

FLORIDA POWER AND LIGHT

REVIEW OF AMPACITY RATINGS FOR POWER CABLES
IN CONDUITS AND TRAYS WITH THERMO-LAG 330-1 COVERING

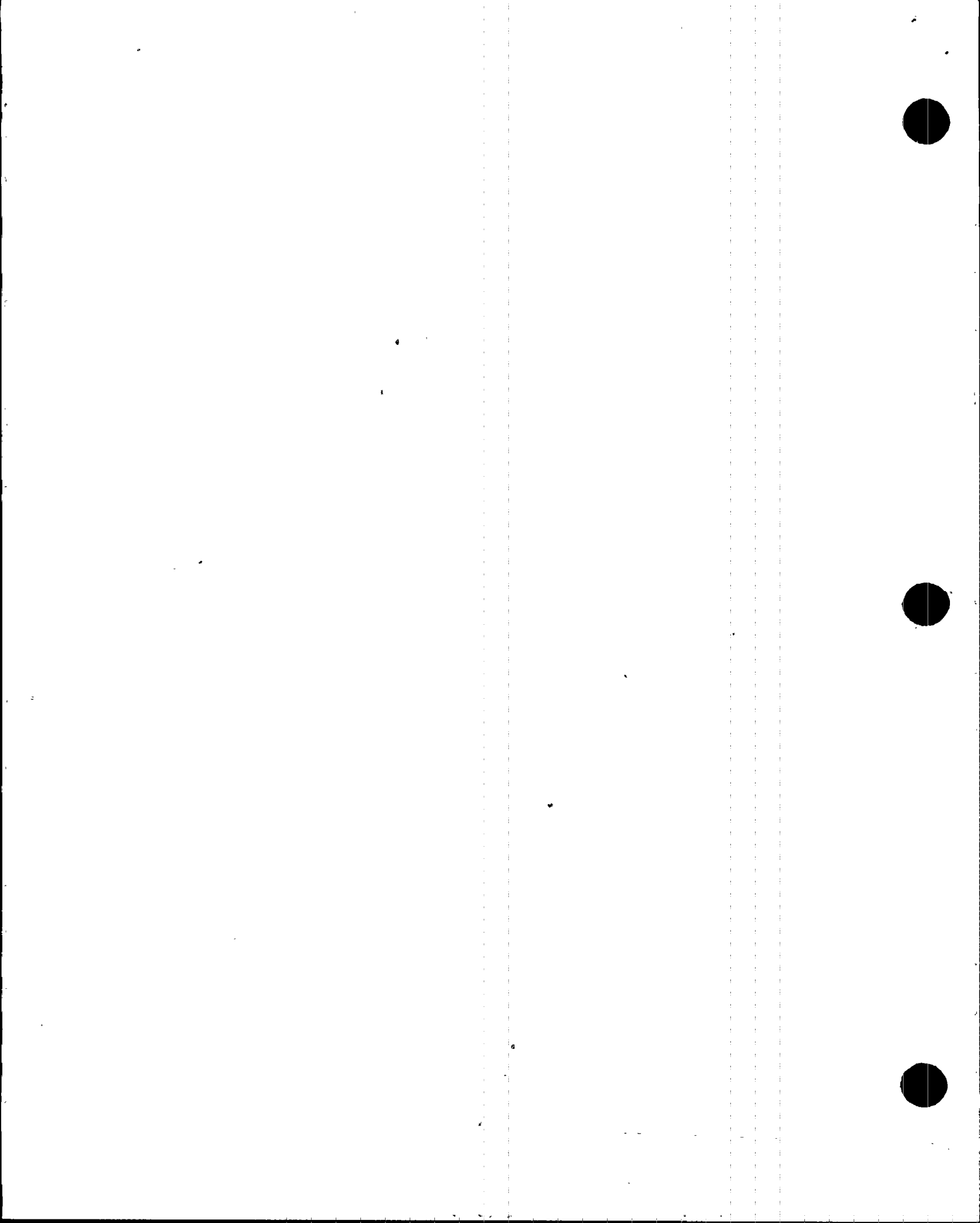
TURKEY POINT

UNITS 3 & 4

JFM-PTM-SKEP-96-011

Revision 0

NUCLEAR SAFETY RELATED



REVIEW AND APPROVAL RECORD

PLANT TURKEY POINT NUCLEAR UNIT 3 AND 4
TITLE REVIEW OF AMPACITY RATINGS FOR POWER CABLES IN CONDUITS AND TRAYS
WITH THERMO-LAG 330-1 COVERING

LEAD DISCIPLINE ELECTRICAL

ENGINEERING ORGANIZATION PRODUCTION ENGINEERING GROUP

REVIEW/APPROVAL:

GROUP	INTERFACE TYPE			PREPARED	VERIFIED	APPROVED	FPL APPROVED*
	INPUT	REVIEW	N/A				
MECH	X						N/A
ELECT	X						N/A
I&C			X	N/A	N/A	N/A	N/A
CIVIL			X	N/A	N/A	N/A	N/A
NUC**		X		N/A	N/A		N/A
ESI			X	N/A	N/A	N/A	N/A
NUC FUEL			X	N/A	N/A	N/A	N/A
FIRE PROT		X		N/A	N/A		N/A

* For Contractor Evals As Determined By Projects

** Review Interface As A Min On All 10CFR50.59 Evals and PLAs

FPL PROJECTS APPROVAL: DATE: 5-31-94

OTHER INTERFACES

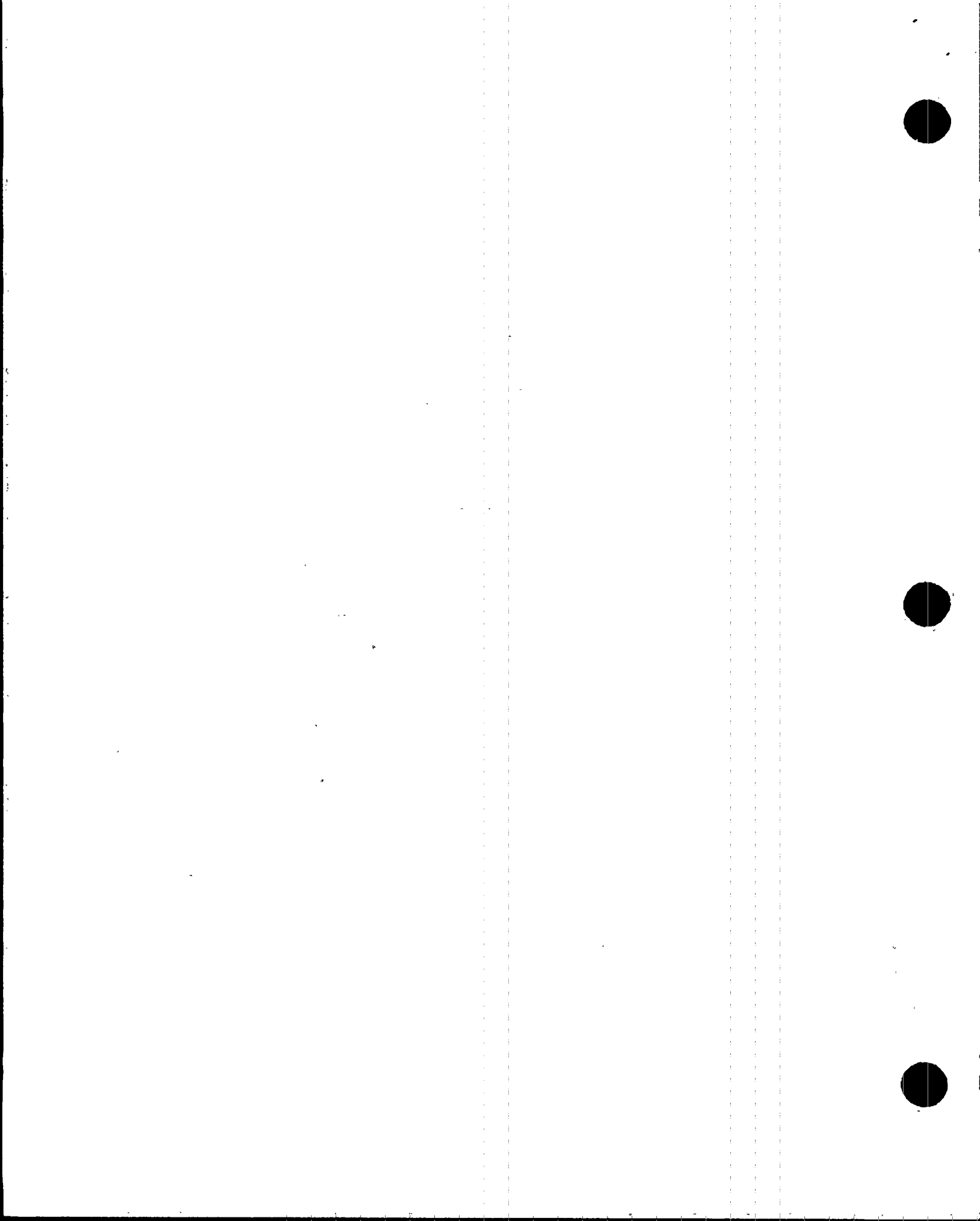
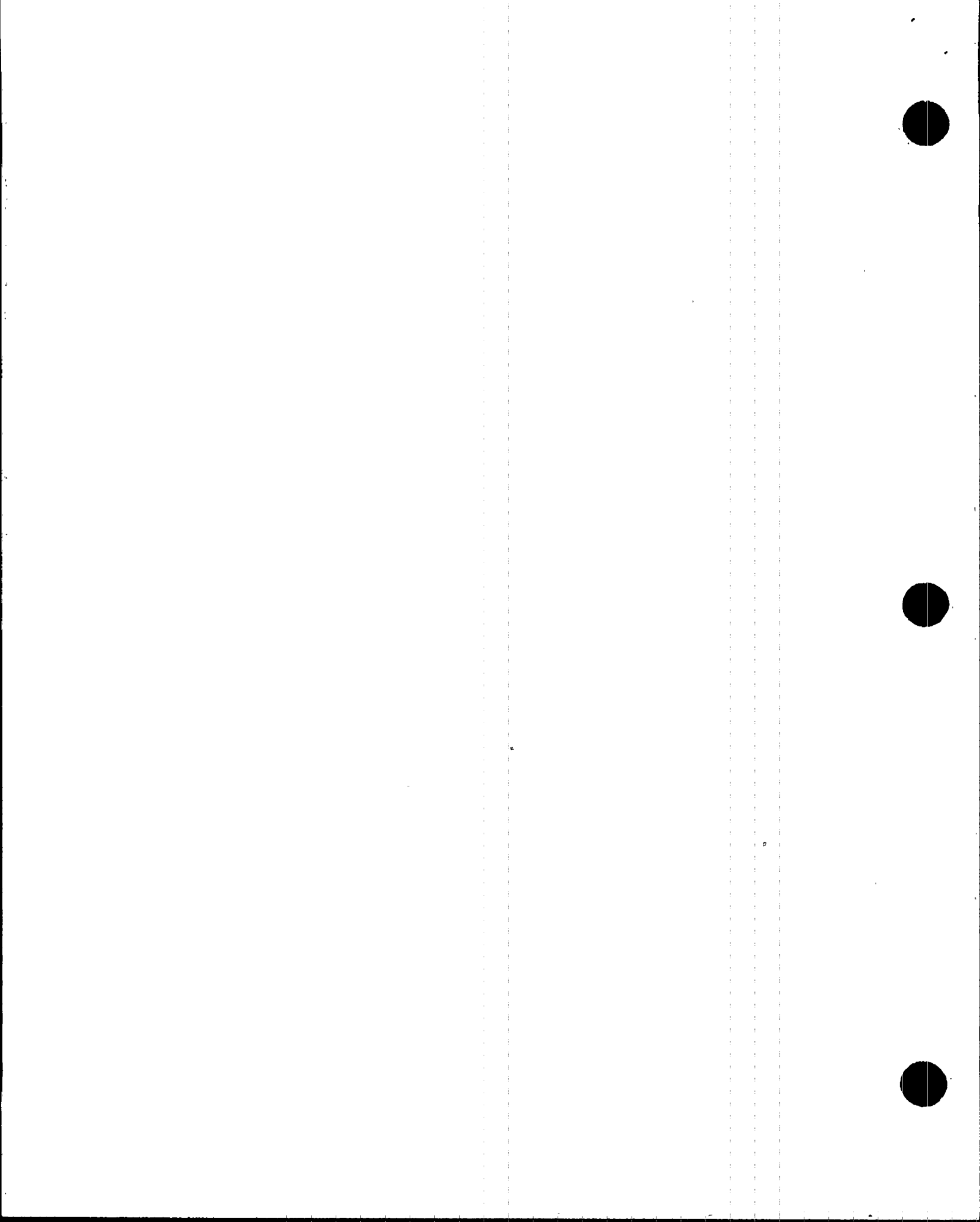


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1.0 Description and Purpose

In their letter of September 29, 1995 (Ref. 6.32), the NRC requested additional information regarding Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers" (Ref. 6.6), with regard to ampacity derating. In our response dated November 16, 1995 (Ref. 6.33) to the NRC request, the NRC was informed:

"that FPL will be evaluating the Turkey Point Units 3 and 4 installed Thermo-Lag configurations relative to the Texas Utilities tested configurations. The evaluations will analyze any differences between the Turkey Point installed configurations and the tested configurations. The results of these detailed evaluations will determine whether the ampacity derating issue can be closed based on Turkey Point's configuration being bounded by the Texas Utilities tests or whether further testing and/or analyses need to be performed".

This evaluation reviews the ampacity rating of power cables routed in conduits and cable tray with Thermo-Lag 330-1 fire barrier coverings. Power cables from the following distribution sources are addressed in this evaluation:

4160 Volt AC Switchgear

480 Volt AC Load Centers

480 Volt AC Motor Control Centers

120 Volt AC Vital Inverters and Power Panels

125 Volt DC Busses

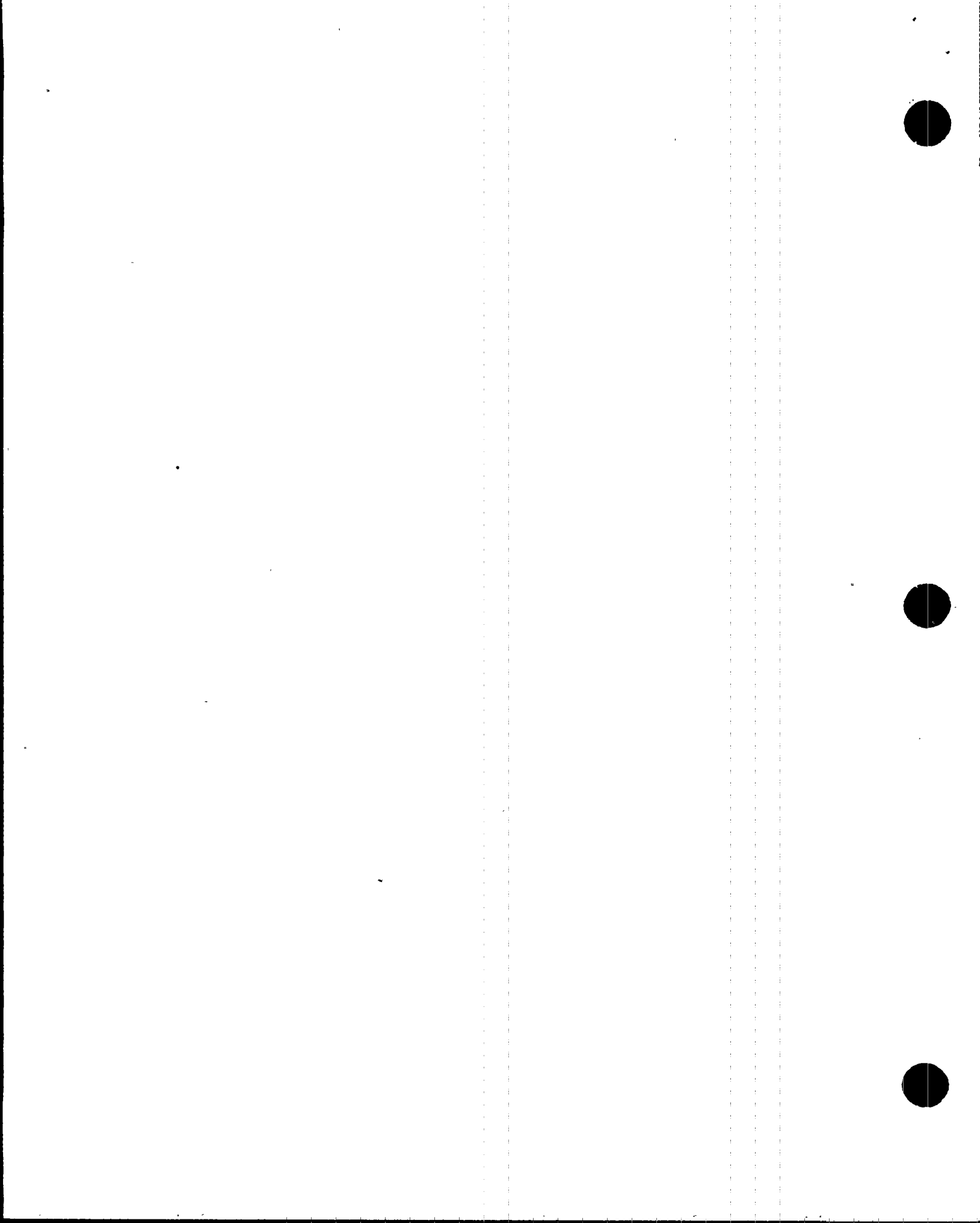
Ampacity correction factors for 1 hour and 3 hour Thermo-Lag as determined in Calculation PTN-BFJM-96-005 (Ref. 6.4) will be used in this evaluation. The Ampacity correction factors determined in Calculation PTN-BFJM-96-005 are based on testing of Thermo-Lag wrapped raceways performed at Omega Point Laboratories for Texas Utilities Comanche Peak Plant (Ref. 6.5).

2.0 Analysis

Applicability of Ampacity Correction Factors to Turkey Point

The Thermo-lag fire barrier ampacity correction factors (ACF) used in this evaluation are based on testing performed at Omega Point Laboratories. A copy of the test summary is included in Reference 6.4. The testing was performed for raceway configurations determined to bound configurations at the Comanche Peak plant.

The referenced ampacity testing was performed for conduits ranging in size from 3/4 inches to 5 inches which bound the sizes evaluated at Turkey Point. Ampacity testing for cable tray was performed for 24 inch wide tray which is sufficiently wide that the results will be applicable to any width of tray. The tray widths evaluated for Turkey point range from 18 to 30 inches.



Banked conduits were not tested; therefore the ampacity correction factors for cable tray are applied to the banked conduits. The application of the cable tray ampacity correction factors to banked conduit has been determined to be valid based on the geometric similarity. The evaluated conduits are banked in a single plane, and the maximum depth of the banked configuration with the maximum conduit size of 4 inches is similar to the depth of cable tray. Banked conduit is not expected to be as heavily loaded as the tested cable tray due to the shape of the conduits and the spacing between the conduits.

The referenced testing did not include tests for raceway with 3 hour barrier. In Reference 6.4, calculations were performed to extrapolate the test results for raceway with 1 hour barrier to provide an ampacity correction factor for raceway with 3 hour barrier. The extrapolation was based on the documented thermal conductivity of the Thermo-lag material.

The heat load (I^2R loss) from each section of raceway is calculated in Attachments 1 and 2. These heat loads were compared to the test results to assure that ampacity rating methodology and ampacity correction factors limit the heat load to a value which is consistent with the tested values. The tested heat loads are calculated in Reference 6.4 based on the test current. Attachment 3 provides a graphical comparison of the test heat load to the heat load with operating current. The heat loads calculated using operating currents are less than the tested values and demonstrate the additional margin of the installed configuration.

Ampacity Rating Methodology for Cables in Wrapped Conduit

Attachment 1 lists all Thermo-Lag 330-1 wrapped conduits containing power cables. Wrapped conduits were identified by review of the Essential Cable List (ECL) 5610-E-2000 (Ref. 6.7) and Raceway Fire Protection Wrap layout drawings (Ref. 6.35 - 6.58). Power cables located in the conduits were determined by review of the ECL and the Cable and Raceway Schedule (CARS) 5610-E-305 (Ref. 6.8). 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. 6.9). Load currents were determined from the listed references in Attachment 1. 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. 6.10) "Cable Ampacity in Duct Bank, Maintained Space Tray Conduit and Free Air" and EC-096 (Ref. 6.9) "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. 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. 6.16):

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

Where:

I	-	The 90°C cable ampacity (Ref. 6.10)
T _a	-	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 _a '	-	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. 6.11) "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. 6.12). The following ampacity correction factors were taken from Attachment 5 of Calculation 5177-EF-15 (Ref. 6.11) "Ampacity Verification for Cables Installed in 1 Hour Thermo-lag 330-1 covered conduits (Unit 4 and Common):"

<u>Number of Conduits in Group with Pc-37 Cables</u>	<u>Ampacity Correction Factor</u>
2	0.94
3	0.91
4	0.88
5	0.87
6	0.86

The ampacities of cables in conduits wrapped with Thermo-Lag 330-1 fire barrier material were corrected using the following factors taken from Calculation PTM-BFJM-96-005 (Ref. 6.4) "Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier:"

<u>Wrapped Configuration</u>	<u>Ampacity Correction Factor</u>
1 Hr Wrapped Single Conduit	0.89
1 Hr Wrapped Banked Conduit	0.69
3 Hr Wrapped Single Conduit	0.80
3 Hr Wrapped Banked Conduit	0.60

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 of margin between rated ampacity and actual load current was calculated as follows:

% Margin = 100(Rated Ampacity - Load Current)/(Load Current)

The total heat loads (watts per foot) are totaled for each conduit section.

Ampacity Rating Methodology for Cables in Wrapped Tray

Attachment 2 lists all wrapped cable trays containing power cables. Wrapped trays were identified by review of the Essential Cable List (ECL) 5610-E-2000 (Ref. 6.7) and layout drawing 5610-E-150A (Ref. 6.13). Power cables located in the trays were determined by review of the ECL (Ref. 6.7 and CARS (Ref. 6.8). 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 (Ref. 6.9). Load currents were determined from the listed references in Attachment 2. Operating heat load (watts per foot) for the cables were calculated as previously discussed above for conduits.

Cable tray 3AUT10 contains two 3-1/C, size 500 MCM, 600 Volt power cables (note that cables associated with scheme 3B0406 were spared during the EPS Enhancement Project). The ampacity for these cables (assuming a Flamastic coating) is given as 540 amps by Calculation 5177-EF-10 (Ref. 6.14).

Cable tray 3AXT10 contains two 3-1/C, size 750 MCM, 600 Volt power cables. The



ampacity for these cables (assuming a Flamastic coating) is given as 698 amps by Calculation 5177-EF-10 (Ref. 6.14).

Cable tray 4AXT10 contains two 3-1/C, size 750 MCM, 600 Volt power cables. The ampacity for these cables (assuming a Flamastic coating) is given as 629.4 amps by Calculation 5177-EF-13 (Ref. 6.15). However, this ampacity rating is conservative since it is for tray with 24% fill. The actual fill is 13.3% (Ref. 6.8). Using the methodology of Standard IEEE 3-135-1-62/ICEA P-46-426 (Ref. 6.16), the ampacity for six 750 MCM cables without maintained spacing is determined as follows:

$$I_{\text{rated}} = I_{\text{cable}}(CF_{\text{VIII}}) = 898 \times 0.8 = 718.4\text{A}$$

where:

I_{cable} = Cable rating in air from page 215 of the standard - 898A
 CF_{VIII} = Correction factor from Table VIII of the standard - 0.8 (6 conductors)

Derating for a Flamastic coating on the cable (See Calculation 5177-EF-01, Ref. 6.10):

$$I_{\text{rated}} = 718.4 \times 0.9481 = 681\text{A}$$

The ampacities for power cables in trays 4LAT20, 4LAT30 and 4LAT40 are given in Calculation EC-182 (Ref. 6.17) as 588A for 750 MCM and 790A for 1250 MCM.

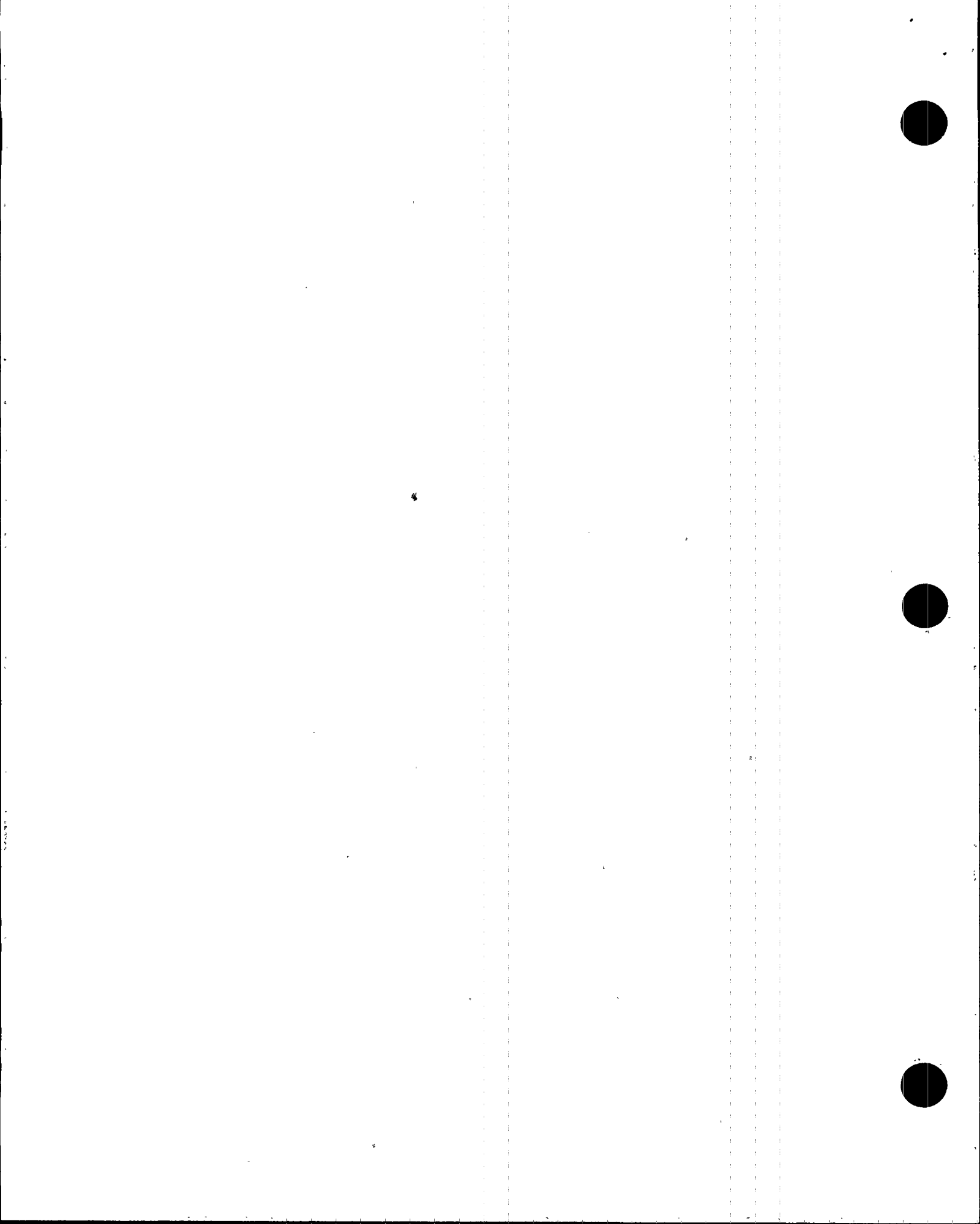
The ampacities of cables in trays wrapped with Thermo-Lag 330-1 fire barrier material were corrected using the following factors taken from Calculation PTN-BFJM-96-005 (Ref. 6.4) "Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier:"

<u>Wrapped Configuration</u>	<u>Ampacity Correction Factor</u>
1 Hr Wrapped Cable Tray	0.69
3 Hr Wrapped Cable Tray	0.60

Maximum watts per foot and percent margin were calculated as previously discussed above for conduits. The total watts/ foot (Actual and Maximum) are totaled for each cable tray section.

3.0 10CFR50.59 Applicability

This evaluation concerns the ampacity rating of power cables for loads in several safety-related systems. These systems are described in the Updated Final Safety Analysis Report (Ref. 6.1). However, this evaluation concludes that the cable ampacity ratings are adequate for the operating loads. As such, the function or operation of the systems described in the SAR are not affected. Therefore, it can not be considered to be a change to the facility as described in the SAR. Certainly it is not a procedure described in the SAR nor is it a test or experiment not



described in the SAR. This evaluation/analysis does not effect the Turkey Point Technical Specifications (Ref. 6.2). Therefore this modification does not require a 10 CFR 50.59 Safety Evaluation.

4.0 Conclusion

The Thermo-Lag ampacity correction factors used in this evaluation for the various Turkey Point configurations are based on testing of Comanche Peak plant raceway configurations (Ref. 6.5). The testing has been shown to be applicable to Turkey Point raceway configurations (See Section 2.0). The correction factors for Turkey Point configurations were determined in Calculation PTN-BFJM-96-005 (Ref. 6.4). This evaluation determines that the operating heat loads are below the tested values.

The smallest margin between derated cable ampacity and load ampacity as determined in this evaluation for any power cable in Thermo-Lag wrapped conduit is 25.1%. For any power cable in Thermo-Lag wrapped tray, the smallest margin is 9.46%. Based upon the above evaluation the power cables installed in Thermo-lag protected conduits and trays at Turkey Point Nuclear Units 3 and 4 are adequately sized to carry anticipated load currents.

5.0 Verification Summary

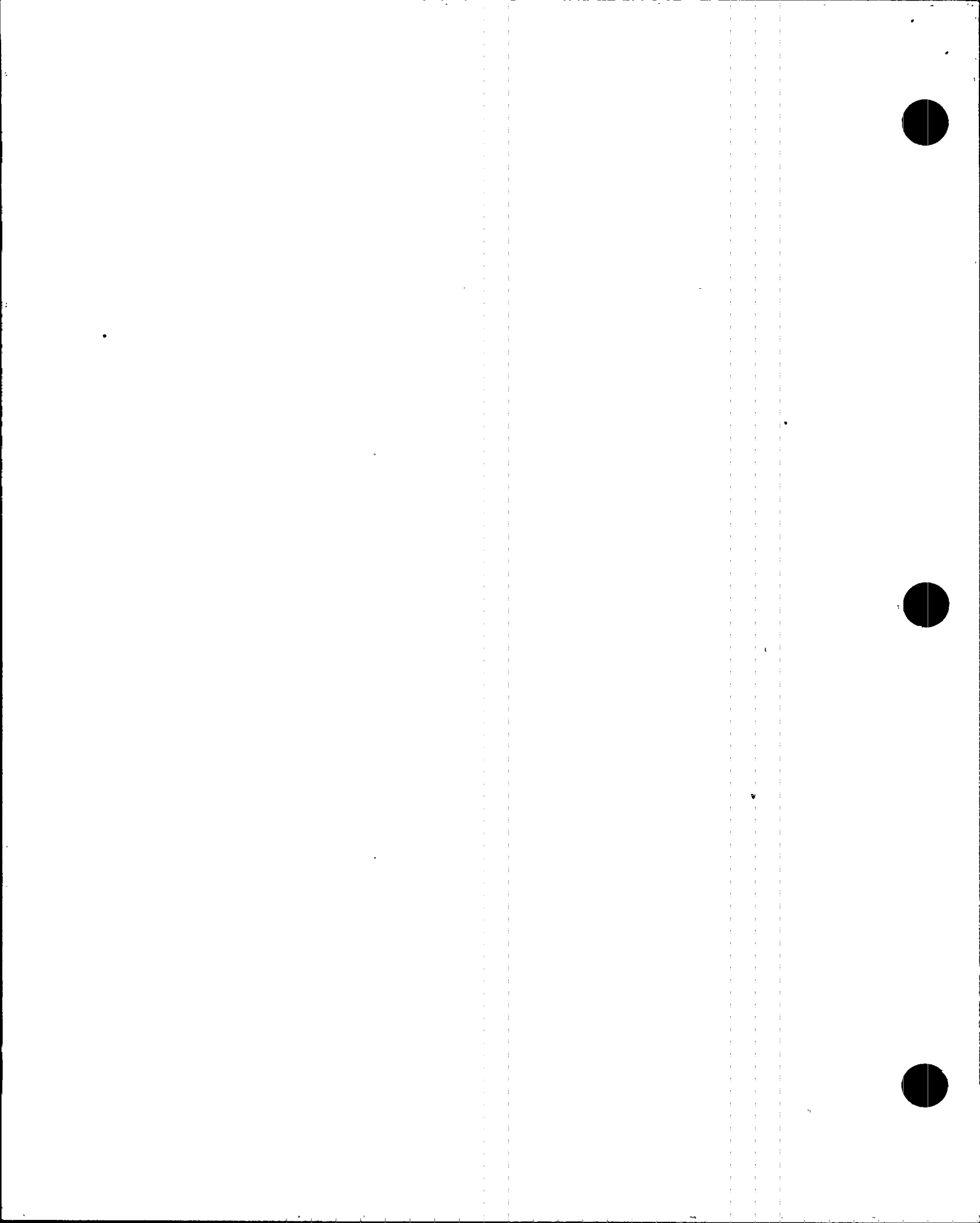
The design bases were reviewed against the DBD, UFSAR, 10CFR50, JPN Quality Instructions and Nuclear Industry Reference Guides to ensure that the evaluation considers all applicable codes, standards and Regulatory requirements and that design interfaces were properly assigned. The codes, standards, design bases and regulatory requirements are properly identified. The assumptions and design inputs used to perform this design are adequately described, reasonable, and appropriately identified for subsequent reverification. The design inputs are correctly selected and incorporated, and applicable operating and construction experience has been considered.

The analysis was verified by review of the design inputs and analytical techniques utilized. Analytical techniques and methodology are appropriate and applied correctly.

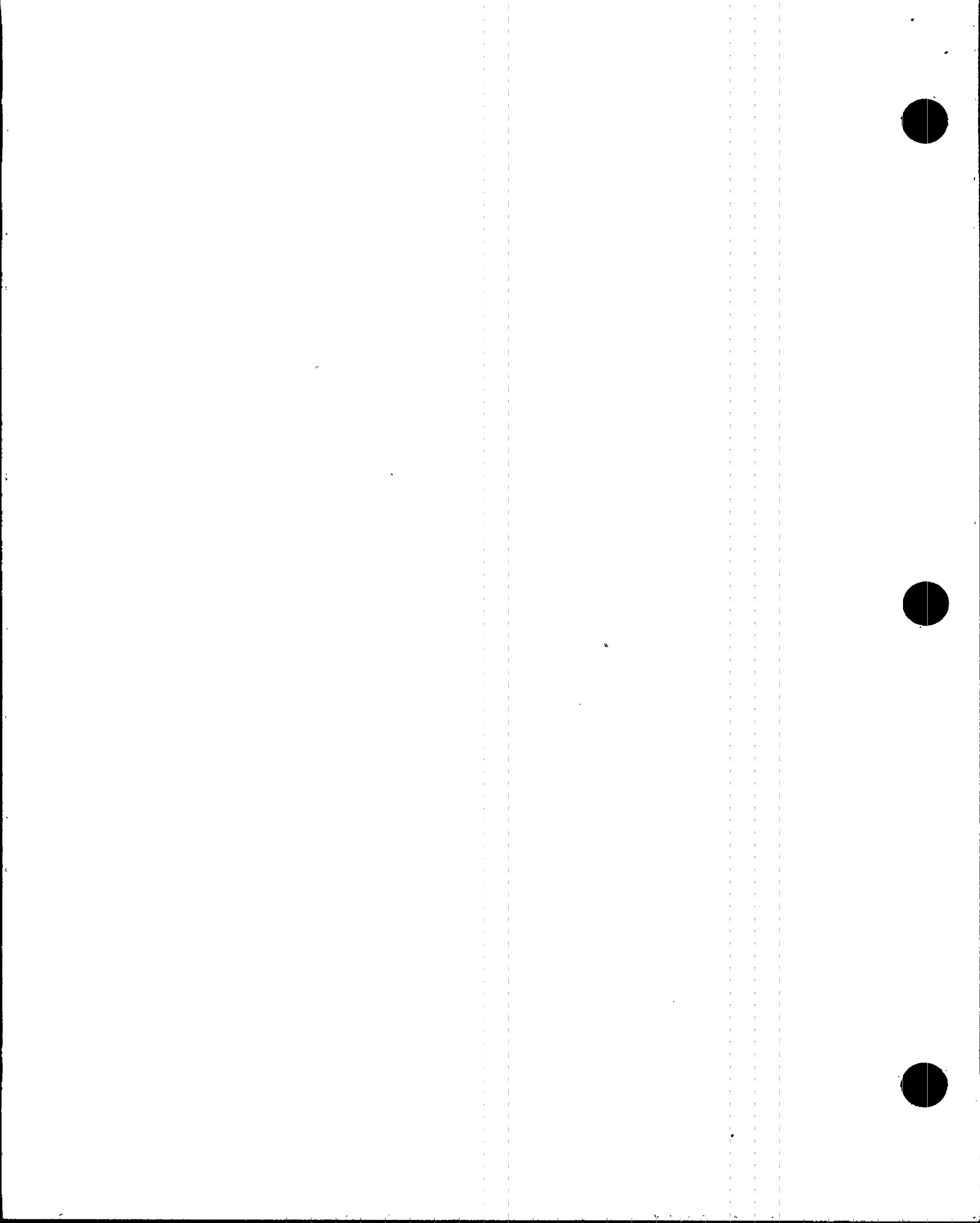
The output provided by this evaluation is reasonable when compared to the inputs. The acceptance criteria is adequately documented to allow verification that the design and regulatory requirements have been satisfactorily accomplished.

The rationale provided in assigning the Safety Classification was verified against the requirements of ENG-QI 2.6, "Safety Classification" (Ref. 6.3). It was correctly concluded that this evaluation be classified as Safety Related.

The Safety Evaluation Applicability was verified by review of the requirements of 10CFR50.59 and ENG-QI 2.1, "10CFR50.59 Screening/Evaluation" (Ref. 6.31), as criteria for establishing whether an activity requires a 10CFR50.59 Safety Evaluation. It has been correctly concluded that this evaluation does not constitute a change to the facility as described in the SAR, constitute a procedure as described in the SAR or constitute a test or experiment not described in the SAR.



- 6.0 References
- 6.1 Turkey Point Units 3 and 4, Updated Final Safety Analysis Report (UFSAR) Revision 12, dated May 1993
- 6.2 Turkey Point Units 3 and 4, Technical Specifications, Amendments 182/176, Effective February 13, 1996
- 6.3 ENG-QI 2.6, Revision 0, Safety Classifications
- 6.4 Calculation JPM-PTN-SFJM-96-005, Rev. 0, Fire Barrier Ampacity Correction Factors - Extrapolation of Test Results for 3 Hour Barrier
- 6.5 Omega Point Lab Test Reports # 12340-94583, 93165, 93168, 93246, Electrical Test to Determine the Ampacity Derating of a Protective Envelope for Class 1E Electrical Conduits
- 6.6 NRC Generic Letter 92-08, Thermo-Lag 330-1 Fire Barriers, Dated 12/17/92.
- 6.7 5610-E-2000, Rev 7, Appendix R Essential Cable List
- 6.8 5610-E-305, Rev. 44, Cable and Raceway Schedule
- 6.9 Calculation EC-096, Rev. 1, Cable Ampacity and Voltage Drop Calculation
- 6.10 Calculation 5177-EF-01, Rev. 2, Cable Ampacity in Duct Bank, Maintained Space Tray, Conduit and Free Air
- 6.11 Calculation 5177-EF-15, Rev. 1, Cable Ampacity Verifications for Cables Installed in 1 Hour Thermo-Lag 330-1 Covered Conduits (Unit 4 and Common)
- 6.12 FPL Letter JPNS-PTN-92-0882, T. P. Heisterman to A. T. Zielonka, Thermo-Lag 330 Inspection/Walkdown, dated 8/14/92
- 6.13 5610-E-150A, Rev. 4, Electrical Layout Drawing Raceway Fire Protection Wrap El. 18 Ft.-0 In., Area 1
- 6.14 Calculation 5177-EF-10, Rev. 1, Ampacity Verification of Cables in Tray Sections 3AXT10 and 3AUT10
- 6.15 Calculation 5177-EF-13, Rev. 0, Ampacity Verification of Cables in Tray Section 4AXT10
- 6.16 Standard IEEE/ICEA S-135-1-62/P-46-426, Power Cable Ampacities - Copper Conductors, 1962
- 6.17 Calculation EC-182, Rev. 0, Ampacity of 8 KV cables in Wrapped Cable Trays
- 6.18 Calculation EC-138, Rev. 4, Switchgear, Load Center and MCC Load Study
- 6.19 Calculation EC-170, Rev. 3, Ampacity and Voltage Drop
- 6.20 Calculation IC-TP.0011, Rev. 0, EDG 125 VDC Load Calculation



- 6.21 Calculation IC-TP.0012, Rev. 0, Vital DC Bus Load Calculation
- 6.22 Calculation EC-132, Rev. 6, Ampacity and Voltage Drop
- 6.23 Calculation 18712-473-E-01, Rev. 1, DC Voltage Drop Calculation for Safe Shutdown Loads
- 6.24 Calculation 5177-462-E-03, Rev. 1, Station Batteries Loading Study
- 6.25 5613-E-11, Sh. 1, Rev. 9, Single Line Diagram Electrical 125V DC and 120V Instrument AC
- 6.26 5613-E-12, Rev. 4, Single Line Diagram Electrical 125V DC and 120V Instrument AC
- 6.27 5614-E-11, Sh. 1, Rev. 5, Single Line Diagram Electrical 125V DC and 120V Instrument AC
- 6.28 5614-E-12, Rev. 5, Single Line Diagram Electrical 125V DC and 120V Instrument AC
- 6.29 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
- 6.30 Vendor Manual AA550, Rev. 3, Instruction & Operating Manual - 400 amp Battery Charger
- 6.31 ENG-QI 2.1, Rev. 0, 10CFR50.59 Screening/Evaluation
- 6.32 NRC Letter to J. H. Goldberg, "Response to the follow-up to the Request for Additional Information Regarding Generic Letter 92-08", dated September 29, 1995.
- 6.33 FPL Letter L-95-301, "Additional Information - Generic Letter 92-08, Thermo-Lag 330-1 Fire Barriers", dated November 16, 1995.
- 6.34 5610-E-303, Sh. 120, Rev. 2, Panel Schedule
- 6.35 5610-E-56A, Rev. 1, Raceway Protection Wrap El. 18'-0" Area 20
- 6.36 5610-E-61A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 18
- 6.37 5610-E-67A, Rev. 1, Raceway Protection Wrap El. 10'-0" & Below Area 9 & 10
- 6.38 5610-E-100A, Rev. 2, Raceway Protection Wrap El. 14'-0" Area 5
- 6.39 5610-E-101A, Rev. 3, Raceway Protection Wrap El. 30'-6" Area 5
- 6.40 5610-E-107A, Rev. 1, Raceway Protection Wrap El. 14'-0" Area 11
- 6.41 5610-E-108A, Rev. 1, Raceway Protection Wrap El. 30'-6" Area 11

- 6.42 5610-E-110A, Rev. 1, Raceway Protection Wrap El. 14'-0" Area 12
- 6.43 5610-E-119A, Rev. 3, Raceway Protection Wrap El. 18'-0" Area 8
- 6.44 5610-E-124A, Rev. 2, Raceway Protection Wrap El. 18'-0" Area 14
- 6.45 5610-E-127A, Rev. 3, Raceway Protection Wrap El. 18'-0" Area 10
- 6.46 5610-E-128A, Rev. 2, Raceway Protection Wrap El. 30'-0" Area 16
- 6.47 5610-E-131A, Rev. 3, Raceway Protection Wrap All Elev. Area 24
- 6.48 5610-E-133A, Rev. 6, Raceway Protection Wrap All Elev. Area 17
- 6.49 5610-E-135A, Rev. 4, Raceway Protection Wrap El. 42'-0" Area 8
- 6.50 5610-E-150A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 1
- 6.51 5610-E-151A, Rev. 3, Raceway Protection Wrap El. 30'-0" & 31'-0" Area 1
- 6.52 5610-E-154A, Rev. 3, Raceway Protection Wrap El. 30'-0" Area 2
- 6.53 5610-E-160A, Rev. 4, Raceway Protection Wrap El. 18'-0" Area 3
- 6.54 5610-E-161A, Rev. 4, Raceway Protection Wrap El. 30'-0" Area 3
- 6.55 5610-E-183A, Rev. 1, Raceway Protection Wrap Intake Struct. Area 23
- 6.56 5610-E-626A, Rev. 0, Raceway Protection Wrap North of U3 Turb. Bldg.
- 6.57 5610-E-629A, Rev. 0, Raceway Protection Wrap North of U3 Turb. Bldg.
Auxiliary Power Upgrade
- 6.58 5610-E-791A, Rev. 2, Raceway Protection Wrap Area 16 Above El. 58'-0"

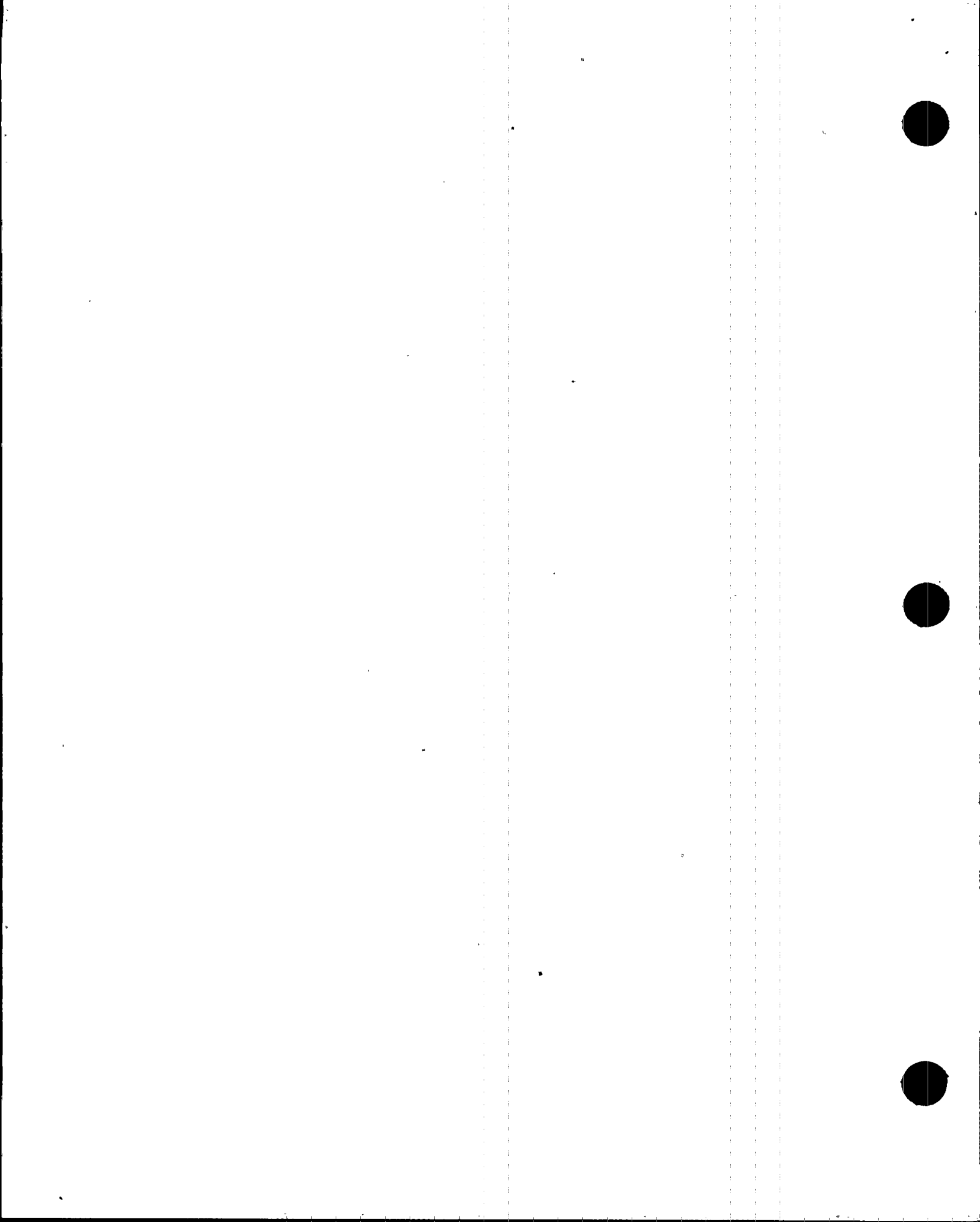
AMPACITY DERATING FOR CABLES ROUTED IN CONDUIT WRAPPED WITH THERMO-LAG 330-1

JPH-PTN-SEEP-98-011, REV. 0

ATTACHMENT 1

1 OF 8

CABLE		RACEWAY		COND.	CABLE		CABLE	LOAD	LOAD	OPER.	CABLE	TEMP.	COND.	GRPING	T-LAG	RATED	MAX.	%
SCH	SUB	NUM	WP	SIZE	# COND	SIZE	RESIST.	AMPS	REF.	W/FT	AMPACITY	C. F.	C. F.	C. F.	C. F.	AMPC	W/FT	MARGIN
3AB09	1	3A058	3	4	3-1/C	0000	0.0689	66.60	17	0.9168	278	.956	1	1	.8	212.61	9.34	219.24
		3A058 Total								0.9168							9.34	
3AB14	1	3A064	3	4	3-1/C	0000	0.0689	130.50	17	3.5202	278	.956	1	1	.8	212.61	9.34	62.92
		3A064 Total								3.5202							9.34	
3D2301	A	3A1354	1	3	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.8	1	.89	92.56	3.62	9156.00
3D2302	A	3A1354	1	3	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.8	1	.89	92.56	3.62	9156.00
3D2304	A	3A1354	1	3	2-1/C	2	0.2110	33.16	17	0.4640	130	1	.8	1	.89	92.56	3.62	179.13
		3A1354 Total								0.4640							10.85	
3D0106	A	3A1364	3	2	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.8	1	.8	114.56	3.49	11356.00
3D0108	A	3A1364	3	2	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.8	1	.8	114.56	3.49	11356.00
		3A1364 Total								0.0003							6.96	
3D0106	A	3A1365	3	2	2-1/C	0	0.1330	1.00	17	0.0003	179	1	1	1	.8	143.20	6.45	14220.00
		3A1365 Total								0.0003							5.45	
3B0204	F	3A1375	1	4	3-1/C	0000	0.0689	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.63
		3A1375 Total								4.9660							12.65	
3B0204	F	3A1379	1	4	3-1/C	0000	0.0689	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.63
		3A1379 Total								4.9660							12.65	
3D0104	F	3A1388	3	2	2-1/C	2	0.2110	23.50	17	0.2330	130	1	1	1	.8	104.00	4.56	342.59
		3A1388 Total								0.2330							4.56	
3D2305	F	3A1397	1	1.5	2-1/C	2	0.2110	2.00	17	0.0017	130	1	1	1	.89	115.70	5.65	5685.00
		3A1397 Total								0.0017							5.65	
3B0112	1	3A451	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		3A451 Total								2.6880							14.06	
3B0112	2	3A452	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		3A452 Total								2.6880							14.06	
3B0112	1	3A502	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		3A502 Total								2.6880							14.06	
3B0112	2	3A503	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		3A503 Total								2.6880							14.06	
3B0713	F	3C1155	1	3	1-3/C	12	2.2360	5.50	17	0.2029	27	1	1	1	.89	24.03	3.87	336.91
		3C1155 Total								0.2029							3.87	
3B0713	F	3C1173	1	3	1-3/C	12	2.2360	5.50	17	0.2029	27	1	1	1	.89	24.03	3.87	336.91
		3C1173 Total								0.2029							3.87	
3AA15	1	3E015	3	4	3-1/C	0000	0.0689	39.03	1	0.3149	278	.956	1	1	.8	212.61	9.34	444.75
		3E015 Total								0.3149							9.34	
3B0105	F	3E101	1	4	3-1/C	350	0.0432	50.00	17	0.3240	384	.956	1	1	.89	326.72	13.83	553.45
		3E101 Total								0.3240							13.83	
3B0203	H	3E141	1	4	3-1/C	350	0.0432	181.00	17	4.2458	384	1	1	1	.89	341.76	15.14	68.82
		3E141 Total								4.2458							15.14	
3D2301	A	3F1341	1	4	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.7	1	.89	80.99	2.77	7999.00
3D2302	A	3F1341	1	4	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.7	1	.89	80.99	2.77	7999.00
3D2303	A	3F1341	1	4	2-1/C	2	0.2110	33.16	17	0.4640	130	1	.7	1	.89	80.99	2.77	144.24
3D2304	A	3F1341	1	4	2-1/C	2	0.2110	33.16	17	0.4640	130	1	.7	1	.89	80.99	2.77	144.24



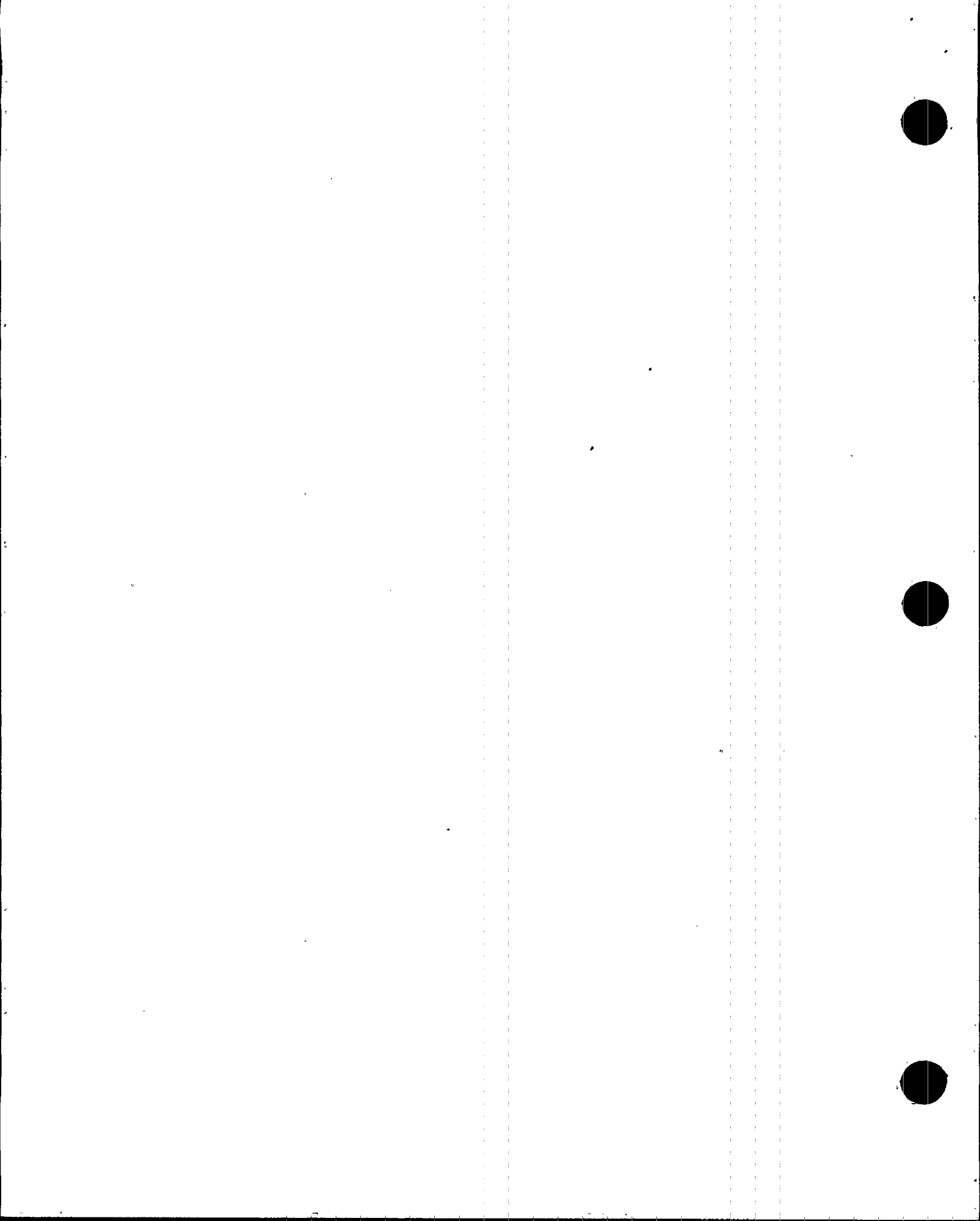
AMPACITY DERATING FOR CABLES ROUTED IN CONDUIT WRAPPED WITH THERMO-LAQ 330-1

JPM-PTH-CEEP-84-011, REV. 0

ATTACHMENT 1

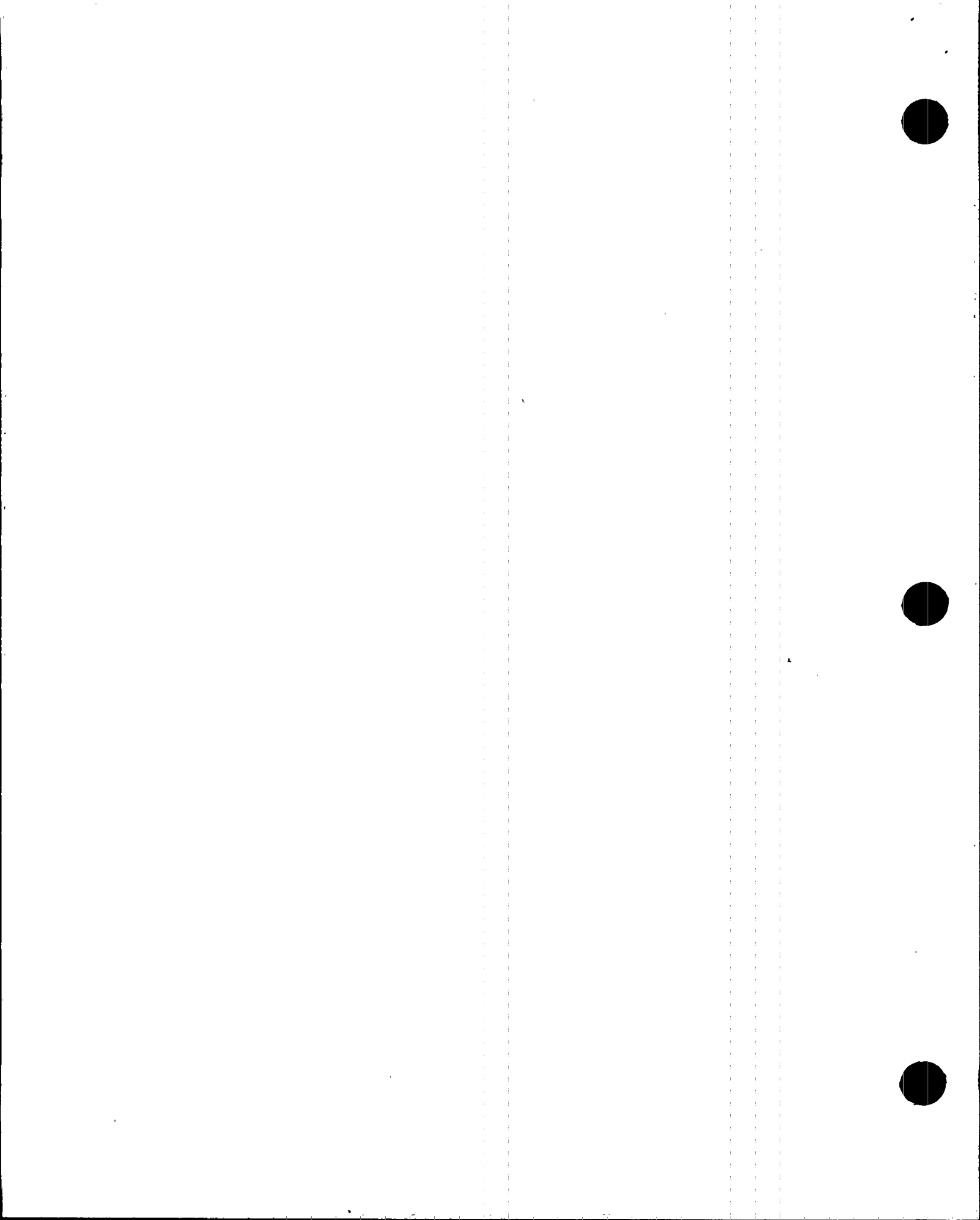
2 OF 8

CABLE		RACEWAY		COND. SIZE	CABLE		CABLE RESIST.	LOAD AMPS	LOAD REF.	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	COND. C. F.	GRPING C. F.	T-LAQ C. F.	RATED AMPS	MAX. W/FT	% MARGIN
SCH	SUB	NUM	WP		# COND	SIZE												
3D2306	A	3F1341	1	4	1-2/C	12	2.1500	4.88	17	0.1024	27	1	.7	1	.89	18.82	1.22	244.69
4D0100	A	3F1341	1	4	2-1/C	2	0.2110	33.16	17	0.4840	130	1	.7	1	.89	80.99	2.77	144.24
		3F1341 Total								1.4953							15.09	
3Y07	A	3F1345	3	2	2-1/C	0	0.1360	62.50	14	1.0625	179	1	1	1	.8	143.20	5.58	129.12
		3F1345 Total								1.0625							5.58	
3D2327	OF	3F1396	1	4	4-1/C	500	0.0278	172.50	6	3.3089	477	1	.8	1	.89	330.62	12.83	98.88
		3F1396 Total								3.3089							12.83	
3D2327	OF	3F1396(3)	3	4	4-1/C	500	0.0278	172.50	6	3.3089	477	1	.8	1	.8	305.28	10.30	76.97
		3F1396(3) Total								3.3089							10.30	
3B0635	A	3J1607	3	2	3-1/C	2	0.2130	65.56	4	2.7465	130	1	1	1	.8	104.00	6.91	58.63
		3J1607 Total								2.7465							6.91	
3Y02	A	3J1618	3	3	2-1/C	0	0.1360	62.50	13	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
3Y05	A	3J1618	3	3	2-1/C	0	0.1360	62.50	14	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
		3J1618 Total								2.1250							7.14	
3B0635	A	3J1663	3	2	3-1/C	2	0.2130	65.56	4	2.7465	130	1	1	1	.8	104.00	6.91	58.63
		3J1663 Total								2.7465							6.91	
3D0104	F	3J1712	1	3	2-1/C	2	0.2110	23.50	17	0.2330	130	1	.8	1	.89	92.56	3.62	293.87
3D0131	C	3J1712	1	3	2-1/C	4	0.3360	1.00	12	0.0007	97	1	.8	1	.89	69.06	3.21	6808.40
3D0147	F	3J1712	1	3	2-1/C	0	0.1330	15.40	17	0.0631	179	1	.8	1	.89	127.45	4.32	727.58
3D0147	C	3J1712	1	3	2-1/C	0	0.1330	15.40	17	0.0631	179	1	.8	1	.89	127.45	4.32	727.58
		3J1712 Total								0.3599							15.46	
3D0104	F	3J1712(3)	3	3	2-1/C	2	0.2110	23.50	17	0.2330	130	1	.8	1	.8	83.20	2.92	254.04
3D0131	C	3J1712(3)	3	3	2-1/C	4	0.3360	1.00	12	0.0007	97	1	.8	1	.8	62.08	2.59	6108.00
3D0147	F	3J1712(3)	3	3	2-1/C	0	0.1330	15.40	17	0.0631	179	1	.8	1	.8	114.56	3.49	643.90
3D0147	C	3J1712(3)	3	3	2-1/C	0	0.1330	15.40	17	0.0631	179	1	.8	1	.8	114.56	3.49	643.90
		3J1712(3) Total								0.3599							12.49	
4Y01	F	3J1747	1	2	2-1/C	0000	0.0689	96.00	12	1.2700	278	1	1	1	.89	247.42	8.44	157.73
		3J1747 Total								1.2700							8.44	
3Y01	A	3J1777	1	3	2-1/C	0	0.1360	62.50	13	1.0625	179	1	.8	1	.89	127.45	4.42	103.92
3Y01	F	3J1777	1	3	2-1/C	0000	0.0689	97.00	12	1.2966	278	1	.8	1	.89	197.94	5.40	104.06
		3J1777 Total								2.3591							9.82	
3Y01	A	3J1777(3)	3	3	2-1/C	0	0.1360	62.50	13	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
3Y01	F	3J1777(3)	3	3	2-1/C	0000	0.0689	97.00	12	1.2966	278	1	.8	1	.8	177.92	4.36	83.42
		3J1777(3) Total								2.3591							7.93	
3D0114	F	3J1779	1	1	2-1/C	8	0.8490	0.94	17	0.0015	55	1	1	1	.89	48.95	4.07	5111.88
		3J1779 Total								0.0015							4.07	
3D2314	F	3J1781	1	1.5	2-1/C	6	0.5340	2.00	8	0.0043	75	1	1	1	.89	66.75	4.76	3237.50
		3J1781 Total								0.0043							4.76	
P412A4	F	3J1815	3	1	1-2/C	10	1.3500	16.00	20	0.6912	36	1	1	1	.8	28.80	2.24	80.00
		3J1815 Total								0.6912							2.24	
3D2335	OF	3J1919	1	4	2-1/C	750	0.0185	34.85	17	0.0449	596	1	1	1	.89	532.22	10.48	1427.17
		3J1919 Total								0.0449							10.48	
3D2328	OF	3J1920	3	3	2-1/C	00	0.1100	3.00	7	0.0020	204	1	.7	1	.8	114.24	2.87	3708.00



CABLE		RACEWAY		COND. SIZE	CABLE		CABLE RESIST.	LOAD AMPS	LOAD REF.	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	CO. ID. C. F.	GRPING C. F.	T-LAG C. F.	RATED AMPS	MAX. W/FT	% MARGIN
SCH	SUB	NUM	WP		# COND	SIZE												
3D2328	OS	3J1920	3	3	2-1/C	00	0.1100	3.00	7	0.0020	204	1	.7	1	.8	114.24	2.87	3708.00
3D2328	F	3J1920	3	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.7	1	.8	100.24	2.67	608.41
3D2328	C	3J1920	3	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.7	1	.8	100.24	2.67	608.41
3J1920 Total										0.1105							11.00	
3B5001	F	3J1948	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	1	.89	532.22	19.03	165.88
3J1948 Total										2.9073							19.03	
3B5001	C	3J1947	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	1	.89	532.22	19.03	155.88
3J1947 Total										2.9073							19.03	
3B5001	F	3J1948	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	1	.89	532.22	19.03	155.88
3J1948 Total										2.9073							19.03	
3B5001	F	3J1949	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	.91	.69	375.48	9.47	80.52
3J1949 Total										2.9073							9.47	
3B5001	C	3J1950	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	.91	.69	375.48	9.47	80.52
3J1950 Total										2.9073							9.47	
3B5001	F	3J1951	1	4	3-1/C	750	0.0224	208.00	17	2.9073	598	1	1	.91	.69	375.48	9.47	80.52
3J1951 Total										2.9073							9.47	
3P0622	OF	3J2040	1	3	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
3P0622	OC	3J2040	1	3	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
3P0624	OF	3J2040	1	3	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
3P0624	OC	3J2040	1	3	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
3J2040 Total										1.6848							8.47	
3B0610	F	3J2047	1	3	3-1/C	2	0.2130	18.00	17	0.2070	130	1	1	1	.89	115.70	8.55	542.78
3J2047 Total										0.2070							8.55	
3V2913	C	3K1605	1	4	1-5/C	12	2.2360	1.00	11	0.0112	27	1	.8	1	.89	19.22	4.13	1822.40
3K1605 Total										0.0112							4.13	
3D2301	A	3K1606	1	4	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.8	1	.89	92.56	3.62	9156.00
3D2302	A	3K1606	1	4	2-1/C	2	0.2110	1.00	12	0.0004	130	1	.8	1	.89	92.56	3.62	9156.00
3D2304	A	3K1606	1	4	2-1/C	2	0.2110	33.16	17	0.4640	130	1	.8	1	.89	92.56	3.62	179.13
3K1606 Total										0.4649							10.85	
3D2306	A	3K1701	1	0.75	1-2/C	12	2.1500	4.88	17	0.1024	27	1	1	1	.89	24.03	2.48	302.42
3K1701 Total										0.1024							2.48	
3AS284	A	3K1712	1	3	2-1/C	0	0.1380	15.00	10	0.0621	179	1	.8	1	.89	127.45	4.48	749.65
3P93	A	3K1712	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	1	.89	69.06	3.21	187.77
3P93	B	3K1712	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	1	.89	69.06	3.21	187.77
3K1712 Total										0.8362							10.80	
3AS284	A	3K1713	1	3	2-1/C	0	0.1290	15.00	10	0.0621	179	1	.7	1	.89	111.52	3.43	843.45
3D2316	A	3K1713	1	3	2-1/C	6	0.5340	1.00	17	0.0011	75	1	.7	1	.89	48.73	2.33	4572.50
3P93	A	3K1713	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.7	1	.89	60.43	2.45	151.80
3P93	B	3K1713	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.7	1	.89	60.43	2.45	151.80
3K1713 Total										0.8373							10.67	
3B0204	F	3K1718	1	3	3-1/C	0000	0.0685	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.83
3K1718 Total										4.9660							12.65	
3D2305	F	3K1759	1	3	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.7	1	.89	80.99	2.77	3949.50

CABLE	RACEWAY			COND.	CABLE		CABLE	LOAD	OPER.	CABLE	TEMP.	COND.	GRPING	T-LAG	RATED	MAX.	%
SCH	SUB	NUM	WP	SIZE	# COND	SIZE	RESIST.	AMPS	W/FT	AMPACITY	C. F.	C. F.	C. F.	C. F.	AMPS	W/FT	MARGIN
3D2328	F	3K1759	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.7	.89	111.52	3.31	688.11
3D2328	C	3K1759	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.7	.89	111.52	3.31	688.11
4D0104	OC	3K1759	1	3	2-1/C	6	0.5340	24.00	17	0.6152	75	1	.7	.89	46.73	2.33	94.60
		3K1759 Total								0.7234						11.72	
3D2305	F	3K1761	1	3	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.8	.89	92.56	3.62	4528.00
3D2328	F	3K1761	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	.89	127.45	4.32	800.69
3D2328	C	3K1761	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	.89	127.45	4.32	800.69
		3K1761 Total								0.1082						12.26	
3D2305	F	3K1763	1	1.5	2-1/C	2	0.2110	2.00	17	0.0017	130	1	1	.89	115.70	5.65	6685.00
		3K1763 Total								0.0017						5.65	
3D2328	F	3K1767	1	2	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	.89	127.45	4.32	800.69
3D2328	C	3K1767	1	2	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	.89	127.45	4.32	800.69
		3K1767 Total								0.1065						8.64	
3B0407	F	3K1966	1	4	3-1/C	750	0.0224	94.83	17	0.1548	598	1	1	.89	532.22	19.03	1008.79
		3K1966 Total								0.1548						19.03	
3B5202	F	3K1992	1	1.5	1-3/C	10	1.4040	3.38	17	0.0481	36	1	1	.89	32.04	4.32	847.93
3B5207	F	3K1992	1	1.5	3-1/C	6	0.5340	8.41	19	0.1133	75	1	1	.89	66.75	7.14	693.70
		3K1992 Total								0.1814						11.46	
4D0158	OF	3K2022	1	4	2-1/C	750	0.0185	34.85	17	0.0449	598	1	1	.69	412.62	6.30	1063.90
		3K2022 Total								0.0449						6.30	
4D0147	OF	3K2031	1	4	2-1/C	750	0.0185	43.75	17	0.0708	598	1	1	.69	363.11	4.88	729.90
		3K2031 Total								0.0708						4.88	
3D2335	OF	3K2034	1	4	2-1/C	750	0.0185	34.85	17	0.0449	598	1	1	.69	363.11	4.88	941.91
		3K2034 Total								0.0449						4.88	
4B0407	OF	3K2036	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	363.11	8.66	282.90
		3K2036 Total								0.6043						8.66	
4B0407	OC	3K2037	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	363.11	8.66	282.90
		3K2037 Total								0.6043						8.66	
4B0407	OF	3K2057	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	412.62	11.44	335.12
		3K2057 Total								0.6043						11.44	
4B0407	OC	3K2058	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	412.62	11.44	335.12
		3K2058 Total								0.6043						11.44	
3D2335	OF	3K2060	1	4	2-1/C	750	0.0185	34.85	17	0.0449	598	1	1	.69	412.62	6.30	1063.90
		3K2060 Total								0.0449						6.30	
4D0147	OF	3K2062	1	4	2-1/C	750	0.0185	43.75	17	0.0708	598	1	1	.69	412.62	6.30	843.13
		3K2062 Total								0.0708						6.30	
4D0147	OF	3K2081	1	4	2-1/C	750	0.0185	43.75	17	0.0708	598	1	1	.69	363.11	4.88	729.90
		3K2081 Total								0.0708						4.88	
4B0407	OF	3K2082	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	363.11	8.66	282.90
		3K2082 Total								0.6043						8.66	
4B0407	OC	3K2083	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.69	363.11	8.66	282.90
		3K2083 Total								0.6043						8.66	
3D2335	OF	3K2086	1	4	2-1/C	750	0.0185	34.85	17	0.0449	598	1	1	.69	363.11	4.88	941.91



AMPACITY DERATING FOR CABLES ROUTED IN CONDUIT WRAPPED WITH THERMO-LAG 330-1

JPN-PTH-SEEP-94-011, REV. 0

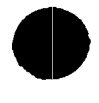
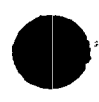
ATTACHMENT 1

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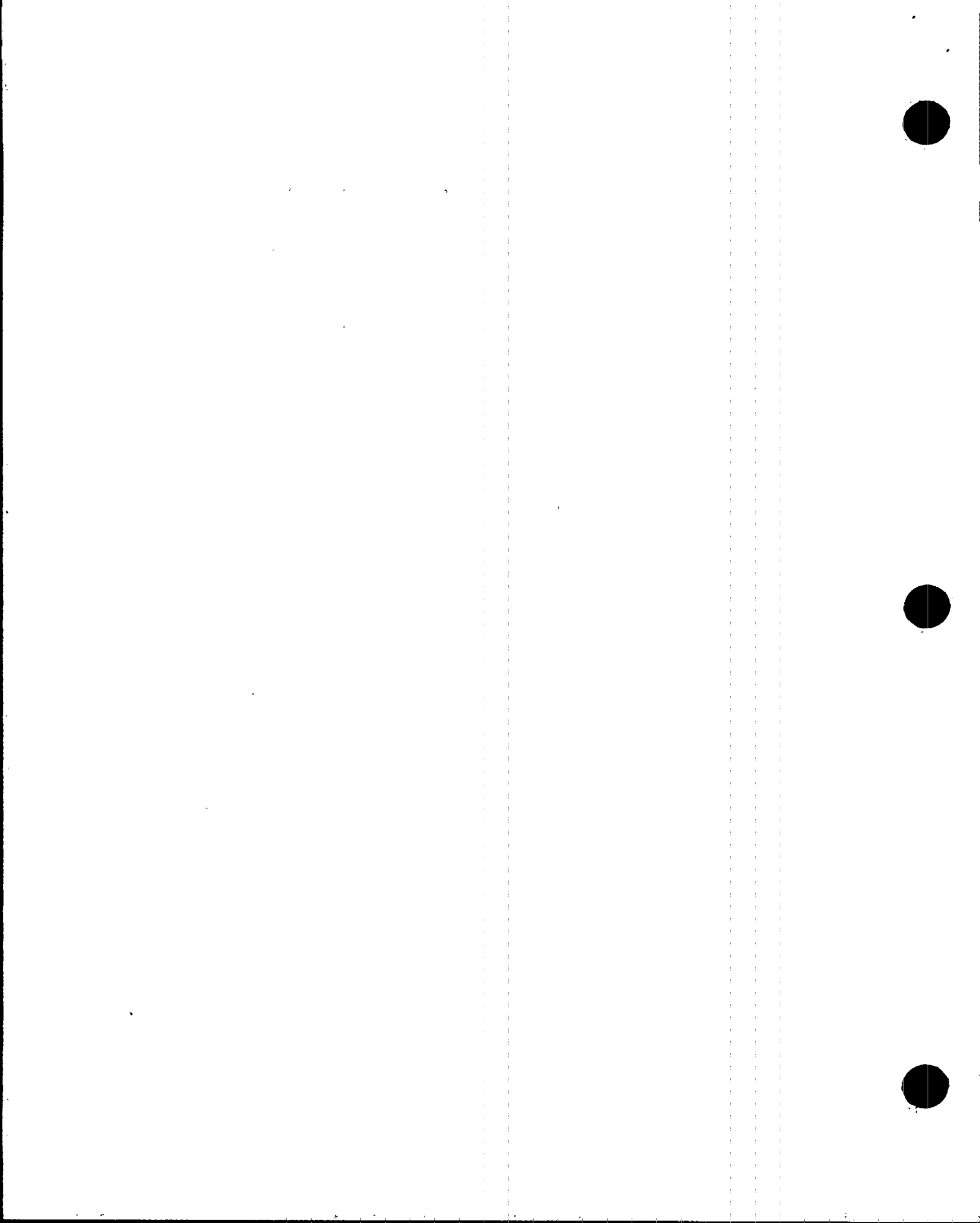
CABLE		RACEWAY		COND. SIZE	CABLE		CABLE RESIST.	LOAD AMPS	LOAD REF.	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	COND. C. F.	GRPING C. F.	T-LAG C. F.	RATED AMPS	MAX. W/FT	% MARGIN
SCH	SUB	NUM	WP		# COND	SIZE												
		3K2088 Total								0.0449							4.85	
3AB17	1	3R067	1	4	3-1/C	0000	0.0689	46.00	17	0.4374	278	.956	1	1	.89	236.53	11.56	414.20
		3R067 Total								0.4374							11.56	
3AB17	1	3R077	1	4	3-1/C	0000	0.0689	46.00	17	0.4374	278	.956	1	1	.89	236.63	11.56	414.20
		3R077 Total								0.4374							11.56	
4AB09	1	4A058	3	4	3-1/C	0000	0.0689	63.51	2	0.8337	278	.956	1	1	.8	212.61	9.34	234.77
		4A058 Total								0.8337							9.34	
4AB14	1	4A064	3	4	3-1/C	0000	0.0689	135.10	3	3.7727	278	.956	1	1	.8	212.61	9.34	87.36
		4A064 Total								3.7727							9.34	
3D2303	A	4A1345	1	3	2-1/C	2	0.2110	33.16	17	0.4840	130	1	.8	1	.89	92.56	3.62	179.13
4D0109	A	4A1345	1	3	2-1/C	2	0.2110	33.16	17	0.4840	130	1	.8	1	.89	92.56	3.62	179.13
		4A1345 Total								0.9281							7.23	
4B0204	F	4A1353	1	4	3-1/C	0000	0.0689	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.63
		4A1353 Total								4.9660							12.65	
4B0204	F	4A1354	1	4	3-1/C	0000	0.0689	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.63
		4A1354 Total								4.9660							12.65	
4B0204	F	4A1357	1	4	3-1/C	0000	0.0689	155.00	17	4.9660	278	1	1	1	.89	247.42	12.65	59.63
		4A1357 Total								4.9660							12.65	
4B0407	OF	4A1492	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.91	.69	375.48	9.47	295.96
		4A1492 Total								0.6043							9.47	
4B0407	OC	4A1493	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.91	.69	375.48	9.47	295.96
		4A1493 Total								0.6043							9.47	
4B0407	OF	4A1524	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.94	.69	387.86	10.11	309.01
		4A1524 Total								0.6043							10.11	
4B0407	OF	4A1524(3)	3	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.94	.6	337.27	7.64	255.66
		4A1524(3) Total								0.6043							7.64	
4B0407	OC	4A1525	1	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.94	.69	387.86	10.11	309.01
		4A1525 Total								0.6043							10.11	
4B0407	OC	4A1525(3)	3	4	3-1/C	750	0.0224	94.83	17	0.6043	598	1	1	.94	.6	337.27	7.64	255.66
		4A1525(3) Total								0.6043							7.64	
4B0112	2	4A451	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		4A451 Total								2.6880							14.06	
4B0112	1	4A452	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		4A452 Total								2.6880							14.06	
4B0112	2	4A857	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		4A857 Total								2.6880							14.06	
4B0112	1	4A858	3	4	3-1/C	750	0.0224	200.00	17	2.6880	598	.956	1	1	.8	457.35	14.06	128.68
		4A858 Total								2.6880							14.06	
4B0105	OF	4F101	1	4	3-1/C	350	0.0432	211.85	17	5.8165	384	.956	1	1	.89	328.72	13.83	54.22
		4F101 Total								5.8165							13.83	
4Y02	OA	4F1331	3	3	2-1/C	0	0.1360	62.50	15	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
4Y05	A	4F1331	3	3	2-1/C	0	0.1360	62.50	16	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
		4F1331 Total								2.1250							7.14	

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CABLE	RACEWAY			COND.	CABLE		CABLE	LOAD	LOAD	OPER.	CABLE	TEMP.	CON'D.	GRPING	T-LAG	RATED	MAX.	%
SCH	SUB	NUM	WP	SIZE	# COND	SIZE	RESIST.	AMPS	REF.	W/FT	AMPACITY	C. F.	C. F.	C. F.	C. F.	AMPS	W/FT	MARGIN
3D0106	A	4F1360	3	2	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.8	1	.8	114.56	3.49	11356.00
3D0106	A	4F1360	3	2	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.8	1	.8	114.56	3.49	11356.00
		4F1360 Total								0.0005							6.98	
4P93	A	4F1360	1	2	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	1	.89	69.06	3.21	187.77
4P93	B	4F1360	1	2	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	1	.89	69.06	3.21	187.77
		4F1360 Total								0.7741							6.41	
4D0107	F	4F1373	3	2	2-1/C	2	0.2110	50.00	17	1.0550	130	1	1	1	.8	104.00	4.56	108.00
		4F1373 Total								1.0550							4.56	
4D0107	F	4F1374	3	2	2-1/C	2	0.2110	50.00	17	1.0550	130	1	1	1	.8	104.00	4.56	108.00
		4F1374 Total								1.0550							4.56	
4B0709	F	4F1379	3	1.5	3-1/C	2	0.2130	65.56	4	2.7465	130	1	1	1	.8	104.00	6.91	58.63
		4F1379 Total								2.7465							6.91	
4B0203	H	4F141	1	4	3-1/C	350	0.0432	181.00	17	4.2458	384	.956	1	1	.89	326.72	13.83	80.51
		4F141 Total								4.2458							13.83	
3D2334	OP	4F1533	1	2	2-1/C	00	0.1050	13.80	17	0.0400	204	1	1	1	.89	181.56	6.92	1215.65
		4F1533 Total								0.0400							6.92	
4B0625	F	4J1195	1	1.5	3-1/C	2	0.2130	48.00	5	1.4723	130	1	1	1	.89	115.70	8.55	141.04
		4J1195 Total								1.4723							8.55	
4Y02	B	4J1606	3	3	2-1/C	0000	0.0689	96.00	12	1.2700	179	1	.8	.91	.8	121.43	2.03	26.49
4Y02	D	4J1606	3	3	2-1/C	0000	0.0689	97.00	12	1.2966	278	1	.8	.91	.6	121.43	2.03	25.19
		4J1606 Total								2.5665							4.06	
4Y02	OA	4J1607	3	3	2-1/C	0	0.1360	62.50	15	1.0625	179	1	.8	.91	.6	78.19	1.66	25.10
4Y05	A	4J1607	3	3	2-1/C	0	0.1360	62.50	16	1.0625	179	1	.8	1	.6	78.19	1.66	25.10
		4J1607 Total								2.1250							3.33	
3B0715	A	4J1615	3	3	3-1/C	0000	0.0689	114.00	18	2.6863	278	1	1	.91	.6	151.79	4.78	33.15
		4J1615 Total								2.6863							4.78	
3D2328	F	4J1760	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	1	.89	127.45	4.32	800.66
3D2328	C	4J1760	1	3	2-1/C	0	0.1330	14.15	17	0.0533	179	1	.8	1	.89	127.45	4.32	800.66
4D0104	OC	4J1760	1	3	2-1/C	6	0.5340	24.00	17	0.6152	75	1	.8	1	.89	53.40	3.05	122.50
		4J1760 Total								0.7217							11.69	
4B0614	A	4J1768	3	4	3-1/C	0000	0.0689	104.50	17	2.2572	278	1	.7	1	.8	155.68	5.01	48.96
4D3106	F	4J1768	3	4	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.7	1	.8	100.24	2.67	9924.00
4D0106	F	4J1768	3	4	2-1/C	0	0.1330	17.79	17	0.0842	179	1	.7	1	.8	100.24	2.67	463.48
4D0112	F	4J1768	3	4	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.7	1	.8	72.80	2.24	3540.00
4D0126	F	4J1768	3	4	2-1/C	2	0.2110	50.00	17	1.0550	130	1	.7	1	.8	72.80	2.24	45.80
		4J1768 Total								3.3964							14.83	
4B0614	A	4J1769	1	4	3-1/C	0000	0.0689	104.50	17	2.2572	278	1	.7	1	.89	173.19	6.20	65.74
4B0624	F	4J1769	1	4	1-3/C	10	1.4040	2.63	17	0.0291	36	1	.7	1	.89	22.43	2.12	752.78
4B0639	F	4J1769	1	4	1-3/C	10	1.4040	3.00	17	0.0379	36	1	.7	1	.89	22.43	2.12	647.80
4D0106	F	4J1769	1	4	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.7	1	.89	111.52	3.31	11051.70
4D0106	F	4J1769	1	4	2-1/C	0	0.1330	17.79	17	0.0842	179	1	.7	1	.89	111.52	3.31	526.85
4D0112	F	4J1769	1	4	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.7	1	.89	80.96	2.77	3049.50
4D0126	F	4J1769	1	4	2-1/C	2	0.2110	50.00	17	1.0550	130	1	.7	1	.89	80.96	2.77	61.96



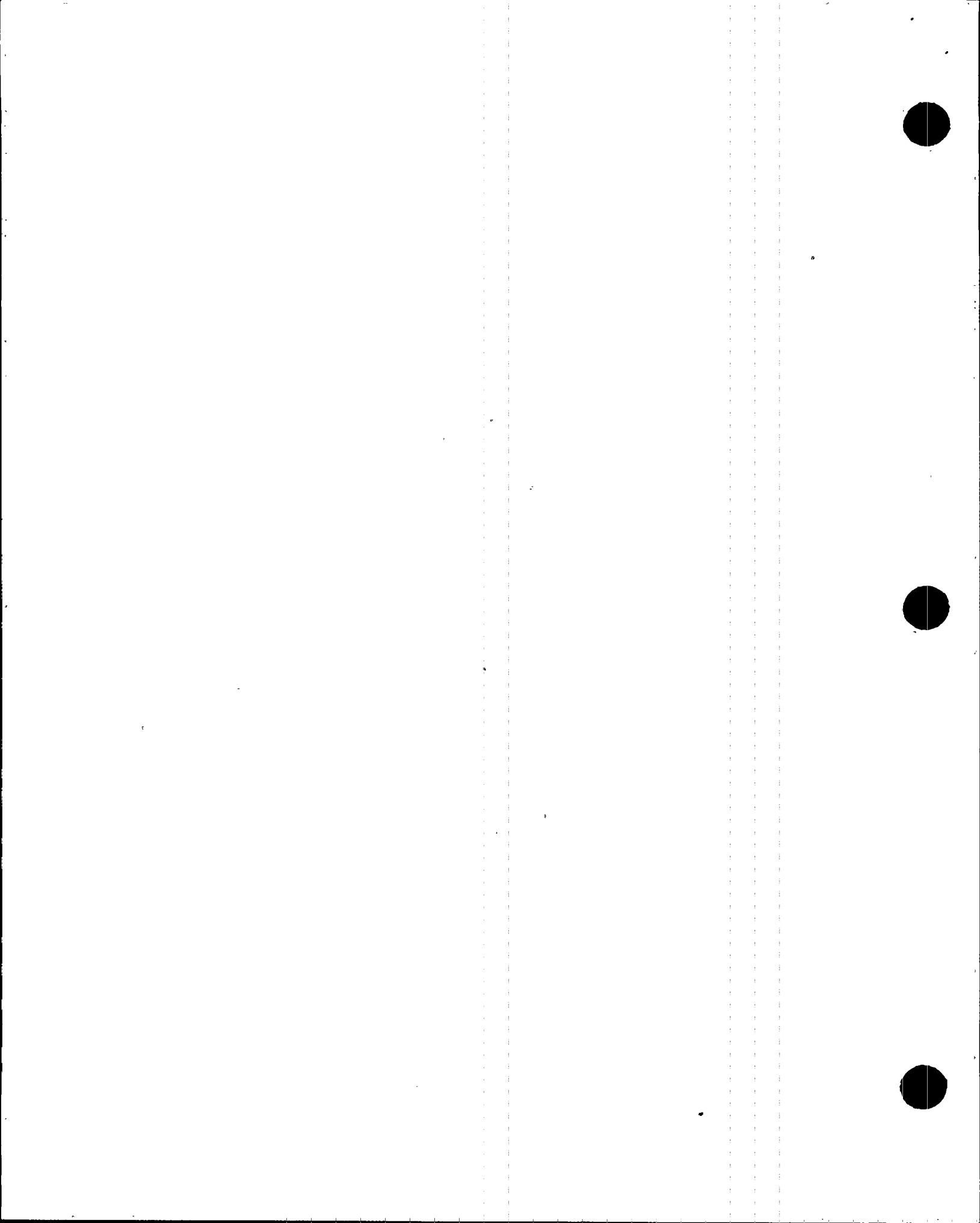
AMPACITY DERATING FOR CABLES ROUTED IN CONDUIT WRAPPED WITH THERMO-LAG 330-1

JPN-PTH-SEEP-06-011, REV. 0

ATTACHMENT 1

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CABLE SCH.	RACEWAY SUB	RACEWAY HUM	COND. WP	COND. SIZE	CABLE # COND	CABLE SIZE	CABLE RESIST.	LOAD AMPS	LOAD REF.	OPER. W/FT	CABLE AMPACITY	TEMP. C. F.	COND. C. F.	GRPING C. F.	T-LAG C. F.	RATED AMPS	MAX. W/FT	% MARGIN
		4J1769 Total								3.4654							22.50	
4B0614	A	4J1769(3)	3	4	3-1/C	0000	0.0689	104.50	17	2.2572	278	1	.7	1	.8	155.68	5.01	48.98
4B0624	F	4J1769(3)	3	4	1-3/C	10	1.4040	2.63	17	0.0291	36	1	.7	1	.8	20.16	1.71	666.54
4B0639	F	4J1769(3)	3	4	1-3/C	10	1.4040	3.00	17	0.0379	36	1	.7	1	.8	20.16	1.71	572.00
4D0106	F	4J1769(3)	3	4	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.7	1	.8	100.24	2.67	9924.00
4D0106	F	4J1769(3)	3	4	2-1/C	0	0.1330	17.79	17	0.0842	179	1	.7	1	.8	100.24	2.67	463.46
4D0112	F	4J1769(3)	3	4	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.7	1	.8	72.60	2.24	3540.00
4D0126	F	4J1769(3)	3	4	2-1/C	2	0.2110	50.00	17	1.0550	130	1	.7	1	.8	72.60	2.24	45.00
		4J1769(3) Total								3.4654							18.25	
4B0606	F	4J1775	1	3	1-3/C	12	2.2360	1.00	17	0.0067	27	1	.7	1	.89	16.82	1.90	1582.10
4D0106	F	4J1775	1	3	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.7	1	.89	111.52	3.31	11051.70
4D0106	F	4J1775	1	3	2-1/C	0	0.1330	17.79	17	0.0842	179	1	.7	1	.89	111.52	3.31	626.85
4D0112	F	4J1775	1	3	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.7	1	.89	80.99	2.77	3949.50
		4J1775 Total								0.0928							11.28	
4D0106	F	4J1776	1	3	2-1/C	0	0.1330	1.00	17	0.0003	179	1	.8	1	.89	127.45	4.32	12644.60
4D0106	F	4J1776	1	3	2-1/C	0	0.1330	17.79	17	0.0842	179	1	.8	1	.89	127.45	4.32	616.40
4D0112	F	4J1776	1	3	2-1/C	2	0.2110	2.00	17	0.0017	130	1	.8	1	.89	92.56	3.62	4526.00
		4J1776 Total								0.0861							12.26	
4Y01	A	4J1801	1	2	2-1/C	0	0.1360	62.50	15	1.0625	179	1	.8	1	.89	127.45	4.42	103.92
4Y07	A	4J1801	1	2	2-1/C	0	0.1360	62.50	16	1.0625	179	1	.8	1	.89	127.45	4.42	103.92
		4J1801 Total								2.1250							8.84	
4Y01	F	4J1805	1	2	2-1/C	0000	0.0689	96.00	12	1.2700	278	1	1	1	.89	247.42	8.44	157.73
		4J1805 Total								1.2700							8.44	
4Y01	A	4J1806	3	2	2-1/C	0	0.1360	62.50	15	1.0625	179	1	1	1	.8	143.20	5.58	129.12
4Y07	A	4J1806	3	2	2-1/C	0	0.1360	62.50	16	1.0625	179	1	.8	1	.8	114.56	3.57	83.30
		4J1806 Total								2.1250							9.15	
4D0158	OF	4J1967	1	4	2-1/C	750	0.0185	34.85	17	0.0449	598	1	1	1	.89	532.22	10.48	1427.17
		4J1967 Total								0.0449							10.48	
4D0147	OF	4J1988	1	4	2-1/C	750	0.0185	43.75	17	0.0708	598	1	1	1	.69	412.62	6.30	843.13
		4J1988 Total								0.0708							6.30	
4DC104	OF	4J2096	3	3	2-1/C	6	0.5340	24.00	17	0.6152	75	1	1	1	.8	60.00	3.84	150.00
		4J2096 Total								0.6152							3.84	
4P0813	OF	4J2144	1	2	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
4P0813	OC	4J2144	1	2	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
4P0817	OF	4J2144	1	2	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
4P0817	OC	4J2144	1	2	1-3/C	10	1.4040	10.00	9	0.4212	36	1	.7	1	.89	22.43	2.12	124.28
		4J2144 Total								1.6848							8.47	
4V2915	D	4K1232	1	4	1-5/C	12	2.2360	1.00	11	0.0112	27	1	.8	.94	.69	14.01	2.19	1300.96
		4K1232 Total								0.0112							2.19	
4V2915	D	4K1235	1	0.75	1-5/C	12	2.2360	1.00	11	0.0112	27	1	.8	1	.89	19.22	4.13	1822.40
		4K1235 Total								0.0112							4.13	
4B0204	F	4K1412	1	3	3-1/C	0000	0.0689	155.00	17	4.9680	278	1	1	1	.89	247.42	12.65	59.63
		4K1412 Total								4.9680							12.65	



AMPACITY DERATING FOR CABLES ROUTED IN CONDUIT WRAPPED WITH THERMO-LAQ 338-1

JPN-PTH-SSEP-86-011, REV. 0

ATTACHMENT 1

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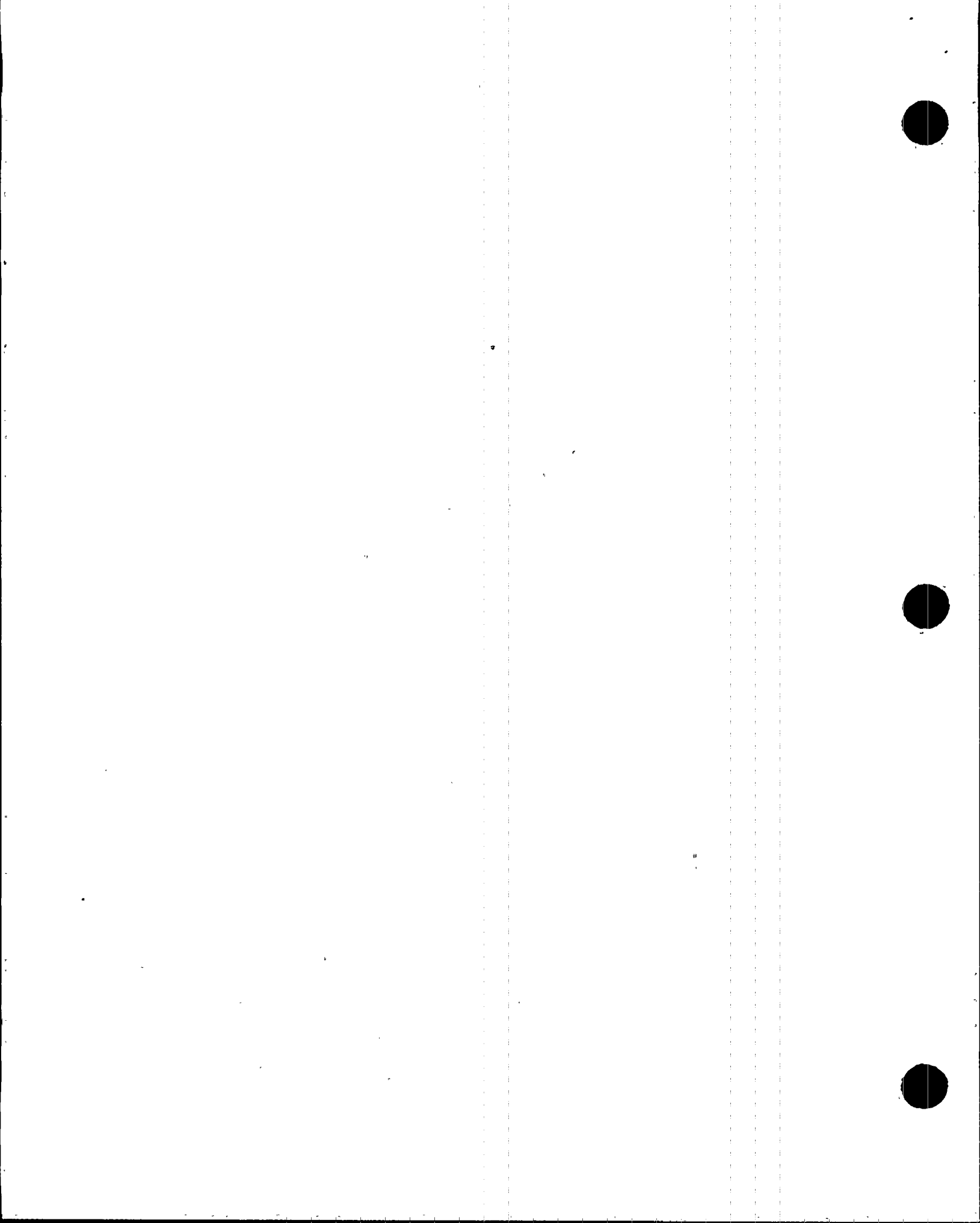
CABLE	RACEWAY			COND.	CABLE		CABLE	LOAD	LOAD	OPER.	CABLE	TEMP.	COND.	GRPING	T-LAQ	RATED	MAX.	%
SCH	SUB	NUM	WP	SIZE	# COND	SIZE	RESIST.	AMPS	REF.	W/FT	AMPACITY	C. F.	C. F.	C. F.	C. F.	AMPS	W/FT	MARGIN
4AS264	A	4K1417	1	3	2-1/C	0	0.1380	15.00	10	0.0621	179	1	.8	.94	.86	92.36	2.38	519.20
4P93	A	4K1417	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	.94	.86	60.33	1.70	109.71
4P93	B	4K1417	1	3	2-1/C	4	0.3360	24.00	10	0.3871	97	1	.8	.94	.86	60.33	1.70	109.71
		4K1417 Total								0.8362							6.79	
4B0606	F	4K1426	1	2	1-3/C	12	2.2360	1.00	17	0.0087	27	1	1	1	.86	24.03	3.87	2303.00
4D0126	F	4K1426	1	2	2-1/C	2	0.2110	60.00	17	1.0650	130	1	.8	1	.86	92.56	3.62	85.12
		4K1426 Total								1.0817							7.49	
4B0606	F	4K1427	1	1.5	1-3/C	12	2.2360	1.00	17	0.0087	27	1	1	1	.86	24.03	3.87	2303.00
		4K1427 Total								0.0087							3.87	
4D0133	F	4K1436	1	3	1-2/C	10	1.3500	6.25	17	0.1055	36	1	1	1	.86	32.04	2.77	412.64
		4K1436 Total								0.1055							2.77	
4D0133	F	4K1436(3)	3	3	1-2/C	10	1.3500	6.25	17	0.1055	36	1	1	1	.8	28.80	2.24	360.80
		4K1436(3) Total								0.1055							2.24	
4D0129	F	4K1441	1	4	1-2/C	12	2.1500	4.30	17	0.0795	27	1	1	1	.86	24.03	2.48	458.84
		4K1441 Total								0.0795							2.48	
4AB17	1	4R067	1	4	3-1/C	0000	0.0686	48.00	17	0.4374	278	.956	1	1	.86	236.53	11.56	414.20
		4R067 Total								0.4374							11.56	
4AB17	1	4R077	1	4	3-1/C	0000	0.0686	48.00	17	0.4374	278	.956	1	1	.86	236.53	11.56	414.20
		4R077 Total								0.4374							11.56	

LOAD REFERENCES

- 1) EC-136, REV. 4; $I = \text{SORT}(240.65^2 + 123.29^2)/(4^* \text{SORT}3) = 39.03A$
- 2) EC-136, REV. 4; $I @ 4KV = (550.40A \text{ MODE } 6)^*480/4160 = 63.51A$
- 3) EC-136, REV. 4; $I @ 4KV = (1170.87A \text{ MODE } 4)^*480/4160 = 135.10A$
- 4) EC-136, REV. 4; $I = \text{SORT}(39.18^2 + 34.55^2)/(48^* \text{SORT}3) = 65.56A$
- 5) EC-136, REV. 4; $I = \text{SORT}(29.93^2 + 26.39^2)/(48^* \text{SORT}3) = 48A$
- 6) EC-170, REV. 3
- 7) IC-TP-0011, REV. 0
- 8) IC-TP-0012, REV. 0
- 9) EC-132, REV. 6
- 10) 5177-EF-15, REV. 1
- 11) 18712-473-E-01, REV. 1; $I = 3 \times 35.1/12 = 0.84A$
- 12) 5177-482-E-03, REV. 1

LOAD REFERENCES

- 13) 5613-E-11, SH. 1, REV. 9; $I = 7.5KVA/.12KV = 62.5A$
- 14) 5613-E-12, REV. 4; $I = 7.5KVA/.12KV = 62.5A$
- 15) 5614-E-11, SH. 1, REV. 5; $I = 7.5KVA/.12KV = 62.5A$
- 16) 5614-E-12, REV. 5; $I = 7.5KVA/.12KV = 62.5A$
- 17) PTN-BFJE-93-001, REV. 0
- 18) VENDOR MANUAL AAS50
- 19) 5613-E-10, SH. 2, REV. 6; $I = 7KVA/(48^* \text{SORT}3) = 8.41A$
- 20) 5610-E-303, SH. 120, REV. 2; 80% OF BREAKER RATING = 16A



AMPACITY DERATING FOR CABLES IN TRAY WRAPPED WITH THERMO LAG 330-1

JPN-PIN-SEEP-88-011, REV. 0

ATTACHMENT 2

PAGE 1 OF 1

TRAY	FIRE WRAP	AREA/ ZONE	TRAY			CABLE							LOAD AMPS	LOAD REF.	OPER. W/FT	CABLE AMPACITY	T-LAG CORR. FACT.	RATED AMPS	MAX. W/FT	CABLE FUNCTION	MARGIN	
			LEN	SIZE	% FILL	SCHEME	FROM	TO	SUB	# COND	SIZE	RESIST.										
JAUT10	3	X-71	25'	4x30	15.2	3B0408	3B04	3B13	1	3-1/C	500	0.0278	271	1	6.12	540	0.6	324.00	8.75	POWER - PRESS HTR 3B1	19.56	
						3B0408	3B04	3B13	2	3-1/C	500	0.0278	271	1	6.12	540	0.6	324.00	8.75	POWER - PRESS HTR 3B1	19.56	
JAUT10 TOTAL =															12.25					17.51		

3AXT10	3	X-71	50'	4x30	9.1	3B0206	3B02	3B06	1	3-1/C	750	0.0224	135	1	1.22	698	0.6	418.80	11.79	MCC 3B FEEDER POWER	210.22
						3B0206	3B02	3B06	2	3-1/C	750	0.0224	135	1	1.22	698	0.6	418.80	11.79	MCC 3B FEEDER POWER	210.22
3AXT10 TOTAL =															2.45				23.57		

4AX1.	3	V-68	24'	4x30	13.3	4B0206	4B02	4B06	1	3-1/C	750	0.0224	133	2	1.19	681	0.6	408.60	11.22	MCC 4B FEEDER POWER	207.22
						4B0206	4B02	4B06	2	3-1/C	750	0.0224	133	2	1.19	681	0.6	408.60	11.22	MCC 4B FEEDER POWER	207.22
4AX110 TOTAL =															2.38			22.44			

4LAT20	1	O/D-81	20'	5x18	24.2	4AB21	4AB21	4C12E	OP	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OO	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OR	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AD06	4AD06	4AB19	OP	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
						4AD06	4AD06	4AB19	OO	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
4LAT20 TOTAL =															20.08				36.12		

4LAT30	1	O/D-81	12'	5x18	24.2	4AB21	4AB21	4C12E	OP	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OO	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OR	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AD06	4AD06	4AB19	OP	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
						4AD06	4AD06	4AB19	OO	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
4LAT30 TOTAL =															20.08				36.12		

4LAT40	1	O/D-81	20'	5x18	24.2	4AB21	4AB21	4C12E	OP	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OO	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AB21	4AB21	4C12E	OR	1-1/C	1250	0.0157	498	3	3.89	790	0.69	545.10	4.67	POWER - EDG 4B BREAK	9.46
						4AD06	4AD06	4AB19	OP	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
						4AD06	4AD06	4AB19	OO	3-1/C	750	0.0224	250	4	4.20	588	0.69	405.72	11.06	POWER - BUS 4B-4D TIE	62.29
4LAT40 TOTAL =														20.08				36.12			

LOAD REFERENCES

- 1) EC-138, REV. 4; 1 - 135A, MODE 7 LOAD PLUS 10% GROWTH
NOTE: CURRENT IS DIVIDED BETWEEN 2 CONDUCTORS PER PHASE
- 2) EC-138, REV. 4; 1 - 133A, MODE 7 LOAD PLUS 10% GROWTH
NOTE: CURRENT IS DIVIDED BETWEEN 2 CONDUCTORS PER PHASE

- 3) EC-132, REV. 6
- 4) EC-182, REV. 0

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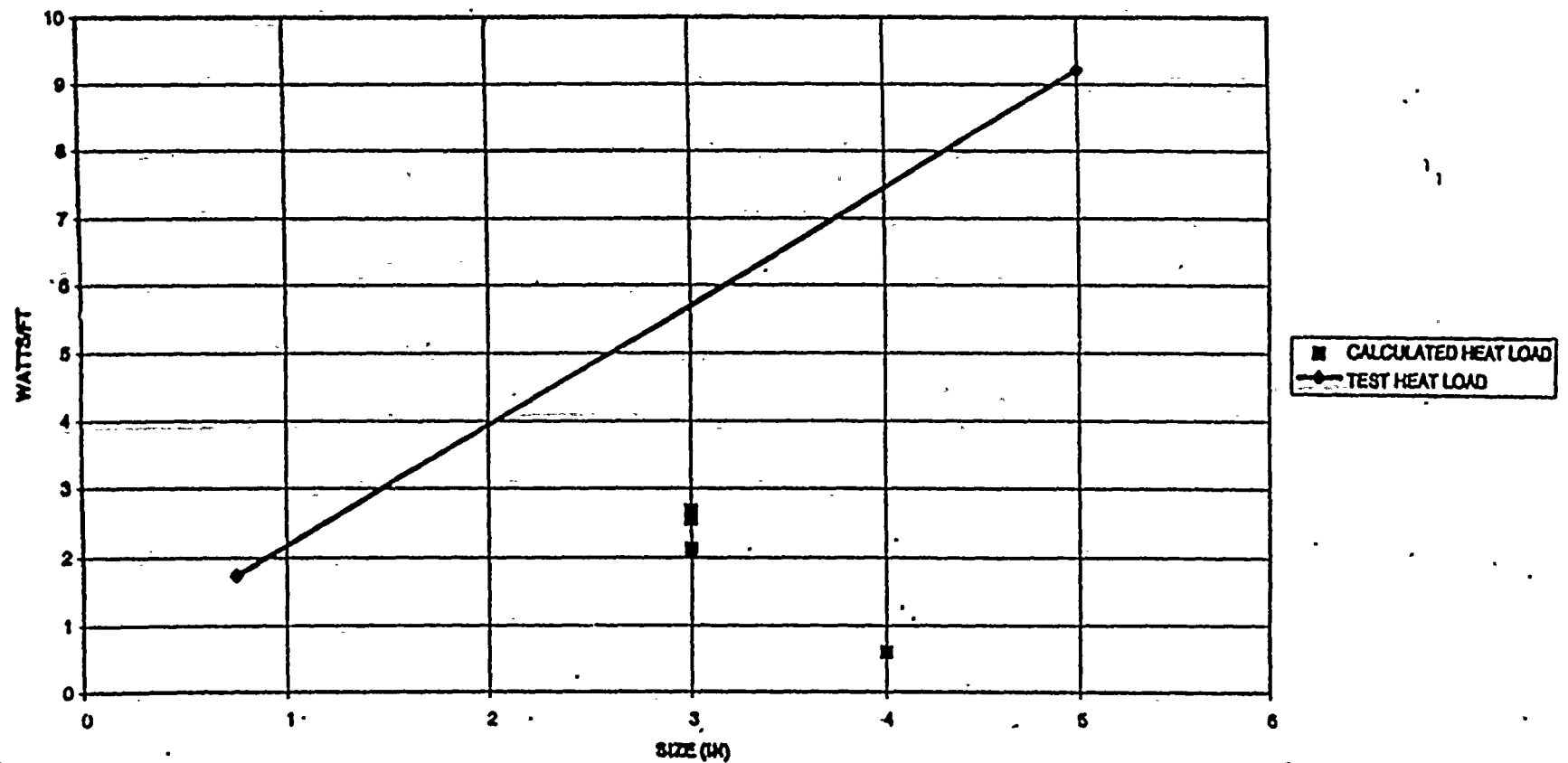


RACEWAY HEAT LOSS

JPN-PTN-SEEP-00-011, REV. 0
ATTACHEMENT 3
1 OF 6

3 HOUR WRAP BANKED CONDUIT

NOTE: TEST DATA FOR 2" TRAY WAS CONVERTED TO OTHER SIZES BY A RATIO OF SIZES.

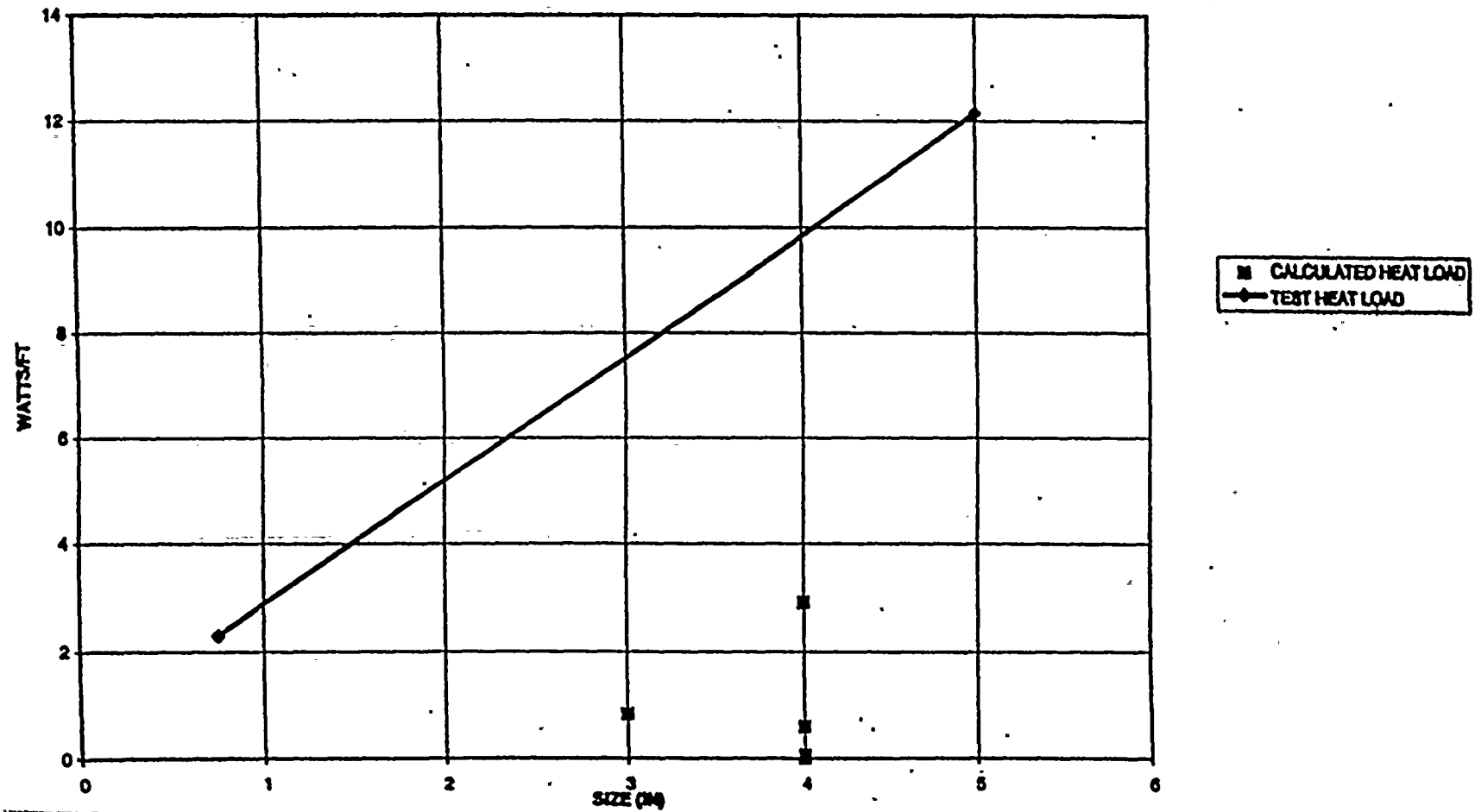


RACEWAY HEAT LOSS

JPN-PTH-SEEP-88-011, REV. 8
ATTACHMENT 3
2 OF 6

1 HOUR WRAP BANKED CONDUIT

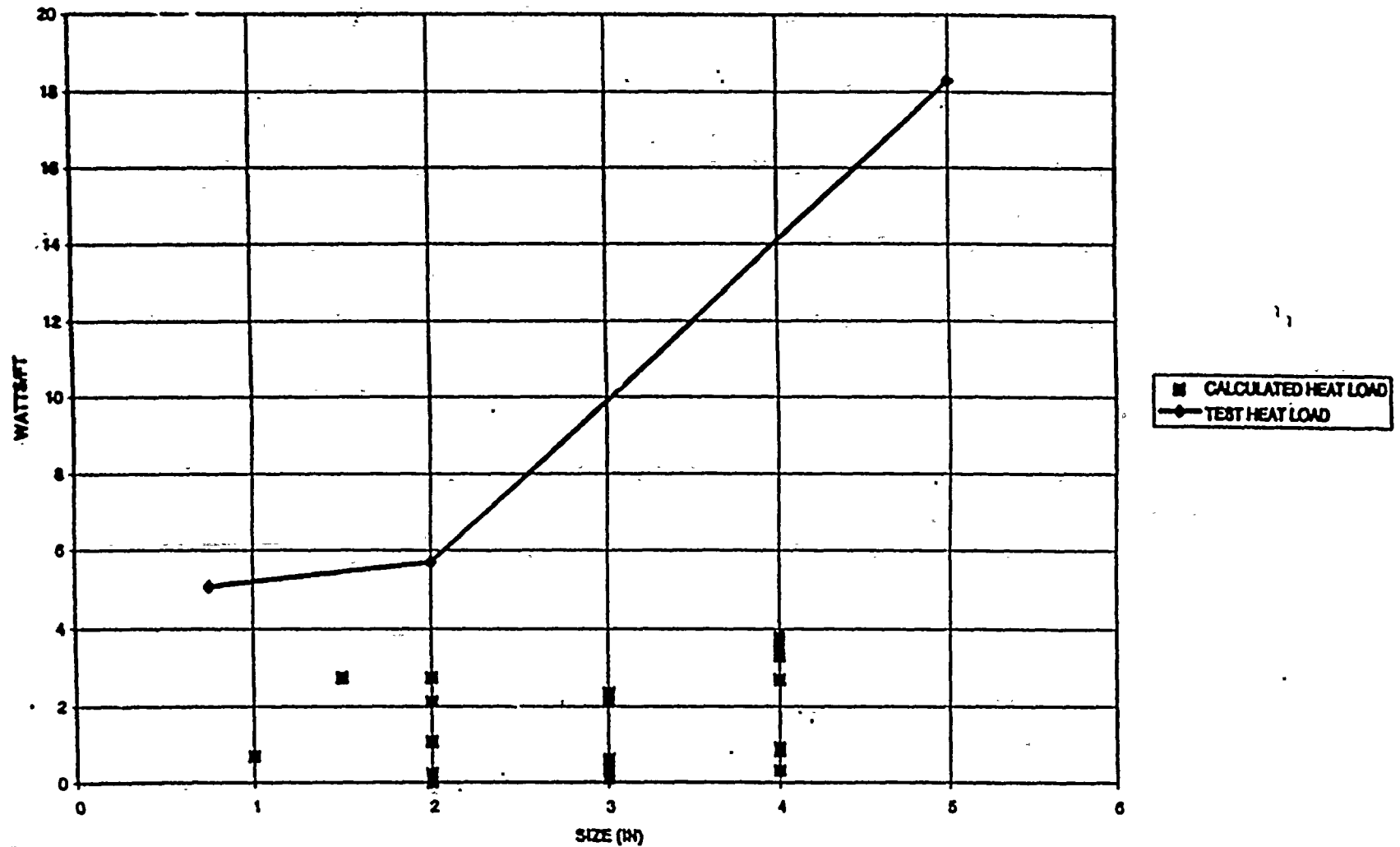
NOTE: TEST DATA FOR 24" TRAY WAS CONVERTED TO OTHER SIZES BY A RATIO OF SIZES.



FACEWAY HEAT LOSS

JPN-PTN-SEEP-00-011, REV. 0
ATTACHMENT 3
3 OF 6

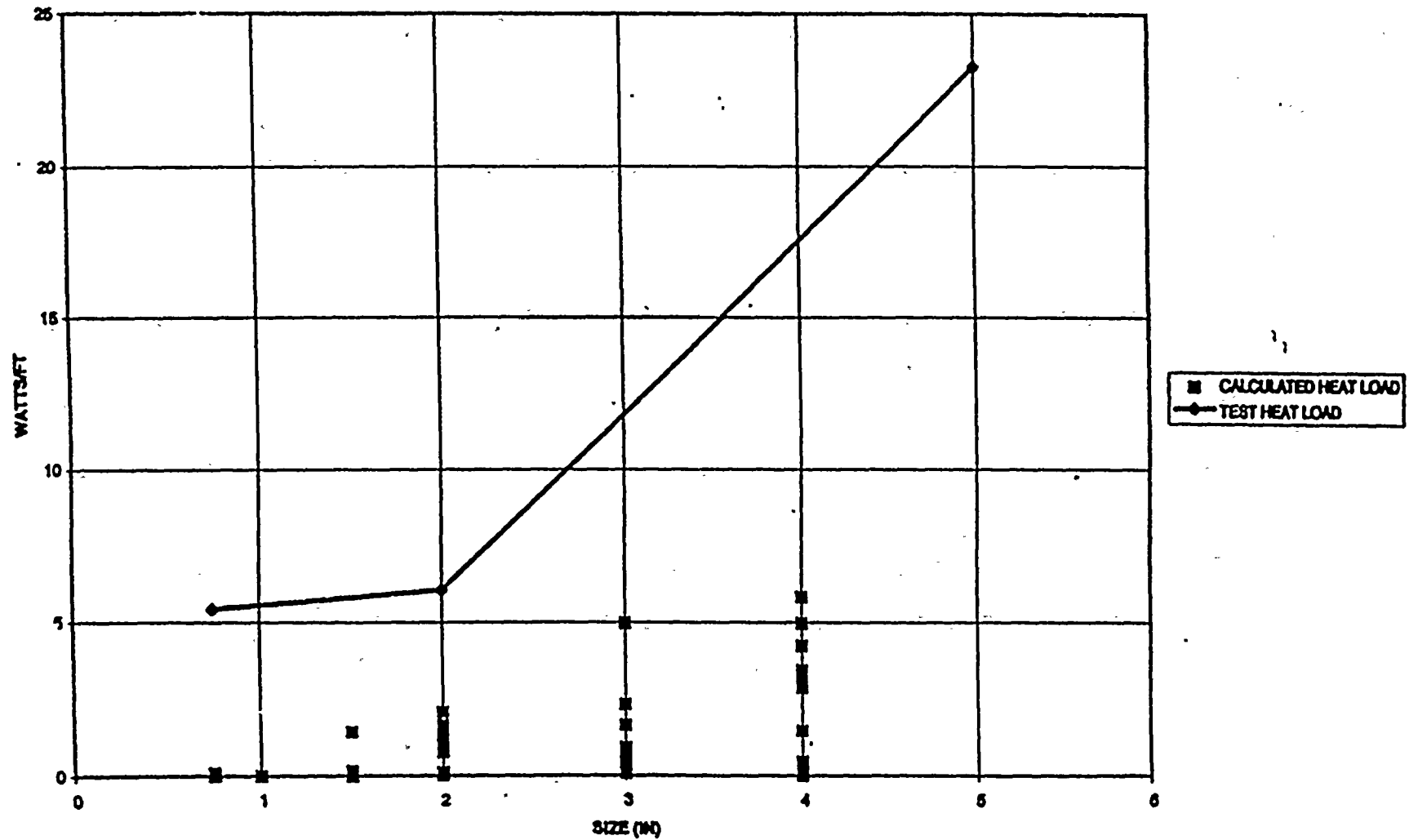
3 HOUR WRAPPED CONDUIT



RACEWAY HEAT LOSS

JPN-PTH-SEEP-06-011, REV. 0
ATTACHMENT 3
4 OF 8

1 HOUR WRAPPED CONDUIT



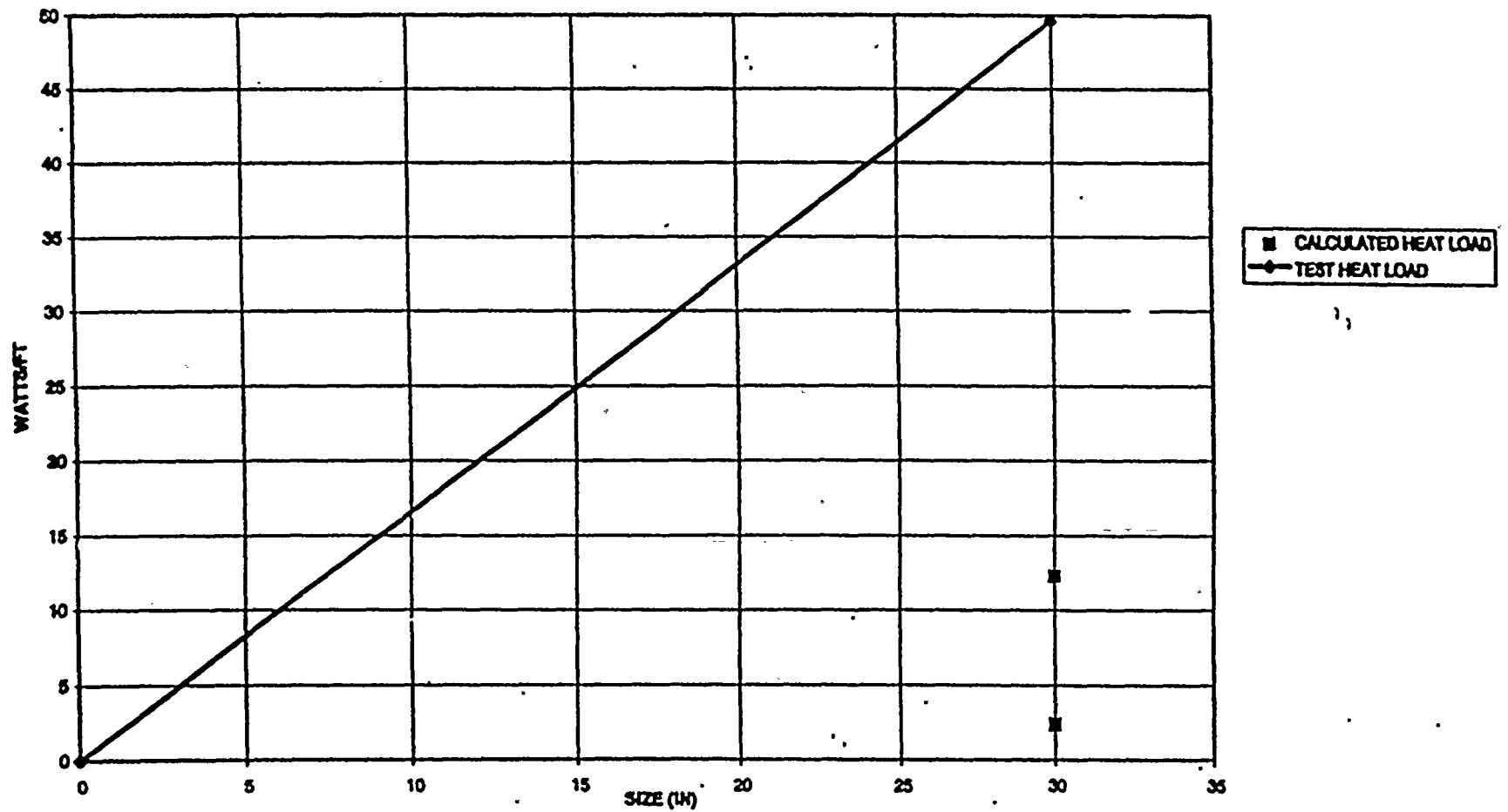
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RACEWAY HEAT LOSS

JPH-PTN-SEEP-06-011, REV. 0
ATTACHMENT 3
5 OF 6

3 HOUR WRAPPED TRAY

NOTE: TEST DATA FOR 2" TRAY WAS CONVERTED TO OTHER SIZES BY A
RATIO OF SIZES.





RACEWAY HEAT LOSS

JPN-PTN-SEEP-06-011, REV. 0
ATTACHMENT 3
6 OF 6

1 HOUR WRAPPED TRAY

NOTE: TEST DATA FOR 24" TRAY WAS CONVERTED TO OTHER SIZES BY A
RATIO OF SIZES.

