	0000	0.0889	83.30	15	0.9582	278	1	.8	.88	0.74	144.83	2.89	57.52
3Y05	D	3F1331	3	3	1-2/C	4	0.3380	12.02	11	0.0971	97	1	.8	.88	0.74	50.53	1.72	23.78
3Y02	J	3F1340	3	2	2-1/C	4	0.3380	24.00	12	0.3871	97	1	.8	.88	0.74	50.53	1.72	47.49
4Y05	J	3F1340	3	2	2-1/C	4	0.3380	24.00	13	0.3871	97	1	.8	.88	0.74	50.53	1.72	47.49
4Y05	E	3F1340	3	2	2-1/C	0000	0.0889	83.30	18	0.9582	278	1	.8	.88	0.74	144.83	2.89	57.52
3Y07	A	3F1345	3	2	2-1/C	0	0.1380	82.50	8	1.0825	178	1	1	1	0.82	148.78	5.88	42.58
380835	A	3J1808	3	2	3-1/C	2	0.2130	65.58	17	2.7485	130	1	1	.88	0.74	84.68	4.58	77.44
3Y02	D	3J1871	3	3	1-2/C	4	0.3380	12.02	5	0.0971	97	1	.7	1	0.82	55.88	2.08	21.59
3Y05	D	3J1871	3	3	1-2/C	4	0.3380	12.02	11	0.0971	97	1	.7	1	0.82	55.88	2.08	21.59
4Y02	D	3J1871	3	3	1-2/C	4	0.3380	12.02	7	0.0971	97	1	.7	1	0.82	55.88	2.08	21.59
4Y05	D	3J1871	3	3	1-2/C	4	0.3380	12.02	8	0.0971	97	1	.7	1	0.82	55.88	2.08	21.59
300105	P	3J1754	3	2	2-1/C	0	0.1380	58.00	3	0.8530	178	1	1	1	0.82	148.78	5.88	38.15
400107	P	4F1373	3	2	2-1/C	2	0.2110	50.00	8	1.0550	130	1	1	1	0.82	108.60	4.80	48.80
400107	P	4F1374	3	2	2-1/C	2	0.2110	50.00	8	1.0550	130	1	1	1	0.74	98.20	3.81	51.98
480824	P	4F1378	3	2	1-3/C	10	1.4040	2.83	8	0.0291	38	1	.8	1	0.82	23.82	2.35	11.14
480839	P	4F1378	3	2	1-3/C	10	1.4040	3.00	8	0.0378	38	1	.8	1	0.82	23.82	1.57	12.70
4Y02	B	4J1808	3	3	2-1/C	0000	0.0889	88.00	12	1.2700	278	1	.8	.94	0.74	154.70	3.30	82.08
4Y04	D	4J1808	3	3	2-1/C	0000	0.0889	87.00	12	1.2988	278	1	.8	.94	0.74	154.70	3.30	82.70
380715	A	4J1815	3	3	3-1/C	0000	0.0889	114.00	10	2.8883	278	1	1	1	0.82	227.98	10.74	50.01
400109	A	4J1738	3	2	2-1/C	2	0.2110	33.18	8	0.4840	130	1	1	1	0.82	108.60	4.80	31.11



CABLE		RACEWAY		COND.	CABLE		CABLE	LOAD	LOAD	OPER.	CABLE	TEMP.	COND.	GRPING	T-LAG	RATED	MAX.	% CABLE
SCH	SUB	NUM	WP		SIZE	# COND	SIZE	res/1000'	AMPS	Source	AMPACITY	C. F.	C. F.	C. F.	C. F.	AMPS	W/FT	LOADING
400107	P	4J1835	3	2	2-1/C	2	0.2110	50.00	8	1.0550	130	1	1	1	0.82	106.60	4.80	48.90
400133	P	4K1438	3	3	1-2/C	10	1.3500	8.25	8	0.1055	38	1	1	1	0.82	29.52	2.35	21.17

LOAD AMPS SOURCE

- 1) EC-138, REV. 4; $1 - \text{SQRT}(4.05^2 + 2.51^2) \times 48^{\circ} \text{SQRT} 3) = 5.98\text{A}(\text{REFERENCE } 2.18)$
- 2) EC-138, REV. 4; $1 - \text{SQRT}(2.43^2 + 1.51^2) \times 48^{\circ} \text{SQRT} 3) = 3.59\text{A}(\text{REFERENCE } 2.18)$
- 3) EC-138, REV. 4(REFERENCE 2.18)
- 4) 5177-482-E-03, REV. 1(REFERENCE 2.24)
- 5) 5813-E-11, SH. 1, REV. 8; $1 - 10.0\text{KVA}, 48^{\circ} \text{SQRT} 3) = 12.02\text{A}(\text{REFERENCE } 2.25)$
- 6) 5813-E-12, REV. 4; $1 - 7.5\text{KVA}, 12\text{KV} = 82.5\text{A}(\text{REFERENCE } 2.28)$
- 7) 5814-E-11, SH. 1, REV. 5; $1 - 10.0\text{KVA}, 48^{\circ} \text{SQRT} 3) = 12.02\text{A}(\text{REFERENCE } 2.27)$
- 8) 5814-E-12, REV. 5; $1 - 10.0\text{KVA}, 48^{\circ} \text{SQRT} 3) = 12.02\text{A}(\text{REFERENCE } 2.28)$
- 9) PTN-87JE-83-001, REV. 0(REFERENCE 2.2)
- 10) VENDOR MANUAL AA550(REFERENCE 2.14)
- 11) 5813-E-12, REV. 4; $1 - 10.0\text{KVA}, 48^{\circ} \text{SQRT} 3) = 12.02\text{A}(\text{REFERENCE } 2.26)$
- 12) 5813-E-11, SH. 1, REV. 8; 80% OF BREAKER RATING(30A) - 24A(REFERENCE 2.25)
- 13) 5814-E-12, REV. 5; 80% OF BREAKER RATING(30A) - 24A(REFERENCE 2.28)
- 14) 5813-E-11, SH. 1, REV. 8; $1 - 10.0\text{KVA}, 12\text{KV} = 83.3\text{A}(\text{REFERENCE } 2.25)$
- 15) 5814-E-11, SH. 1, REV. 8; $1 - 10.0\text{KVA}, 12\text{KV} = 83.3\text{A}(\text{REFERENCE } 2.27)$
- 16) 5814-E-12, REV. 5; $1 - 7.5\text{KVA}, 12\text{KV} = 82.5\text{A}(\text{REFERENCE } 2.28)$
- 17) EC-138, REV. 4; $1 - \text{SQRT}(39.18^2 + 34.55^2) \times 48^{\circ} \text{SQRT} 3) = 65.58\text{A}(\text{REFERENCE } 2.18)$

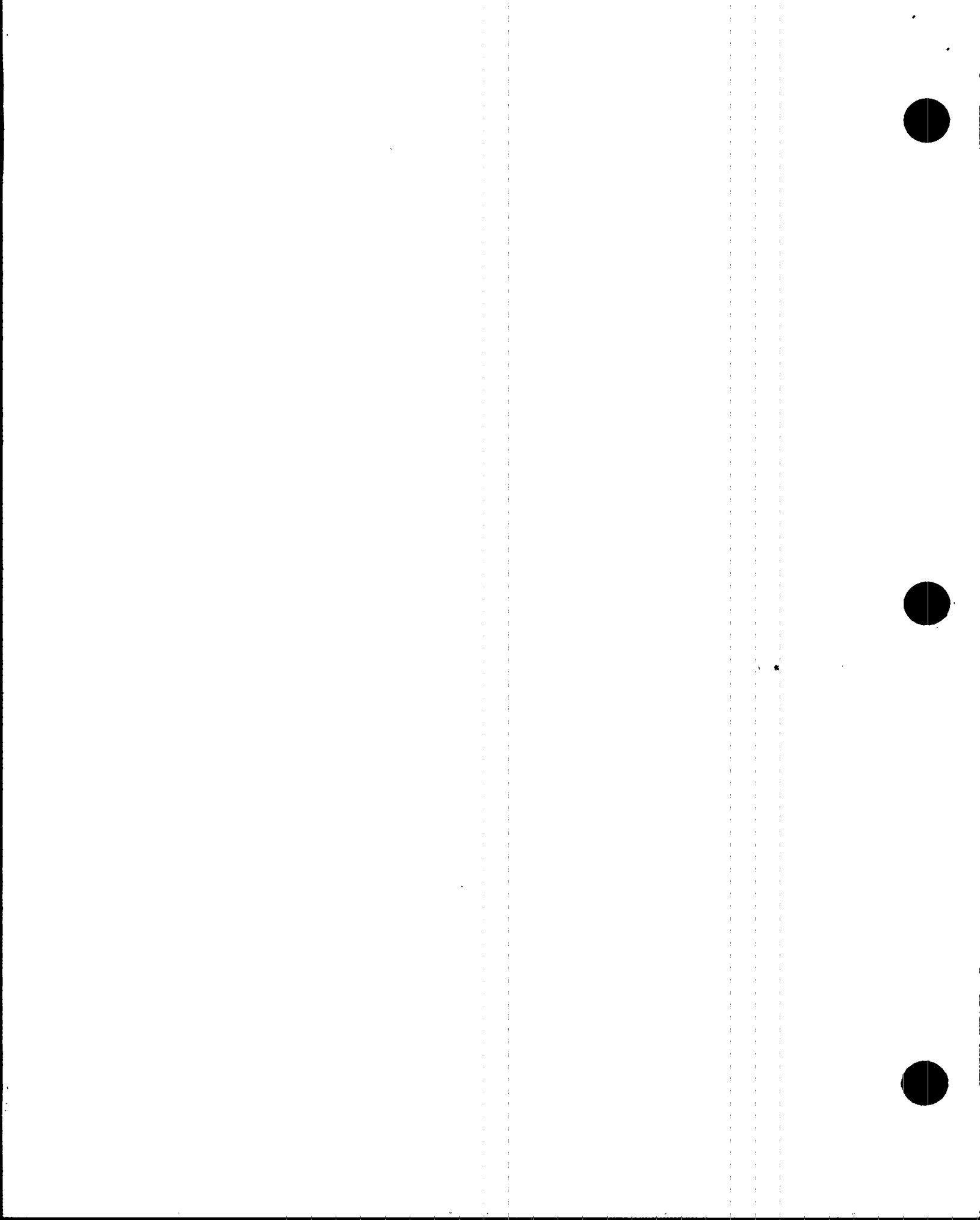
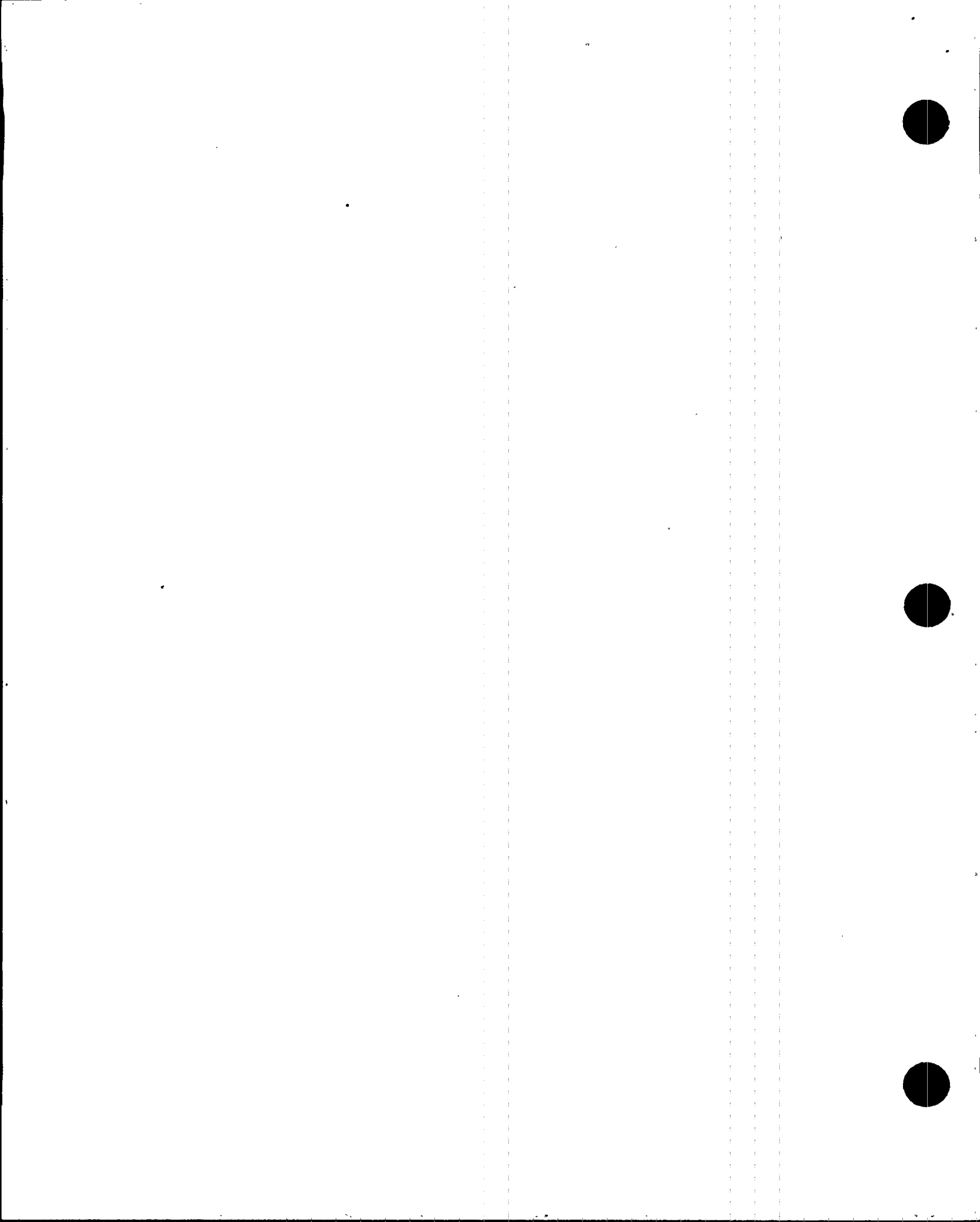


TABLE 4
SHEET NO. 20

CABLE		RACEWAY		BOX		CABLE		CABLE	LOAD	LOAD	CABLE	T-LAG	RATED	%CABLE
SCHEME	SUB	NUM	WRAP	SIZE	#COND	SIZE	RES/1000'	AMPS	Source	AMPC	C.F.	AMPS	LOAD	
380635	A	PB3823	3	24X24X8	3-1/C	2	0.2130	85.58	7	130	0.70	91.00	72.0440	
3Y02	A	PB3823	3	24X24X8	2-1/C	0	0.1380	82.50	2	179	0.70	125.30	49.8803	
3Y05	A	PB3823	3	24X24X8	2-1/C	0	0.1380	82.50	3	179	0.70	125.30	49.8803	
4Y02	A	PB4818	3	24X24X8	2-1/C	0	0.1380	82.50	4	179	0.70	125.30	49.8803	
4Y05	A	PB4818	3	24X24X8	2-1/C	0	0.1380	82.50	5	179	0.70	125.30	49.8803	
400108	P	PB4887	3	24X20X8	2-1/C	0	0.1330	1.00	1	179	0.70	125.30	0.7981	
400108	P	PB4887	3	24X20X8	2-1/C	0	0.1330	17.79	1	179	0.70	125.30	14.1979	
400107	P	PB4887	3	24X20X8	2-1/C	2	0.2110	50.00	1	130	0.70	91.00	54.9451	
400112	P	PB4887	3	24X20X8	2-1/C	2	0.2110	2.00	1	130	0.70	91.00	2.1978	
480824	P	PB4887	3	24X20X8	1-3/C	10	1.4040	3.83	1	38	0.70	25.20	14.4048	
480839	P	PB4887	3	24X20X8	1-3/C	10	1.4040	3.83	1	38	0.70	25.20	14.4048	
480814	A	PB4887	3	24X20X8	3-1/C	0000	0.0889	104.50	1	278	0.70	194.80	53.8999	
400126	R	PB4887	3	24X20X8	2-1/C	2	0.2110	50.00	1	130	0.70	91.00	54.9451	
302328	P	TB7368	3	24X24X12	2-1/C	0	0.1330	39.00	8	179	0.70	125.30	31.1253	
302328	Q	TB7368	3	24X24X12	2-1/C	0	0.1330	39.00	8	179	0.70	125.30	31.1253	
LOAD AMPS SOURCE														
1) PTN-8FJE-93-001, REV. 0(REFERENCE 2.2)														
2) 5613-E-11, SH. 1, REV. 9: 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.25)														
3) 5613-E-12, REV. 4: 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.26)														
4) 5614-E-11, SH. 1, REV. 5: 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.27)														
5) 5614-E-12, REV. 5: 1 - 7.5KVA/12KV - 82.5A(REFERENCE 2.28)														
6) EC-136, REV. 4(REFERENCE 2.19)														
7) EC-138, REV. 4: 1 - $\sqrt{3}(39.18^2 + 34.55^2)(.48 \cdot \sqrt{3})$ - 65.58A(REFERENCE 2.18)														

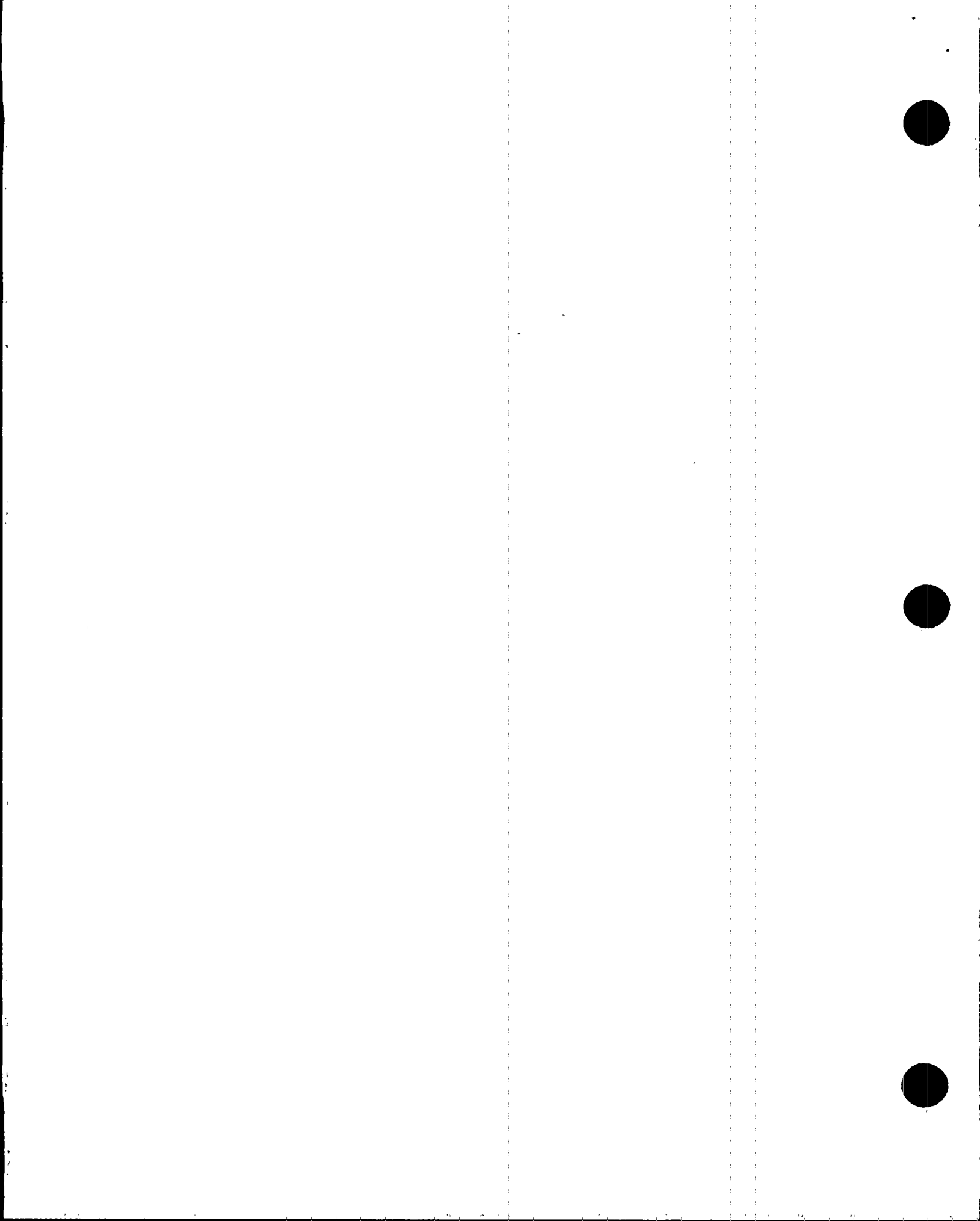


REF.

Conclusion:

The original design selection of power cables for use at Turkey Point Nuclear (PTN) 3 and 4 used conservatism created by the selection of cables using voltage drop and short circuit withstand capability analysis and then by evaluating worst case scenarios for cable ampacity derating based on cables in a filled tray section. In addition to the evaluation of cable sizes by design, to reduce the inventory and purchasing of new cable sizes, cables for several circuits were selected and installed as the next larger 'standard' size if that size met the design and installation requirements and was readily available on site and in the inventory system.

Based on the results of this calculation for derating of cable ampacity for raceways that are fire protected with Thermo-Lag 330-1 (for 1hr) and Thermo-Lag 330-1 w/layer of Thermo-Lag 770-1 (for 3hr) the cables installed at Turkey Point Nuclear Units 3 and 4 were conservatively design with adequate margin to provide allowances for ampacity derating which encompass the new fire wrap design installed to meet the Appendix 'R' requirements.



Listing of Intervener/Interfering Conduits
 Thermo-Lag 330-1, 3-Hour Upgrade

Item No. Location	Raceway ID	Zone	Intervener/ Interfering	Additional Coverage
18 S Inver 1 hr	4J1760	108A	N/A	
	3J1920		N/A	
	4J2096		N/A	
	PB7368		B-3F-1376-1"	1'-6"
			S-4J-1669-3/4"	1'-6"
			3/4" Conduit	1'-6"
			1 1/2" Conduit	1'-6"
			3/4" Light Conduit	1'-6"
19 N Inver 1 hr	3J1712	108B	N/A	
20 N Inver 1 hr	3J1777	108B		
21 B Switchgr	3A451	70	B-3A-1171-3"	3'-4"
			B-3A-1096-2"	3'-4"
			B-3A-1635-4"	1'-8"
			B-3A-1636-4"	1'-8"
			3/4" to Alarm 1-1	3'-4"
22 B Switchgr	3A452	70	3A451 (bk)	24'-2'
			3A452 (bk)	24'-2"

Note: Additional coverage assumes two layers of Thermo-Lag 770-1 over existing 3-hour layer of Thermo-Lag 330-1

Done by: [REDACTED] Date: 12/5/96

Chkd by: [REDACTED] Date: 12/6/96

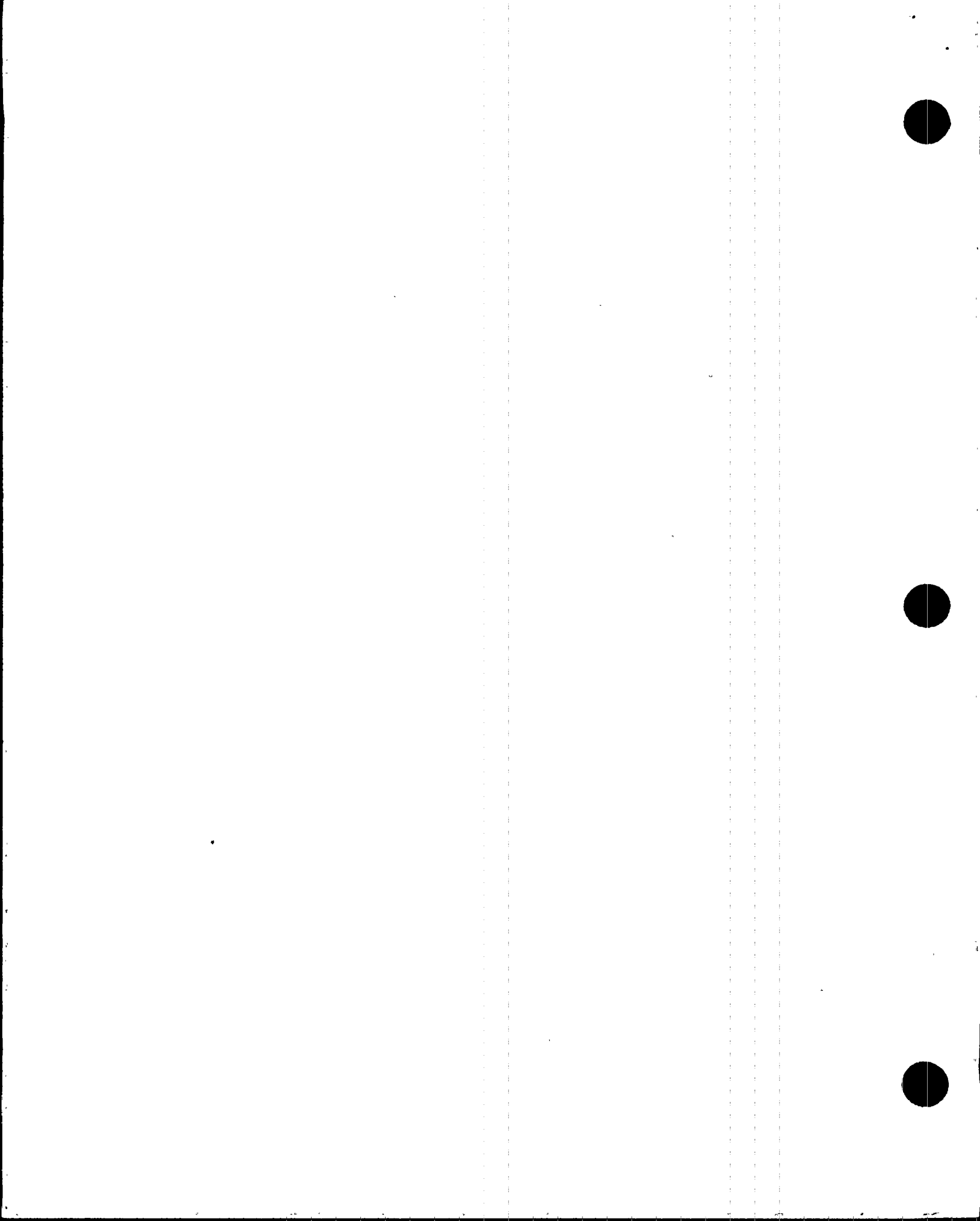
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Listing of Intervener/Interfering Conduits
 Thermo-Lag 330-1, 3-Hour Upgrade

Item	Raceway		Intervener/	Additional
<u>No. Location</u>	<u>ID</u>	<u>Zone</u>	<u>Interfering</u>	<u>Coverage</u>
9 West Pen	3K1814	19		
10 West Pen	PB3711	19		
11 S DC Equip	4F1360	101	84-857-1"	3'-4"
			SR-4J-1482-1"	3'-4"
			B-4J-1507-2"	3'-4"
			B-4J-1736-2"	4'-0"
			B-3J-1644-1 1/2"	4'-0"
			A-3F-1345-2"	3'-4"
12 N DC Equip	4J1607(bk)	104	B-4J-1606-3" (bk)	7'-1"
			B-4J-1606-3"	3'-6"
			A-3J-1754-2"	6'-8"
			A-4J-1615-3"	6'-8"
			3/4" EMT	1'-6"
13 N DC Equip	PB4818	104		
14 N DC Equip	3J1618 (bk)	104	B-3F-1331-3" (bk)	3'-7"
			B-3F-1340-3" (bk)	3'-7"
			B-3J-1608-2" (bk)	12'-10"
			B-3J-1644-1 1/2"	3'-6"
			B-3J-753-3"	3'-6"
			TB-3117	19"x13"x6"
15 N DC Equip	PB3823	104		
16 N DC Equip	3J1611	104		
17 N DC Equip	4F1331	104		



Listing of Intervener/Interfering Conduits
Thermo-Lag 330-1, 3-Hour Upgrade

Item No. Location	Raceway ID	Zone	Intervener/ Interfering	Additional Coverage
1 Elev/Ves	3J1330	64	B-3K-1810-1 1/2"	12'-6"
2 Elev/Ves	3J1336	64		
3 Elev/Ves	3K1787	64		
4 Elev/Ves	PB3836	64		
5 Elec Equip	4J1768	25	B-4F-1326-1 1/2"	3'-4"
			B-4J-1835-2"	1'-9"
			B-4F-1373-2"	4'-0"
			B-3J-1671-3"	4'-4"
			S-4F-1098-2" (bk)	3'-4"
			B-4K-1438-1"	0'-6"
			1" conduit (bk)	3'-4"
6 Elec Equip	4J1769	25	B-4K-1451-1 1/2"	2'-10"
			B-4J-1781-3/4"	2'-0"
			B-4K-1438-1"	13'-6"
			B-4F-1382-1"	3'-4"
			4J-1648-1 1/2" (bk)	11'-2"
			4J-1649-1 1/2" (bk)	11'-2"
			3F-1328-1 1/2" (bk)	11'-2"
			B-4F-1374-2" (bk)	11'-2"
			B-4F-1366-1 1/2" (bk)	11'-2"
			B-4F-1376-2"	5'-0"
7 Elec Equip	PB4887	25		
8 West Pen	3K1284	19	B-3K-1818-1"	3'-4"
			B-3K-1286-1"	3'-4"
			B-3K-1285-3"	1'-0"

