Attachment 3

TVA calculation EPM-MCP-071689, "Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building Electrical Board Room Areas (EL. 692.0 & 708.0)," Revision 21
(Letter Item 4, SSER 23 Appendix HH Item Number 108)

LEGIBILITY EVALUATED AND

ACCEPTED FOR ISSUE. ALL PAGES

Scott Dulin 12/15/11 NPG CALCULATION COVERSHEET/CCRIS UPDATE

SIGNATURE REV 21 DATE

Page ia

REV 0 EDMS/RIMS NO.	EDMS TYPE:	EDMS ACCESSION NO (N/A for REV. 0)
B26 900726 258	calculations(nuclear)	T 9 3 1 1 1 2 1 9 0 0 5

Calc Title:

Cooling / Heating Load & Equipment / Component Performance Analysis for the Control Building – Electrical Board Room Areas (El. 692.0 and 708.0)

CALC ID	TYPE	ORG	PLANT	BRANCH	NUMBER	CUR REV	NEW REV	REVISION APPLICABILITY
CURRENT	CN	NUC	WBN	MEB	EPMMCP071689	020	021	Entire calc x Selected pages ☐
NEW	CN	NUC						

ACTION	NEW ☐ REVISION X	DELETE ☐ RENAME ☐	SUPERSEDE ☐ DUPLICATE ☐	CCRIS UPDATE ONLY ☐ (Verifier Approval Signatures Not Required)	No CCRIS Changes ☐ (For calc revision, CCRIS been reviewed and no CCRIS changes required)

UNITS	SYSTEMS	UNIDS
001, 002	031	N/A

DCN,EDC, N/A	APPLICABLE DESIGN DOCUMENT(S)	CLASSIFICATION
N/A	NONE	E

QUALITY RELATED?	SAFETY RELATED? (If yes, QR = yes)	UNVERIFIED ASSUMPTION	SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS?	DESIGN OUTPUT ATTACHMENT?	SAR/TS and/or ISFSI SAR/CoC AFFECTED
Yes X No ☐	Yes X No ☐	Yes X No ☐	Yes ☐ No X	Yes ☐ No X	Yes ☐ No X

PREPARER ID	PREPARER PHONE NO	PREPARING ORG (BRANCH)	VERIFICATION METHOD	NEW METHOD OF ANALYSIS
dsnaik	423-365-8186	Bechtel MEB	Design Review	☐ Yes X No

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
DSNaik Dsnaik	12/14/11	RDAndre RDA	12/14/11
VERIFIER SIGNATURE	DATE	APPROVAL SIGNATURE	DATE
RDAndre RDA	12/14/11	FAKOOWTZ	12-16-11

STATEMENT OF PROBLEM/ABSTRACT

This calculation determines the cooling/heating loads and steady state conditions (both temperature and humidity) for all rooms served by the Electrical Board Room (EBR) HVAC system during both normal and worst case accident conditions. These rooms are located on elevations 692.0 and 708.0 of the Control Building. The calculation also evaluates the adequacy of the equipment/components associated with the EBR HVAC system.

Standard ASHRAE methods were used in determining the loads and temperature / humidity conditions.

Results indicate that adequate chiller and AHU coil capacities exists to maintain acceptable environmental conditions within spaces served for all normal operational and worst case DBE conditions.

The calculation was updated on Revision 16 to address Unit 2 / Dual Unit Operation. An unverified assumption for Unit 2 only assumes this stage 3 of DCN 51656-A will be cancelled. Stage 3 of DCN 51656-A is not cancelled as evident by Revision 18. Revision of the Appendix 11 analysis for Unit 2 / Dual Unit Operation was not changed in support of stage 3 of DCN 51656-A and PIC 52252-A.

Revision 021 was initiated to provide humidity for the Unit 2 Auxiliary Instrument Room for the during LOCA condition. Revision of the Appendix 11 analysis for Unit 2 Operation was not within the scope of Revision 021 and was not changed. Therefore; UVA was not removed.

MICROFICHE/EFICHE Yes ☐ No X FICHE NUMBER(S) ☐

☐ LOAD INTO EDMS AND DESTROY

X LOAD INTO EDMS AND RETURN CALCULATION TO CALCULATION LIBRARY. ADDRESS: EQB 1M - WBN

☐ LOAD INTO EDMS AND RETURN CALCULATION TO:

NPG CALCULATION COVERSHEET/CCRIS UPDATE

CALC ID	TYPE	ORG	PLANT	BRANCH	NUMBER	REV
	CN	NUC	WBN	MEB	EPMMCP071689	021

ALTERNATE CALCULATION IDENTIFICATION

BLDG	ROOM	ELEV	COORD/AZIM	FIRM	Print Report Yes ☐
05	N/A	N/A	N/A	BECHTEL	

CATEGORIES NA

KEY NOUNS (A-add, D-delete)

ACTION (A/D)	KEY NOUN	A/D	KEY NOUN

CROSS-REFERENCES (A-add, C-change, D-delete)

ACTION (A/C/D)	XREF CODE	XREF TYPE	XREF PLANT	XREF BRANCH	XREF NUMBER	XREF REV
A	P	DW	WBN	MEB	2-47E235-17	
A	P	DW	WBN	MEB	2-47E235-19	

CCRIS ONLY UPDATES:

Following are required only when making keyword/cross reference CCRIS updates and page 1 of form NEDP-2-1 is not included:

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
PREPARER PHONE NO.	EDMS ACCESSION NO.		

TVA

REVISION LOG

Title: COOLING & HEATING LOAD ANALYSIS - CONTROL BUILDING - ELECTRICAL BOARD ROOMS

Revision No.	DESCRIPTION OF REVISION	Date Approved
0	INITIAL ISSUE	
1	REVISED PAGES: 8, 12, 16, 51, 52, 53, 54, 63, 67, 68, 69, 70, 91, 106, 107, 110, 66, 3, 4, 11, 98, 108, 109 TO REFLECT NEW ELECTRICAL LOADS AS IDENTIFIED IN WBN EEB MS TI09-0007 R2 REC 3/21/00 WBN EEB MS TI09-0022 ~~R1~~, R2 WBN EEB MS TI09-0042 ~~R1~~, R2 REC 3/21/91 WBN EEB MS TI09-0058 ~~R0~~, ~~R2~~ REC 3/21/91 ADDED SECTION 6.2.3 ON PAGE 8 PAGES ADDED: 0 PAGES DELETED: 0 p.6a Design Verification form	4-5-91

PROJECT No.: 8573-05
CALC. NO.: EPM-MCP-071689, REV. 0 | R3 dP 3/5/93 DL 3/5/93
Page 2 of ~~186~~ R2 111
Prepared: MGC Date: 6-27-90
Reviewed: SDL Date: 6-27-90

R1 computed PWB date 2/15/91
R1 checked VKS date 4/1/91

R2 dP 10/24/92 DL 10/26/92

TITLE: COOLING AND HEATING LOAD ANALYSIS, CONTROL BLDG-ELECTRICAL BOARD ROOMS WBN-31-D053, EPM-MCP-071689		REV LOG
REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
2	CALC REVISED TO INCORPERATE CHANGES MADE TO ELECTRICAL LOADS. NEW MODES OF OPERATION WITH REDUCED FLOW RATES WERE ADDED-WITH BATTERY ROOMS EXHAUST FAN C-B IN OPERATION PAGES ADDED: 1a,2a,3,3b,5a,5b,6-178A, attach.2-4 (182-186). PAGES DELETED: (REV. 1) 3,4,5,7-102,106-122. PAGES REVISED: 1,2,3,3a,4,5,179,180,181. DCCM AND CCRIS WERE REVIEWED ON 10/20/92 AND THE CHANGES IDENTIFIED BY DCN'S S-09714-A, P-06202-B, M-11807-A, P-05297-C, M-16301-A WERE INCORPERATED INTO THIS CALCULATION. NO OTHER CHANGE PACKAGES IMPACT THIS CALCULATION. 2 BY J. Paris DATE 10/21/92 2 CHKD. BY R Rodrigo DATE 10/26/92	10/30/92

TITLE: COOLING AND HEATING LOAD ANALYSIS, CONTROL BLDG-ELECTRICAL BOARD ROOMS WBN-31-DO53, EPM-MCP-071689		REV LOG
REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
3	CALC REVISED TO INCORPORATE LATEST CHANGES IN ELECTRICAL LOADS. THIS REVISION ALSO INCLUDES AIR FLOW CHANGES REQUIRED TO MAINTAIN A RETURN AIR TEMPERATURE COMPATIBLE WITH THE INACCURACY BAND OF TEMPERATURE SWITCHES 0-TS-31-150-150B AND 0-TS-31-157B. THESE CHANGES ARE REFLECTED IN ATTACHMENT 2. OPERATION OF BATTERY ROOM EXHAUST FAN C-B IS DELETED PER DCN M-22223-A . PAGES ADDED: 2b,4,5,5a,6,10,11,12,13,13a,19,19b,20-103,attach 2. PAGES DELETED: 4,5,5a,6,10,11,12,13,13a,19,19a,19b,20-165,165a,165b,165c,165d,166-178,178a,attach 2. PAGES REVISED:1a,1,2,2a,3,3a,3b,7,8,8a,9,14-19,19a. DCCM AND CCRIS WERE REVIEWED ON 3/1/93 AND NO CHANGE PACKAGES IMPACT THIS CALCULATION. R3 BY J Davis DATE 3/5/93 R3 CHKD. BY RSalyer DATE 3/5/93	3/5/93

TVA 10534 (EN DES-4-78)

i.i.c | R14 3/24/04

~~Page 2c~~

TITLE: COOLING AND HEATING LOAD ANALYSIS, CONTROL BLDG ELECTRICAL BOARD ROOMS EPM-MCP-071689, WBN-31-D053	Revision Log

REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
4	Revised to incorporate changes made by DCN M-11410-A. Equipment located at 708.0-C3 is replaced. This revision calculates the new heat load and temperature for that room. Pages Added: 1b, 2c, 4a Pages Revised: 5, 6, 12, 13, 80, 81, 82, 83, 84, 96, 98, 100, 102 Pages Deleted: None DCCM and CCRIS were reviewed on 6-17-93 and no DCNs or other changes which impact this calculation were found. ~~Number of pages submitted for microfilming is 16.~~ VE 6-17-93 Prepared By _____ Date 6-17-1993 Checked By MAT Date 6-17-93	6/17/93

TITLE: Cooling and Heating Load Analysis - Control Building Electrical Board Rooms

REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
5	Calculation revised to incorporate change from the latest revision of electrical calcs, to change the minimum design outside air temperature from 15°F to 13°F and to reduce the credit taken for internal loads in the heating section of the calculation to 25% of the total. Pages Added: 2d, 4b, 19b, 19c, 94A Pages Deleted: None Pages Revised: 1b, 5, 6, 7, 10, 12, 13, 13a, 19, 19d, 22, 23, 26, 27, 30, 31, 32, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 49, 50, 53, 54, 57, 58, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 77, 78, 80, 81, 82, 83, 84, 85, 89, 90, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 107 DCCM and CCRIS were reviewed on 11-18-93 for outstanding changes affecting this revision and none were found. R5 Prepared By: [signature] Date: 11/19/93 R5 Checked By: [signature] Date: 11/20/93	11/23/93

R14
3/24/04 | ii.e
~~SHEET 2e~~

REVISION LOG

MEB-WBN-31, WBN-31-D053, EPM-MCP-071689

TITLE: Cooling and Heating Load Analysis - Control Building Electrical Board Rooms

REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
6	Revision 6 of this calculation is a "rev log" change and applies only to the changes resulting from DCN S-37195-A. This revision is issued to document these changes which will be incorporated into the calculation in a later revision. This change is in accordance with section 4.1.7.2 of NEP 3.1 rev 2. Analyzed of the effects of a single failure of the standby isolation damper for the battery room exhaust fan as identified on TDN 95-0707. The analysis is added as Appendix A. The test deficiency is added as Attachment 5. Pages Added: 2e, 4c, Appendix A (4 shts) and Attachment 5 (7 shts) Pages Deleted: None Pages Revised: 1b, 5, 6, 13, 103 This rev log change contains 18 pages. DCCM and CCRIS were reviewed on 7-10-95 for outstanding changes affecting this revision and none were found. Prepared by [signature] date 7/12/95 Checked by [signature] date 7/12/95	7/12/95

REVISION LOG

R14 3/24/04 | ii. f ~~SHEET 2F~~

MEB-WBN-31, WBN-31-D053, EPM-MCP-071689

TITLE: Cooling and Heating Load Analysis - Control Building Electrical Board Rooms

REVISION NUMBER	DESCRIPTION OF REVISION	DATE APPROVED
7	Revision 7 of this calculation is a "rev log" change and applies only to the changes resulting from DCN S-37939-A that are related to the Control Building Electrical Board Room HVAC System. This change is in accordance with section 4.1.7.2 of NEP 3.1 rev 2. Analysis of the effects of reduced airflow on the room temperature of the Unit 1 Auxiliary Instrument Room, the Computer Room, and the Mechanical Equipment Room (North) as identified on TDN 95-0714. The analysis is added as Appendix B. The test deficiency is added as Attachment 6. Pages Added: 1c, 2f, 4d, 6, 103, Appendix B (6 shts) and Attachment 6 (12 shts) Pages Deleted: 6, 103 Pages Revised: 5, 13, 97, 98 This rev log change contains 27 pages. DCCM and CCRIS were reviewed on 8-31-95 for outstanding changes affecting this revision and none were found. Calculation EPM-MCP-090189 R5 is a successor c alculation and is also revised by DCN S-37939-A. Prepared by Donald T Arthur date 9/8/95 Checked by A PINEDA A Pineda date 9/8/95	9-8-95

TVAN CALCULATION RECORD OF REVISION

EPM-MCP-071689

Title Cooling And Heating load Analysis , Control Building- Electrical Board Rooms.

Revision No.	DESCRIPTION OF REVISION	Date Approved
8	This Revision is a page replacement type revision. This Revision , Revision 8 is as described below. Revision 8 of this calculation documents the Heat load analysis and establishes room temperature condition due to the replacement of Unit 1 Westinghouse Plant Process Computer with an integrated Computer System (ICS) in support of DCN M39911-A. The resultant room temperature changes (NORMAL /LOCA) in the Aux. Instrument Room 708- C1 and Computer Room 708-C3 and Battery Board Room 692-C4 due to sensible load changes. There has been a descripancy found for Room 708-C1 maximum temperature in LOCA condition vs. the environmental drawing (47E235-17) and Environmental calculation WBNAPS4-004. The PER (CHPER980147) has been written for corrective action needed to revise environmental drawing and successor calculation. The computer Room 708-C3 and Battery Board Room 692 -C4 temperatures have no impact on environmental drawings. Also additional existing non-conservative methodology for certain rooms were found and corrected and resulted in no increase in NORMAL/ LOCA temperatures condition. Thus these changes have no adverse affect on Electric Board rooms HVAC system. Pages Added : 2g (Revision log), 4e (IR Form). Pages Deleted : None Pages Changed: 1c, 5, 5a, 6, , 12, 13, 20, 21, 22, 23, 28, 29, 38, 39, 59, 60, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 84, 93, 95, 96, ,97, 98, 99, 100, 101,102 103, Appendix B pages 103 h, 103 i and 103 j, This Revision log contains 42 pages. Prepared by [signature] date 12-1-98 Checked by [signature] date 12-1-98	12/8/98

TVAN CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER	EPM-MPC-071689	Page ~~2h~~ ii.h
Title	COOLING AND HEATING LOAD ANALYSIS - CONTROL BUILDING - ELECTRIC BOARD ROOMS.	

R14 3/24/00

Revision No.	DESCRIPTION OF REVISION	
9	Revised to incorporate changes reflected by DCN C50479. The DCN noted increased the electrical load in the Central Alarm Station (room 12A) located in the control Bay at elevation 692. This revision shows that the normal cooling room air temperature increased from 78.6°F to 82.7°F. Because of this slight increase the mixed air return temperature remained the same. The normal cooling space loads increased from 17,752 BTUH to 20,551 BTUH. This revision shows that the resultant room temperatures remain within the boundaries noted on the various data sheets. Pages added: 2h, ~~4d~~, and 4f. GAS 1/21/00 Pages deleted: none Pages replaced: none Pages changed: 1c, 6, 13, 59, 60, 61, 62, 65 through 68, 94a, 95, 96, 97, 98, 100, 101, 102, and 103. GAS 1/21/00 Total pages: 167 Prepared by: GAS date 1/21/00 checked by: MD date 1/21/00 CCRIS was reviewed on 01/18/00 and 2 calc's were identified as being impacted, both are being revised (EPM-JAL-121890, and EPM-MCP-090189). MCAD 01/21/00	2/7/2000
10	Revised to incorporate changes reflected by DCN D50451A. The DCN noted increased the electrical load in the Unit 1 Auxiliary Instrument room (room C1) located in the control Bay at elevation 708. The normal cooling space loads increased from 242,834 BTUH to 243,223 BTUH. This revision shows that the resultant room temperatures remain within the boundaries noted on the various data sheets. There is no change in the space temperature in the heating mode as a result of this electrical load increase. Pages added: 1d, 4g Pages deleted: none Pages replaced: 96, 98, 100, and 102. Pages changed: 2h, 6, 10, 13, 73 through 78, 93, 94a, 99, 101, 103, 103h, and 103i. Total pages: ~~170~~ 169 Prepared by: GAS date 3/17/00 checked by: MD date 3/16/00 CCRIS was reviewed on 03/10/00 and 1 calc's was identified as being impacted it is being revised (EPM-MCP-090189). MD 3/16/00	3/20/2000

TVAN CALCULATION RECORD OF REVISION		
CALCULATION IDENTIFIER EPM-MPC-071689		Page ~~2i~~ iii.i
Title	COOLING AND HEATING LOAD ANALYSIS -CONTROL BUILDING -ELECTRIC BOARD ROOMS	

RJH 3/24/09

Revision No.	DESCRIPTION OF REVISION
11	This calculation has been revised to reflect the changes in the electrical equipment load presented in WBN EEB-MS-TI09-0042, Revision 11 affecting the Unit 1 Auxiliary Instrument Room. The previous electrical equipment load for El. 708.0-C1 during normal and LOCA operation was 53,319 watts. The present calculated electrical equipment load is 56,856 watts. As well, this calculation has been revised to reflect the changes in the electrical equipment load presented in WBN EEB-MS-TI09-0022, Revision 10 affecting the Computer Room. The previous electrical equipment load for El. 708.0-C3 during normal and LOCA operation was 12,617.8 watts. The present calculated electrical equipment load is 9,372.8 watts. The supporting DCN is D50301A. This revision also reflects formatting changes and minor error corrections in response to Problem Evaluation Report # 98-16345-000 Appendix A and Appendix B have been deleted. The information from these appendices have been incorporated into the main body of the calculation. In section 6.0, note that revision bars have been applied only if electrical loads have changed (per DCN D50301A) or if final room temperatures were changed due to numerical iterations performed in response to Note 11 of section 6. Pages added: Revision Log for revision 11, Design Verification Form for revision 11, Computer Input File Storage Information Sheet Pages Revised: All pages have been renumbered in consecutive order. The calculation classification appears on the cover sheet. Pages deleted: Design Verification Sheets for revision 0 through revision 10, Calculation Classification Forms, Appendix A, Appendix B Total Page Count 136 Prepared By [signature] Date 4/28/2000 Checked By [signature] Date 4/28/00

R14 Chen 3/24/04

TVAN CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPM-MCP-071689

Title: COOLING AND HEATING LOAD ANALYSIS AND EQUIPMENT/COMPONENT PERFORMANCE ANALYSIS - ELECTRICAL ROARD ROOMS ELs 692.0 & 708.0 - CONTROL BUILDING.

Revision No.	DESCRIPTION OF REVISION
12	This calculation is performed in accordance with the requirements of NEDP-2 as a result of the corrective action program PER 98-016345. This calculation is revised and reformatted in its entirety. In accordance with the corrective action program, this calculation revision updates room areas, heat transfer coefficients, steady state temperatures, references, and modes of operation. It also incorporates calculation EPM-MCP-090189 which evaluates the HVAC equipment/components performance for the Electrical Board Rooms in the Control Bldg. Consequently, calculation EPM-MCP-090189 was voided. SAR Section have been reviewed by 5/2/01. Changes associated with this revision do not affect the SAR (Section 9.4) Tech Specs have been reviewed and determined not to be affected. Total Number of Pages in Rev 12: 210 Prepared by: T E Collins Date: 05/07/01 T. E. Collins Checked by: M. J. Matani Date: 05/07/01 M. J. Matani DCCM and CCRIS were reviewed on 5/01/01 and no DCNs or other changes which impact the calculation were found.

~~Page 2k~~ ii.k | R14 3/24/04

TVAN CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPM-MCP-071689

Title: COOLING AND HEATING LOAD ANALYSIS AND EQUIPMENT/COMPONENT PERFORMANCE ANALYSIS - ELECTRICAL ROARD ROOMS ELs 692.0 & 708.0 - CONTROL BUILDING.

Revision No.	DESCRIPTION OF REVISION
13	This calculation is performed in accordance with the requirements of NEDP-2. The entire calculation was completely revised and renumbered. Revision 13 determined the coil and chiller adequacy for the EBR AHU temperature transmitter set point (baseline) of 75 ^{0}F during the normal cooling mode for the Electrical Board Rooms located on ELs 692.0 and 708.0 in the Control Building. Revision 13 determined the EEB AHU temperature transmitter set point such that Unit 1 Auxiliary Instrument Room can be maintained at 68 ^{0}F or lower during the normal cooling mode per DCN D-50409-A. It determines the adequacy of the coils and chiller. Using the set point determined for the normal cooling mode, the steady state room temperatures and humidity were calculated for LOCA cooling, and normal and LOCA/LOOP heating. Total Number of Pages in Rev 13: 328 Prepared by: _____ Date: 2/6/02 T. E. Collins Checked by: _____ Date: 2/6/02 L. Nicholson

TVAN CALCULATION RECORD OF REVISION		
CALCULATION IDENTIFIER: EPM-MCP-071689		Page ii.i
Title: Cooling/Heating Load and Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)		
Revision No	DESCRIPTION OF REVISION	
14	This calculation is performed in accordance with the requirements of NEDP – 2. The calculation was extensively revised and all pages were renumbered. Therefore, revision bars were not added. Revision 14 incorporated changes per DCN D51656A which lowered each AHU bypass damper controller setpoint to 68°F to decrease the environmental temperature limits in the spaces served by the Electrical Board Room (EBR) air conditioning subsystem. Also the design flow rate to Secondary Alarm Station Room (692.0 – C12) was reduced to 200 cfm for personnel comfort reasons. In addition, this revision corrected the analysis to include changes per DCN M02693-A. This DCN removed EBR AHUs face damper(s) prior to initial start-up of the unit. Rev. 14 calculated steady state room temperatures and cooling loads during normal (summer & winter) operating conditions and LOCA (summer) and LOOP (winter) accident conditions and evaluated adequacy of the coils and chillers. Rev.14 reduced the lower limit of the environmental temperature from 60 °F to 55 °F in all areas served by EBR subsystem with the exception of the Unit1 Auxiliary Instrument Room. FSAR Change package # 1845 was initiated to revise the FSAR Section 9.4.1. Total number of pages in Rev.14: 533 Prepared by: L Nicholson Date: 2-2-05 L. Nicholson Checked by: R. A. Sulfridge Date: 2/9/05 R. Sulfridge	

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPMMCP071689 Page ii.m

Title: Cooling/Heating Load and Equipment/Component Performance Analysis for the Control Building – Electrical Board Room Areas (El. 692.0 and 708.0)

Revision No.	DESCRIPTION OF REVISION
015	Revision 015 of this calculation was created to capture the effects of DCN 52317-A. This involved increasing the cooling load in the 250V Battery Board Room (C4) at El. 692.0, but the difference in room temperature was within the margin originally introduced in the calculation. The conclusions are not affected, thus it was not necessary to rerun the AIRCOOL model. Also, the environmental drawings for the rooms are not affected and no successor calculations are impacted, so no revisions are required. CCRIS was corrected in response to PER 158531: Calculation MDQ00003120010065 was changed from a successor to a predecessor. Revision levels of the references were updated to reflect the most current documents. The total number of pages in each attachment and appendix is as follows:

Attachments	No. of Pages
1 – Old Cover Sheets	10
2 – Not Used	1
3 – Not Used	1
4 – Carrier Single Package Cooling Units Performance Data	2
5 – Computer Room Supplemental Cooling A/C Unit A	2
6 – EBR AHU Coil Parameter Data from TRANE 2/6/01	2
7 – EBR AHU Coil Information Sheets from TRANE 1/6/01	4
8 – EBR Chiller Guaranteed Performance Data	5
9 – SSD-0-LPT-31-336-S	11
10 – WBN Reduced Capacity of HVAC Cooling Equipment	1
11 – Computer Room Supplemental AHU Transfer Contract	4
12 – DCN M-2693-A	33
13 – Partial Copy of Contract P-93NNS-75678C-000	39
14 – EBR AHU A-Size Drawing 47A373-1	1
15 – SSD-0-ITC-31-511A-S	2

Appendices	No. of Pages
1 – Excel Spreadsheet for New Design Flow Rates	8
2 – Simplified Air Flow Diagram for Normal and LOCA (Summer)	1
3 – Simplified Air Flow Diagram for Normal and LOCA (Winter)	1
4 – AIRCOOL Input Data	2
5 – ASHRAE Psychrometric Chart No. 1	1
6 – EBR AIRCOOL Benchmark Model and Results	3
7 – Evaluation of EBR AHU Cooling Coil Bypass Flowrate	10
8 – Computer Room Supplemental Cooling Unit AIRCOOL Model	3
9 – Temperature Evaluation for LOCA-Summer 1 Condition, 70% Flow	27
10 – Evaluation of Interim Condition for DCN D51656A	98

Pages Added: b.i, a.i, ii.m, iii.1, iv.2,

Pages Revised/Replaced: v, 5.1, 5.2, 6.3, 6.4, 6.5, 6.6, 7.8.1-7.8.24, 7.9.1-7.9.24, 7.10.1-7.10.24, 7.11.1-7.11.24, 7.12.1-7.12.24, 7.13.1-7.13.24, 8.1-8.7, Appendix 9 – Pages 1 through 24, Appendix 10 – Pages A.10.1 through A.10.4.24,

Pages Deleted: none

Total number of pages in this revision including Attachments: 538 Pages

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPMMCP071689 Page ii.n

Title: Cooling/Heating Load and Equipment/Component Performance Analysis for the Control Building – Electrical Board Room Areas (EL.692.0 and 708.0)

Revision No.	DESCRIPTION OF REVISION
016	Revision 016 of this calculation was created to update Unit 2/ Dual Unit Operation applicability. This revision incorporated new heat loads from the Electrical Heat Loads Calculations (WBNEEBMSTI090022 R12, WBNEEBMSTI090042 R14 and WBNEEBMSTI090058 R8) which were revised recently to meet the new methodology and engineering guidelines. The cooling load calculation WBNMEBMDQ0031000065 data is applicable to Unit 1 operation only. The heat load from Electrical Heat Load Calculations will be directly used for dual unit operation. As a result of the update of new heat load, the Excel spreadsheet has been reiterated and the steady state temperatures in the Control Building – Electrical Board Room Areas (EL.692.0 and 708.0) for the dual unit operation are established and listed in Appendix 11. Revision 016 adds an unverified assumption for Unit 2 only. It assumes that Stage 3 of DCN 51656 will be cancelled for dual unit operation. The unverified assumptions are discussed in Appendix 11 in Section 2.2 on page 1 of 194. Affected engineering judgments and assumptions were reviewed and were revised as necessary to ensure adequacy. Ultimate heat sink (UHS) temperature was not used as an input to the calculation analyses. Therefore, existing calculation results will not be affected by changing the UHS technical specification temperature. FSAR AND TECHNICAL SPECIFICATIONS HAVE BEEN REVIEWED AND ARE NOT AFFECTED BY THIS REVISION OF THE CALCULATION. Reviewer: Lien K Nguyen 11/5/09 Pages Added: c.i, d.i, ii.n, iii.2, iv.3, Appendix 11: 194 Pages Revised: V, 8.1 Pages Replaced: N/A Pages Deleted: N/A Total number of pages in this revision including Attachments: 737 Pages This page is added by Rev.016

NPG CALCULATION RECORD OF REVISION	
CALCULATION IDENTIFIER EPMMCP071689	
Title	**Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)**
Revision No.	DESCRIPTION OF REVISION
017	DCN 54429A replaces the existing Loose Parts Monitoring System for WBN U1 with upgraded equipment in the Unit 1 Auxiliary Instrument Room (708.0-C01) of the Control Building. The installation of this equipment increases the heat load in 708.0-C01 by 1,260 Watts, which results in a total theoretical electrical equipment heat load of 53,812 watts as reported in predecessor calculation WBNEEBMSTI090042 R016. This calculation documents the electrical equipment loads in the U1 Aux Instr. Rm from predecessor calculation WBNEEBMSTI090042, R016; however, the electrical equipment loads from predecessor calculation MDQ00003120010065 are utilized in the analysis (see Section 6.9, Item 3). Therefore, no computations, results, or conclusions are impacted, and no successor calculations are impacted. Appendix 11, which was developed to address dual unit operation, utilizes total design heat loads from predecessor calculation WBNEEBMSTI090042, R014 (67,176 W), which are higher than those documented in WBNEEBMSTI090042, R016 (64,132 W) for the U1 Aux. Instr. Rm. Therefore, no changes are made to Appendix 11. This is conservative. Impacts to UFSAR and Tech Specs are reviewed under parent DCN 54429. Pages Revised/Replaced: i, v, 6.5, & 6.6 Pages Added: ia, ii.o, iii.3 & iv.4 Pages Deleted: d.i, c.i, b.i, a.i, & i.a Total Number of Pages (R017): 736

dll 5/25/10

NPG CALCULATION RECORD OF REVISION	
CALCULATION IDENTIFIER EPM-MCP-071689	
Title:	Cooling/Heating Load & Equipment /Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)
Revision No.	DESCRIPTION OF REVISION
18	This revision incorporates the results of air flow measurements recorded in support of stage 3 of DCN 51656-A which were outside the G-37 acceptance criteria of +/-10%. PIC 52252-A is being issued for stage 3 of the DCN and revision 18 to the analysis provides the necessary documentation to adjust the design basis relative to normal and post LOCA temperature and relative humidity values accordingly. Specifically, the measured air flow rates were as follows: The 24V and 48V Battery Board and Charger Room (692.0-C8) supply air flow rate was 724 cfm as compared to 1,000 cfm (as required by DCN 51656-A). The Secondary Alarm Station (692.0-C12) supply air flow rate was 346 cfm as compared to 200 cfm (as required by DCN 51656-A). The 250V Battery Board Room #1 (692.0-C4) supply air flow rate was 3,297 cfm as compared to 2,700 cfm (as required by DCN 51656-A). The Battery Room Exhaust Fan Room (692.0-C2) supply air flow rate was 419 cfm as compared to 255 cfm (as required by DCN 51656-A). These air flow rates were incorporated into the analysis and factored into each of the six cases associated with both normal plant operation and post LOCA conditions. Overall, the changes had very minimal impact on the existing room temperatures and relative humidity values. Also, the 70% of design air flow case included in Appendix 9 was revised in consideration of the measured flows. Appendix 10 was deleted since stage 3 of DCN 51656-A is implemented. It should be noted that the existing unverified assumption relative to Unit 2 / dual unit operation will not be valid since this revision does incorporate changes resulting from stage 3 of DCN 51656-A and PIC 52252-A. Revision of Appendix 11 to consider the measured air flow rates was outside the scope of revision 18. Impacts to the WBN UFSAR and Technical Specifications are reviewed under PIC 52252-A. Pages Revised/Replaced: i, ia, iii, v, 1.1, 4.2, 4.3, 5.1, 5.2, 7.2 through 7.6, 7.8.1 through 7.8.27, 7.9.1 through 7.9.30, 7.10.1 through 7.10.27, 7.11.1 through 7.11.30, 7.12.1 through 7.12.25, 7.13.1 through 7.13.30, 8.1 through 8.1 through 8.7, Appendix 1 (pages 1, and 2 only), Appendix 2 (1 page), Appendix 3 (1 page), Appendix 9 (29 pages), and Appendix 10 (1 page) Pages Added: iip, iv.5, 2.1.1, 5.3, and Appendix 1 (page 9) Pages Deleted: iii.1, iii.2, iii.3, and Appendix 10 (97 pages) Total Number of Pages: 643 pages including all attachments and appendices

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPMMCP071689

Title **Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)**

Revision No.	DESCRIPTION OF REVISION
019	DCN 55250A upgrades equipment located in the Secondary Alarm Station (SAS) Room (692.0-C12). These changes significantly increase the cooling load within this room and require a change in supply airflow. More than adequate flow exists in the subsequent room, the Communications Room (692.0-C9). The design flow rate in the SAS will be increased and the design flow in the Communications Room decreased. The calculation was updated in revision 16 to address Unit 2 / Dual Unit Operation. An unverified assumption for Unit 2 only assumes that stage 3 of DCN 51656-A will be cancelled. Stage 3 of DCN 61656-A is not cancelled as evident by revision 18. Revision of the Appendix 11 analysis for Unit 2 / Dual Unit Operation was not within the scope of revision 19 and was not changed. Revision Bars have not been included on the pages showing the various Case computations. These computations are the result of an excel spreadsheet with formulas linking multiple cells. There is no added value in identifying every change to the spreadsheet. Dual signatures on the coversheet indicate full responsibility by each individual for preparation, review, and verification of all changes associated with this revision. Impacts to UFSAR and Tech Specs are reviewed under DCN 55250 and PIC 56694. T. Powell 10/26/10 Successor calculations have been reviewed and the following calculations will be revised due to the changes in this revision: MDQ00006720030079 EPMMCP090589 EPMRAV112492 EPMMA041592 Pages Revised/Replaced: i, ia, iii, v, 4.1, 4.2, 5.1, 5.3, 6.3, 6.4, 6.5, 6.6, 7.8.1 through 7.8.27, 7.9.1 through 7.9.30, 7.10.1 through 7.10.27, 7.11.1 through 7.11.30, 7.12.1 through 7.12.55, 7.13.1 through 7.13.24, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7 Appendix 1 pages 1 and 2, Appendix 2 page 1, Appendix 3 page 1, Appendix 9 pages 1 through 29 Pages Added: ii.q, iii.a, iv.6 Pages Deleted: Appendix 1 pages 3-9 Total Number of Pages (R019): 639

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER EPMMCP071689

Title **Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)**

Revision No.	DESCRIPTION OF REVISION
020	Revision 20 incorporates the modifications made by DCNs 52853, 56903, and 58262. DCNs 52853 and 56903 are part of the Digital Controls System (DCS) upgrade and add/remove equipment in the Unit 1 Auxiliary Instrument Room (708.0-C1) and Computer Room (708.0-C3). The cooling load reported in predecessor calculation MDQ00003120010065 increased in the Unit 1 Auxiliary Instrument Room and was unchanged for the Computer Room. The change in cooling load in the Unit 1 Auxiliary Instrument Room caused an increase above the design temperature at the previously analyzed airflow, which was a measured value. This revision shows a requirement to increase the airflow to the Unit 1 Auxiliary Instrument Room to its design flow. DCN 58262 supports the security upgrades being made to the Secondary Alarm Station (692.0-C12). The cooling load reported in predecessor calculation MDQ00003120010065 increased for the Secondary Alarm Station (SAS). The cooling load increased significantly and caused an increase above the design temperature at the previously analyzed airflow. This revision shows a requirement to increase the design flow to the SAS. More than adequate flow exists in the adjacent room, the Communications Room (692.0-C9). The design flow rate in the SAS is increased and the design flow in the Communications Room decreased. The theoretical loads reported on pages 6.5 and 6.6 have been updated to reflect the most recent revisions to the Electrical calculations. The calculation was updated in revision 16 to address Unit 2 / Dual Unit Operation. An unverified assumption for Unit 2 only assumes that stage 3 of DCN 51656-A will be cancelled. Stage 3 of DCN 61656-A is not cancelled as evident by revision 18. Revision of the Appendix 11 analysis for Unit 2 / Dual Unit Operation was not within the scope of revision 20 and was not changed. Revision Bars have not been included on the pages showing the various Case computations. These computations are the result of an excel spreadsheet with formulas linking multiple cells. There is no added value in identifying every change to the spreadsheet. L Powell 9-26-11 Impacts to UFSAR and Tech Specs are reviewed under DCNs 52853, 56903, 56904, and 58262. Successor calculations have been reviewed and the following calculations will be revised due to the changes in this revision: MDQ00006720030079 EPMMCP090589 EPMRAV112492 EPMMA041592 Pages Revised/Replaced: i, ia, iii, iii.a, 5.1, 5.3, 6.3, 6.4, 6.5, 6.6, 7.8.1 through 7.8.27, 7.9.1 through 7.9.30, 7.10.1 through 7.10.24, 7.11.1 through 7.11.30, 7.12.1 through 7.12.55, 7.13.1 through 7.13.24, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7 Appendix 1 pages 1 and 2, Appendix 2 page 1, Appendix 3 page 1, Appendix 7 pages 1 through 3, Appendix 9 pages 1 through 29 Pages Added: ii.r, iv.7 Pages Deleted: None Total Number of Pages (R020): 641

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER : EPMMCP071689 Page iis

Title: Cooling / Heating Load & Equipment / Component Performance Analysis for the Control Building – Electrical Board Room Areas (El. 692.0 and 708.0)

Revision No.	DESCRIPTION OF REVISION
021	Revision 21 was initiated to provide humidity for the Unit 2 Auxiliary Instrument Room during LOCA condition. Appendix 12 was added to provide the humidity for the Unit 2 Auxiliary Instrument Room. The calculation was updated on Revision 16 to address Unit 2 / Dual Unit Operation. An unverified assumption for Unit 2 only assumes this stage 3 of DCN 51656-A will be cancelled. Stage 3 of DCN 51656-A is not cancelled as evident by Revision 18. Revision of the Appendix 11 analysis for Unit 2 / Dual Unit Operation was not changed in support of stage 3 of DCN 51656-A and PIC 52252-A. Revision of the Appendix 11 analysis for Unit 2 Operation was not within the scope of Revision 021 and was not changed. Therefore; UVA was not removed. Successor calculations have been reviewed and the successor calculation WBNAPS4004 needs to be revised to reflect the minimum relative humidity for abnormal condition. PL-11-4230 has been initiated to track this item. Ultimate heat sink (UHS) temperature was not used as an input to the calculation analyses. Therefore, existing calculation results will not be affected by changing the UHS technical specification temperature. The effect of Unit 2 / dual operation on Unit 1 margins have been reviewed with no impact. Successor calculations have been reviewed and are not impacted by this revision. FSAR AND TECHNICAL SPECIFICATIONS HAVE BEEN REVIEWED AND ARE NOT AFFECTED BY THIS REVISION OF THE CALCULATION. Reviewer: K.W. Peterman 12/15/11 Pages Added: iis, iiib, Appendix 12 – 1 page Pages Revised: V Pages Replaced: i, ia Pages Deleted: None Total number of pages in this revision including Attachments: 644 Pages (Rev. 020 – 641 pages plus 3 added by Rev. 021) This page added by Revision 021

NPG CALCULATION VERIFICATION FORM

Calculation Identifier EPMMCP071689 Revision 020

Method of verification used:

1. Design Review ☒
2. Alternate Calculation ☐
3. Qualification Test ☐

Verifier Frank Loscalzo Date 9-25-11

Comments:

This calculation has been reviewed for technical adequacy of the methodology, acceptable basis, proper references and assumptions, and compliance with the applicable codes, standards, and procedures. This calculation is acceptable.

NPG INTERFACE REVIEW MEETING NOTICE AND MEETING RESULTS

Review Number EPMMCP071689, Rev. 020

Review Results

Comment/Concern/Disagreement	Resolution
Calc WBPE030904011 is the only I&C successor listed in CCRIS against EPMMCP071689. WBPE030904011 uses controller setpoints from EPMMCP071689. Since these setpoints are not being changed by Rev 20 of the calculation, there is no impact to WBPE030904011.	N/A

Comments By / Date: Lynn Cowan Lynn Cowan 8/24/11	Resolution By / Date: N/A
Organization/Phone: S&L 423 752-5540	Resolution Concurrence By / Date:

cc: EDMS, _____

NPG CALCULATION VERIFICATION FORM

Calculation Identifier	EPMMCP071689	Revision 021

Method of verification used:		
1. Design Review	☒	Verifier Robert D. Andre Date
2. Alternate Calculation	☐	[signature] 12/14/11
3. Qualification Test	☐	

Comments:

The purpose of this calculation revision was to identify the relative humidity in the Unit 2 Auxiliary Instrument Room during a LOCA. This was done satisfactorily using appropriate methods and design input.

This page added by Revision 021

Computer Input File
Storage Information Sheet

Document: EPM-MCP-071689 Rev: 14 Plant: WBN Page 1 V

Subject: CONTROL BLDG. EBR TEMP. ANALYSIS

Prepared by: [signature] Date 2/9/05

Checked by: RAS Date 2/9/05

_____ Electronic storage of the input files for this calculation is not required.

Comments: _____

_____

✓ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires reverification of its contents prior to use)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R14.xls
User Name	rasulfri
Group Name	
Keyword/Problem Number	dcn 51656a
Creation Date	
Modification Date	2005-02-08 09:14
Owner Name	r. a. sulfridge
Owner Address	eqb 2n-wbn
Hardcopy Number	epmmcp071689r14
Source Hardware	ultra-enterprise
Source OS System	sunos 5.8
Application	excel
Access Class	public
Plant Name	watts_bar
File Size	2269184
File Type	file
Reference ID	307012
Backup ID	/farm/rasulfri/s18005d0109105t103809

Description: control bldg el. 692.0 temp. analysis

Computer Input File
Storage Information Sheet

Document: EPM-MCP-071689 Rev: 14 Plant: WBN Page iv. 1

Subject: CONTROL BLDG. EBR TEMP. ANALYSIS

Prepared by: [signature] Date 2/9/05

Checked by: RAS Date 2/9/05

_____ Electronic storage of the input files for this calculation is not required.

Comments: _____

_____

_✓_ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires reverification of its contents prior to use)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R14Interim.xls
User Name	rasulfri
Group Name	
Keyword/Problem Number	dcn 51656a
Creation Date	
Modification Date	2005-02-03 08:00
Owner Name	r. a. sulfridge
Owner Address	eqb 2n wbn
Hardcopy Number	epmmcp071689r14
Source Hardware	ultra-enterprise
Source OS System	sunos 5.8
Application	excel
Access Class	public
Plant Name	watts_bar
File Size	1261568
File Type	file
Reference ID	307013
Backup ID	/farm/rasulfri/s18005d0109105t104041

Description: control bldg. el. 692.0 temp. analysis

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPMMCP071689	Rev. 15	Plant: WBN	

Subject:
Cooling/Heating Load and Equipment/Component Performance Analysis for the Control Building – Electrical Board Room Areas (El. 692.0 and 708.0)

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R15.xls
Keyword/Problem Number	dcn 52317a
Modification Date	20081212
Hardcopy Number	EPMMCP071689R15.xls
Application	excel
Plant Name	watts_bar
Document Identifier	311140
Description: control bldg el.	692.0 temp. analysis

File Name	EPMMCP071689R15Interim.xls
Keyword/Problem Number	dcn 52317a
Modification Date	20081212
Hardcopy Number	EPMMCP071689R15Interim.xls
Application	excel
Plant Name	watts_bar
Document Identifier	311142
Description: control bldg el.	692.0 temp. analysis

☐ Microfiche/eFiche

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPMMCP071689	Rev. 016	Plant: WBN	1&2

Subject:
Excel Workbook

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R16.xls
Keyword/Problem Number	hvac spreadsheet
Modification Date	10/20/2009
Application	excel
Plant Name	watts_bar
Document Identifier	313021
Description:	692.0 temp. analysis for dual unit operation

File Name	EPMMCP071689R16_Preliminary.xls
Keyword/Problem Number	hvac spreadsheet
Modification Date	11/05/2009
Application	excel
Plant Name	watts_bar
Document Identifier	313161
Description:	692.0 temp analysis for dual unit operation

This page is added by Rev.016

☐ Microfiche/eFiche

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPMMCP071689	Rev. 017	Plant: WBN	1&2

Subject:
Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R17.xls
Keyword/Problem Number	hvac spreadsheet
Modification Date	5/19/2010
Application	excel
Plant Name	watts_bar
Document Identifier	314890
Description:	692.0 temp. analysis

☐ Microfiche/eFiche

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPM-MCP-071689	Rev. 18	Plant: WBN	

Subject:

Cooling/Heating Load & Equipment /Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name:	EPMMCP071689R18.xlxs
Keyword/Problem Number:	hvac spreadsheet
Modification Date:	8/13/2010
Application:	excel
Plant Name:	watts bar
Document Identifier:	315685
Description:	EBR AREA TEMP. ANALYSIS

☐ Microfiche/eFiche

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPMMCP071689	Rev. 019	Plant: WBN	1&2

Subject:
Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R19.xls
Keyword/Problem Number	hvac spreadsheet
Application	Excel
Plant Name	watts_bar
Document Identifier	316252
Description:	692.0 temp. analysis

☐ Microfiche/eFiche

NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document EPMMCP071689	Rev. 020	Plant: WBN	1&2

Subject:

Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building - Electrical Board Room Areas (El. 692.0 and 708.0)

☐ Electronic storage of the input files for this calculation is not required. Comments:

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

File Name	EPMMCP071689R20.xls
Keyword/Problem Number	hvac spreadsheet
Application	Excel
Plant Name	watts_bar
Document Identifier	318458
Description:	692.0 temp. analysis

☐ Microfiche/eFiche

NPG CALCULATION TABLE OF CONTENTS

Calculation Identifier: EPMMCP071689 | Revision: 019

TABLE OF CONTENTS

R19

R21

This page Replaced by Revision 19.

1.0 Purpose

The purpose of this calculation is:

- To determine the steady state room temperatures and humidities for the spaces served by the Electrical Board Room (EBR) air conditioning (AC) system located on elevations 692.0 and 708.0 of the WBN Control Building. Steady state temperatures and humidities were determined for normal plant operating conditions (summer & winter) and Design Basis Event (DBE) accident conditions of Loss of Coolant Accident (LOCA) during the summer and Loss of Offsite Power (LOOP) during the winter.

  The accident scenario for EBR AC system which results in minimum room temperatures is one which minimizes the cooling loads within the rooms served. This will occur during DBE LOOP (winter) without a concurrent LOCA since only safety–related loads would be present and additional loads required for LOCA event mitigation within certain rooms such as Unit 1 Auxiliary Instrument Room would be not present.

  The accident scenario for the EBR AC system which results in maximum room temperature is one which maximizes the cooling loads within the rooms served. This will occur during DBE LOCA (summer) without a concurrent LOOP since safety- and non-safety–related loads would be present.

- To evaluate the cooling loads and cooling capacities of both the AHU cooling coils and chiller. The temperature controller setpoint used in this evaluation for each of the AHUs is 68°F as changed by DCN D51656-A (Ref. 5.32) and PIC 52252-A (Ref. 5.63). This new setpoint temperature is addressed in calculation EPM-WVC-101089 (Ref. 5.45). R18

2.0 Criteria

2.1 Temperature Requirements

The Control Building Electrical Board Room HVAC system is designed to maintain the temperatures and humidities (see references 5.5 through 5.11) in the building for protection and operation of plant controls and equipment. The current (prior to implementation of DCN D51656-A) normal and post LOCA temperature ranges for all spaces in the Control Building on El's 692.0 and 708.0 are listed below.

ROOM		REF.	NORMAL		LOCA	
			TEMP	RH	TEMP	RH
NAME	EL. & No.		^{0}F DB	%	^{0}F DB	%
MECH EQUIP RM (WEST)	692 - C1	5.5	73 - 86	20 - 60	62 - 89	NA
MECH EQUIP RM	692 - C2	5.5	73 - 86	20 - 60	65 - 83	NA
250 V BATTERY RM 1	692 - C3	5.6	75 - 90	18 - 60	65 - 88	NA
250 V BTRY BD RM 1	692 - C4	5.6	75 - 90	26 - 60	67 - 85	NA
250 V BTRY BD RM 2	692 - C5	5.6	75 - 90	26 - 60	67 - 85	NA
250 V BATTERY RM 2	692 - C6	5.6	75 - 90	18 - 60	67 - 88	NA
24 V & 48V BTRY RM	692 - C7	5.6	75 - 90	18 - 60	64 - 90	NA
24 V & 48V BTRY BD RM	692 - C8	5.6	75 - 90	26 - 60	64 - 74	NA
COMMUNICATION RM	692 - C9	5.6	75 - 90	18 - 60	67 - 88	NA
MECH EQUIP RM (EAST)	692 - C10	5.5	73 -86	20 - 60	60 - 87	NA
SECONDARY ALARM STA	692 - C12	5.6	75 - 90	26 - 60	65 - 79	NA
U1 AUX INST RM	708 - C1	5.7	75 - 90	27 - 60	63 - 89	NA
COMPUTER RM	708 - C3	5.7	65 -74	40 - 60	63 - 82	NA
U2 AUX INST RM	708 - C4	5.7	75 - 90	27 - 60	62 - 87	NA

2.0 Criteria (cont.)

2.1 Temperature Requirements (cont.)

The new normal and post LOCA temperature and RH ranges ranges for all spaces in the Control Building on elevations 692.0 and 708.0 (after implementation of DCN D51656-A, and in consideration of PIC 52252-A) are listed below.

ROOM		REF.	NORMAL		LOCA	
			TEMP	RH	TEMP	RH
NAME	EL. & No.		^{0}F DB	%	^{0}F DB	%
MECH EQUIP RM (WEST)	692 - C1	5.5	66 - 86	20 - 60	55 - 89	NA
MECH EQUIP RM	692 - C2	5.5	66 - 86	20 - 60	55 - 83	NA
250 V BATTERY RM 1	692 - C3	5.6	70 - 90	18 - 65	55 - 88	NA
250 V BTRY BD RM 1	692 - C4	5.6	70 - 90	18 - 65	55 - 85	NA
250 V BTRY BD RM 2	692 - C5	5.6	70 - 90	18 - 65	55 - 85	NA
250 V BATTERY RM 2	692 - C6	5.6	70 - 90	18 - 60	55 - 88	NA
24 V & 48V BTRY RM	692 - C7	5.6	70 - 90	18 - 65	55 - 90	NA
24 V & 48V BTRY BD RM	692 - C8	5.6	70 - 90	26 - 65	55 - 85	NA
COMMUNICATION RM	692 - C9	5.6	70 - 90	18 - 65	55 - 88	NA
MECH EQUIP RM (EAST)	692 - C10	5.5	66 -86	20 - 60	55 - 87	NA
SECONDARY ALARM STA	692 - C12	5.6	70 - 90	18 - 65	55 - 82	NA
U1 AUX INST RM	708 - C1	5.7	64 - 90	40 - 60	60 - 89	NA
COMPUTER RM	708 - C3	5.7	65 -74	40 - 70	55 - 82	NA
U2 AUX INST RM	708 - C4	5.7	64 - 90	40 - 70	55 - 87	NA

2.0 Criteria (cont'd)

2.2 Equipment

The Electrical Board Room (EBR) HVAC system consist of the following components:

A. Air Handling Units (AHUs)

Train A - AHU A-A, AHU B-A
Train B - AHU C-B, AHU D-B

Each AHU is 50% capacity, therefore two operate in parallel to provide 100% flow. One train operates while the opposite one is in standby. The total design air flow rate = 36,400 cfm (Ref. 5.2).

The total air flow rates credited in the analysis for both normal plant operation & a LOCA concurrent with the maximum summer design outside temperature are documented in Appendixes 1 & 2 and Assumption 4.1.1. The total air flow rates credited in the analysis for both normal plant operation & a DBE LOOP concurrent with the minimum winter design outside temperature are documented in Appendixes 1 & 3 and Assumption 4.1.2.

The EBR AHU fan static pressure requirements have been addressed in calculation EPM-MCP-090589 (Ref. 5.31).

> Note: The face damper portion of each AHU "face & bypass damper" was removed prior to startup via DCN M02693-A (Ref. 5.33).

B. Water Chillers (Ref 5.42 and 5.67)

Chiller A-A, Chiller B-B

Each chiller is 100% capacity. One chiller is in operation, while the other is in standby.
The maximum refrigeration capacity is 155 tons at 42 ^{0}F leaving water temperature (Ref. 5.42). However, a reduced ERCW flow to the condenser results in a reduced chiller capacity to 150.6 tons or 1,807,200 BTUH (Ref. 5.36 and 5.37).

C. Chilled Water Pumps

The adequacy of the chilled water pumps (head and pressure loss) has been evaluated in calculation EPM-CES-072489 (Ref. 5.40)

Flow rate = 530 gpm (Ref. 5.1, Section 3.2.1.6)
BHP = 14 (Ref. 5.61)

2.0 Criteria (cont'd)

2.2 Equipment (cont'd)

D. Electric Duct Heaters (See 47A376 - Series drawings)

Mark # 47A376 - 9, 1 - 20 KW Duct Heater
Mark # 47A376 - 11, 1 - 10 KW Duct Heater
Mark # 47A376 - 15, 2 - 10 KW Duct Heater

Each heater is mounted in the duct and is controlled by temperature sensors mounted on walls in various rooms. These heaters are non-safety-related and are not credited in the LOOP (winter) evaluation. They are only credited in the normal winter plant operational mode.

E. Computer Room Supplemental AHUs (Ref. 5.1, Sections 3.1.11 & 3.1.12)

Also see Attachments 5, 11, and Appendix 4.

3.0 Applicable Codes and Standards

There are no applicable codes or standards.

4.0 Assumptions

4.1 Justified Assumptions

4.1.1 The air flow rates shown on the simplified flow diagram of Appendix 2 and in the Excel spreadsheets for both summertime normal plant operation & a LOCA do not necessarily match the flow rates shown on the air flow diagram 1-47W866-4, Ref. 5.2.

Technical Justification: Air flow rates shown on the simplified flow diagram of Appendix 2 were conservatively adjusted to account for worst case conditions as follows:

- Pre-op test results were used in cases where flow was deficient as shown on flow diagram 1-47W866-4. These values are typically shown in brackets on the flow diagram (see Note 15, Ref. 5.2) and were outside the G-37 acceptance criteria of +/- 10%.
- The battery room exhaust fan air flow was increased by 10%, since this brings in more outside air (cooling load) during summer normal and LOCA conditions.
- The AHU design flow rates were lowered by 10% to reduce the air flow rate to the individual rooms thus maximizing the computed temperatures. G37 Criteria allows measured flow rates to be within +/- 10% of the design values shown on the flow diagram (Ref. 5.2).
- 3000 cfm outside air flow rate was used for LOCA (CRI mode) summer condition. Exfiltration was considered to balance the excess flow between the outside air intake and battery room exhaust fan.

~~As a result of the reduced bypass damper controller setpoint of 68°F (DCN D51656-A), minor air flow rate changes were made to most of the rooms on elevation 692.0 to prevent over-cooling the Secondary Alarm Station room. Details associated with these flow changes are presented in Appendix 1. The changes are minor and do not alter the total branch supply flow to rooms on elevation 692.0, downstream of mechanical equipment room 692.0-C1.~~ R19

4.1.2 The air flow rates shown on the simplified flow diagram of Appendix 3 and in the Excel spreadsheets for both wintertime normal plant operation & a DBE LOOP do not necessarily match the flow rates shown on the air flow diagram 1-47W866-4, Ref. 5.2.

Technical Justification: Air flow rates shown on the simplified flow diagram of Appendix 3 were conservatively adjusted to account for worst case conditions as follows:

- The battery room exhaust fan air flow was increased by 10%, since this brings in more outside air (cooling load) during winter conditions.
- The AHU design flow rates were amplified by 10% to increase the air flow rate to the individual rooms thus minimizing the computed temperatures. G37 Criteria allows measured flow rates to be within +/- 10% of the design values shown on the flow diagram (Ref. 5.2).

~~As a result of the reduced bypass damper controller setpoint of 68°F (DCN D51656-A), minor air flow rate changes were been made to most of the rooms on elevation 692.0 to prevent over-cooling the Secondary Alarm Station room. Details associated with these flow changes are presented in Appendix 1. The changes are minor and do not alter the total branch supply flow to rooms on elevation 692.0, downstream of mechanical equipment room 692.0-C1.~~ R19

4.0 Assumptions (cont'd)

4.1 Justified Assumptions (cont'd)

4.1.3 The simplified air flow diagrams of Appendixes 1 ~~(pg.2)~~ (pg.1), 2 and 3 represent balanced air flow conditions. R19

Technical Justification: The supply and the exhaust air to each room was balanced using information from reference 5.2 and in consideration of the air flow changes required by DCN D51656-A and PIC 52252-A. Also see Assumption 4.1.1 for use of exfiltration.

4.1.4 The abnormal maximum & minimum temperatures defined on the Environmental Data Drawings (EDDs) for the Turbine building were used as boundary temperatures when modeling the LOCA (summer) & LOOP (winter) DBE conditions.

Technical Justification: Equipment in the Turbine Building is non-safety related, thus LOCA temperatures have not been specified on the EDDs for these areas (Ref. 5.8). The abnormal maximum & minimum temperatures specified were based on a postulated outside air temperature excursion of 102°F or 6°F, respectively. In consideration of the DBE LOCA duration of 100 days, use of the abnormal maximum & minimum temperatures is considered to be conservative.

4.1.5 For calculation purposes the latitude of Watts Bar Nuclear Plant will be 35^0.

Technical Justification: Per reference 5.12, page 24.13 the latitude of Athens, TN (the closest listing in Tennessee to WBNP) is 35^0. A latitude for Spring City, TN (i. e. WBNP) is not listed, so the closest latitude of 35^0 was chosen.

4.1.6 The electrical cooling loads computed for the East and West Stairwells, 692 - C1 & C2, 708 - C1 & C2 were based on lighting only.

Technical Justification: The cooling loads in the stairwells were not computed in reference 5.26 or 5.28. Other than lighting, there are no significant sources of heat within the stairwell areas of the control building. A conservative assumed heat load of 2 watt/ft^2 was used based on information contained in Appendix B of Ref. 5.35.

4.1.7 The temperature of the chilled water supplied to each AHU was assumed to range from as low as 42°F to as high as 48°F.

Technical Justification: A copy of SSD-0-ITC-31-511A-S is included as Attachment number 15. 0-ITC-31-511A controls the supply water temperature to each train A AHU. The setpoint temperature is specified as 45°F on this document with low and high "AS FOUND" limits of 42°F and 48°F, respectively. Therefore, the analysis conservatively uses a 42°F supply water temperature when evaluating wintertime conditions. Both 42 and 48°F setpoints were considered when evaluating summertime conditions in combination with the minimum and maximum chilled water flow rates (also see Assumption 4.1.8). Use of these values conservatively minimizes the computed space temperatures during winter cases and maximizes space temperatures during the summer cases. In addition, using these extremes conservatively maximizes the predicted cooling load for the chiller.

4.0 Assumptions (cont'd)

4.1 Justified Assumptions (cont'd)

4.1.8 Chilled water flow rate to the AHUs was assumed to vary from a minimum of 216 gpm to a maximum of (284 gpm +10%).

Technical Justification: Table 9.6, "Design Parameters for Primary Safety-Related HVAC System Components" of the Control Building HVAC System Description (reference 5.1) specifies a minimum flow rate to each AHU of 216 gpm. Reference 5.1 is referred to in note 7 of the chilled water flow diagram (reference 5.41) as the source for minimum flow rates. Since a minimum flow rate to each AHU minimizes the heat removed from the spaces, 216 gpm was used for the normal and LOCA during summer cases to predict maximum room temperatures. A second set of summer time normal/LOCA cases were modeled which consider the maximum flow rates in combination with the minimum chilled water temperature in order to compute the maximum chiller load under these conditions. For the winter time cases, the flow rate to each AHU was considered to be 10% greater than the values currently shown on reference 5.41. This results in flow rates of 216 * 1.1 = 238 gpm for one AHU and 284 * 1.1 = 312 gpm for the other. Use of these max/min flow rates for the specific case under consideration supports a conservative estimation of the resulting space temperatures.

4.1.9 Assumed the Secondary Alarm Station (SAS) & Unit 2 Auxiliary Instrument rooms are occupied by one person, Unit 1 Auxiliary Instrument Room, Computer Room and Communications Room are populated by two people, and the remaining rooms are unoccupied.

Technical Justification: The number of people in the rooms used in the previous revisions (to calculate the latent load) was unrealistically high. Only the SAS, room C12-El.692.0' has one person stationed there permanently. The remaining rooms are normally unoccupied. Conservatively, consider Unit 1 Auxiliary Instrument Room, Computer Room and Communications Room are populated by 2 people and Unit 2 Auxiliary Instrument Room by one person.

4.1.10 The internal loads during LOOP (winter) conditions are defined only for the following rooms: 692.0-C1, 692.0-C10, 708.0-C1, 708.0-C3 & 708.0-C4, as shown in Table 6.8. For the remaining rooms @ El. 692.0 & 708.0 the internal loads were assumed to be zero.

Technical Justification: It is conservative to consider no internal loads for the remaining rooms @ El. 692.0 & 708.0 since this results in the lowest environmental temperature limits for the rooms served by the EBR air conditioning subsystem.

4.2 Unverified Assumptions (UVAs):

The calculation was updated on revision 16 to address Unit 2 / Dual Unit Operation. An unverified assumption for Unit 2 only assumes that stage 3 of DCN 51656-A will be cancelled. Stage 3 of DCN 51656-A (as modified by PIC 52252-A) is not cancelled and is incorporated into the analysis for Unit 1 on revision 18. Revision of Appendix 11 for Unit 2 / Dual Unit Operation was not within the scope of revision 18 and was not changed.

5.0 References

5.1 N3-30CB-4002, Rev. 15 "System Description for Control Building Heating, Ventilating, Air Conditioning and Air Cleanup System"
5.2 1-47W866-4, Rev. 39, "Flow Diagram Heating, Ventilation and Air Conditioning Air Flow"
5.3 47W930-1 Rev. EE, "Mechanical Heating, Ventilation and Air Conditioning"
5.4 47W930-2 Rev. R, "Mechanical Heating, Ventilation and Air Conditioning"
5.5 47E235-23 Rev. 5, "Environmental Data, Environment - Mild, EL 692.0" (For rooms EL 692 - C1, C2, C10)
5.6 47E235-19 Rev. 6, "Environmental Data, Environment - Mild, El 692.0" (For rooms EL 692 - C3, C4, C5, C6, C7, C8, C12, C9)
5.7 47E235-17 Rev. 6, "Environmental Data, Environment - Mild, EL 708.0" (For room EL 708 - C1, C3, C4)
5.8 a) 47E235-22 Rev. 5, "Environmental Data, Environment -Mild, EL 708.0" (For room TB EL 708)
b) 47E235-20 Rev. 4, "Environmental Data, Environment -Mild, EL 729.0" (For room TB EL 729)
5.9 47E235-25 Rev. 4, "Environmental Data, Environment - Mild, EL 729.0" (For Spreading Room EL 729.0)
5.10 47E235-62 Rev. 8, "Environmental Data, Environment - Harsh, EL 692.0" (For rooms in Aux Bldg EL 692.0 - A1, A3, A5, A27)
5.11 47E235-85 Rev. 6, "Environmental Data, Environment - Harsh, EL 692.0" (For rooms in Aux Bldg El 692.0 A29, A30)
5.12 ASHRAE 1989, "Fundamentals Handbook"
5.13 47E235-36 Rev. 4, "Environmental Data, Environment - Mild, Outside Atmosphere"
5.14 46W402-1 Rev. H, "Architectural, Plans EL 692.0 and 708.0"
5.15 46W405-1 Rev. D, "Architectural, Reinforced Masonry Walls Plans and Details"
5.16 46W405- 2 Rev. F, "Architectural, Reinforced Masonry Walls - Elevation and Details"
5.17 ASHRAE 1987, "Systems and Applications Handbook"
5.18 46W404-6 Rev. C & -7 Rev. F, "Architectural Wall Sections"
5.19 Contract No. 75K31-83121, Dwg. No. 6966-1741 "Model J1, 150 PSEG Steam"
5.20 Calc EPM-JTB-061289 Rev. 1, "Heat Transmission Coefficients"
5.21 1-47W610-31-3 Rev.11 & -1 Rev. 24, "Control Diagram"
5.22 47A373-1, Rev. 2, "Mechanical Heating Ventilating and Air Cond. Air Handling Units" (Copy included as Attachment 14)
5.23 Contract No. 77K38-821350 "Outline Views Air Handling Unit ACH 751"
5.24 ASHRAE 1985, "Fundamentals Handbook"
5.25 TVA Gen. Engineering Specification G-37 Rev. 4, "Testing and Balancing of HVAC Systems During Installation, Modification, and Maintenance"
5.26 Calc. WBNEEBMSTI090022 Rev. 17, "Heat Generation In The Control Building on EL 692.0, 708.0 and 755.0" R20
5.27 Calc. WBNEEBMSTI090042 Rev. 22, "Electrical Heat Generation in The Control Building Main Control Room, EL. 708.0 (rooms C1 and C4), and EL 729.0 (room C1)" R20
5.28 Calc. WBNEEBMSTI090058 Rev. 14, "Heat Generation in the Control Building 692.0 (C11, C12), 708.0 (C2), 755.0 (C2, C3, C5, C7, C9, C10, C14, C16, C17, C18, C19, C20)" R20
5.29 Calc. MDQ00003120010065 Rev. 6, "Cooling Load analysis for Rooms Served by the Main Control and Electrical Board Rooms HVAC Systems" R20

5.0 References (cont'd)

5.30 Psychrometric Chart - ASHRAE Psychrometric Chart 1.
5.31 Calc. WBN EPM-MCP-090589 Rev. 4, "Static Pressure Analysis-Electrical Board Rooms HVAC System-Control Building"
5.32 DCN D51656-A
5.33 DCN M02693-A, "EBR AHU Fan Drive System and Damper Failures", issue RIMS T56 930203 921, closure RIMS T56 941221 829 (see Attachment 12 – partial copy)
5.34 EBR Cooling Coil Contract 75678C – contains certification that type DD coils (24x105, 8 row) manufactured in 1976 are identical to those manufactured today (see Att. 13 –partial copy)
5.35 Calculation WBN EEB-MS-TI09-0040 Rev. 5, "Electrical Heat Generation in the Auxiliary Building – Elev. 757.0 (Rooms A1, A3-A5, A21-A23, and A25-A28"
5.36 1-47W845-4, Rev. 31, "Flow Diagram, Essential Raw Cooling Water"
5.37 Memorandum to J. K. Hannifin from G. P. Cooper, Dated Nov 25, 1985, "Watts Bar N. P. - Reduced Capacity of HVAC Cooling Equip - ERCW Systems Equip Flow Requalification - Quality Design Information
5.38 Calculation WBN EPM-GEB-061290, Rev 3, "Ventilation Flow Rate to Limit the Hydrogen Concentration in Battery Rooms 692.0-C3, 692.0-C6, 692.0-C7"
5.39 Calculation EDQ001000-20020001 Rev.1, "Post Accident Heat Rate Scaling Factor"
5.40 Calculation EPM-CES-072489 Rev. 2, "Static Pressure and Chilled Water Analysis - Electrical Board Rooms HVAC Systems"
5.41 1-47W865-7 Rev. 22 & -12 Rev. 2, "Flow Diagram Air Conditioning Chilled Water"
5.42 Contract 75K35-83119-2, "Electrical Board Room Chillers, Guaranteed Data and Equipment Data"
5.43 Contract 75K36-825328 (YCN) transfer REQNs 75701A and 75746A
5.44 Calculation WBNOSG4145, Rev. 1, "Steady State DBE LOCA Temperature Analysis of the Cable Spreading Room"
5.45 Calculation EPMWVC101089, Rev.28, "WBN Instrument Safety Limits HVAC Systems 30, 31 and 65"
5.46 1-47W865-12 Rev. 2, "Flow Diagram Chilled Water Air Conditioning"
5.47 41N477-1 Rev. G, "Concrete, Floor EL 708 & Cols Below, Outline"
5.48 41N473-1 Rev. F "Concrete, Walls & Roof EL 775.0, Outline"
5.49 46W454-4 Rev. W, "Arch, Door & Hardware Schedule"
5.50 41N470-1 Rev. B, "Concrete, Base Slab - EL 689.5, Outline"
5.51 41N379-1 Rev. B, "Concrete, Floor EL 729 & Cols Below, Outline"
5.52 41N483-2 Rev. E, "Partition Walls Outline & Reinforcement"
5.53 44W368-1 Rev. E, "Watertight Personnel Doors, Arrangement & Details, Sheet 1"
5.54 41N315-2 Rev. A, "Concrete EL 713 Floor Outline"
5.55 Calculation WBN EPM-RAV-112492, Rev. 2, "Assessment of Non-safety Heater Failure in the Control Building ... "
5.56 47E235-70 Rev. 6, "Environmental Data, Environment - Harsh EL 676.0"
5.57 47E235-52 Rev. 7, "Environmental Data, Environment - Harsh EL 713.0"
5.58 ASHRAE 1985 Fundamentals, page 6.17, example 5
5.59 Fax, dated Feb 6, 2001, from "The Trane Company", Cooling Coil, Attachment 6
5.60 Fax, dated Feb 6, 2001, from "The Trane Company", Cooling Coil, Attachment 7
5.61 Calculation EPMGDU041593, Rev. 19, "Brake Horsepower Analysis for Safety-related components"

This page replaced by Rev.18

5.0 References (cont'd)

5.62 WO 04-818592-002
5.63 PIC 52252-A
5.64 DCN 55250A – CAS/SAS Upgrade R19
5.65 DCN 52853 - Digital Controls System Upgrade
5.66 DCN 56903 - Digital Controls System Upgrade R20
5.67 DCN 58262 - CAS/SAS Upgrade

6.0 Design Input and Methodology

6.1 Boundary Room Temperatures (Normal Operational Conditions - Summer)

Room	EL (Ft)	Room #	Max Temp °F	Ref
Ground (floor & wall) (Summer)	NA	NA	68	5.17, Pg 12.9
AB Gen Floor	692	A1	104	5.10
AB Gas Decay Tk Rm	692	A5, A3	104	5.10
AB Holdup Tk Rm	676	A2, A3	104	5.56
AB Spare Rm	692	A31	104	See Note Below
AB Boric Acid Pack Rm A	692	A30	104	5.11
AB Boric Acid Pack Rm B	692	A29	104	5.11
AB Conc Filter Rm	692	A27	104	5.10
AB Gen Area	713	A1	104	5.57
AB Waste Gas Comp Rm A & B	713	A25, A26	104	5.57
AB Ion Exch & Filter Rm	713	NA	104	See Note Below
CB Spreading Rm	729	C1	95	5.9
Turbine Bldg	708 & 729	NA	110	5.8

Note:
The AB Spare Rm (EL 692, A31) and the AB Ion Exch & Filter Rm (EL 713) are not defined in the Environmental Data Drawings, the same temperature was used as the surrounding rooms.

6.2 Boundary Room Temperatures (LOCA Condition - Summer)

Room	EL (Ft)	Room #	Max Temp °F	Ref
Ground (floor & wall) (Summer)	NA	NA	68	5.17, Pg 12.9
AB Gen Floor	692	A1	119	5.10
AB Gas Decay Tk Rm	692	A5, A3	104	5.10
AB Holdup Tk Rm	676	A2, A3	104	5.56
AB Spare Rm	692	A31	104	See Note Below
AB Boric Acid Pack Rm A	692	A30	111	5.11
AB Boric Acid Pack Rm B	692	A29	111	5.11
AB Conc Filter Rm	692	A27	119	5.10
AB Gen Area	713	A1	118	5.57
AB Waste Gas Comp Rm A & B	713	A25 A26	112 113	5.57
AB Ion Exch & Filter Rm	713	NA	104	See Note Below
CB Spreading Rm	729	C1	116	5.9, 5.44
Turbine Bldg	708 & 729	NA	120	5.8, Assumption 4.1.4

Note:
The AB Spare Rm (EL 692, A31) and the AB Ion Exch & Filter Rm (EL 713) are not defined in the Environmental Data Drawings, the same temperature was used as the surrounding rooms.

6.3 Boundary Room Temperatures (Normal Operational Conditions - Winter)

Room	EL (Ft)	Room #	Min Temp ^{0}F	Ref
Ground (floor & wall) (Winter)	NA	NA	50	5.17, Pg 12.9
AB Gen Floor	692	A1	60	5.10
AB Gas Decay Tk Rm	692	A5, A3	60	5.10
AB Holdup Tk Rm	676	A2, A3	60	5.56
AB Spare Rm	692	A31	60	See Note Below
AB Boric Acid Pack Rm A	692	A30	60	5.11
AB Boric Acid Pack Rm B	692	A29	60	5.11
AB Conc Filter Rm	692	A27	60	5.10
AB Gen Area	713	A1	60	5.57
AB Waste Gas Comp Rm A & B	713	A25, A26	60	5.57
AB Ion Exch & Filter Rm	713	NA	60	See Note Below
CB Spreading Rm	729	C1	60	5.9
Turbine Bldg	708 & 729	NA	50	5.8

Note:
The AB Spare Rm (EL 692, A31) and the AB Ion Exch & Filter Rm (EL 713) are not defined in the Environmental Data Drawings, the same temperature was used as the surrounding rooms.

6.4 Boundary Room Temperatures (LOOP Condition - Winter)

Room	EL (Ft)	Room #	Min Temp ^{0}F	Ref
Ground (floor & wall) (Winter)	NA	NA	50	5.17, Pg 12.9
AB Gen Floor Area	692	A1	60	5.10
AB Gas Decay Tk Rm	692	A5, A3	60	5.10
AB Holdup Tk Rm	676	A2, A3	60	5.56
AB Spare Rm	692	A31	60	See Note Below
AB Boric Acid Pack Rm A	692	A30	60	5.11
AB Boric Acid Pack Rm B	692	A29	60	5.11
AB Conc Filter Rm	692	A27	60	5.10
AB Gen Floor Area	713	A1	60	5.57
AB Waste Gas Comp Rm A & B	713	A25, A26	60	5.57
AB Ion Exch & Filter Rm	713	NA	60	See Note Below
CB Spreading Rm	729	C1	60	5.9
Turbine Bldg	708 & 729	NA	40	5.8, Assumption 4.1.4

Note:
The AB Spare Rm (EL 692, A31) and the AB Ion Exch & Filter Rm (EL 713) are not defined in the Environmental Data Drawings, the same temperature was used as the surrounding rooms

6.5 ROOM INTERNAL LOAD SUMMARY (NORMAL OPERATION - SUMMER)

(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM DESCRIPTION	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES
ROOMS AT FLOOR ELEVATION 692.0'			
MECHANICAL EQUIP. ROOM WEST (C1)		11,356	5.29
MECHANICAL EQUIPMENT ROOM (C2)		4,467	5.29
250V BATTERY ROOM 1 (C3)		3,823	5.29
250V BATTERY BOARD ROOM 1 (C4)		36,558	5.29
250V BATTERY BOARD ROOM 2 (C5)		38,540	5.29
250V BATTERY ROOM 2 (C6)		3,823	5.29
24V & 48V BATTERY ROOM (C7)		373	5.29
24V & 48V BATTERY BOARD ROOM (C8)		12,248	5.29
COMMUNICATION ROOM (C 9) [1]	2	28,419	5.29
MECHANICAL EQUIP. ROOM EAST (C10)		52,014	5.29
CORRIDOR (C 11)		2,908	5.29
SECONDARY ALARM STATION (C12) [1]	1	31,069	5.29
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6
ROOMS AT FLOOR ELEVATION 708.0'			
UNIT # 1 AUX INSTRUMENT ROOM (C1) [1]	2	122,026	5.29
CORRIDOR (C 2)		1,085	7.5 HP MOTOR (AHU) Computer Rm Supplemental Cooling Unit Also see 5.28
COMPUTER ROOM (C3) [1]	2	91,816	5.29
UNIT # 2 AUX INSTRUMENT ROOM (C4) [1]	1	35,318	5.29
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6

R20

R20

NOTES:
1. See Assumption 4.1.9

6.6 ROOM INTERNAL LOAD SUMMARY (LOCA CONDITION - SUMMER)
(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES	
ROOMS AT FLOOR ELEVATION 692.0'				
MECHANICAL EQUIP. ROOM WEST (C1)		11,356	5.29	
MECHANICAL EQUIPMENT ROOM (C2)		4,467	5.29	
250V BATTERY ROOM 1 (C3)		3,823	5.29	
250V BATTERY BOARD ROOM 1 (C4)		36,558	5.29	
250V BATTERY BOARD ROOM 2 (C5)		38,540	5.29	
250V BATTERY ROOM 2 (C6)		3,823	5.29	
24V & 48V BATTERY ROOM (C7)		373	5.29	
24V & 48V BATTERY BOARD ROOM (C8)		12,248	5.29	
COMMUNICATION ROOM (C 9) [1]	2	31,261	5.29	
MECHANICAL EQUIP. ROOM EAST (C10)		52,014	5.29	
CORRIDOR (C 11)		2,908	5.29	
SECONDARY ALARM STATION (C12) [1]	1	31,069	5.29	R20
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6	
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6	
ROOMS AT FLOOR ELEVATION 708.0'				
UNIT # 1 AUX INSTRUMENT ROOM (C1) [1]	2	197,026	5.29	R20
CORRIDOR (C 2) [2]		1,085	5.28	
COMPUTER ROOM (C3) [1] [2]	2	91,816	5.29	
UNIT # 2 AUX INSTRUMENT ROOM (C4) [1]	1	72,818	5.29	
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6	
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6	

NOTES:
1. See Assumption 4.1.9.

2. Supplemental AHU cooling is credited in the LOCA summer case number 2, Section 7.11. See Note 19, Section 6.9.

6.7 ROOM INTERNAL LOAD SUMMARY (NORMAL OPERATION - WINTER)

ROOM	THEORETICAL NORMAL						ACTUAL [1] INTERNAL LOAD BTU/HR	ELECTRICAL LOAD TO BE USED		
	PEOPLE NOTE 3	LIGHTING (WATTS)	EQUIPMENT (WATTS)	CABLE TRAYS (WATTS)	REFERENCE & NOTES	TOTAL BTU/HR		BTU/HR	NOTES	
ROOMS AT FLOOR ELEVATION 692.0'										
MECHANICAL EQUIPMENT ROOM WEST (C1)		0.0	261.0		5.26	891	11,356	11,356	NOTE 2	R20
MECHANICAL EQUIPMENT ROOM (C2)		0.0	783.0		5.26	2,672	4,467	4,467	NOTE 2	
250V BATTERY ROOM 1 (C3)		0.0	604.0		5.26	2,061	3,823	3,823	NOTE 2	
250V BATTERY BOARD ROOM 1 (C4)		0.0	19,233.0	29.0	5.26	65,833	36,558	36,558	NOTE 2	R20
250V BATTERY BOARD ROOM 2 (C5)		0.0	18,303.0	56.0	5.26	62,468	38,540	38,540	NOTE 2	
250V BATTERY ROOM 2 (C6)		0.0	604.0		5.26	2,061	3,823	3,823	NOTE 2	
24V & 48V BATTERY ROOM (C7)		0.0	340.0		5.26	1,160	373	373	NOTE 2	
24V & 48V BATTERY BOARD ROOM (C8)		0.0	4,924.0		5.26	16,806	12,248	12,248	NOTE 2	R20
COMMUNICATION ROOM (C 9)	0	0.0	27,551.0		5.26	94,032	28,419	28,419	NOTE 2	
MECHANICAL EQUIPMENT ROOM EAST (C10)		0.0	23,428.0		5.26	79,960	52,014	52,014	NOTE 2	
CORRIDOR (C 11)		0.0	276.0		5.28	942	2,908	2,908	NOTE 2	R20
SECONDARY ALARM STATION (C12)		0.0	10,885.0		5.28	37,151	31,069	31,069	NOTE 2	
WEST STAIRWELL (STAIR C1)		0.0	0.0		NOTE 4	0		0	NOTE 4	
EAST STAIRWELL (STAIR C2)		0.0	0.0		NOTE 4	0		0	NOTE 4	
ROOMS AT FLOOR ELEVATION 708.0'										
UNIT # 1 AUX INSTRUMENT ROOM (C1)	0	0.0	58,759.0		5.27	200,544	122,026	122,026	NOTE 2	
CORRIDOR (C 2)		0.0	69.0		5.28	235	1,085	1,085	NOTE 2	R20
COMPUTER ROOM (C3)	0	0.0	9,663.0	79.0	5.26	32,980	91,816	91,816	NOTE 2	
UNIT # 2 AUX INSTRUMENT ROOM (C4)	0	0.0	44,940.0		5.27	153,380	35,318	35,318	NOTE 2	
WEST STAIRWELL (STAIR C1)		0.0	0.0		NOTE 4	0		0	NOTE 4	
EAST STAIRWELL (STAIR C2)		0.0	0.0		NOTE 4	0		0	NOTE 4	

NOTES:

(1) FOR ACTUAL LOAD SEE REFERENCE 5.29 .
(2) THE ELECTRICAL LOAD TO BE USED IS 100% OF THE ACTUAL INTERNAL LOAD.
(3) LATENT COOLING LOAD DUE TO PERSONNEL WAS NOT CONSIDERED; CONSERVATIVE.
(4) ELECTRICAL LOADS FOR THE STAIRWELLS IS SPECIFIED IN ASSUMPTION 4.1.6.
IT CONSIDERED "ZERO" FOR THIS OPERATIONAL CONDITION; CONSERVATIVE.

6.8 ROOM INTERNAL LOADS SUMMARY (LOOP CONDITION - WINTER)

ROOM	THEORETICAL LOCA/LOOP						NORMAL LOAD (Ref. 5.29)	WITH 10% SF FOR LOCA (Ref. 5.29)	ELECTRICAL LOAD CREDITED		
	PEOPLE (NOTE 2)	LIGHTING (WATTS)	LIGHTING BTU/HR	EQUIPMENT (WATTS)	CABLE TRAYS (WATTS)	REFERENCE & NOTES	BTU/HR	BTU/HR	BTU/HR	NOTES	
ROOMS AT FLOOR ELEVATION 692.0'											
MECHANICAL EQUIPMENT ROOM WEST (C1)		1,204.0	4,109.3	261.0		5.26	10,324	11,356	6,215	NOTE 1	R20
MECHANICAL EQUIPMENT ROOM (C2)		774.0	2,641.7	783.0		5.26	-2,766	4,467	0	NOTE 1	
250V BATTERY ROOM 1 (C3)		516.0	1,761.1	604.0		5.26	-280	3,823	0	NOTE 1	
250V BATTERY BOARD ROOM 1 (C4)		774.0	2,641.7	19,233.0	29.0	5.26	33,234	36,558	0	NOTE 1	R20
250V BATTERY BOARD ROOM 2 (C5)		774.0	2,641.7	18,303.0	56.0	5.26	35,037	38,540	0	NOTE 1	
250V BATTERY ROOM 2 (C6)		516.0	1,761.1	604.0		5.26	-384	3,823	0	NOTE 1	
24V & 48V BATTERY ROOM (C7)		258.0	880.6	340.0		5.26	339	373	0	NOTE 1	
24V & 48V BATTERY BOARD ROOM (C8)		516.0	1,761.1	4,924.0		5.26	11,135	12,248	0	NOTE 1	R20
COMMUNICATION ROOM (C 9)	0	2,752.0	9,392.6	27,551.0		5.26	25,835	31,261	0	NOTE 1	
MECHANICAL EQUIPMENT ROOM EAST (C10)		1,376.0	4,696.3	23,428.0		5.26	47,286	52,014	42,590	NOTE 1	
CORRIDOR (C 11)		1,376.0	4,696.3	276.0		5.28	-3,175	2,908	0	NOTE 1	R20
SECONDARY ALARM STATION (C12)		1,204.0	4,109.3	10,885.0		5.28	28,245	31,069	0	NOTE 1	
WEST STAIRWELL (STAIR C1)		0.0	0.0	0.0		NOTE 3		0	0	NOTE 3	
EAST STAIRWELL (STAIR C2)		0.0	0.0	0.0		NOTE 3		0	0	NOTE 3	
ROOMS AT FLOOR ELEVATION 708.0'											
UNIT # 1 AUX INSTRUMENT ROOM (C1)	0	10,320.0	35,222.2	58,759.0		5.27	110,933	197,026	165,468	NOTE 4	
CORRIDOR (C 2)		344.0	1,174.1	69.0	6.0	5.28	0	1,085	0	NOTE 1	
COMPUTER ROOM (C3)	0	3,526.0	12,034.2	9,663.0	79.0	5.26	83,469	91,816	54,444	NOTE 4	R20
UNIT # 2 AUX INSTRUMENT ROOM (C4)	0	9,460.0	32,287.0	44,940.0		5.27	32,108	72,818	6,311	NOTE 4	
WEST STAIRWELL (STAIR C1)		0.0		0.0		NOTE 3	0	288	0	NOTE 3	
EAST STAIRWELL (STAIR C2)		0.0		0.0		NOTE 3	0	288	0	NOTE 3	

NOTES:

1. The full measured normal load minus the theoretical lighting load was assigned to the two mechanical equipment rooms which contain HVAC equipment that will continue to run during the LOCA/LOOP scenario. The auxiliary instrument room loads were conservatively set to only the portion that the room load would increase by following a LOCA per notes 3 and 4 on page 73 of ref. 5.29. The net and +10% load values were obtained from reference 5.29. The theoretical equipment and cable loads are for information only.
2. Latent cooling load due to personnel was not considered; conservative.
3. Electrical loads for the stairwells is specified in Assumption 4.1.6. It is powered form non-safety related source and considered "ZERO" for this mode of operation.
4. Electrical loads per Ref. 5.39, Attachment B, for rooms @ El. 708.0': C1: 19182 Watts
   C3: 15952 Watts
   C4: 1849 Watts

This page replaced by Revision 20.

6.9 Methodology

1. Simplified Flow Diagrams depicting conservative air flow rates for normal (summer & winter) operating conditions and LOCA (summer) & LOOP (winter) accident conditions are shown in Appendixes 2 and 3, respectively. Also see Assumptions 4.1.1, 4.1.2 & 4.1.3.

2. The outdoor design minimum wintertime temperature is 13^0F for normal operating and LOOP accident conditions per Reference 5.13. This value represents the 99% winter design dry bulb for Athens, Tennessee as listed in Reference 5.12.

3. Cooling loads associated with equipment located in all areas other than the stairwells are based on Reference 5.29, Table 8.1.

4. Overall heat transfer coefficients ("U" factors) were obtained from Ref. 5.20.

5. Room dimensions were taken from architectural drawings Refs. 5.14, 5.15, 5.16 and 5.18. Also see note 16.

6. During all but the LOOP condition in winter, the full equipment cooling loads are considered. Refer to Sections 6.5 through 6.8 for electrical loads.

7. This note deleted on revision 14.

8. During LOCA (summer) and LOOP (winter) accident conditions, heaters and/or humidifers are not considered since neither are classified as safety related nor backed by diesel power (Ref. 5.39). A failure of one non-safety related heater in the "On" position concurrent with LOCA is addressed in Ref. 5.55.

9. During normal plant operation, the duct heaters will operate intermittently as required in response to their respective thermostat controller. Duct heaters were credited during the normal operational winter case. They also would be available to function during warmer months depending on the thermostat setpoint chosen, thus "NORMAL (SUMMER CASE 2)" credited heaters 0-HTR-31-85 & -87 (see pg. 7.9.1) .

10. This note deleted on revision 14.

11. Relative humidity for each room was obtained from the psychrometric chart data using the calculated humidity ratio and the dry bulb air temperature for each room.

12. Calculated temperatures/humidity during the normal cooling and heating modes of operation were compared to the criteria values.

6.9 Methodology (cont'd)

13. The supply air temperature is controlled by a by-pass damper system (formally a face and bypass damper until the face damper portion was deleted by DCN M02693-A, Ref. 5.33). A thermostat, which is mounted in the return air duct to each AHU, senses the mixed return air temperature to the AHUs and modulates the bypass damper in each AHU in an attempt to maintain a constant temperature. If the return air temperature is greater than 68°F, the by-pass damper may be fully closed. If the return air temperature is less than 68°F, the bypass damper may be fully open. Therefore, even during the LOOP (winter) case with the bypass damper fully open, a significant portion of the total air flow will continue to flow through the cooling coils. A methodology was developed on revision 14 to estimate the air flow rate through the coil during this condition and is detailed in Appendix 7. During the normal plant operation and LOCA condition cases concurrent with the maximum outside design temperature, full flow is required through the coil since the return air temperature to the AHU is greater than the controller set point temperature of 68°F. During the normal plant operation case concurrent with the minimum outside air temperature, the bypass dampers will be in a throttled position with the majority of the flow continuing through each coil (see Section 7.12 for specifics). During the LOOP case concurrent with the minimum outside design temperature, the bypass damper was determined to be fully open (see Section 7.13 for specifics).

14. All average earth temperatures were taken from Reference 5.17, page 12.9.

15. Calculation EPM-GEB-061290 (Ref. 5.38), page 14 lists the required ventilation flow rate to maintain the hydrogen concentration under 2%. This value is much less than the measured flow rate to each battery room. Therefore, the airflow rates used in this calculation are more than adequate for hydrogen removal.

16. The wall, ceiling and floor materials, and thickness of the structures were taken from the drawing references listed in Section 5.0. Also see note 5.

17. The summertime humidity ratio (specific humidity) used was 0.0133 # moisture/# dry air based on 95 ^{0}F DB, 74 ^{0}F WB, Ref. 5.13.

18. The winter outdoor air humidity ratio during the LOOP condition (specific humidity is 0.0003 # moisture/# dry air) was based on 13 ^{0}F DB, 20% Relative Humidity. Since Ref. 5.12 does not indicate a wet bulb temperature, 20 % Relative Humidity was used based on Ref. 5.13 which reflects a normal minimum temperature of 13 ^{0}F DB and normal minimum relative humidity of 20 %. Since the rooms are not required to maintain a defined humidity range during a LOOP, this specific humidity was only used to provide a general humidity estimate in each room.

    18a. The winter outdoor air humidity ratio during normal plant operation (specific humidity is 0.0003 # moisture/# dry air) was based on 60 ^{0}F DB, 5% Relative Humidity since the 144 KW outside air duct heater raised the outside air temperature from 13 ^{0}F DB to 60 ^{0}F DB, with no moisture added.

6.9 Methodology (cont'd)

18b. During normal plant operation in the winter, the specific humidity leaving the AHU was considered the same as during the normal cooling mode (.0084 # moisture/# dry air- See Section 7.3) since the cooling coils operate during both summer and winter conditions.

19. The EBR AHUs are equipped with temperature controllers (0-TC-31-335, -336, -337 & -338) with their associated temperature elements located in the return air duct of each AHU. These temperature controllers govern the position of the cooling coil bypass damper associated with each AHU such that the return air temperature entering the air handling unit remains at the required setpoint value. Note that the cooling coil face dampers were removed as discussed previously (See Ref. 5.33 & Attachment 12).

Each of the Excel spreadsheets presented in Sections 7.8 through 7.13 uses the same basic methodology in determining the steady state temperatures for each of the rooms served by the EBR air conditioning system. The process involves a trial and error iterative solution until assumed room temperatures (which feed into the heat transmission portion of the spreadsheet) and computed room temperatures (computed from the summation of the transmission loads with the internal loads, and the supply air temperature) are within a fraction of a degree (approximately 0.1°F). At the same time, the mixed EBR AHUs return air temperature and relative humidity are used as input to the AIRCOOL program to compute an off-coil air temperature from each EBR AHU. The supply air temperature to each room from the AHUs is then calculated based on this off-coil temperature, heat addition from the supply fans/motors, and the effects of steam injection, if applicable. Only copies of the final iterations are included in the calculation.

Sections 7.8, 7.9, and 7.11 include AIRCOOL models of the supplemental cooling AHUs serving the computer room. Since these units are non-safety-related, they were only credited in the normal summertime cases (Section 7.8 & 7.9) & LOCA (Section 7.11) summertime case which maximizes the cooling loads on the chiller.

20. Performance of each EBR AHU was predicted by the AIRCOOL program. Required coil data for the program are listed in Attachments 6 and 7. The EBR AHU coils were replaced via DCN M-02693-A (Ref. 5.33) with identical TRANE type DD coils as those manufactured in 1976 per information contained in contract 75678C (Ref. 5.34). A benchmarking case was run based on the performance data listed on dwg. 47A373-1 (Ref.5.22 and Attachment 14). The minimum sensible heat removal capacity of each AHU is specified as 715,000 Btu/hr and the total (sensible + latent) minimum heat removal capacity is 890,000 Btu/hr at the conditions specified on Ref. 5.22. The AIRCOOL model performance prediction at these same conditions is 738,023 Btu/hr (sensible) and 836,543 Btu/hr (total) which agrees well with the requirement. The sensible heat removal capability predicted by AIRCOOL is within approximately 3% of the value specified on Ref. 5.22. A copy of the AIRCOOL report for this benchmark case is included as Appendix 6.

6.9 Methodology (cont'd)

21. In a similar manner (see note 20), an AIRCOOL benchmarking case was run for the computer room supplemental cooling AHUs based on data presented in Attachment 5. A copy of the AIRCOOL results is presented in Appendix 8. Drawing 47A373-26 (DCA-P05297-109) indicates a minimum sensible heat removal capacity of 127,910 Btu/hr. The AIRCOOL model conservatively predicts 118,186 Btu/hr for the same entering water, air temperature conditions and air flow rate. These AHUs are not safety related, however, they do receive chilled water from the EBR chillers. Therefore, they can contribute to the total EBR chiller load for certain cases.

22. Adequacy of the coils is based on computed steady state room temperatures and humidities being within the design parameters of the EDDs (Ref. 5.5 to 5.7). Also the heat removal capability (Total / Sensible / Latent) from the AIRCOOL Program was compared to the final iterated cooling load (Total / Sensible / Latent) to determine if there is adequate coil capability.

23. The EBR AHUs (Contract 77K38-821350 – Ref.5.23 & Attachment 6) were purchased for 90 gpm per coil or 180 gpm of chilled water per AHU. However, flow diagram 1-47W865-7 (Ref. 5.41) shows that AHUs A-A & C-B each receive 216 gpm, and AHUs B-A & D-B each receive 284 gpm. The computer room supplemental AHU (Contract 79K38-825328 – Attachment 5 & 11) receives 22 gpm of chilled water per 1-47W865-12 (Ref. 5.46). These flow rates are used in the AIRCOOL program (see Sections 7.8 to 7.13).

7.0 Calculations

7.1 Determination of the Transmission Coefficients through Basement Walls and Floors

The heat transfer coefficients were estimated using the method described in Chapter 25, page 25.6 of the 1989 ASHRAE Handbook of Fundamentals (Ref. 5.12)

There are two floor elevations in the Control Building located below grade level of 728-0':

a) Elevation 708-0' is 20ft below grade 728-0'.

b) Elevation 692-0" is 36ft below grade 728-0'.

Wall Transmission Coefficients:

Using Table 3 and considering the heat loss constant 7 ft below grade level, then use .069 BTU/hr-ft-^{0}F for depths greater than 7 ft.

Therefore from Table 3:

DEPTH	BTU/hr-ft-^{0}F
0-1	0.410
1-2	0.222
2-3	0.155
3-4	0.119
4-5	0.096
5-6	0.079
6-7	0.069
Subtotal =	1.150

Walls - For rooms located on EL 708.0':

EL 728.0 - EL 708.0 = 20 ft
Therefore, using 0.069 BTU/hr-ft-^{0}F for depths greater than 7 ft, then 20 ft - 7 ft = 13 ft
13 ft x 0.069 BTU/hr-ft-^{0}F = 0.897

Therefore 1.150 + 0.897 = 2.047 BTU/hr-ft-^{0}F

Walls - For rooms located on EL 692.0':

EL 708.0 minus the floor thickness of 1'-6" = EL 706.5
EL 706.5 - 692.0 = 14.5 ft.
Therefore, using 0.069 BTU/hr-ft-^{0}F for depths greater than 7 ft
14.5 x 0.069 BTU/hr-ft-^{0}F = 1.00 BTU/hr-ft-^{0}F

7.1 (cont'd)

Note: Since the EL 692.0 is 36 ft below the grade level the heat loss/gain is considered constant.

Therefore, to determine the heat loss through the basement wall multiply 1.00 BTU/hr-ft-^{0}F x the wall length.

Basement Floor - For rooms located on EL 692.0':

Using Table 4, the average heat loss per ft^2 is 0.026 BTU/ hr-ft^2-^{0}F.

7.2 Determination of the AHU's Supply Air Temperature and the Specific Humidity during Normal & LOCA Cooling Modes Based on the Guaranteed Vendor Data

The leaving air temperature of the coil is 50.9 DB, 49 WB (Ref. 5.22) - Guaranteed Vendor Data.

The supply air temperature leaving the AHU can be estimated using the following equation:

$Ts = Tz + q/(1.08 \times Q)$

where Ts = Supply Air Temperature
Tz = Air Temperature leaving the cooling coil
q = Heat released from motor in - driven machine in
1.08 = Conversion Coefficient
Q = Air Flow Rate CFM

The electrical board room AHU is a draw through type with the fan and the motor in the air stream. The AHU motor is a 50 HP (Ref. 5.31). The brake horsepower is 34.5.

The heat released from the fan and the 34.5 BHP motor is 98,435 Btuh (Ref. 5.12, pg 26.8).

For normal & LOCA summer operating conditions, the minimum evaluated air flow rate is 32,063 / 2 or 16,032 CFM per AHU (See Appendix 2).

Therefore, $\Delta T_{FAN} = 98,435 / (1.08 \times 16,032 \text{ CFM}) = 5.69^0$F

In order to determine the leaving air temperature of the AHU, 5.69 ^{0}F was added to the leaving air temperature of the coil to account for motor and fan heat addition. Therefore, the AHU supply air temperature (at guaranteed vendor data entering air temperature conditions) is 50.9 + 5.69 = 56.59^{0}F or 56.6^{0}F. Since only heat (no moisture) is added to the air stream, the relative humidity decreases with an increase in wet bulb temperature. Therefore, from the psychrometric chart the final leaving supply AHU temperature is 56.6 ^{0}F DB, 51.5 ^{0}F WB (.0069 # moist/# dry air).

7.3 Determination of the Specific Humidity during Normal Cooling Operation

The supply air may be humidified after leaving the cooling coil (Ref. 5.23). The humidity ratio of the supply air can be calculated by applying Equation (44) (Ref. 5.12, pg. 6.17 and 6.18 or Ref. 5.24 pg. 6.17).

(1) $mah_1 + mwhw = mah_2$ (44)

(2) $maw_1 + mw = maw_2$

where : ma = Air Mass Flow

mw = Water Mass Flow @ Saturation

h_1 = Enthalpy of Dry Air (before humidification)

hw = Enthalpy of Saturated Water

w_1 & w_2 = Humidity Ratio Before and After Humidification.

h_2 = Enthalpy of Air (after humidification)

From the psychrometric chart, the air volume (specific volume) @ 50.9 ^{0}FDB, 49.0 ^{0}FWB is 13.00 ft^3 per pound of dry air.

Air Mass (ma) = 32,063 CFM x 1 # / 13.00 ft^3 = 2466 # / min dry air (REF. 5.2) RIB

Enthalpy of Dry Air (h_1) = 19.8 Btu / # of dry air before humidification (at 50.9^{0}FDB, 49.0^{0}FWB leaving coil temperature)

Note: The steam generator supplies a total of 226 # of steam / hr or 113 # / hr to each AHU. Since 32,063 CFM is the total airflow rate for both AHU's operating, then 226 # of steam / hr is used as the mass flow rate. RIB

Water Mass Flow @ Saturation (mw) = 226 # of steam / hr x 1 hr / 60 min = 3.77 # / min of steam (Ref. 5.19)

Humidity Ratio (w_1) = 0.0069 # of water / # of dry air (at 50.9 ^{0}FDB, 49.0 ^{0}FWB)

Note: This humidity level is applicable for LOCA (summer) and LOOP (winter) conditions since the humidifiers are non-safety-related and considered as not operating during this modes.

Enthalpy of Saturated Water vapor (steam) (hw) = 1163 Btu / # of steam (at 15 psi steam press + 14.7096 psia = 29.7096 psia) (Ref. 5.12 Chapter 6.11)

7.3 (cont'd)

Final Enthalpy of Air (after humidification) (h_2) = ?

Therefore:

(1) $(2466 \times 19.8) + (3.77 \times 1163) = 2466\ h_2$

$h_2 = 21.57$ Btu / # of dry air (after humidification)

(2) $w_2 = (2466 \times 0.0069) + 3.77) / 2466$

$w_2 = 0.0084$ # of water / # of dry air (after humidification)

Note: This value is used also during normal (winter) operating condition since the steam injection system will be in service during this condition.

7.4 Determination of the Final Leaving Air Temperature at the AHU after Steam Injection for Normal Plant Operation (summer and winter) Based on the Guaranteed Vendor Data

7.4.1 Normal Operation (Summer):

As discussed above, the fan and motor heat raises the temperature of the leaving air by 5.69°F. Since the air leaving the AHU is 50.9 °F + 5.69°F = 56.6 °F, this temperature will be used to determine the final supply air temperature to the rooms (See Ref. 5.58).

Note: The coil leaving air is humidified before entering the fan. For the purpose of establishing the final temperature, it does not make any difference if the fan heat is added before or after humidification.

See Psychrometric Chart (Ref. 5.30) - Appendix 5.

Plot $w_2 = 0.0084$ # of water / # of dry air (See Section 7.3) on the Psychrometric Chart and draw a straight line across the chart. This is the specific humidity of the coil leaving air temperature after steam injection.

Plotting the leaving air temperature of the cooling coil (50.9 °F DB, 49 °F WB) and adding 5.69 °F DB, draw line straight across (since no moisture is being added at this point) until it reaches 56.6 °F DB. Read 51.5 °F WB. From Section 7.3, the enthalpy of the steam is 1163 BTU / # of steam. Thus, according to Eq. (44) (see Section 7.3), the condition line on the Psychrometric Chart connecting States 1 and 2 must have a direction of $(\Delta h / \Delta W) = 1163$.

7.4 (cont'd):

The condition line was drawn with the (Δh / ΔW) protractor as shown on the Psychrometric Chart. Draw a second line parallel to the established protractor line starting from 56.6 ^{0}F DB, 51.5 ^{0}F WB (State 1). This second line is the condition line. State 2 is established at the intersection of the condition line with the horizontal line extended from 0.0084 # of water / # of dry air. At that intersection read 57.0 ^{0}F DB, 54^{0}F WB. Therefore, the final leaving temperature of the AHU is 57.0 ^{0}F DB*, 54 ^{0}F WB*, 0.0084 # of water /# of dry air. This is a 6.1 ^{0}F DB rise (57 ^{0}F DB minus 50.9 ^{0}F DB) from the cooling coil to the discharge of the AHU. Thus, the total air temperature rise through each EBR AHU, including the addition of steam is 6.1 ^{0}F. A 6.1^{0}F temperature rise was used in each of the normal summertime cases (sections 7.8 and 7.9).

*Note: Based on the guaranteed vendor data

7.4.2 Normal Operation (Winter):

Since there is less steam in the air because of the greater assumed air flow rate of 40,632 cfm (Appendix 3), then for the simplification of this calculation the temperature rise during this operating condition is calculated as follows:
From Section 7.2, the leaving air temperature from the coil is 50.9 ^{0}F DB, 49 ^{0}F WB. The temperature rise through the fan is 5.69 ^{0}F (from above). Therefore 5.69 ^{0}F + 50.9 ^{0}F = 56.59 ^{0}F. From this Section the AHU final leaving dry bulb temperature (including fan heat and steam injection) is 57 ^{0}F. Therefore 57 ^{0}F- 56.59 ^{0}F = 0.41 ^{0}F is the temperature rise due to the steam injection. This is used in Section 7.12 for normal operation during winter conditions.

7.5 Supply Air Temperature Rise through the Fan and Fan Motor for LOCA (summer) and LOOP (winter) Conditions

The supply air temperature leaving the AHU can be estimated using the following equation:

$Ts = Tz + q/(1.08 \times Q)$

where Ts = Supply Air Temperature
Tz = Air Temperature leaving the cooling coil
q = Heat released from motor in - mach in
1.08 = Conversion Coefficient
Q = Air Flow Rate CFM

The electrical board room AHU is a draw through type with the fan and the motor in the air stream. The AHU motor is a 50 HP (Ref. 5.31). The brake horsepower is 34.5.

The heat released from the fan and the 34.5 BHP motor is 98,435 Btuh (REF. 5.12, pg 26.8).

For LOCA (summer) condition, the air flow rate is 32,063 / 2 or 16,031 CFM per AHU (See Appendix 2).

7.5 (cont'd):

Therefore, ΔTfan = 98,435 / (1.08 x 16,031 CFM) = 5.69 ^{0}F. Since the steam injection system could also be in service during this mode (no concurrent LOOP), the same total temperature rise as in the normal cooling mode of 6.1°F was used (see Section 7.4 above). The spreadsheets of Sections 7.10 and 7.11 both reflect a temperature rise of 6.1° F.

For the LOOP winter operating condition, the steam injection system was not modeled as functioning since it is non-safety-related and not backed by diesel power. Therefore, ΔTfan = 98,435 / (1.08 x 20,316 CFM) = 4.5^{0}F. The spreadsheet of Section 7.13 incorporates this equation in computing the supply air temperature to the rooms.

7.6 Supply Air Temperature Rise through Heaters

7.6.1 144 KW outside air heater (0-HTR-31-421)
At 100% operation the 144 KW heater maintains the incoming outside air at ≥ 60 ^{0}F per Ref. 5.1, Section 3.1.5.

7.6.2 20 KW duct heater to El. 692.0 rooms (0-HTR-31-83) – located in room C2, El. 692.0
At 100% heater operation the air temperature rise is:
(20KW x 3413 Btuh / KW) / (1.08 x 14,787 CFM) = 4.27^{0}F (This equation is programmed into spreadsheet Section 7.12)

7.6.3 10 KW duct heater to EL.708.0, Auxiliary Instrument Rm #1 – C1 (1-HTR-31-85)
At 100% heater operation the air temperature rise is:
(10KW x 3413 Btuh / KW) / (1.08 x 8,602CFM) = 3.67^{0}F (This equation is programmed into spreadsheet Section 7.12)

7.6.4 10KW duct heater to EL.708.0, Computer Rm – C3 (0-HTR-31-85)
Note:
The 10 KW duct heater can vary from 100% to 0% operation depending on the room temperature.

At 100% heater operation the air temperature rise is:
(10KW x 3413 Btuh / KW) / (1.08 x 6,677cfm) = 4.73^{0}F

Note: This heater was not credited in the evaluation of normal operation during winter conditions since the room temperature was acceptable without the heater and without the supplemental coolers during this mode. However, the equation is programmed into the spreadsheet with a percent operation value of zero.)

7.6 (cont'd)

7.6.5 10 KW duct heater to EL 708.0, Auxiliary Instrument Rm # 2 – C4 (2-HTR-31-89)
Note:
The 10 KW duct heater can vary from 100% to 0% operation depending on the room temperature.

At 100% heater operation the temperature rise is:
(10KW x 3413 Btuh / KW) / (1.08 x 9,268CFM) = 3.41^{0}F. (This equation is programmed into spreadsheet Section 7.12).

7.7 Supplemental AHUs

Both the communication room and computer room are equipped with non-safety-related supplemental cooling units. Communication room supplemental cooling is provided by two air conditioning units (See Attachment 4) located within the room. See N3-30CB-4002, Section 3.1.11 (Ref. 5.1). The computer room has supplemental cooling provided by two AHUs (See Attachment 5), located in the corridor which receive chilled water from the EBR chillers (See N3-30CB-4002, Section 3.1.12, Ref. 5.1). Only the computer room supplemental AHUs were integrated into the Excel spreadsheets. See Attachments 5 and 11 and Appendix 4 for the computer room supplemental AHU coil parameter used in AIRCOOL Program. The computer room supplemental cooling units were credited in spreadsheet sections 7.8, 7.9, and 7.11. A 2.63°F temperature rise (see below) was added to the AIRCOOL predicted off-coil temperature to account for motor and fan heat addition. This is based on assuming both the AHU fan and motor are within the air stream and are both downstream of the cooling coil. (It should be noted that each computer room supplemental cooling AHU motor is mounted externally to the unit. Therefore, heat from the motor will not go directly into the air stream. Assuming the motor heat is within the air stream is conservative since it results in a slightly higher supply air temperature). The temperature rise was computed based on the equation presented in Section 7.2 as follows:

Motor BHP = 7.5 hp = 22,700 Btu/hr (motor in driven equipment in) (Atts. 5, 11, and table 24, page 26.25 of Ref. 5.24)
Air flow rate = 8,000 cfm (Ref. 5.2)
Air density factor = 1.08 (density factor for air at approximately 70 °F)

Temp Rise = 22,700 Btu/hr/(1.08*8,000) = 2.63°F.

7.8 Chilled Water Pump Heat Load

The heat load transferred to the chilled water via the chilled water pump and rejected to the chiller is determined using the following equation:

Q = 2545 x BHP where BHP = 14 (Ref. 5.61, Table 7.1)

Thus Q = 35700 Btu/h or 2.975 TON

7.8 NORMAL OPERATION (SUMMER CASE 1)

NORMAL OPERATION (SUMMER - CASE 1) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 2
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- MINIMUM CHILLED WATER FLOW RATES OF 216 GPM TO EACH EBR AHU
- MAXIMUM CHILLED WATER SUPPLY TEMPERATURE OF 48°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.5
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU RUNNING

This case conservatively minimizes the cooling capability of the EBR AHUs by modeling the minimum chilled water flow rate concurrent with maximum chilled water temperature. This case also conservatively maximizes the predicted room temperatures. The EXCEL spreadsheet (see pg.7.8.2 to.7.8.24) and AIRCOOL models (see pg.7.8.25 to 7.8.30) were iterated until the mixed return air temperature (both dry and wet bulb) to the AHU coils calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equates to approximately Tr = 76.1°F (see pgs. 7.8.24 & 7.8.27) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

Tz = 51.07 °F (estimated air side outlet temperature for each EBR AHU based on the AIRCOOL model; see pg. 7.8.27)

Δt = 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.4)

Ts = Tz + Δt = 57.2 °F

Since the computer room supplemental AHU is also credited in this normal cooling mode, an AIRCOOL model of this unit is included in this section (see pg. 7.8.28 to 7.8.30). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet. These values are approximately 70°F and 50% relative humidity.

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 77.0 °F
Design Rm Humidity %: 20-60
Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (FT)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	77.0	-9.0	-378
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	77.0	-9.0	-423
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	77.0	-9.0	-207
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	104.0	77.0	27.0	1,535
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	77.0	27.0	456
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	74.5	77.0	-2.5	-248
EAST	Door C2	8.0	7.2	57.6	0.448	74.5	77.0	-2.5	-65
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.5	77.0	-4.5	-139
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	77.0	-9.0	-462
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	77.0	33.0	19,868
					TOTAL TRANSMISSION LOAD =				19,939

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0	X 250	=	0
	ELECTRICAL LOAD			=	11,356
TOTAL ROOM SENSIBLE LOAD:					**31,295**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
Flow Rate (cfm)	3574	984
Temperature, °F	74.5	57.2

Total flow = 4,558 cfm
Supply air temperature: 70.8 °F

ROOM TEMPERATURE (Tr) = (Ts 70.8) + (Q 31,295 / (1.08 x CFM 4,558) = 77.1 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
Flow Rate (cfm)	3574	984
Humidity ratio	0.0084	0.0084

Total flow = 4,558 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **77.0 °F dry bulb**
43 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 74.5 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	77.0	74.5	2.5	251
WEST	Door C2	7.2	8.0	57.6	0.448	77.0	74.5	2.5	65
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	77.0	74.5	2.5	549
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	73.4	74.5	-1.1	-56
SOUTH	Door C3	7.2	8.0	57.6	0.448	73.4	74.5	-1.1	-28
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.5	74.5	-2.0	-225
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	74.5	29.5	862
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	74.5	29.5	1,577
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	74.5	-6.5	-167
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	78.4	74.5	3.9	1,176
					TOTAL TRANSMISSION LOAD =				4,004

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,467
TOTAL ROOM SENSIBLE LOAD:					**8,471**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
Flow Rate (cfm)	3344	230
Temperature, °F	73.4	57.2

Total flow = 3,574 cfm
Supply air temperature: 72.4 °F

ROOM TEMPERATURE (Tr) = (Ts 72.4) + (Q 8,471 /(1.08 x CFM 3,574) = 74.6 °F

LATENT LOAD: Q latent

PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
Flow Rate (cfm)	3344	230
Humidity ratio	0.0084	0.0084

Total flow = 3,574 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **74.5 °F dry bulb, 47 % RH**

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 73.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 77.0 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.8	77.0	-4.2	-923
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	74.5	77.0	-2.5	-549
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	73.4	77.0	-3.6	-510
SOUTH	Door C4	7.2	3.7	26.6	0.448	73.4	77.0	-3.6	-43
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	77.0	27.0	622
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	77.0	27.0	1,311
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	77.0	-9.0	-182
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	78.4	77.0	1.4	331
					TOTAL TRANSMISSION LOAD =				59

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: **3,882**

ROOM TEMPERATURE (Tr) = (Ts 73.4) + (Q 3,882 / (1.08 x CFM 990) = 77.0 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	77.0 °F dry bulb 44 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2430 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 72.8 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	73.4	72.8	0.6	88
SOUTH	Door C5	7.2	6.3	45.2	0.448	73.4	72.8	0.6	12
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	72.8	31.2	2,426
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	72.0	72.8	-0.8	-176
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	77.0	72.8	4.2	923
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	72.8	-4.8	-105
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	78.4	72.8	5.6	1,439
					TOTAL TRANSMISSION LOAD =				4,607

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	36,558
TOTAL ROOM SENSIBLE LOAD:					**41,165**

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 41,165 / (1.08 x CFM 2,430)) = 72.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2430) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.8 °F dry bulb**
	51 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2610 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 72.0 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	73.4	72.0	1.4	236
SOUTH	Door C6	7.2	6.3	45.2	0.448	73.4	72.0	1.4	28
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	72.0	32.0	2,036
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	72.0	32.0	787
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	75.8	72.0	3.8	835
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.8	72.0	0.8	176
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	72.0	-4.0	-99
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.376	69.3	72.0	-2.7	-778
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	78.4	72.0	6.4	371
					TOTAL TRANSMISSION LOAD =				3,592

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:				
PEOPLE	0	X 250	=	0
ELECTRICAL LOAD			=	38,540
TOTAL ROOM SENSIBLE LOAD:				**42,132**

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 42,132 / (1.08 x CFM 2,610) = 72.1 °F

LATENT LOAD:			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2610) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.0 °F dry bulb**
	51 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 73.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 75.8 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	73.4	75.8	-2.4	-340
SOUTH	Door C7	7.2	3.7	26.5	0.448	73.4	75.8	-2.4	-29
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	75.8	28.2	1,760
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	75.8	28.2	260
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.9	75.8	-0.9	-198
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	72.0	75.8	-3.8	-835
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	75.8	-7.8	-157
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	70.7	75.8	-5.1	-441
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.376	69.3	75.8	-6.5	-1,286
					TOTAL TRANSMISSION LOAD =				-1,265

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X 250	=	0
ELECTRICAL LOAD			=	3,823
TOTAL ROOM SENSIBLE LOAD:				**2,558**

ROOM TEMPERATURE (Tr) = (Ts 73.4) + (Q 2,558 / (1.08 x CFM 990) = 75.8 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	75.8 °F dry bulb 45 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 73.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 74.9 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	73.4	74.9	-1.5	-94
SOUTH	Door C8	7.2	3.7	26.5	0.448	73.4	74.9	-1.5	-18
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	74.9	29.1	1,011
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	74.6	74.9	-0.3	-66
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	75.8	74.9	0.9	198
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	74.9	-6.9	-68
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	70.7	74.9	-4.2	-594
					TOTAL TRANSMISSION LOAD =				369

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	373
TOTAL ROOM SENSIBLE LOAD:					**742**

	Ts		Q	CFM		
ROOM TEMPERATURE (Tr) = (	73.4	) + (	742	/(1.08 x 440)	=	75.0 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = **0.0084**

STEADY STATE ROOM CONDITIONS:	74.9 °F dry bulb 47 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 724 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 74.6 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	73.4	74.6	-1.2	-128
SOUTH	Door C9	7.2	3.7	26.5	0.448	73.4	74.6	-1.2	-14
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	74.6	29.4	1,627
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.3	74.6	6.7	914
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.7	74.6	0.1	8
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.9	74.6	0.3	66
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	74.6	-6.6	-103
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	70.7	74.6	-3.9	-879
					TOTAL TRANSMISSION LOAD =				1,491

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	12,248
TOTAL ROOM SENSIBLE LOAD:					**13,739**

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 13,739 / (1.08 x CFM 724)) = 74.7 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 724) = **0.0084**

STEADY STATE ROOM CONDITIONS:	74.6 °F dry bulb 47 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 76.6 °F
Design Rm Humidity %: 18-60
Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.3	76.6	4.7	641
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.7	76.6	-1.9	-158
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	80.8	76.6	4.2	422
EAST	Door C11	7.2	8.0	57.4	0.448	80.8	76.6	4.2	108
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	73.4	76.6	-3.2	-444
SOUTH	Door C10	7.2	8.0	57.4	0.448	73.4	76.6	-3.2	-82
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	72.0	76.6	-4.6	-546
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	104.0	76.6	27.4	1,685
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	104.0	76.6	27.4	1,937
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	76.6	-8.6	-320
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	70.7	76.6	-5.9	-2,577
							TOTAL TRANSMISSION LOAD =		664

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	28,419
TOTAL ROOM SENSIBLE LOAD:					**29,583**

SUPPLIMENTAL AIR HANDLING UNIT: Not credited in consideration of room temp **0**

NET ROOM SENSIBLE LOAD: **29,583**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
Flow Rate (cfm)	1107	1665
Temperature, °F	81.3	57.2

Total flow = 2,772 cfm
Supply air temperature: 66.8 °F

ROOM TEMPERATURE (Tr) = (Ts 66.8) + (Q 29,583 /(1.08 x CFM 2,772) = 76.7 °F

LATENT LOAD:

				Q latent
PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
Flow Rate (cfm)	1107	1665
Humidity ratio	0.0084	0.0084

Total flow = 2,772 cfm
Wr' = 0.0084 # moist / # dry air
Wr = 0.0084 + 400 /(4840 x 2,772) = **0.0084**

STEADY STATE ROOM CONDITIONS: **76.6 °F dry bulb**
47 % RH

This page replaced by Revision 20.

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2673 cfm (Supply from AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 80.8 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	80.8	-12.8	-538
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	80.8	-12.8	-602
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	80.8	-12.8	-282
NORTH	692.0' - AB/A27, 42" Cl	21.0	14.5	304.5	0.212	104.0	80.8	23.2	1,498
NORTH	692.0' - AB/A29, 42" Cl	4.0	14.5	58.0	0.212	104.0	80.8	23.2	285
WEST*	692.0' - C9, 36" Cl	33.0	14.5	420.9	0.236	76.6	80.8	-4.2	-417
WEST	Door C11	8.0	7.2	57.6	0.448	76.6	80.8	-4.2	-108
WEST	692.0' - Stair C2, 36" Cl	9.0	14.5	130.5	0.236	72.0	80.8	-8.8	-271
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	80.8	-12.8	-657
CEILING	708.0 - TB/T1, 18" Cl	42.0	47.0	1974.0	0.305	110.0	80.8	29.2	17,580
					TOTAL TRANSMISSION LOAD =				16,489

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	52,014
TOTAL ROOM SENSIBLE LOAD:					**68,503**

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 68,503 / (1.08 x CFM 2,673) = 80.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2673) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**80.8 °F dry bulb**
	38 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 73.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	73.4	-5.4	-977
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	74.5	73.4	1.1	56
NORTH	Door C3	7.2	8.0	57.4	0.448	74.5	73.4	1.1	28
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	77.0	73.4	3.6	510
NORTH	Door C4	7.2	3.7	26.5	0.448	77.0	73.4	3.6	43
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	72.8	73.4	-0.6	-88
NORTH	Door C5	7.2	6.3	45.2	0.448	72.8	73.4	-0.6	-12
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	72.0	73.4	-1.4	-236
NORTH	Door C6	7.2	6.3	45.2	0.448	72.0	73.4	-1.4	-28
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	75.8	73.4	2.4	340
NORTH	Door C7	7.2	3.7	26.5	0.448	75.8	73.4	2.4	29
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	74.9	73.4	1.5	94
NORTH	Door C8	7.2	3.7	26.5	0.448	74.9	73.4	1.5	18
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	74.6	73.4	1.2	128
NORTH	Door C9	7.2	3.7	26.5	0.448	74.6	73.4	1.2	14
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	81.3	73.4	7.9	279
NORTH	Door C13	7.2	3.0	21.5	0.448	81.3	73.4	7.9	76
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	74.7	73.4	1.3	36
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	76.6	73.4	3.2	425
NORTH	Door C10	7.2	8.0	57.4	0.448	76.6	73.4	3.2	82
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	72.0	73.4	-1.4	-60
EAST	Door C12	7.2	3.0	21.5	0.448	72.0	73.4	-1.4	-13
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.5	73.4	-0.9	-39
WEST	Door C1	7.2	3.0	21.5	0.448	72.5	73.4	-0.9	-9
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	73.4	-5.4	-203
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	78.4	73.4	5.0	830
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	89.4	73.4	16.0	1,523
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	70.7	73.4	-2.7	-601
					TOTAL TRANSMISSION LOAD =				2,242

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:					**5,150**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8.

Room	C4	C5	C8
Flow Rate (cfm)	2430	2610	724
Temperature, °F	72.8	72.0	74.6

Total flow = 5,764 cfm
Supply air temperature: 72.7 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	72.7	) + (	5,150	/(1.08 x	5,764	) =	73.5 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
Flow Rate (cfm)	2430	2610	724
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 5,764 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 73.4 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1107 cfm (Supply from AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 81.3 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	76.6	81.3	-4.7	-641
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	74.6	81.3	-6.7	-914
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	73.4	81.3	-7.9	-279
SOUTH	Door C13	7.2	3.0	21.5	0.448	73.4	81.3	-7.9	-76
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	81.3	22.7	346
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	104.0	81.3	22.7	130
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	81.3	-13.3	-127
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	74.7	81.3	-6.6	-798
					TOTAL TRANSMISSION LOAD =				-2,357

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	31,069
TOTAL ROOM SENSIBLE LOAD:					**28,962**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	57.2	) + (	28,962	/(1.08 x	1,107	) =	81.4 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 1,107) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**81.3 °F dry bulb**
	38 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - N/A Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: ATTIC (above C12)

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 74.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	76.6	74.7	1.9	158
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	74.6	74.7	-0.1	-8
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	73.4	74.7	-1.3	-36
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	74.7	29.3	273
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	104.0	74.7	29.3	102
FLOOR	692.0 - C12	11.0	33.3	366.3	0.330	81.3	74.7	6.6	798
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	70.7	74.7	-4.0	-447
					TOTAL TRANSMISSION LOAD =				841

STEADY STATE ROOM CONDITIONS:	74.7 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 72.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	77.0	72.5	4.5	123
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.5	-4.5	-1,175
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	74.5	72.5	2.0	225
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	73.4	72.5	0.9	39
EAST	Door C1	7.2	3.0	21.5	0.448	73.4	72.5	0.9	9
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.5	-4.5	-17
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-796

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**187**

STEADY STATE ROOM CONDITIONS:	72.5 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 72.0 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	73.4	72.0	1.4	60
WEST	Door C12	7.2	3.0	21.5	0.448	73.4	72.0	1.4	13
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.0	-4.0	-1,044
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	76.6	72.0	4.6	546
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	80.8	72.0	8.8	241
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.0	-4.0	-15
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-198

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								785

STEADY STATE ROOM CONDITIONS:	72.0 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 7038 cfm (Supply from AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 78.4 °F Design Rm Temp: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	110.0	78.4	31.6	9,918
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	91.3	78.4	12.9	2,264
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	104.0	78.4	25.6	787
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	104.0	78.4	25.6	560
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	104.0	78.4	25.6	455
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	104.0	78.4	25.6	5,433
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	104.0	78.4	25.6	1,450
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	104.0	78.4	25.6	1,450
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	89.4	78.4	11.0	621
EAST	Door C22	7.2	6.00	43.0	0.448	89.4	78.4	11.0	212
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	69.3	78.4	-9.1	-2,449
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	110.0	78.4	31.6	4,827
WEST	Door C20	7.3	3.50	25.6	0.448	110.0	78.4	31.6	362
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	91.3	78.4	12.9	748
WEST	Door C21	7.2	3.00	21.5	0.448	91.3	78.4	12.9	124
FLOOR	692.0' - C2, 18" CI			989.0	0.305	74.5	78.4	-3.9	-1,176
FLOOR	692.0' - C3, 18" CI			775.9	0.305	77.0	78.4	-1.4	-331
FLOOR	692.0' - C4, 18" CI			842.5	0.305	72.8	78.4	-5.6	-1,439
FLOOR	692.0' - C5, 18" CI			189.8	0.305	72.0	78.4	-6.4	-371
FLOOR	692.0' - C11, 18" CI			544.0	0.305	73.4	78.4	-5.0	-830
CEILING	729.0 - C1, 18" CI			3341.2	0.305	95.0	78.4	16.6	16,916
					TOTAL TRANSMISSION LOAD =				39,530

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	122,026
TOTAL ROOM SENSIBLE LOAD:					**162,056**

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 162,056 /(1.08 x CFM 7,038) = 78.5 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 400 / (4840 x 7,038) = **0.0084**

STEADY STATE ROOM CONDITIONS:	78.4 °F dry bulb 41 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 89.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	70.7	89.4	-18.7	-1,056
EAST	Door C24	7.2	6.0	43.0	0.448	70.7	89.4	-18.7	-360
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	78.4	89.4	-11.0	-621
WEST	Door C22	7.2	6.0	43.0	0.448	78.4	89.4	-11.0	-212
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	110.0	89.4	20.6	3,579
SOUTH	Door C26	7.2	3.4	24.4	0.448	110.0	89.4	20.6	225
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	69.3	89.4	-20.1	-7,211
NORTH	Door C23	7.2	6.0	43.0	0.448	69.3	89.4	-20.1	-387
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	312.0	0.305	73.4	89.4	-16.0	-1,523
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	312.0	0.305	95.0	89.4	5.6	533
					TOTAL TRANSMISSION LOAD =				-7,034

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	1,085.0	X	3.413	X	100%	=	3,703
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								309

STEADY STATE ROOM CONDITIONS:	89.4 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity: 40-60
Steady State Temperature: 69.3 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	89.4	69.3	20.1	7,211
SOUTH	Door C23	7.2	6.0	43.0	0.448	89.4	69.3	20.1	387
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	69.3	34.7	1,118
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	104.0	69.3	34.7	5,110
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	70.7	69.3	1.4	455
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	78.4	69.3	9.1	2,955
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	765.9	0.376	72.0	69.3	2.7	778
FLOOR	692.0' - C6, 18" CI	[illegible]	[illegible]	526.1	0.376	75.8	69.3	6.5	1,286
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	1292.0	0.305	95.0	69.3	25.7	10,128
					TOTAL TRANSMISSION LOAD =				29,426

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	2	X	250		=	500
ELECTRICAL LOAD					=	91,816
TOTAL ROOM SENSIBLE LOAD:						**121,742**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5367	8000	
Temperature, °F	57.2	63.5	(See below)

Total flow = 13,367 cfm
Supply air temperature: 60.9 °F

Note: Calculated temperature from the AIRCOOL program (see pg.7.8.30): 60.82 °F
Temperature rise due to motor (see Section 7.7): 2.6 °F
Supplemental AHU supply temperature : 60.82) + (2.63) = 63.45 °F

ROOM TEMPERATURE (Tr) = (Ts 60.9) + (Q 121,742 /(1.08 x CFM 13,367) = 69.4 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5,367	8,000	
Humidity ratio	0.0084	0.0080	← See pg. 7.8.30

Total flow = 13,367 cfm
Wr' = 0.0082 # moist / # dry air
Wr = 0.0082 + 400 /(4840 x 13,367) = **0.0082**

STEADY STATE ROOM CONDITIONS: **69.3 °F dry bulb**
54 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7236 cfm (Supply from AHU)
AHU Supply Air Temp: 57.2 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 70.7 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	110.0	70.7	39.3	13,582
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	85.3	70.7	14.6	2,562
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	104.0	70.7	33.3	1,155
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	104.0	70.7	33.3	715
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	104.0	70.7	33.3	605
NORTH	713.0' - Ion, fltr rm, 36" CI	42.0	16.00	672.0	0.236	104.0	70.7	33.3	5,281
NORTH	713'-AB Gen Area, 36" CI	48.0	16.00	768.0	0.236	104.0	70.7	33.3	6,036
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	69.3	70.7	-1.4	-471
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	89.4	70.7	18.7	1,056
WEST	Door C24	7.2	6.0	43.0	0.448	89.4	70.7	18.7	360
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	110.0	70.7	39.3	6,240
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	85.3	70.7	14.6	846
EAST	Door C25	7.2	3.0	21.5	0.448	85.3	70.7	14.6	141
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.376	75.8	70.7	5.1	441
FLOOR	692.0' - C11, 18" CI	74.0	8.0	592.0	0.376	73.4	70.7	2.7	601
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.376	74.9	70.7	4.2	594
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.376	74.6	70.7	3.9	879
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	74.7	70.7	4.0	447
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.305	76.6	70.7	5.9	2,577
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	3595.7	0.305	95.0	70.7	24.3	26,649
					TOTAL TRANSMISSION LOAD =				70,297

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250		=	250
ELECTRICAL LOAD					=	35,318
TOTAL ROOM SENSIBLE LOAD:						**105,865**

	Ts	Q	CFM
ROOM TEMPERATURE (Tr) =	57.2	+ 105,865	/(1.08 x 7,236) = 70.7 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 7,236) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**70.7 °F dry bulb**
	54 % RH

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 91.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	91.3	18.7	688
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	91.3	18.7	1,549
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	78.4	91.3	-12.9	-2,264
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	78.4	91.3	-12.9	-748
EAST	Door C21	7.2	3.0	21.5	0.448	78.4	91.3	-12.9	-124
FLOOR (See Note)	[illegible]								
CEILING (See Note)	[illegible]								
								TOTAL TRANSMISSION LOAD =	-899

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

	PEOPLE	0	X	250			=	0
	LIGHTING (See page 45)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								84

STEADY STATE ROOM CONDITIONS:	91.3 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 85.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	85.3	24.7	909
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	85.3	24.7	2,046
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	70.7	85.3	-14.6	-2,562
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	70.7	85.3	-14.6	-982
WEST	Door C25	7.2	3.0	21.5	0.448	70.7	85.3	-14.6	-141
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-729

Note: No transmission through the fllor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING (See page 46)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**254**

STEADY STATE ROOM CONDITIONS:	85.3 °F dry bulb

7.8 NORMAL OPERATION (SUMMER CASE 1)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

ROOM	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2673	80.8	0.0084	22.5	215,978
COMMUNICATION ROOM (692.0' - C9)	2772	76.6	0.0084	23.4	212,335
MECHANICAL EQUIP. ROOM WEST (C1)	4558	77.0	0.0084	38.3	350,928
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	7038	78.4	0.0084	59.2	551,779
COMPUTER ROOM (708.0' - C3)	5367	69.3	0.0082	43.8	371,933
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7236	70.7	0.0084	60.8	511,550
OUTSIDE AIR	2420	95.0	0.0133	32.2	229,900
TOTAL	Vreturn = 32,063			280.2	2,444,403

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn:	Treturn = 76.2 °F
Return Air Humidity Ratio from EBR spaces:	Wreturn = 0.0087 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:58:28 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:58:28 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:58:28 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	45.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	16032.00
Inlet Temperature (degrees F):	48.00	76.00
Outlet Temperature (degrees F):	52.39	51.07
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1826.81	10.15
Clean Pressure Drop (psi):	32.88	Not Calculated
Fouled Pressure Drop (psi):	39.32	Not Calculated
Velocity (ft/s and ft/min):	9.93	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 475335/ 426751/ 48584 Btu/hr
Average Overall Heat Transfer Coefficient: 7.01 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 51.07 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, November 08, 2002 at 12:53:13 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

CALC I.D. EPM-MCP-07 6B9 R14
Sheet 7.8.29

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, November 08, 2002 at 12:53:13 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, November 08, 2002 at 12:53:13 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: Supp 2
DATE: 11-08-02
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	68.89
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	48.00	70.00
Outlet Temperature (degrees F):	55.20	60.82
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	722.79	12.07
Clean Pressure Drop (psi):	2.11	Not Calculated
Fouled Pressure Drop (psi):	2.51	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 79460/ 79460/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 7.11 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 50.59 deg F

7.9 NORMAL OPERATION (SUMMER CASE 2)

NORMAL OPERATION (SUMMER - CASE 2) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTIONS 6.9 & 7.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 2
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.5
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU RUNNING
- HEATERS 0-HTR-31-83 (SUPPLY AIR TO ROOMS @ EL. 692) AND 0-HTR-31-85 (COMPUTER ROOM) ARE RUNNING SINCE THE PRELIMINARY ANALYSIS INDICATED THAT TEMPERATURE IN ROOM C9, EL. 692.0 AND ROOM C3, EL. 708.0 WILL FALL BELOW THE TEMPERATURE SWITCHES SETPOINT TEMPERATURE OF 68 °F, THUS THE HEATERS WILL BE RUNNING.

This case conservatively maximizes the cooling capability of the EBR AHUs by modeling the maximum chilled water flow rate concurrent with minimum chilled water temperature. This case was performed to conservatively predict the maximum load on the chillers during normal summer time operation since this value is reported in the system description (Ref. 5.1) Table 9.6.

The EXCEL spreadsheet (see pg.7.9.2 to.7.9.24) and AIRCOOL models (see pg. 7.9.25 to 7.9.30) were iterated until the return mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equates to approximately Tr = 73.8°F (see pg.7.9.24) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$T_{Z(B\text{-}A)}$ = 45.79 °F (estimated air side outlet temperature for EBR AHU B-A based on the AIRCOOL model; see pg. 7.9.30)

$T_{Z(A\text{-}A)}$ = 46.13 °F (estimated air side outlet temperature for EBR AHU A-A based on the AIRCOOL model; see pg. 7.9.27)

Tz = 46.0 °F (calculated average air temperature just downstream of coil)

Δt = 6.1 °F (total air temperature rise thru AHU including fan/motor and steam injection temperature rise; see Section 7.4)

$Ts = Tz + \Delta t$ = 52.1 °F

Since the computer room supplemental AHU is also credited in this normal cooling mode, an AIRCOOL model of this unit is included in this section (see pg. 7.9.31 to 7.9.33). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet. These values are approximately 65.7°F and 59.3% relative humidity.

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 75.8 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (FT)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	75.8	-7.8	-328
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	75.8	-7.8	-367
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	75.8	-7.8	-179
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	104.0	75.8	28.2	1,604
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	75.8	28.2	477
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	74.1	75.8	-1.7	-169
EAST	Door C2	8.0	7.2	57.6	0.448	74.1	75.8	-1.7	-44
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.5	75.8	-3.3	-102
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	75.8	-7.8	-400
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	75.8	34.2	20,591
					TOTAL TRANSMISSION LOAD =				21,083

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0	X 250	=	0
	ELECTRICAL LOAD			=	11,356
TOTAL ROOM SENSIBLE LOAD:					32,439

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
Flow Rate (cfm)	3574	984
Temperature, °F	74.1	52.1

Total flow = 4,558 cfm
Supply air temperature: 69.3 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	69.3	) + (	32,439	/(1.08 x	4,558	) =	75.9 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
Flow Rate (cfm)	3574	984
Humidity ratio	0.0084	0.0084

Total flow = 4,558 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **75.8 °F dry bulb**
45 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 74.1 °F
Design Rm Humidity %: 20-60
Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	75.8	74.1	1.7	171
WEST	Door C2	7.2	8.0	57.6	0.448	75.8	74.1	1.7	44
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	76.4	74.1	2.3	505
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	73.1	74.1	-1.0	-51
SOUTH	Door C3	7.2	8.0	57.6	0.448	73.1	74.1	-1.0	-26
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.5	74.1	-1.6	-180
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	74.1	29.9	874
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	74.1	29.9	1,598
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	74.1	-6.1	-157
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	74.7	74.1	0.6	181
					TOTAL TRANSMISSION LOAD =				2,959

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0 X	250	=	0
	ELECTRICAL LOAD			=	4,467
TOTAL ROOM SENSIBLE LOAD:					7,426

DUCT HTR (KW)	% Htr Opr	FLOW RATE	SUP. TEMP	HTR BTUR	SUPPLY TEMP
20 (See Sect. 7.6)	100	11,439	52.1	68260	57.6

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU	
Flow Rate (cfm)	3344	230	
Temperature, °F	73.1	57.6	(after heater)

Total flow = 3,574 cfm
Supply air temperature: 72.1 °F

ROOM TEMPERATURE (Tr) = (Ts 72.1) + (Q 7,426 /(1.08 x CFM 3,574) = 74.0 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
Flow Rate (cfm)	3344	230
Humidity ratio	0.0084	0.0084

Total flow = 3,574 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **74.1 °F dry bulb**
48 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 73.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 76.4 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.8	76.4	-3.6	-791
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	74.1	76.4	-2.3	-505
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	73.1	76.4	-3.3	-467
SOUTH	Door C4	7.2	3.7	26.6	0.448	73.1	76.4	-3.3	-39
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	76.4	27.6	636
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	76.4	27.6	1,341
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	76.4	-8.4	-169
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	74.7	76.4	-1.7	-402
					TOTAL TRANSMISSION LOAD =				-398

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**3,425**

ROOM TEMPERATURE (Tr) = (Ts 73.1) + (Q 3,425 / (1.08 x CFM 990)) = 76.3 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**76.4 °F dry bulb**
	43 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2430 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.6 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 72.8 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	73.1	72.8	0.3	44
SOUTH	Door C5	7.2	6.3	45.2	0.448	73.1	72.8	0.3	6
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	72.8	31.2	2,426
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	72.0	72.8	-0.8	-176
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	76.4	72.8	3.6	791
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	72.8	-4.8	-105
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	74.7	72.8	1.9	488
					TOTAL TRANSMISSION LOAD =				3,475

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	36,558
TOTAL ROOM SENSIBLE LOAD:					**40,033**

ROOM TEMPERATURE (Tr) = (Ts 57.6) + (Q 40,033) / (1.08 x CFM 2,430) = 72.8 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2430) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.8 °F dry bulb**
	49 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2610 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.6 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 72.0 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	73.1	72.0	1.1	186
SOUTH	Door C6	7.2	6.3	45.2	0.448	73.1	72.0	1.1	22
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	72.0	32.0	2,036
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	72.0	32.0	787
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	75.1	72.0	3.1	681
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.8	72.0	0.8	176
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	72.0	-4.0	-99
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.376	66.0	72.0	-6.0	-1,728
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	74.7	72.0	2.7	156
					TOTAL TRANSMISSION LOAD =				2,217

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	38,540
TOTAL ROOM SENSIBLE LOAD:					**40,757**

ROOM TEMPERATURE (Tr) = (Ts 57.6) + (Q 40,757 /(1.08 x CFM 2,610) = 72.0 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 /(4840 x 2610) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.0 °F dry bulb**
	49 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 73.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 75.1 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	73.1	75.1	-2.0	-283
SOUTH	Door C7	7.2	3.7	26.5	0.448	73.1	75.1	-2.0	-24
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	75.1	28.9	1,803
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	75.1	28.9	267
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.1	75.1	-1.0	-220
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	72.0	75.1	-3.1	-681
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	75.1	-7.1	-143
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	67.1	75.1	-8.0	-691
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.376	66.0	75.1	-9.1	-1,800
					TOTAL TRANSMISSION LOAD =				-1,773

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: **2,050**

ROOM TEMPERATURE (Tr) = (Ts 73.1) + (Q 2,050 /(1.08 x CFM 990) = 75.0 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	75.1 °F dry bulb 45 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 73.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 74.1 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	73.1	74.1	-1.0	-62
SOUTH	Door C8	7.2	3.7	26.5	0.448	73.1	74.1	-1.0	-12
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	74.1	29.9	1,039
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	74.2	74.1	0.1	22
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	75.1	74.1	1.0	220
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	74.1	-6.1	-60
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	67.1	74.1	-7.0	-990
					TOTAL TRANSMISSION LOAD =				156

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	373
TOTAL ROOM SENSIBLE LOAD:					**529**

ROOM TEMPERATURE (Tr) = (Ts 73.1) + (Q 529 / (1.08 x CFM 440) = 74.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**74.1 °F dry bulb**
	46 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 724 cfm (Supply from the AHU)
AHU Supply Air Temp: 57.6 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 74.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	73.1	74.2	-1.1	-117
SOUTH	Door C9	7.2	3.7	26.5	0.448	73.1	74.2	-1.1	-13
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	74.2	29.8	1,649
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.5	74.2	7.3	995
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.9	74.2	-0.3	-25
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.1	74.2	-0.1	-22
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	74.2	-6.2	-97
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	67.1	74.2	-7.1	-1,600
					TOTAL TRANSMISSION LOAD =				770

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	12,248
TOTAL ROOM SENSIBLE LOAD:					**13,018**

ROOM TEMPERATURE (Tr) = (Ts 57.6) + (Q 13,018) / (1.08 x CFM 724) = 74.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 724) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**74.2 °F dry bulb**
	46 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 18-60
Steady State Temperature: 76.5 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.5	76.5	5.0	682
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.9	76.5	-2.6	-217
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	81.1	76.5	4.6	462
EAST	Door C11	7.2	8.0	57.4	0.448	81.1	76.5	4.6	118
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	73.1	76.5	-3.4	-472
SOUTH	Door C10	7.2	8.0	57.4	0.448	73.1	76.5	-3.4	-87
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	72.1	76.5	-4.4	-523
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	104.0	76.5	27.5	1,691
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	104.0	76.5	27.5	1,944
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	76.5	-8.5	-316
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	67.1	76.5	-9.4	-4,105
					TOTAL TRANSMISSION LOAD =				-823

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:						
	PEOPLE	2	X	250	=	500
	ELECTRICAL LOAD				=	28,419
TOTAL ROOM SENSIBLE LOAD:						**28,096**
SUPPLIMENTAL AIR HANDLING UNIT:	Not credited in consideration of room temp					**0**
NET ROOM SENSIBLE LOAD:						**28,096**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU	
Flow Rate (cfm)	1107	1665	
Temperature, °F	81.5	57.6	(See supply temperature for room C2)
Total flow =	2,772 cfm		
Supply air temperature:	67.1 °F		

ROOM TEMPERATURE (Tr) = (Ts 67.1) + (Q 28,096 / (1.08 x CFM 2,772) = 76.5 °F

LATENT LOAD:

				Q latent
PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
Flow Rate (cfm)	1107	1665
Humidity ratio	0.0084	0.0084
Total flow =	2,772 cfm	
Wr ' =	0.0084 # moist / # dry air	
Wr =	0.0084 + 400 / (4840 x 2,772) =	**0.0084**

STEADY STATE ROOM CONDITIONS: **76.5 °F dry bulb**
47 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2673 cfm (Supply from AHU)
AHU Supply Air Temp: 57.6 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 81.1 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	81.1	-13.1	-550
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	81.1	-13.1	-616
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	81.1	-13.1	-288
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	104.0	81.1	22.9	1,478
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	104.0	81.1	22.9	282
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	76.5	81.1	-4.6	-457
WEST	Door C11	8.0	7.2	57.6	0.448	76.5	81.1	-4.6	-119
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	72.1	81.1	-9.0	-277
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	81.1	-13.1	-672
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	81.1	28.9	17,400
					TOTAL TRANSMISSION LOAD =				16,180

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	52,014
TOTAL ROOM SENSIBLE LOAD:					**68,194**

ROOM TEMPERATURE (Tr) = (Ts 57.6) + (Q 68,194 / (1.08 x CFM 2,673) = 81.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2673) = **0.0084**

STEADY STATE ROOM CONDITIONS:	81.1 °F dry bulb 36 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 73.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	73.1	-5.1	-923
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	74.1	73.1	1.0	51
NORTH	Door C3	7.2	8.0	57.4	0.448	74.1	73.1	1.0	26
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	76.4	73.1	3.3	467
NORTH	Door C4	7.2	3.7	26.5	0.448	76.4	73.1	3.3	39
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	72.8	73.1	-0.3	-44
NORTH	Door C5	7.2	6.3	45.2	0.448	72.8	73.1	-0.3	-6
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	72.0	73.1	-1.1	-186
NORTH	Door C6	7.2	6.3	45.2	0.448	72.0	73.1	-1.1	-22
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	75.1	73.1	2.0	283
NORTH	Door C7	7.2	3.7	26.5	0.448	75.1	73.1	2.0	24
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	74.1	73.1	1.0	62
NORTH	Door C8	7.2	3.7	26.5	0.448	74.1	73.1	1.0	12
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	74.2	73.1	1.1	117
NORTH	Door C9	7.2	3.7	26.5	0.448	74.2	73.1	1.1	13
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	81.5	73.1	8.4	296
NORTH	Door C13	7.2	3.0	21.5	0.448	81.5	73.1	8.4	81
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	73.9	73.1	0.8	22
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	76.5	73.1	3.4	452
NORTH	Door C10	7.2	8.0	57.4	0.448	76.5	73.1	3.4	87
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	72.1	73.1	-1.0	-43
EAST	Door C12	7.2	3.0	21.5	0.448	72.1	73.1	-1.0	-10
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.5	73.1	-0.6	-26
WEST	Door C1	7.2	3.0	21.5	0.448	72.5	73.1	-0.6	-6
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	73.1	-5.1	-192
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	74.7	73.1	1.6	265
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	87.6	73.1	14.5	1,380
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	67.1	73.1	-6.0	-1,336
					TOTAL TRANSMISSION LOAD =				886

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:					**3,794**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8.

Room	C4	C5	C8
Flow Rate (cfm)	2430	2610	724
Temperature, °F	72.8	72.0	74.2

Total flow = 5,764 cfm
Supply air temperature: 72.6 °F

ROOM TEMPERATURE (Tr) =	(	Ts	) + (	Q	/(1.08 x	CFM	) =	73.2 °F
		72.6		3,794		5,764		

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
Flow Rate (cfm)	2430	2610	724
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 5,764 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 73.1 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1107 cfm (Supply from AHU)
AHU Supply Air Temp: 57.6 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 81.5 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	76.5	81.5	-5.0	-682
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	74.2	81.5	-7.3	-995
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	73.1	81.5	-8.4	-296
SOUTH	Door C13	7.2	3.0	21.5	0.448	73.1	81.5	-8.4	-81
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	81.5	22.5	343
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	104.0	81.5	22.5	129
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	81.5	-13.5	-129
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	73.9	81.5	-7.6	-919
					TOTAL TRANSMISSION LOAD =				-2,629

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	31,069
TOTAL ROOM SENSIBLE LOAD:					**28,690**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	57.6	) + (	28,690	/(1.08 x	1,107	) =	81.6 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 1,107) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**81.5 °F dry bulb**
	37 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - N/A Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: ATTIC (above C12)

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 73.9 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	76.5	73.9	2.6	217
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	74.2	73.9	0.3	25
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	73.1	73.9	-0.8	-22
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	73.9	30.1	281
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	104.0	73.9	30.1	105
FLOOR	692.0 - C12	11.0	33.3	366.3	0.330	81.5	73.9	7.6	919
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	67.1	73.9	-6.8	-760
					TOTAL TRANSMISSION LOAD =				765

STEADY STATE ROOM CONDITIONS:	73.9 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 72.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	75.8	72.5	3.3	90
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.5	-4.5	-1,175
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	74.1	72.5	1.6	180
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	73.1	72.5	0.6	26
EAST	Door C1	7.2	3.0	21.5	0.448	73.1	72.5	0.6	6
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.5	-4.5	-17
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-889

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**94**

STEADY STATE ROOM CONDITIONS:	72.5 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 72.1 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	73.1	72.1	1.0	43
WEST	Door C12	7.2	3.0	21.5	0.448	73.1	72.1	1.0	10
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.1	-4.1	-1,070
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	76.5	72.1	4.4	523
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	81.1	72.1	9.0	246
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.1	-4.1	-15
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-264

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								719

STEADY STATE ROOM CONDITIONS:	72.1 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 7038 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 74.7 °F Design Rm Temp: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	110.0	74.7	35.3	11,079
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	89.2	74.7	14.5	2,545
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	104.0	74.7	29.3	900
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	104.0	74.7	29.3	641
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	104.0	74.7	29.3	520
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	104.0	74.7	29.3	6,218
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	104.0	74.7	29.3	1,660
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	104.0	74.7	29.3	1,660
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	87.6	74.7	12.9	729
EAST	Door C22	7.2	6.00	43.0	0.448	87.6	74.7	12.9	249
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	66.0	74.7	-8.7	-2,341
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	110.0	74.7	35.3	5,392
WEST	Door C20	7.3	3.50	25.6	0.448	110.0	74.7	35.3	404
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	89.2	74.7	14.5	840
WEST	Door C21	7.2	3.00	21.5	0.448	89.2	74.7	14.5	140
FLOOR	692.0' - C2, 18" Cl			989.0	0.305	74.1	74.7	-0.6	-181
FLOOR	692.0' - C3, 18" Cl			775.9	0.305	76.4	74.7	1.7	402
FLOOR	692.0' - C4, 18" Cl			842.5	0.305	72.8	74.7	-1.9	-488
FLOOR	692.0' - C5, 18" Cl			189.8	0.305	72.0	74.7	-2.7	-156
FLOOR	692.0' - C11, 18" Cl			544.0	0.305	73.1	74.7	-1.6	-265
CEILING	729.0 - C1, 18" Cl			3341.2	0.305	95.0	74.7	20.3	20,687
					TOTAL TRANSMISSION LOAD =				50,633

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	122,026
TOTAL ROOM SENSIBLE LOAD:					**173,159**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 173,159 / (1.08 x CFM 7,038) = 74.8 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 400 / (4840 x 7,038) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**74.7 °F dry bulb**
	44 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 87.6 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	67.1	87.6	-20.5	-1,158
EAST	Door C24	7.2	6.0	43.0	0.448	67.1	87.6	-20.5	-395
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	74.7	87.6	-12.9	-729
WEST	Door C22	7.2	6.0	43.0	0.448	74.7	87.6	-12.9	-249
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	110.0	87.6	22.4	3,891
SOUTH	Door C26	7.2	3.4	24.4	0.448	110.0	87.6	22.4	245
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	66.0	87.6	-21.6	-7,749
NORTH	Door C23	7.2	6.0	43.0	0.448	66.0	87.6	-21.6	-416
FLOOR	692.0' - C11, 18" CI			312.0	0.305	73.1	87.6	-14.5	-1,380
CEILING	729.0 - C1, 18" CI			312.0	0.305	95.0	87.6	7.4	704
					TOTAL TRANSMISSION LOAD =				-7,235

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	1,085.0	X	3.413	X	100%	=	3,703
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**108**

STEADY STATE ROOM CONDITIONS:	87.6 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 66.0 °F
Design Rm Humidity: 40-60
Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	87.6	66.0	21.6	7,749
SOUTH	Door C23	7.2	6.0	43.0	0.448	87.6	66.0	21.6	416
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	66.0	38.0	1,224
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	104.0	66.0	38.0	5,596
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	67.1	66.0	1.1	357
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	74.7	66.0	8.7	2,825
FLOOR	692.0' - C5, 18" CI			765.9	0.376	72.0	66.0	6.0	1,728
FLOOR	692.0' - C6, 18" CI			526.1	0.376	75.1	66.0	9.1	1,800
CEILING	729.0 - C1, 18" CI			1292.0	0.305	95.0	66.0	29.0	11,428
					TOTAL TRANSMISSION LOAD =				33,123

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	91,816
TOTAL ROOM SENSIBLE LOAD:					**125,439**

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.8)	100	5367	52.1	34130	57.9

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5367	8000	
Temperature, °F	57.9	57.06	(See below)

Total flow = 13,367 cfm
Supply air temperature: 57.4 °F

Note: Calculated temperature from the AIRCOOL program (see pg.7.9.33): 54.43 °F
Temperature rise due to motor (see Section 7.7): 2.63 °F
Supplemental AHU supply temperature : 54.43) + (2.63) = 57.06 °F

ROOM TEMPERATURE (Tr) = (Ts 57.4) + (Q 125,439) / (1.08 x CFM 13,367) = 66.1 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5,367	8,000	
Humidity ratio	0.0084	0.0082	← See pg. 7.9.33

Total flow = 13,367 cfm
Wr' = 0.0083 # moist / # dry air
Wr = 0.0083 + 400 / (4840 x 13,367) = **0.0083**

STEADY STATE ROOM CONDITIONS: **66.0 °F dry bulb**
58 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7236 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 67.1 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	110.0	67.1	42.9	14,827
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	83.1	67.1	16.0	2,808
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	67.1	36.9	1,280
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	104.0	67.1	36.9	792
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	104.0	67.1	36.9	671
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	104.0	67.1	36.9	5,852
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	104.0	67.1	36.9	6,688
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	66.0	67.1	-1.1	-370
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	87.6	67.1	20.5	1,158
WEST	Door C24	7.2	6.0	43.0	0.448	87.6	67.1	20.5	395
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	110.0	67.1	42.9	6,811
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	83.1	67.1	16.0	927
EAST	Door C25	7.2	3.0	21.5	0.448	83.1	67.1	16.0	154
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.376	75.1	67.1	8.0	691
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.376	73.1	67.1	6.0	1,336
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.376	74.1	67.1	7.0	990
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.376	74.2	67.1	7.1	1,600
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	73.9	67.1	6.8	760
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	76.5	67.1	9.4	4,105
CEILING	729.0 - C1, 18" Cl			3595.7	0.305	95.0	67.1	27.9	30,597
					TOTAL TRANSMISSION LOAD =				82,073

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
PEOPLE 1 X 250 = 250
ELECTRICAL LOAD = 35,318
TOTAL ROOM SENSIBLE LOAD: 117,641

	Ts	Q	CFM
ROOM TEMPERATURE (Tr) = (	52.1) + (	117,641	/(1.08 x 7,236) = 67.1 °F

LATENT LOAD: Q latent
PEOPLE 1 X 200 = 200
TOTAL ROOM LATENT LOAD: 200

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 7,236) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**67.1 °F dry bulb**
	59 % RH

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 89.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	89.2	20.8	766
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	89.2	20.8	1,723
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	74.7	89.2	-14.5	-2,545
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	74.7	89.2	-14.5	-840
EAST	Door C21	7.2	3.0	21.5	0.448	74.7	89.2	-14.5	-140
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-1,036

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING (See page 45)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								-53

STEADY STATE ROOM CONDITIONS:	89.2 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 83.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	83.1	26.9	990
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	83.1	26.9	2,228
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	67.1	83.1	-16.0	-2,808
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	67.1	83.1	-16.0	-1,076
WEST	Door C25	7.2	3.0	21.5	0.448	67.1	83.1	-16.0	-154
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-819

Note: No transmission through the flior & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:							
PEOPLE	0	X	250			=	0
LIGHTING (See page 46)	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**163**

STEADY STATE ROOM CONDITIONS: 83.1 °F dry bulb

7.9 NORMAL OPERATION (SUMMER CASE 2)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2673	81.1	0.0084	22.5	216,780
COMMUNICATION ROOM (692.0' - C9)	2772	76.5	0.0084	23.4	212,058
MECHANICAL EQUIP. ROOM WEST (C1)	4558	75.8	0.0084	38.3	345,459
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	7038	74.7	0.0084	59.2	525,739
COMPUTER ROOM (708.0' - C3)	5367	66.0	0.0083	44.5	354,222
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7236	67.1	0.0084	60.8	485,502
OUTSIDE AIR	2420	95.0	0.0133	32.2	229,900
TOTAL	Vreturn = 32,063			280.8	2,369,659

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn:	Treturn = 73.9 °F
Return Air Humidity Ratio from EBR spaces:	Wreturn = 0.0088 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:01:42 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:01:42 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:01:42 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	49.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	16032.00
Inlet Temperature (degrees F):	42.00	73.70
Outlet Temperature (degrees F):	47.27	46.13
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1906.47	10.14
Clean Pressure Drop (psi):	39.48	Not Calculated
Fouled Pressure Drop (psi):	47.21	Not Calculated
Velocity (ft/s and ft/min):	10.94	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 629901/ 472197/ 157703 Btu/hr
Average Overall Heat Transfer Coefficient: 7.77 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 46.13 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:02:46 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:02:46 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:02:46 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	49.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	16032.00
Inlet Temperature (degrees F):	42.00	73.70
Outlet Temperature (degrees F):	46.10	45.79
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2383.07	10.13
Clean Pressure Drop (psi):	64.02	Not Calculated
Fouled Pressure Drop (psi):	76.55	Not Calculated
Velocity (ft/s and ft/min):	14.34	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 642914/ 478665/ 164249 Btu/hr
Average Overall Heat Transfer Coefficient: 7.93 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.79 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

CALC I.D. EPMMCP0716 01
Sheet 7.9.31

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, January 28, 2005 at 2:01:37 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, January 28, 2005 at 2:01:37 PM

***** QA REFERENCES *****

CALC I.D. EPM-MKP-071689
Sheet 7.9.32

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

CALC I.D. EDMMCR07689
Sheet 7.9.38

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, January 28, 2005 at 2:01:37 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: Supp 1
DATE: 11-15-02
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	59.30
Outlet Relative Humidity (%):	Not Required	88.68
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	42.00	65.70
Outlet Temperature (degrees F):	50.90	54.43
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	693.53	12.08
Clean Pressure Drop (psi):	2.13	Not Calculated
Fouled Pressure Drop (psi):	2.54	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 98333/ 98333/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 8.95 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 51.20 deg F

7.10 LOCA CONDITION (SUMMER CASE 1)

LOCA CONDITION (SUMMER - CASE 1) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 2
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MINIMUM CHILLED WATER FLOW RATES OF 216 GPM TO EACH EBR AHU
- MAXIMUM CHILLED WATER SUPPLY TEMPERATURE OF 48°F
- LOCA CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.6
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- STEAM INJECTION SYSTEM IN SERVICE (SEE SECTION 7.5)

This case conservatively minimizes the cooling capability of the EBR AHUs by modeling the minimum chilled water flow rate concurrent with maximum chilled water temperature. This case also conservatively maximizes the predicted room temperatures by assuming no concurrent LOOP. The EXCEL spreadsheet (see pg.7.10.2 to 7.10.24) and AIRCOOL models (see pg. 7.10.25 to 7.10.27) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equates to approximately 83.9°F (see pg. 7.10.24) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$Tz =$ 50.97 °F (estimated air side outlet temperature for each EBR AHU based on the AIRCOOL model; see pg.7.10.27)

$\Delta t =$ 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.5)

$Ts = Tz + \Delta t =$ 57.1 °F

Since the computer room supplemental AHUs are not safety-related and this case is predicting maximum LOCA room temperatures, these were not credited. For this scenario, the computer room is only cooled by air supplied by EBR AHUs as reflected in the spreadsheet.

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 79.8 °F Design Rm Temp °F: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	79.8	-11.8	-496
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	79.8	-11.8	-555
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	79.8	-11.8	-271
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	119.0	79.8	39.2	2,229
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	79.8	24.2	409
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	76.7	79.8	-3.1	-308
EAST	Door C2	8.0	7.2	57.6	0.448	76.7	79.8	-3.1	-80
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	73.8	79.8	-6.0	-185
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	79.8	-11.8	-606
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	79.8	40.2	24,203
					TOTAL TRANSMISSION LOAD =				24,342

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	11,356
TOTAL ROOM SENSIBLE LOAD:					**35,698**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	3574	984
Temperature, °F	76.7	57.1

Total flow = 4,558 cfm
Supply air temperature: 72.5 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	72.5	) + (	35,698	/(1.08 x	4,558	) =	79.7 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	3574	984
Humidity ratio	0.0069	0.0069

Total flow = 4,558 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 79.8 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 76.7 °F Design Rm Temp °F: 83

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	79.8	76.7	3.1	311
WEST	Door C2	7.2	8.0	57.6	0.448	79.8	76.7	3.1	80
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	79.6	76.7	2.9	637
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	75.0	76.7	-1.7	-87
SOUTH	Door C3	7.2	8.0	57.6	0.448	75.0	76.7	-1.7	-44
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	73.8	76.7	-2.9	-326
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	76.7	27.3	798
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	76.7	27.3	1,459
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	76.7	-8.7	-224
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	88.5	76.7	11.8	3,559
					TOTAL TRANSMISSION LOAD =				6,164

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,467
TOTAL ROOM SENSIBLE LOAD:					**10,631**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	3344	230
Temperature, °F	75.0	57.1

Total flow = 3,574 cfm
Supply air temperature: 73.8 °F

ROOM TEMPERATURE (Tr) = (Ts 73.8) + (Q 10,631) / (1.08 x CFM 3,574) = 76.6 °F

LATENT LOAD:

				Q latent
PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	3344	230
Humidity ratio	0.0069	0.0069

Total flow = 3,574 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 76.7 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 75.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 79.6 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	73.9	79.6	-5.7	-1,252
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	76.7	79.6	-2.9	-637
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	75.0	79.6	-4.6	-651
SOUTH	Door C4	7.2	3.7	26.6	0.448	75.0	79.6	-4.6	-55
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	79.6	24.4	563
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	79.6	24.4	1,185
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	79.6	-11.6	-234
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	88.5	79.6	8.9	2,106
					TOTAL TRANSMISSION LOAD =				1,024

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**4,847**

ROOM TEMPERATURE (Tr) = (Ts 75.0) + (Q 4,847 /(1.08 x CFM 990) = 79.5 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS:	79.6 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,430 cfm (Supply from AHU)
AHU Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 73.9 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	75.0	73.9	1.1	161
SOUTH	Door C5	7.2	6.3	45.2	0.448	75.0	73.9	1.1	22
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	73.9	30.1	2,341
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	73.1	73.9	-0.8	-176
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	79.6	73.9	5.7	1,252
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	73.9	-5.9	-129
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	88.5	73.9	14.6	3,752
					TOTAL TRANSMISSION LOAD =				7,223

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	36,558
TOTAL ROOM SENSIBLE LOAD:					**43,781**

ROOM TEMPERATURE (Tr) = (Ts 57.1) + (Q 43,781 / (1.08 x CFM 2,430)) = 73.8 °F

LATENT LOAD:

					Q latent
PEOPLE	0	X	200		0
TOTAL ROOM LATENT LOAD:					**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2430) = **0.0069**

STEADY STATE ROOM CONDITIONS:	73.9 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2,610 cfm (Supply from AHU)
AHU Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 73.1 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	75.0	73.1	1.9	321
SOUTH	Door C6	7.2	6.3	45.2	0.448	75.0	73.1	1.9	38
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	73.1	30.9	1,966
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	73.1	30.9	760
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	78.3	73.1	5.2	1,142
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	73.9	73.1	0.8	176
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	73.1	-5.1	-127
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	78.3	73.1	5.2	1,215
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	88.5	73.1	15.4	892
					TOTAL TRANSMISSION LOAD =				6,383

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	38,540
TOTAL ROOM SENSIBLE LOAD:					**44,923**

ROOM TEMPERATURE (Tr) = (Ts 57.1) + (Q 44,923 / (1.08 x CFM 2,610) = 73.0 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2610) = **0.0069**

STEADY STATE ROOM CONDITIONS: 73.1 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 75.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 78.3 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	75.0	78.3	-3.3	-467
SOUTH	Door C7	7.2	3.7	26.5	0.448	75.0	78.3	-3.3	-39
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	78.3	25.7	1,604
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	78.3	25.7	237
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	77.2	78.3	-1.1	-242
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	73.1	78.3	-5.2	-1,142
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	78.3	-10.3	-208
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.305	77.3	78.3	-1.0	-70
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	78.3	78.3	0.0	0
					TOTAL TRANSMISSION LOAD =				-328

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**3,495**

ROOM TEMPERATURE (Tr) = (Ts 75.0) + (Q 3,495 / CFM (1.08 x 990)) = 78.3 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS: 78.3 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 75.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 77.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	75.0	77.2	-2.2	-137
SOUTH	Door C8	7.2	3.7	26.5	0.448	75.0	77.2	-2.2	-26
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	77.2	26.8	931
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	76.1	77.2	-1.1	-242
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	78.3	77.2	1.1	242
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	77.2	-9.2	-90
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.305	77.3	77.2	0.1	11
					TOTAL TRANSMISSION LOAD =				689

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	373
TOTAL ROOM SENSIBLE LOAD:					**1,062**

ROOM TEMPERATURE (Tr) = (Ts 75.0) + (Q 1,062 / (1.08 x CFM 440) = 77.2 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = **0.0069**

STEADY STATE ROOM CONDITIONS:	**77.2 °F dry bulb**

7.10 LOCA CONDITION (SUMMER CASE 1)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 724 cfm (Supply from AHU)
AHU Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 76.1 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	75.0	76.1	-1.1	-117
SOUTH	Door C9	7.2	3.7	26.5	0.448	75.0	76.1	-1.1	-13
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	76.1	27.9	1,544
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.8	76.1	5.7	777
EAST (ABOVE C12	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	78.3	76.1	2.2	183
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	77.2	76.1	1.1	242
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	76.1	-8.1	-126
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	77.3	76.1	1.2	219
					TOTAL TRANSMISSION LOAD =				2,709

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	12,248
TOTAL ROOM SENSIBLE LOAD:					**14,957**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) =	(57.1	) + (	14,957	/(1.08 x	724	) =	76.2 °F	

LATENT LOAD: Q latent

PEOPLE	0 X	200			0
TOTAL ROOM LATENT LOAD:					**0**

ROOM HUMIDITY RATIO (Wr) =	0.0069	+	0	/ (4840 x	724	) =	**0.0069**

STEADY STATE ROOM CONDITIONS:	**76.1 °F dry bulb**

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 78.5 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	81.8	78.5	3.3	450
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	78.3	78.5	-0.2	-17
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	82.7	78.5	4.2	422
EAST	Door C11	7.2	8.0	57.4	0.448	82.7	78.5	4.2	108
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	75.0	78.5	-3.5	-486
SOUTH	Door C10	7.2	8.0	57.4	0.448	75.0	78.5	-3.5	-90
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	73.1	78.5	-5.4	-641
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	111.0	78.5	32.5	1,998
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	111.0	78.5	32.5	2,298
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	78.5	-10.5	-391
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	77.3	78.5	-1.2	-524
					TOTAL TRANSMISSION LOAD =				3,127

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	31,261
TOTAL ROOM SENSIBLE LOAD:					**34,888**

SUPPLIMENTAL AIR HANDLING UNIT: **0**

NET ROOM SENSIBLE LOAD: **34,888**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	1107	1665
Temperature, °F	81.8	57.1

Total flow = 2,772 cfm
Supply air temperature: 66.9 °F

ROOM TEMPERATURE (Tr) = (Ts 66.9) + (Q 34,888 / (1.08 x CFM 2,772) = 78.6 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	1107	1665
Humidity ratio	0.0069	0.0069

Total flow = 2,772 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 2,772) = **0.0069**

STEADY STATE ROOM CONDITIONS: **78.5 °F dry bulb**

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,673 cfm (Supply from AHU)
AHU Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 82.7 °F Design Rm Temp °F: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqf	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	82.7	-14.7	-617
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	82.7	-14.7	-691
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	82.7	-14.7	-323
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	119.0	82.7	36.3	2,343
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	111.0	82.7	28.3	348
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	78.5	82.7	-4.2	-417
WEST	Door C11	8.0	7.2	57.6	0.448	78.5	82.7	-4.2	-108
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	73.1	82.7	-9.6	-296
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	82.7	-14.7	-754
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	82.7	37.3	22,457
					TOTAL TRANSMISSION LOAD =				21,941

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LAOD				=	52,014
TOTAL ROOM SENSIBLE LOAD:					**73,955**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) =	(57.1	) + (	73,955	/(1.08 x	2,673)	=	82.7 °F	

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2673) = **0.0069**

STEADY STATE ROOM CONDITIONS: 82.7 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 75.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	75.0	-7.0	-1,267
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	76.7	75.0	1.7	87
NORTH	Door C3	7.2	8.0	57.4	0.448	76.7	75.0	1.7	44
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	79.6	75.0	4.6	652
NORTH	Door C4	7.2	3.7	26.5	0.448	79.6	75.0	4.6	55
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	73.9	75.0	-1.1	-161
NORTH	Door C5	7.2	6.3	45.2	0.448	73.9	75.0	-1.1	-22
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	73.1	75.0	-1.9	-321
NORTH	Door C6	7.2	6.3	45.2	0.448	73.1	75.0	-1.9	-38
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	78.3	75.0	3.3	467
NORTH	Door C7	7.2	3.7	26.5	0.448	78.3	75.0	3.3	39
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	77.2	75.0	2.2	137
NORTH	Door C8	7.2	3.7	26.5	0.448	77.2	75.0	2.2	26
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	76.1	75.0	1.1	117
NORTH	Door C9	7.2	3.7	26.5	0.448	76.1	75.0	1.1	13
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	81.8	75.0	6.8	240
NORTH	Door C13	7.2	3.0	21.5	0.448	81.8	75.0	6.8	66
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	78.3	75.0	3.3	91
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	78.5	75.0	3.5	465
NORTH	Door C10	7.2	8.0	57.4	0.448	78.5	75.0	3.5	90
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	73.1	75.0	-1.9	-82
EAST	Door C12	7.2	3.0	21.5	0.448	73.1	75.0	-1.9	-18
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	73.8	75.0	-1.2	-52
WEST	Door C1	7.2	3.0	21.5	0.448	73.8	75.0	-1.2	-12
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	75.0	-7.0	-264
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	88.5	75.0	13.5	2,240
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	96.2	75.0	21.2	2,017
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.305	77.3	75.0	2.3	415
					TOTAL TRANSMISSION LOAD =				5,025

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:						
	PEOPLE	0	X	250	=	0
	ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:						**7,933**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2430	2610	724
Temperature, °F	73.9	73.1	76.1

Total flow = 5,764 cfm
Supply air temperature: 73.8 °F

ROOM TEMPERATURE (Tr) = (Ts 73.8) + (Q 7,933) / (1.08 x CFM 5,764) = 75.1 °F

LATENT LOAD:

				Q latent
PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2430	2610	724
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 5,764 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 75.0 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1,107 cfm (Supply from AHU)
AHU Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 81.8 °F Design Rm Temperature: 79

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	78.5	81.8	-3.3	-450
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	76.1	81.8	-5.7	-777
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	75.0	81.8	-6.8	-240
SOUTH	Door C13	7.2	3.0	21.5	0.448	75.0	81.8	-6.8	-66
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	81.8	22.2	339
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	111.0	81.8	29.2	167
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	81.8	-13.8	-131
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	78.3	81.8	-3.5	-423
					TOTAL TRANSMISSION LOAD =				-1,581

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	31,069
TOTAL ROOM SENSIBLE LOAD:					**29,738**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	57.1	) + (	29,738	/(1.08 x	1,107	) =	81.9 °F

				Q latent
LATENT LOAD:				
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 1,107) = **0.0069**

STEADY STATE ROOM CONDITIONS: 81.8 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 78.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	78.5	78.3	0.2	17
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	76.1	78.3	-2.2	-183
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	75.0	78.3	-3.3	-91
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	78.3	25.7	240
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	111.0	78.3	32.7	114
FLOOR	692.0' C12	11.0	33.3	366.3	0.330	81.8	78.3	3.5	423
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	77.3	78.3	-1.0	-112
					TOTAL TRANSMISSION LOAD =				408

STEADY STATE ROOM CONDITIONS:	78.3 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 73.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	79.8	73.8	6.0	164
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	73.8	-5.8	-1,514
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	76.7	73.8	2.9	326
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	75.0	73.8	1.2	52
EAST	Door C1	7.2	3.0	21.5	0.448	75.0	73.8	1.2	12
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	73.8	-5.8	-22
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		-982

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								1

STEADY STATE ROOM CONDITIONS:	73.8 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 73.1 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	75.0	73.1	1.9	82
WEST	Door C12	7.2	3.0	21.5	0.448	75.0	73.1	1.9	18
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	73.1	-5.1	-1,331
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	78.5	73.1	5.4	641
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	82.7	73.1	9.6	263
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	73.1	-5.1	-19
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-346

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								637

STEADY STATE ROOM CONDITIONS:	73.1 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,038 cfm
Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 88.5 °F Design Rm Temp: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	120.0	88.5	31.5	9,886
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	102.1	88.5	13.6	2,387
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	104.0	88.5	15.5	476
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	104.0	88.5	15.5	339
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	104.0	88.5	15.5	275
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	118.0	88.5	29.5	6,260
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	112.0	88.5	23.5	1,331
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	113.0	88.5	24.5	1,388
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	96.2	88.5	7.7	435
EAST	Door C22	7.2	6.00	43.0	0.448	96.2	88.5	7.7	148
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	78.3	88.5	-10.2	-2,745
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	120.0	88.5	31.5	4,811
WEST	Door C20	7.3	3.50	25.6	0.448	120.0	88.5	31.5	361
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	102.1	88.5	13.6	788
WEST	Door C21	7.2	3.00	21.5	0.448	102.1	88.5	13.6	131
FLOOR	692.0' - C2, 18" CI	[illegible]	[illegible]	989.0	0.305	76.7	88.5	-11.8	-3,559
FLOOR	692.0' - C3, 18" CI	[illegible]	[illegible]	775.9	0.305	79.6	88.5	-8.9	-2,106
FLOOR	692.0' - C4, 18" CI	[illegible]	[illegible]	842.5	0.305	73.9	88.5	-14.6	-3,752
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	189.8	0.305	73.1	88.5	-15.4	-892
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	544.0	0.305	75.0	88.5	-13.5	-2,240
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	3341.2	0.305	116.0	88.5	27.5	28,024
					TOTAL TRANSMISSION LOAD =				41,748

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:						
	PEOPLE	2	X	250	=	500
	ELECTRICAL LOAD				=	197,026
TOTAL ROOM SENSIBLE LOAD:						239,274

ROOM TEMPERATURE (Tr) = (Ts 57.1) + (Q 239,274 / (1.08 x CFM 7,038)) = 88.5 °F

LATENT LOAD:					Q latent
PEOPLE	2	X	200		400
TOTAL ROOM LATENT LOAD:					400

Room humidity ratio Wr = 0.0069 + 400 / (4840 x 7,038) = 0.0069

STEADY STATE ROOM CONDITIONS: 88.5 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 96.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	77.3	96.2	-18.9	-1,068
EAST	Door C24	7.2	6.0	43.0	0.448	77.3	96.2	-18.9	-364
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	88.5	96.2	-7.7	-435
WEST	Door C22	7.2	6.0	43.0	0.448	88.5	96.2	-7.7	-148
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	120.0	96.2	23.8	4,135
SOUTH	Door C26	7.2	3.4	24.4	0.448	120.0	96.2	23.8	260
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	78.3	96.2	-17.9	-6,421
NORTH	Door C23	7.2	6.0	43.0	0.448	78.3	96.2	-17.9	-345
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	312.0	0.305	75.0	96.2	-21.2	-2,017
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	312.0	0.305	116.0	96.2	19.8	1,884
					TOTAL TRANSMISSION LOAD =				-4,520

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	Does not operate during this LOCA case(Computer Rm Supplement.Cooling)						0
	PEOPLE	0	X	250			=	0
	LIGHTING	1,085.0	X	3.413	X	100%	=	3,703
	EQUIPMENT	217.0	X	3.413	X	100%	=	741
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								-77

STEADY STATE ROOM CONDITIONS:	96.2 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 78.3 °F Design Rm Temp °F: 82

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	96.2	78.3	17.9	6,421
SOUTH	Door C23	7.2	6.0	43.0	0.448	96.2	78.3	17.9	345
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	78.3	25.7	828
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	118.0	78.3	39.7	5,846
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	77.3	78.3	-1.0	-325
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	88.5	78.3	10.2	3,312
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	765.9	0.305	73.1	78.3	-5.2	-1,215
FLOOR	692.0' - C6, 18" CI	[illegible]	[illegible]	526.1	0.305	78.3	78.3	0.0	0
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	1292.0	0.305	116.0	78.3	37.7	14,857
					TOTAL TRANSMISSION LOAD =				30,070

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	91,816
TOTAL ROOM SENSIBLE LOAD:					**122,386**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	5367	0
Temperature, °F	57.1	0.0

Total flow = 5,367 cfm
Supply air temperature: 57.1 °F

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 57.1 + 122,386 / (1.08 x 5,367) = 78.2 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	5,367.0	0.0
Humidity ratio	0.0069	0.0000

Total flow = 5,367 cfm
Wr' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 5,367) = **0.0069**

STEADY STATE ROOM CONDITIONS: 78.3 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,236 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 77.3 °F Design Rm Temperature: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	120.0	77.3	42.7	14,758
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	93.3	77.3	16.0	2,808
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	77.3	26.7	926
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	111.0	77.3	33.7	724
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	111.0	77.3	33.7	612
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	118.0	77.3	40.7	6,455
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	118.0	77.3	40.7	7,377
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	78.3	77.3	1.0	336
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	96.2	77.3	18.9	1,068
WEST	Door C24	7.2	6.0	43.0	0.448	96.2	77.3	18.9	364
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	120.0	77.3	42.7	6,779
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	93.3	77.3	16.0	927
EAST	Door C25	7.2	3.0	21.5	0.448	93.3	77.3	16.0	154
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.305	78.3	77.3	1.0	70
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.305	75.0	77.3	-2.3	-415
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.305	77.2	77.3	-0.1	-11
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.305	76.1	77.3	-1.2	-219
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	78.3	77.3	1.0	112
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	78.5	77.3	1.2	524
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3595.7	0.305	116.0	77.3	38.7	42,441
					TOTAL TRANSMISSION LOAD =				85,790

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	72,818
TOTAL ROOM SENSIBLE LOAD:					**158,858**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) =	57.1	+	158,858	/ (1.08 x	7,236)	=	77.4 °F

				Q latent
LATENT LOAD:				
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) =	0.0069	+	200 / (4840 x	7,236)	=	**0.0069**

STEADY STATE ROOM CONDITIONS: 77.3 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 102.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	102.1	17.9	659
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	102.1	17.9	1,483
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	88.5	102.1	-13.6	-2,387
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	88.5	102.1	-13.6	-788
EAST	Door C21	7.2	3.0	21.5	0.448	88.5	102.1	-13.6	-131
FLOOR (See Note)	[illegible]								
CEILING (See	[illegible]								
					TOTAL TRANSMISSION LOAD =				-1,164

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**-181**

STEADY STATE ROOM CONDITIONS:	102.1 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 93.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	93.3	26.7	983
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	93.3	26.7	2,212
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	77.3	93.3	-16.0	-2,808
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	77.3	93.3	-16.0	-1,076
WEST	Door C25	7.2	3.0	21.5	0.448	77.3	93.3	-16.0	-154
FLOOR (See Note)									
CEILING (See									
					TOTAL TRANSMISSION LOAD =				-843

Note: No transmission through the fllor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**140**

STEADY STATE ROOM CONDITIONS:	93.3 °F dry bulb

7.10 LOCA CONDITION (SUMMER CASE 1)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,673	82.7	0.0069	18.4	221,057
COMMUNICATION ROOM (692.0' - C9)	2,772	78.5	0.0069	19.3	217,602
MECHANICAL EQUIP. ROOM WEST (C1)	4,558	79.8	0.0069	31.4	363,689
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	7,038	88.5	0.0069	48.6	622,863
COMPUTER ROOM (708.0' - C3)	5,367	78.3	0.0069	37.1	420,236
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7,236	77.3	0.0069	50.0	559,304
OUTSIDE AIR	3,000	95.0	0.0133	39.9	285,000
EXFILTRATION (for balancing purpose only)	-580				
TOTAL	Vreturn = 32,063			244.8	2,689,751

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 83.9 °F
Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0076 # MOIST / # DRY AIR

This page replaced by Revision 20.

CALC ID EPMMCP071689
REV 19
SHEET 7.10.25

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, September 10, 2010 at 3:51:08 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

CALC ID EPMMCP071689
REV 19
SHEET 7.10.26

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, September 10, 2010 at 3:51:08 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

CALC ID EPMMCP071689
REV 19
SHEET 7.10.27

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, September 10, 2010 at 3:51:08 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	31.00
Outlet Relative Humidity (%):	Not Required	96.42
Flow Rate (gpm and acfm):	216.00	16032.00
Inlet Temperature (degrees F):	48.00	83.80
Outlet Temperature (degrees F):	53.13	50.97
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1827.89	10.09
Clean Pressure Drop (psi):	32.85	Not Calculated
Fouled Pressure Drop (psi):	39.29	Not Calculated
Velocity (ft/s and ft/min):	9.93	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 554868/ 554868/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 6.94 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 50.03 deg F

7.11 LOCA CONDITION (SUMMER CASE 2)

LOCA CONDITION (SUMMER - CASE 2) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 2
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- LOCA CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.6
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS RUNNING
- STEAM INJECTION SYSTEM IN SERVICE (SEE SECTION 7.5)

This case conservatively maximizes the cooling capability of the EBR AHUs by modeling the maximum chilled water flow rate concurrent with minimum chilled water temperature. This case was performed to conservatively predict the maximum load on the chillers during accident conditions since this value is reported in the system description (Ref. 5.1) Table 9.6.

The EXCEL spreadsheet (see pg.7.11.2 to 7.11.24) and AIRCOOL models (see pg. 7.11.25 to 7.11.33) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equates to approximately 78.4°F (see pg.7.11.24) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$T_{Z(B-A)}$ = 45.71 °F (estimated air side outlet temperature for EBR AHU B-A based on the AIRCOOL model; see pg.7.11.27)

$T_{Z(A-A)}$ = 45.96 °F (estimated air side outlet temperature for EBR AHU A-A based on the AIRCOOL model; see pg. 7.11.30)

Tz = 45.835 °F (calculated average air side outlet temperature for each EBR AHU)

Δt = 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.5)

Ts = Tz + Δt = 51.9 °F

Since the computer room supplemental AHUs are also credited in this LOCA cooling mode, an AIRCOOL model of one of these units is included in this section (see pg. 7.11.31 to 7.11.33). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet. These values are approximately 65°F and 47% relative humidity.

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 75.4 °F Design Rm Temp °F: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	75.4	-7.4	-311
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	75.4	-7.4	-348
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	75.4	-7.4	-170
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	119.0	75.4	43.6	2,479
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	75.4	28.6	484
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	71.8	75.4	-3.6	-358
EAST	Door C2	8.0	7.2	57.6	0.448	71.8	75.4	-3.6	-93
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	71.6	75.4	-3.8	-117
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	75.4	-7.4	-380
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	75.4	44.6	26,852
					TOTAL TRANSMISSION LOAD =				28,039

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	11,356
TOTAL ROOM SENSIBLE LOAD:					**39,395**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	3574	984
Temperature, °F	71.8	51.9

Total flow = 4,558 cfm
Supply air temperature: 67.5 °F

ROOM TEMPERATURE (Tr) = (Ts 67.5) + (Q 39,395 /(1.08 x CFM 4,558) = 75.5 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	3574	984
Humidity ratio	0.0069	0.0069

Total flow = 4,558 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 75.4 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 71.8 °F Design Rm Temp °F: 83

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	75.4	71.8	3.6	361
WEST	Door C2	7.2	8.0	57.6	0.448	75.4	71.8	3.6	93
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	74.8	71.8	3.0	659
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	70.0	71.8	-1.8	-92
SOUTH	Door C3	7.2	8.0	57.6	0.448	70.0	71.8	-1.8	-46
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	71.6	71.8	-0.2	-22
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	71.8	32.2	941
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	71.8	32.2	1,721
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	71.8	-3.8	-98
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	84.1	71.8	12.3	3,710
					TOTAL TRANSMISSION LOAD =				7,228

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0 X	250	=	0
	ELECTRICAL LOAD			=	4,467
TOTAL ROOM SENSIBLE LOAD:					**11,695**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	3344	230
Temperature, °F	70.0	51.9

Total flow = 3,574 cfm
Supply air temperature: 68.8 °F

ROOM TEMPERATURE (Tr) = (Ts 68.8) + (Q 11,695 / (1.08 x CFM 3,574)) = 71.9 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	3344	230
Humidity ratio	0.0069	0.0069

Total flow = 3,574 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 71.8 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 70.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 74.8 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	68.8	74.8	-6.0	-1,318
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	71.8	74.8	-3.0	-659
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	70.0	74.8	-4.8	-680
SOUTH	Door C4	7.2	3.7	26.6	0.448	70.0	74.8	-4.8	-57
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	74.8	29.2	673
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	74.8	29.2	1,418
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	74.8	-6.8	-137
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	84.1	74.8	9.3	2,201
							TOTAL TRANSMISSION LOAD =		1,441

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**5,264**

ROOM TEMPERATURE (Tr) = (Ts 70.0) + (Q 5,264 / (1.08 x CFM 990) = 74.9 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS:	74.8 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,430 cfm (Supply from AHU)
AHU Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 68.8 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	70.0	68.8	1.2	176
SOUTH	Door C5	7.2	6.3	45.2	0.448	70.0	68.8	1.2	24
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	68.8	35.2	2,738
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	67.5	68.8	-1.3	-286
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	74.8	68.8	6.0	1,318
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	68.8	-0.8	-18
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	84.1	68.8	15.3	3,931
					TOTAL TRANSMISSION LOAD =				7,884

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	36,558
TOTAL ROOM SENSIBLE LOAD:					**44,442**

ROOM TEMPERATURE (Tr) = (Ts 51.9) + (Q 44,442 / (1.08 x CFM 2,430)) = 68.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2430) = **0.0069**

STEADY STATE ROOM CONDITIONS:	68.8 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2,610 cfm (Supply from AHU)
AHU Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 67.5 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	70.0	67.5	2.5	422
SOUTH	Door C6	7.2	6.3	45.2	0.448	70.0	67.5	2.5	51
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	67.5	36.5	2,323
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	67.5	36.5	898
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	72.8	67.5	5.3	1,164
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	68.8	67.5	1.3	286
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	67.5	0.5	12
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	65.4	67.5	-2.1	-491
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	84.1	67.5	16.6	961
					TOTAL TRANSMISSION LOAD =				5,626

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	38,540
TOTAL ROOM SENSIBLE LOAD:					**44,166**

ROOM TEMPERATURE (Tr) = (Ts 51.9) + (Q 44,166 / (1.08 x CFM 2,610) = 67.6 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2610) = **0.0069**

STEADY STATE ROOM CONDITIONS:	**67.5 °F dry bulb**

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 70.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 72.8 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	70.0	72.8	-2.8	-397
SOUTH	Door C7	7.2	3.7	26.5	0.448	70.0	72.8	-2.8	-33
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	72.8	31.2	1,947
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	72.8	31.2	288
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	72.4	72.8	-0.4	-88
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	67.5	72.8	-5.3	-1,164
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	72.8	-4.8	-97
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.305	73.0	72.8	0.2	14
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	65.4	72.8	-7.4	-1,187
					TOTAL TRANSMISSION LOAD =				-718

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**3,105**

ROOM TEMPERATURE (Tr) = (Ts 70.0) + (Q 3,105 / (1.08 x CFM 990) = 72.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS: **72.8 °F dry bulb**

7.11 LOCA CONDITION (SUMMER CASE 2)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 70.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 72.4 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	70.0	72.4	-2.4	-150
SOUTH	Door C8	7.2	3.7	26.5	0.448	70.0	72.4	-2.4	-29
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	72.4	31.6	1,098
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	71.4	72.4	-1.0	-220
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	72.8	72.4	0.4	88
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	72.4	-4.4	-43
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.305	73.0	72.4	0.6	69
					TOTAL TRANSMISSION LOAD =				813

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	373
TOTAL ROOM SENSIBLE LOAD:					**1,186**

ROOM TEMPERATURE (Tr) = (Ts 70.0) + (Q 1,186 / (1.08 x CFM 440) = 72.5 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = **0.0069**

STEADY STATE ROOM CONDITIONS: 72.4 °F dry bulb

This page replaced by Revision 20.

7.11 LOCA CONDITION (SUMMER CASE 2)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 724 cfm (Supply from AHU)
AHU Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 71.4 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	70.0	71.4	-1.4	-149
SOUTH	Door C9	7.2	3.7	26.5	0.448	70.0	71.4	-1.4	-17
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	71.4	32.6	1,804
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	76.9	71.4	5.5	750
EAST (ABOVE C12	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.3	71.4	1.9	158
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	72.4	71.4	1.0	220
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	71.4	-3.4	-53
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	73.0	71.4	1.6	293
					TOTAL TRANSMISSION LOAD =				3,005

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	12,248
TOTAL ROOM SENSIBLE LOAD:					**15,253**

ROOM TEMPERATURE (Tr) = (Ts 51.9) + (Q 15,253 / (1.08 x CFM 724) = 71.4 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 724) = **0.0069**

STEADY STATE ROOM CONDITIONS: 71.4 °F dry bulb

This page replaced by Revision 20.

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 73.9 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	76.9	73.9	3.0	409
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.3	73.9	-0.6	-50
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	78.6	73.9	4.7	472
EAST	Door C11	7.2	8.0	57.4	0.448	78.6	73.9	4.7	121
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	70.0	73.9	-3.9	-541
SOUTH	Door C10	7.2	8.0	57.4	0.448	70.0	73.9	-3.9	-100
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	70.8	73.9	-3.1	-368
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	111.0	73.9	37.1	2,281
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	111.0	73.9	37.1	2,623
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	73.9	-5.9	-220
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	73.0	73.9	-0.9	-393
					TOTAL TRANSMISSION LOAD =				4,233

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	31,261
TOTAL ROOM SENSIBLE LOAD:					**35,994**

SUPPLIMENTAL AIR HANDLING UNIT: **0**

NET ROOM SENSIBLE LOAD: **35,994**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	1107	1665
Temperature, °F	76.9	51.9

Total flow = 2,772 cfm
Supply air temperature: 61.9 °F

	Ts		Q	CFM		
ROOM TEMPERATURE (Tr) = (	61.9	) + (	35,994	/(1.08 x 2,772)	=	73.9 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	1107	1665
Humidity ratio	0.0069	0.0069

Total flow = 2,772 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 /(4840 x 2,772) = **0.0069**

STEADY STATE ROOM CONDITIONS: **73.9 °F dry bulb**

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,673 cfm (Supply from AHU)
AHU Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 78.6 °F Design Rm Temp °F: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sq	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	78.6	-10.6	-445
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	78.6	-10.6	-498
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	78.6	-10.6	-233
NORTH	692.0' - AB/A27, 42" Cl	21.0	14.5	304.5	0.212	119.0	78.6	40.4	2,608
NORTH	692.0' - AB/A29, 42" Cl	4.0	14.5	58.0	0.212	111.0	78.6	32.4	398
WEST*	692.0' - C9, 36" Cl	33.0	14.5	420.9	0.236	73.9	78.6	-4.7	-467
WEST	Door C11	8.0	7.2	57.6	0.448	73.9	78.6	-4.7	-121
WEST	692.0' - Stair C2, 36" Cl	9.0	14.5	130.5	0.236	70.8	78.6	-7.8	-240
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	78.6	-10.6	-544
CEILING	708.0 - TB/T1, 18" Cl	42.0	47.0	1974.0	0.305	120.0	78.6	41.4	24,926
					TOTAL TRANSMISSION LOAD =				25,383

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:				
PEOPLE	0	X 250	=	0
ELECTRICAL LAOD			=	52,014
TOTAL ROOM SENSIBLE LOAD:				**77,397**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	51.9	) + (	77,397	/(1.08 x	2,673	) =	78.7 °F

LATENT LOAD: Q latent

PEOPLE	0 X 200		0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2673) = **0.0069**

STEADY STATE ROOM CONDITIONS: 78.6 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 70.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	70.0	-2.0	-362
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	71.8	70.0	1.8	92
NORTH	Door C3	7.2	8.0	57.4	0.448	71.8	70.0	1.8	46
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	74.8	70.0	4.8	680
NORTH	Door C4	7.2	3.7	26.5	0.448	74.8	70.0	4.8	57
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	68.8	70.0	-1.2	-176
NORTH	Door C5	7.2	6.3	45.2	0.448	68.8	70.0	-1.2	-24
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	67.5	70.0	-2.5	-422
NORTH	Door C6	7.2	6.3	45.2	0.448	67.5	70.0	-2.5	-51
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	72.8	70.0	2.8	397
NORTH	Door C7	7.2	3.7	26.5	0.448	72.8	70.0	2.8	33
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	72.4	70.0	2.4	150
NORTH	Door C8	7.2	3.7	26.5	0.448	72.4	70.0	2.4	29
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	71.4	70.0	1.4	149
NORTH	Door C9	7.2	3.7	26.5	0.448	71.4	70.0	1.4	17
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	76.9	70.0	6.9	243
NORTH	Door C13	7.2	3.0	21.5	0.448	76.9	70.0	6.9	66
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	73.3	70.0	3.3	91
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	73.9	70.0	3.9	518
NORTH	Door C10	7.2	8.0	57.4	0.448	73.9	70.0	3.9	100
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	70.8	70.0	0.8	34
EAST	Door C12	7.2	3.0	21.5	0.448	70.8	70.0	0.8	8
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	71.6	70.0	1.6	69
WEST	Door C1	7.2	3.0	21.5	0.448	71.6	70.0	1.6	15
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	70.0	-2.0	-75
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	84.1	70.0	14.1	2,339
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	93.3	70.0	23.3	2,217
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.305	73.0	70.0	3.0	542
					TOTAL TRANSMISSION LOAD =				6,784

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0	X 250	=	0
	ELECTRICAL LOAD			=	2,908
TOTAL ROOM SENSIBLE LOAD:					**9,692**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2430	2610	724
Temperature, °F	68.8	67.5	71.4

Total flow = 5,764 cfm
Supply air temperature: 68.5 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	68.5	) + (	9,692	/(1.08 x	5,764	) =	70.1 °F

LATENT LOAD:			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2430	2610	724
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 5,764 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 70.0 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1,107 cfm (Supply from AHU)
AHU Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 76.9 °F Design Rm Temperature: 79

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	73.9	76.9	-3.0	-409
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	71.4	76.9	-5.5	-750
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	70.0	76.9	-6.9	-243
SOUTH	Door C13	7.2	3.0	21.5	0.448	70.0	76.9	-6.9	-66
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	76.9	27.1	414
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	111.0	76.9	34.1	195
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	76.9	-8.9	-85
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	73.3	76.9	-3.6	-435
							TOTAL TRANSMISSION LOAD =		-1,380

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	31,069
TOTAL ROOM SENSIBLE LOAD:					**29,939**

ROOM TEMPERATURE (Tr) = (Ts 51.9) + (Q 29,939 / (1.08 x CFM 1,107) = 77.0 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 1,107) = **0.0069**

STEADY STATE ROOM CONDITIONS: 76.9 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 73.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	73.9	73.3	0.6	50
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	71.4	73.3	-1.9	-158
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	70.0	73.3	-3.3	-91
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	73.3	30.7	286
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	111.0	73.3	37.7	132
FLOOR	692.0' C12	11.0	33.3	366.3	0.330	76.9	73.3	3.6	435
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	73.0	73.3	-0.3	-34
					TOTAL TRANSMISSION LOAD =				621

STEADY STATE ROOM CONDITIONS:	73.3 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 71.6 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	75.4	71.6	3.8	104
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	71.6	-3.6	-940
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	71.8	71.6	0.2	22
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	70.0	71.6	-1.6	-69
EAST	Door C1	7.2	3.0	21.5	0.448	70.0	71.6	-1.6	-15
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	71.6	-3.6	-13
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		-911

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**72**

STEADY STATE ROOM CONDITIONS:	71.6 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 70.8 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	70.0	70.8	-0.8	-34
WEST	Door C12	7.2	3.0	21.5	0.448	70.0	70.8	-0.8	-8
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	70.8	-2.8	-731
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	73.9	70.8	3.1	368
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	78.6	70.8	7.8	214
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	70.8	-2.8	-10
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	-202

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**781**

STEADY STATE ROOM CONDITIONS:	70.8 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,038 cfm
Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 84.1 °F Design Rm Temp: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	120.0	84.1	35.9	11,267
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	98.8	84.1	14.7	2,571
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	104.0	84.1	19.9	611
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	104.0	84.1	19.9	436
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	104.0	84.1	19.9	353
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	118.0	84.1	33.9	7,194
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	112.0	84.1	27.9	1,580
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	113.0	84.1	28.9	1,637
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	93.3	84.1	9.2	520
EAST	Door C22	7.2	6.00	43.0	0.448	93.3	84.1	9.2	177
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	65.4	84.1	-18.7	-5,033
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	120.0	84.1	35.9	5,483
WEST	Door C20	7.3	3.50	25.6	0.448	120.0	84.1	35.9	411
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	98.8	84.1	14.7	849
WEST	Door C21	7.2	3.00	21.5	0.448	98.8	84.1	14.7	141
FLOOR	692.0' - C2, 18" Cl			989.0	0.305	71.8	84.1	-12.3	-3,710
FLOOR	692.0' - C3, 18" Cl			775.9	0.305	74.8	84.1	-9.3	-2,201
FLOOR	692.0' - C4, 18" Cl			842.5	0.305	68.8	84.1	-15.3	-3,931
FLOOR	692.0' - C5, 18" Cl			189.8	0.305	67.5	84.1	-16.6	-961
FLOOR	692.0' - C11, 18" Cl			544.0	0.305	70.0	84.1	-14.1	-2,339
CEILING	729.0 - C1, 18" Cl			3341.2	0.305	116.0	84.1	31.9	32,508
					TOTAL TRANSMISSION LOAD =				47,564

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	197,026
TOTAL ROOM SENSIBLE LOAD:					**245,090**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	51.9	) + (	245,090	/(1.08 x	7,038	) =	84.2 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr): 0.0069 + 400 /(4840 x 7,038) = **0.0069**

STEADY STATE ROOM CONDITIONS: 84.1 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 93.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	73.0	93.3	-20.3	-1,147
EAST	Door C24	7.2	6.0	43.0	0.448	73.0	93.3	-20.3	-391
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	84.1	93.3	-9.2	-520
WEST	Door C22	7.2	6.0	43.0	0.448	84.1	93.3	-9.2	-177
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	120.0	93.3	26.7	4,638
SOUTH	Door C26	7.2	3.4	24.4	0.448	120.0	93.3	26.7	292
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	65.4	93.3	-27.9	-10,009
NORTH	Door C23	7.2	6.0	43.0	0.448	65.4	93.3	-27.9	-538
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	312.0	0.305	70.0	93.3	-23.3	-2,217
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	312.0	0.305	116.0	93.3	22.7	2,160
					TOTAL TRANSMISSION LOAD =				-7,909

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	1,085.0	X	3.413	X	100%	=	3,703
	EQUIPMENT	217.0	X	3.413	X	100%	=	741
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**175**

STEADY STATE ROOM CONDITIONS:	93.3 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 65.4 °F Design Rm Temp °F: 82

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	93.3	65.4	27.9	10,009
SOUTH	Door C23	7.2	6.0	43.0	0.448	93.3	65.4	27.9	538
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	65.4	38.6	1,243
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	118.0	65.4	52.6	7,746
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	73.0	65.4	7.6	2,468
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	84.1	65.4	18.7	6,071
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	765.9	0.305	67.5	65.4	2.1	491
FLOOR	692.0' - C6, 18" CI	[illegible]	[illegible]	526.1	0.305	72.8	65.4	7.4	1,187
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	1292.0	0.305	116.0	65.4	50.6	19,940
					TOTAL TRANSMISSION LOAD =				49,693

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	91,816
TOTAL ROOM SENSIBLE LOAD:					**142,009**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
cfm	5367	8000	(See below)
Temperature, °F	51.9	58.2	

Total flow = 13,367 cfm
Supply air temperature: 55.7 °F

Note: Calculated temperature from the AIRCOOL program (see pg.7.11.33): 55.52 °F
Temperature rise due to motor (see Section 7.7): 2.63 °F
Supplemental AHU supply temperature : (55.52) + (2.63) = 58.15 °F

ROOM TEMPERATURE (Tr) = Ts 55.7 + Q 142,009 / (1.08 x CFM 13,367) = 65.5 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
cfm	5,367	8,000	
Humidity ratio	0.0069	0.0060	← See pg. 7.11.33

Total flow = 13,367 cfm
Wr' = 0.0064 # moist / # dry air
Wr = 0.0064 + 400 / (4840 x 13,367) = **0.0064**

STEADY STATE ROOM CONDITIONS: 65.4 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,236 cfm (Supply from AHU)
AHU A1654Supply Air Temp: 51.9 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 73.0 °F Design Rm Temperature: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	120.0	73.0	47.0	16,244
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	90.0	73.0	17.0	2,984
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	73.0	31.0	1,075
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	111.0	73.0	38.0	816
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	111.0	73.0	38.0	691
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.50	693.0	0.236	118.0	73.0	45.0	7,360
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.50	792.0	0.236	118.0	73.0	45.0	8,411
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	65.4	73.0	-7.6	-2,556
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	93.3	73.0	20.3	1,147
WEST	Door C24	7.2	6.0	43.0	0.448	93.3	73.0	20.3	391
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	120.0	73.0	47.0	7,462
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	90.0	73.0	17.0	985
EAST	Door C25	7.2	3.0	21.5	0.448	90.0	73.0	17.0	164
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.305	72.8	73.0	-0.2	-14
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.305	70.0	73.0	-3.0	-542
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.305	72.4	73.0	-0.6	-69
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.305	71.4	73.0	-1.6	-293
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	73.3	73.0	0.3	34
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	73.9	73.0	0.9	393
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3595.7	0.305	116.0	73.0	43.0	47,157
					TOTAL TRANSMISSION LOAD =				91,839

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	72,818
TOTAL ROOM SENSIBLE LOAD:					164,907

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 73.0 °F

51.2 + 164,907 / (1.08 x 7,236) = 73.0 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				200

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 7,236) = 0.0069

STEADY STATE ROOM CONDITIONS: 73.0 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 98.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	98.8	21.3	782
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	98.8	21.3	1,760
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	84.1	98.8	-14.7	-2,571
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	84.1	98.8	-14.7	-849
EAST	Door C21	7.2	3.0	21.5	0.448	84.1	98.8	-14.7	-141
FLOOR (See Note)									
CEILING (See									
					TOTAL TRANSMISSION LOAD =				-1,019

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								-36

STEADY STATE ROOM CONDITIONS:	98.8 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 90.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	90.0	30.0	1,104
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	90.0	30.0	2,485
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	73.0	90.0	-17.0	-2,984
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	73.0	90.0	-17.0	-1,143
WEST	Door C25	7.2	3.0	21.5	0.448	73.0	90.0	-17.0	-164
FLOOR (See Note)									
CEILING (See									
					TOTAL TRANSMISSION LOAD =				-701

Note: No transmission through the filor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**282**

STEADY STATE ROOM CONDITIONS:	90.0 °F dry bulb

7.11 LOCA CONDITION (SUMMER CASE 2)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,673	78.6	0.0069	18.4	210,098
COMMUNICATION ROOM (692.0' - C9)	2,772	73.9	0.0069	19.3	204,851
MECHANICAL EQUIP. ROOM WEST (C1)	4,558	75.4	0.0069	31.4	343,636
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	7,038	84.1	0.0069	48.6	591,896
COMPUTER ROOM (708.0' - C3)	5,367	65.4	0.0064	34.2	351,002
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7,236	73.0	0.0069	50.0	528,192
OUTSIDE AIR	3,000	95.0	0.0133	39.9	285,000
EXFILTRATION (for balancing purpose only)	-580				
TOTAL	Vreturn = 32,063			241.8	2,514,673

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 78.4 °F
Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0075 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:25:26 AM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:25:26 AM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:25:26 AM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	37.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	16032.00
Inlet Temperature (degrees F):	42.00	78.40
Outlet Temperature (degrees F):	46.11	45.71
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2383.24	10.11
Clean Pressure Drop (psi):	64.02	Not Calculated
Fouled Pressure Drop (psi):	76.55	Not Calculated
Velocity (ft/s and ft/min):	14.34	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 643986/ 556832/ 87153 Btu/hr
Average Overall Heat Transfer Coefficient: 7.21 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.71 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:24:34 AM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:24:34 AM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 22, 2011 at 8:24:34 AM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	37.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	16032.00
Inlet Temperature (degrees F):	42.00	78.40
Outlet Temperature (degrees F):	47.30	45.96
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1906.65	10.11
Clean Pressure Drop (psi):	39.48	Not Calculated
Fouled Pressure Drop (psi):	47.21	Not Calculated
Velocity (ft/s and ft/min):	10.94	458.06

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 634300/ 551989/ 82312 Btu/hr
Average Overall Heat Transfer Coefficient: 7.14 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.96 deg F

PROGRAM AIRCOOL - REVISION 6.1

CALC ID. EPM-MCP-07 689 R4
Sheet 7.11.31

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, November 15, 2002 at 12:44:19 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

ONLO I.D. EPM-MCO-071689
Sheet 7.11.32

This report was created on: Friday, November 15, 2002 at 12:44:19 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

CALC I.D. EPM-MC-071089 R14
Sheet 7.11.33

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Friday, November 15, 2002 at 12:44:19 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: Supp 1
DATE: 11-15-02
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	70.13
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	42.00	65.00
Outlet Temperature (degrees F):	49.50	55.52
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	686.49	12.09
Clean Pressure Drop (psi):	2.13	Not Calculated
Fouled Pressure Drop (psi):	2.54	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 82805/ 82805/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 7.05 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 45.99 deg F

7.12 NORMAL OPERATION (WINTER)

NORMAL OPERATION (WINTER) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 3
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- ACTUAL CHILLED WATER FLOW RATES AS SHOWN ON DWG. 1-47W865-7 (REF. 5.41)
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.7
- 60°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- LATENT LOADS DUE TO PERSONNEL CONSERVATIVELY NOT CONSIDERED

This case conservatively evaluates the cooling capability of the EBR AHUs by modeling the minimum chilled water temperature. Since the normal summertime Case 2 (discussed in Section 7.9) already considered concurrently both minimum chilled water temperature and maximum chilled water flow in an effort to maximize the chiller load, this combination was not run in the spreadsheet below. Increasing the chilled water flows to 10% would only slightly reduce the room temperatures beyond what has been computed below.

The EXCEL spreadsheet (pg.7.12.2 to 7.12.24) and AIRCOOL models (pg.7.12.25 to.7.12.55) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were both equal to 68.8°F. In order to achieve this condition, the following non-safety related heaters (see Section 7.6) were credited as running @ 100% capacity: 0-HTR-31-83, 1-HTR-31-87 & 2-HTR-21-89. It is recognized that control of these heaters is via local thermostats, but it is reasonable to credit their operation on order to maintain comfortable temperatures (i.e., greater that 64°F).

Iterations between the speadsheet and AIRCOOL indicated that full flow through the coils would not exist during this winter time condition because the mixed return air temperature would be greater than the controller setpoint of 68°F. Therefore, the bypass damper would modulate open to a throttled position. An additional spreadsheet was developed on the previous Rev. 13 which accounts for various bypass flow rates in computing a mixed off-coil temperature. This same speadsheet was utilized in Rev. 20 with the following modifications:

1) The controller setpoint was changed from 75°F to 68°F (Originally done in Revision 14)
2) The total flow rate through each AHU was changed to 20,253 cfm to agree with the flow rates as shown on the simplified flow diagram Appendix 3

Otherwise, the equations remained unchanged. The results indicate approximately 25,000 cfm of the total flow will continue to flow through the coils and approximately 15,506 cfm will bypass (see pg.7.12.25).

Calculated EBR AHU supply temperature Ts:

T_z = 53.3 °F (resulting mixed air AIRCOIL temperature upstream the fans; see this section, pg. 7.12.25)

q = 98435 Btuh (see Section 7.2)

Q = 20,253.0 cfm (See Appendix 3; one fan only)

Δt = 0.41 °F (steam injection temperature rise; see Section 7.2 & 7.4)

$T_s = T_z + \Delta t + q / (1.08 \times Q)$ = 58.2 °F

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Design Rm Humidity %: 20-60
Steady State Temperature: 68.4 °F
Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	50.0	68.4	-18.4	-773
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	68.4	-18.4	-865
NORTH	692.0' - Ground	23.0	NA	NA	1.000	50.0	68.4	-18.4	-423
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	60.0	68.4	-8.4	-478
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	60.0	68.4	-8.4	-142
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	71.7	68.4	3.3	328
EAST	Door C2	8.0	7.2	57.6	0.448	71.7	68.4	3.3	85
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	58.7	68.4	-9.7	-299
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	68.4	-18.4	-944
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	50.0	68.4	-18.4	-13,657
					TOTAL TRANSMISSION LOAD =				-17,168

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 11,356

TOTAL INTERNAL: **11,356**

Total Sensible Load = (Trans + Other Sensible) = -17,168 + 11356 = **-5,812**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	5586	1298
Temperature, °F	71.7	58.2

Total flow = 6,884 cfm
Supply air temperature: 69.2 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	69.2	) + (	-5,812	/(1.08 x	6,884	) =	68.4 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	5586	1298
Humidity ratio	0.0084	0.0084

Total flow = 6,884 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **68.4 °F dry bulb**
56 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 71.7 °F Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	68.4	71.7	-3.3	-331
WEST	Door C2	7.2	8.0	57.6	0.448	68.4	71.7	-3.3	-85
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	73.3	71.7	1.6	352
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	72.1	71.7	0.4	20
SOUTH	Door C3	7.2	8.0	57.6	0.448	72.1	71.7	0.4	10
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	58.7	71.7	-13.0	-1,462
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	60.0	71.7	-11.7	-342
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	60.0	71.7	-11.7	-625
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	50.0	71.7	-21.7	-558
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.376	71.6	71.7	-0.1	-37
					TOTAL TRANSMISSION LOAD =				-3,059

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 4,467

TOTAL INTERNAL: 4,467

Total Sensible Load = (Trans + Other Sensible) = -3,059 + 4467 = 1,408

DUCT HTR (KW)	% Htr Opr	FLOW RATE	SUP. TEMP	HTR BTUR	SUPPLY TEMP
20	100	14,661	58.2	68260	62.6
(See Sect. 7.6)					

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	5167	419
Temperature, °F	72.1	62.6

Total flow = 5,586 cfm
Supply air temperature: 71.4 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	71.4	) + (	1,408	/(1.08 x	5,586	) =	71.6 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	5167	419
Humidity ratio	0.0084	0.0084

Total flow = 5,586 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 71.7 °F dry bulb, 51 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 72.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 73.3 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.5	73.3	-0.8	-176
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	71.7	73.3	-1.6	-352
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	72.1	73.3	-1.2	-170
SOUTH	Door C4	7.2	3.7	26.6	0.448	72.1	73.3	-1.2	-14
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	60.0	73.3	-13.3	-307
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	60.0	73.3	-13.3	-646
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	73.3	-23.3	-470
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.376	71.6	73.3	-1.7	-496
					TOTAL TRANSMISSION LOAD =				-2,630

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT 3,823

TOTAL INTERNAL: **3,823**

Total Sensible Load = (Trans + Other Sensible) = -2,630 + 3823 = **1,193**

ROOM TEMPERATURE (Tr) = (Ts 72.1) + (Q 1,193 /(1.08 x CFM 990) = 73.2 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	73.3 °F dry bulb 48 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 3,297 cfm (Supply from AHU)
Supply Air Temp: 62.6 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 72.5 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	72.1	72.5	-0.4	-59
SOUTH	Door C5	7.2	6.3	45.2	0.448	72.1	72.5	-0.4	-8
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	60.0	72.5	-12.5	-972
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	73.0	72.5	0.5	110
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	73.3	72.5	0.8	176
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	50.0	72.5	-22.5	-493
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.376	71.6	72.5	-0.9	-285
					TOTAL TRANSMISSION LOAD =				-1,531

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	36,558
TOTAL INTERNAL:	**36,558**

Total Sensible Load = (Trans + Other Sensible) = -1,531 + 36558 = **35,027**

ROOM TEMPERATURE (Tr) = Ts 62.6 − Q 35,027 / (1.08 x CFM 3297) = 72.4 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD:	**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 3297) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.5 °F dry bulb** **50 % RH**

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 3,190 cfm
Supply Air Temp: 62.6 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 73.0 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	72.1	73.0	-0.9	-152
SOUTH	Door C6	7.2	6.3	45.2	0.448	72.1	73.0	-0.9	-18
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	60.0	73.0	-13.0	-827
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	60.0	73.0	-13.0	-320
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	72.9	73.0	-0.1	-22
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	72.5	73.0	-0.5	-110
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	50.0	73.0	-23.0	-572
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	69.8	73.0	-3.2	-748
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.376	71.6	73.0	-1.4	-100
					TOTAL TRANSMISSION LOAD =				-2,868

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	
EQUIPMENT	38,540
TOTAL INTERNAL:	**38,540**

Total Sensible Load = (Trans + Other Sensible) = -2,868 + 38540 = **35,672**

	Ts	Q		CFM		
ROOM TEMPERATURE (Tr) =	62.6	35,672	/ (1.08 x	3190	) =	72.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD:	**0**
ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 3190) =	**0.0084**

STEADY STATE ROOM CONDITIONS:	**73.0 °F dry bulb**
	48 % RH

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 72.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 72.9 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	72.1	72.9	-0.8	-113
SOUTH	Door C7	7.2	3.7	26.5	0.448	72.1	72.9	-0.8	-10
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	60.0	72.9	-12.9	-805
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	60.0	72.9	-12.9	-119
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	71.1	72.9	-1.8	-395
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	73.0	72.9	0.1	22
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	72.9	-22.9	-462
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	64.8	72.9	-8.1	-700
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	69.8	72.9	-3.1	-497
					TOTAL TRANSMISSION LOAD =				-3,079

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	3,823
TOTAL INTERNAL:	**3,823**

Total Sensible Load = (Trans + Other Sensible) = -3,079 + 3823 = **744**

ROOM TEMPERATURE (Tr) = (Ts 72.1) + (Q 744 / (1.08 x CFM 990) = 72.8 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**72.9 °F dry bulb**
	49 % RH

7.12 NORMAL OPERATION (WINTER)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 72.1 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 71.1 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	72.1	71.1	1.0	62
SOUTH	Door C8	7.2	3.7	26.5	0.448	72.1	71.1	1.0	12
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	60.0	71.1	-11.1	-386
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	71.7	71.1	0.6	132
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	72.9	71.1	1.8	395
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	50.0	71.1	-21.1	-206
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	64.8	71.1	-6.3	-891
					TOTAL TRANSMISSION LOAD =				-882

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT 373

TOTAL INTERNAL: **373**

Total Sensible Load = (Trans + Other Sensible) = -882 + 373 = **-509**

ROOM TEMPERATURE (Tr) = (Ts 72.1) + (Q -509 / CFM (1.08 x 440) = 71.0 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = **0.0084**

STEADY STATE ROOM CONDITIONS:	71.1 °F dry bulb 52 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 1,100 cfm (Supply from AHU)
Supply Air Temp: 62.6 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 71.7 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	72.1	71.7	0.4	43
SOUTH	Door C9	7.2	3.7	26.5	0.448	72.1	71.7	0.4	5
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	60.0	71.7	-11.7	-647
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	80.8	71.7	9.1	1,241
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	69.6	71.7	-2.1	-175
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	71.1	71.7	-0.6	-132
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	50.0	71.7	-21.7	-338
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	64.8	71.7	-6.9	-1,555
					TOTAL TRANSMISSION LOAD =				-1,559

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	12,248
TOTAL INTERNAL:	**12,248**

Total Sensible Load = (Trans + Other Sensible) = -1,559 + 12248 = **10,689**

ROOM TEMPERATURE (Tr) = Ts 62.6 + Q 10,689 / (1.08 x CFM 1,100) = 71.6 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD:	**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 1,100) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**71.7 °F dry bulb**
	50 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 18-60
Steady State Temperature: 74.8 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	80.8	74.8	6.0	818
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	69.6	74.8	-5.2	-433
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	71.6	74.8	-3.2	-321
EAST	Door C11	7.2	8.0	57.4	0.448	71.6	74.8	-3.2	-82
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	72.1	74.8	-2.7	-375
SOUTH	Door C10	7.2	8.0	57.4	0.448	72.1	74.8	-2.7	-69
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	58.8	74.8	-16.0	-1,900
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	60.0	74.8	-14.8	-910
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	60.0	74.8	-14.8	-1,046
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	50.0	74.8	-24.8	-923
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.376	64.8	74.8	-10.0	-5,384
					TOTAL TRANSMISSION LOAD =				-10,627

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 28,419

TOTAL ROOM SENSIBLE LOAD: **28,419**

SUPPLEMENTAL AIR HANDLING UNIT: **0**

TOTAL INTERNAL: **28,419**

Total Sensible Load = (Trans + Other Sensible) = -10,627 + 28419 = **17,792**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU	
cfm	1353	2035	
Temperature, °F	80.8	62.6	(See supply temperature for room 692.0'-C2)

Total flow = 3,388 cfm
Supply air temperature: 69.8 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	69.8	) + (	17,792	/(1.08 x	3,388	) =	74.7 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	1353	2035
Humidity ratio	0.0084	0.0084

Total flow = 3,388 cfm
Wr ' = 0.0084 # moist / # dry air
Wr = 0.0084 + 0 /(4840 x 3,388) = **0.0084**

STEADY STATE ROOM CONDITIONS: **74.8 °F dry bulb**
48 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 3,267 cfm (Supply from AHU)
Supply Air Temp: 62.6 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 71.6 °F Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	50.0	71.6	-21.6	-907
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	71.6	-21.6	-1,015
NORTH	692.0' - Ground	22.0	NA	NA	1.000	50.0	71.6	-21.6	-475
NORTH	692.0' - AB/A27, 42" Cl	21.0	14.5	304.5	0.212	60.0	71.6	-11.6	-749
NORTH	692.0' - AB/A29, 42" Cl	4.0	14.5	58.0	0.212	60.0	71.6	-11.6	-143
WEST*	692.0' - C9, 36" Cl	33.0	14.5	420.9	0.236	74.8	71.6	3.2	318
WEST	Door C11	8.0	7.2	57.6	0.448	74.8	71.6	3.2	83
WEST	692.0' - Stair C2, 36" Cl	9.0	14.5	130.5	0.236	58.8	71.6	-12.8	-394
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	71.6	-21.6	-1,109
CEILING	708.0 - TB/T1, 18" Cl	42.0	47.0	1974.0	0.376	50.0	71.6	-21.6	-16,032
					TOTAL TRANSMISSION LOAD =				-20,423

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	52,014
TOTAL INTERNAL:	**52,014**

Total Sensible Load = (Trans + Other Sensible) = -20,423 + 52014 = **31,591**

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	62.6	31,591 / (1.08 x	3267)	=	71.5 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 3267) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**71.6 °F dry bulb**
	50 % RH

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 72.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	50.0	72.1	-22.1	-4,000
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	71.7	72.1	-0.4	-20
NORTH	Door C3	7.2	8.0	57.4	0.448	71.7	72.1	-0.4	-10
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	73.3	72.1	1.2	170
NORTH	Door C4	7.2	3.7	26.5	0.448	73.3	72.1	1.2	14
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	72.5	72.1	0.4	59
NORTH	Door C5	7.2	6.3	45.2	0.448	72.5	72.1	0.4	8
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	73.0	72.1	0.9	152
NORTH	Door C6	7.2	6.3	45.2	0.448	73.0	72.1	0.9	18
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	72.9	72.1	0.8	113
NORTH	Door C7	7.2	3.7	26.5	0.448	72.9	72.1	0.8	10
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	71.1	72.1	-1.0	-62
NORTH	Door C8	7.2	3.7	26.5	0.448	71.1	72.1	-1.0	-12
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	71.7	72.1	-0.4	-43
NORTH	Door C9	7.2	3.7	26.5	0.448	71.7	72.1	-0.4	-5
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	80.8	72.1	8.7	307
NORTH	Door C13	7.2	3.0	21.5	0.448	80.8	72.1	8.7	84
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	69.6	72.1	-2.5	-69
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	74.8	72.1	2.7	359
NORTH	Door C10	7.2	8.0	57.4	0.448	74.8	72.1	2.7	69
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	58.8	72.1	-13.3	-572
EAST	Door C12	7.2	3.0	21.5	0.448	58.8	72.1	-13.3	-128
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	58.7	72.1	-13.4	-576
WEST	Door C1	7.2	3.0	21.5	0.448	58.7	72.1	-13.4	-129
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	50.0	72.1	-22.1	-832
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.376	71.6	72.1	-0.5	-102
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.376	65.7	72.1	-6.4	-751
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	64.8	72.1	-7.3	-1,625
					TOTAL TRANSMISSION LOAD =				-7,574

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	2,908
TOTAL INTERNAL:	**2,908**

Total Sensible Load = (Trans + Other Sensible) = -7,574 + 2908 = **-4,666**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	3297	3190	1100
Temperature, °F	72.5	73.0	71.7

Total flow = 7,587 cfm
Supply air temperature: 72.6 °F

		Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(	72.6	) + (	-4,666	/(1.08 x	7,587	) =	72.0 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	3297	3190	1100
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 7,587 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 72.1 °F dry bulb

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1,353 cfm (Supply from AHU)
Supply Air Temp: 62.6 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 80.8 °F Design Rm Temperature: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	74.8	80.8	-6.0	-818
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	71.7	80.8	-9.1	-1,241
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	72.1	80.8	-8.7	-307
SOUTH	Door C13	7.2	3.0	21.5	0.448	72.1	80.8	-8.7	-84
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	60.0	80.8	-20.8	-317
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	60.0	80.8	-20.8	-119
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	50.0	80.8	-30.8	-293
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	69.6	80.8	-11.2	-1,354
					TOTAL TRANSMISSION LOAD =				-4,533

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	31,069
TOTAL INTERNAL:	**31,069**

Total Sensible Load = (Trans + Other Sensible) = -4,533 + 31069 = **26,536**

ROOM TEMPERATURE (Tr) = Ts 62.6 | Q 26,536 / (1.08 x CFM 1,353) = 80.7 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 1,353) = **0.0084**

STEADY STATE ROOM CONDITIONS:	80.8 °F dry bulb 39 % RH

7.12 NORMAL OPERATION (WINTER)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 69.6 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	74.8	69.6	5.2	433
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	71.7	69.6	2.1	175
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	72.1	69.6	2.5	69
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	60.0	69.6	-9.6	-90
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	60.0	69.6	-9.6	-34
FLOOR	692.0' - C12	11.0	33.3	366.3	0.330	80.8	69.6	11.2	1,354
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.376	64.8	69.6	-4.8	-661
					TOTAL TRANSMISSION LOAD =				1,247

STEADY STATE ROOM CONDITIONS:	69.6 °F dry bulb

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 58.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	68.4	58.7	9.7	266
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	58.7	-8.7	-2,271
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	71.7	58.7	13.0	1,462
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	72.1	58.7	13.4	576
EAST	Door C1	7.2	3.0	21.5	0.448	72.1	58.7	13.4	129
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	58.7	-8.7	-33
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				130

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	=	0

TOTAL ROOM SENSIBLE LOAD: 130

STEADY STATE ROOM CONDITIONS:	58.7 °F dry bulb

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 58.8 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	72.1	58.8	13.3	572
WEST	Door C12	7.2	3.0	21.5	0.448	72.1	58.8	13.3	128
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	58.8	-8.8	-2,297
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	74.8	58.8	16.0	1,900
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	71.6	58.8	12.8	350
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	58.8	-8.8	-33
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				621

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	=	0

TOTAL ROOM SENSIBLE LOAD: **621**

STEADY STATE ROOM CONDITIONS:	58.8 °F dry bulb

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 8,602 cfm (Supply from AHU)
Supply Air Temp: 61.9 °F (See below)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 71.6 °F Design Rm Temp: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	50.0	71.6	-21.6	-6,779
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	64.0	71.6	-7.6	-1,334
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	60.0	71.6	-11.6	-356
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	60.0	71.6	-11.6	-254
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	60.0	71.6	-11.6	-206
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	60.0	71.6	-11.6	-2,462
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	60.0	71.6	-11.6	-657
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	60.0	71.6	-11.6	-657
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	65.7	71.6	-5.9	-333
EAST	Door C22	7.2	6.00	43.0	0.448	65.7	71.6	-5.9	-114
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	69.8	71.6	-1.8	-484
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	50.0	71.6	-21.6	-3,299
WEST	Door C20	7.3	3.50	25.6	0.448	50.0	71.6	-21.6	-247
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	64.0	71.6	-7.6	-441
WEST	Door C21	7.2	3.00	21.5	0.448	64.0	71.6	-7.6	-73
FLOOR	692.0' - C2, 18" CI			989.0	0.376	71.7	71.6	0.1	37
FLOOR	692.0' - C3, 18" CI			775.9	0.376	73.3	71.6	1.7	496
FLOOR	692.0' - C4, 18" CI			842.5	0.376	72.5	71.6	0.9	285
FLOOR	692.0' - C5, 18" CI			189.8	0.376	73.0	71.6	1.4	100
FLOOR	692.0' - C11, 18" CI			544.0	0.376	72.1	71.6	0.5	102
CEILING	729.0 - C1, 18" CI			3341.2	0.376	60.0	71.6	-11.6	-14,573
					TOTAL TRANSMISSION LOAD =				-31,249

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
EQUIPMENT 122,026

TOTAL INTERNAL **122,026**

Total Sensible Load = (Trans + Other Sensible) = -31,249 + 122026 = **90,777**

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10	100	8,602	58.2	34130	**61.9**
(See Sect. 7.7)					

(See Notes for this Section)

ROOM TEMPERATURE (Tr) = (Ts 61.9) + (Q 90,777 /(1.08 x CFM 8,602) = 71.7 °F

LATENT LOAD: Q latent

PEOPLE 0 X 200 0

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr):

Wr = 0.0084 + 0 /(4840 x 8,602) = **0.0084**

STEADY STATE ROOM CONDITIONS:	71.6 °F dry bulb 51 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 65.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	64.8	65.7	-0.9	-51
EAST	Door C24	7.2	6.0	43.0	0.448	64.8	65.7	-0.9	-17
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	71.6	65.7	5.9	333
WEST	Door C22	7.2	6.0	43.0	0.448	71.6	65.7	5.9	114
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	50.0	65.7	-15.7	-2,727
SOUTH	Door C26	7.2	3.4	24.4	0.448	50.0	65.7	-15.7	-171
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	69.8	65.7	4.1	1,471
NORTH	Door C23	7.2	6.0	43.0	0.448	69.8	65.7	4.1	79
FLOOR	692.0' - C11, 18" CI			312.0	0.376	72.1	65.7	6.4	751
CEILING	729.0 - C1, 18" CI			312.0	0.376	60.0	65.7	-5.7	-669
					TOTAL TRANSMISSION LOAD =				-888

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	1,085
TOTAL ROOM SENSIBLE LOAD:	**197**

STEADY STATE ROOM CONDITIONS:	**65.7 °F dry bulb**

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Design Rm Humidity: 40-60
Steady State Temperature: 69.8 °F
Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	65.7	69.8	-4.1	-1,471
SOUTH	Door C23	7.2	6.0	43.0	0.448	65.7	69.8	-4.1	-79
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	60.0	69.8	-9.8	-316
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	60.0	69.8	-9.8	-1,443
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	64.8	69.8	-5.0	-1,623
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	71.6	69.8	1.8	584
FLOOR	692.0' - C5, 18" CI			765.9	0.305	73.0	69.8	3.2	748
FLOOR	692.0' - C6, 18" CI			526.1	0.305	72.9	69.8	3.1	497
CEILING	729.0 - C1, 18" CI			1292.0	0.376	60.0	69.8	-9.8	-4,761
					TOTAL TRANSMISSION LOAD =				-7,864

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 91,816

TOTAL ROOM SENSIBLE LOAD: 91,816

Total Sensible Load = (Trans + Other Sensible) = -7,864 + 91816 = **83,952**

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10	0	6,677	58.2	0	58.2
(See Sect. 7.8)					

(See Notes for this Section)

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	6677	0
Temperature, °F	58.2	0.0

Total flow = 6,677 cfm
Supply air temperature: 58.2 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	58.2	) + (	83,952	/(1.08 x	6,677	) =	69.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	6677	0.0
Humidity ratio	0.0084	0.0000

Total flow = 6,677 cfm
Wr' = 0.0084 # moist / # dry air
Wr = 0.0084 + 0 /(4840 x 6,677) = **0.0084**

STEADY STATE ROOM CONDITIONS: **69.8 °F dry bulb**
53 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 9,268 cfm (Supply from AHU)
Supply Air Temp: 61.7 °F (See below)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 64.8 °F Design Rm Temperature: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	50.0	64.8	-14.8	-5,115
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	59.8	64.8	-5.0	-878
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	60.0	64.8	-4.8	-167
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	60.0	64.8	-4.8	-103
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	60.0	64.8	-4.8	-87
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	60.0	64.8	-4.8	-761
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	60.0	64.8	-4.8	-870
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	69.8	64.8	5.0	1,682
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	65.7	64.8	0.9	51
WEST	Door C24	7.2	6.0	43.0	0.448	65.7	64.8	0.9	17
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	50.0	64.8	-14.8	-2,350
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	59.8	64.8	-5.0	-290
EAST	Door C25	7.2	3.0	21.5	0.448	59.8	64.8	-5.0	-48
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.376	72.9	64.8	8.1	700
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.376	72.1	64.8	7.3	1,625
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.376	71.1	64.8	6.3	891
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.376	71.7	64.8	6.9	1,555
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.376	69.6	64.8	4.8	661
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.376	74.8	64.8	10.0	5,384
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3595.7	0.376	60.0	64.8	-4.8	-6,489
					TOTAL TRANSMISSION LOAD =				-4,592

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 35,318
TOTAL ROOM SENSIBLE LOAD: 35,318

Total Sensible Load = (Trans + Other Sensible) = -4,592 + 35318 = 30,726

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.9)	100	9,268	58.2 (See Notes for this Section)	34130	61.7

ROOM TEMPERATURE (Tr) = Ts 61.7 | Q 30,726 | / (1.08 x CFM 9,268) = 64.7 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 9,268) = 0.0084

STEADY STATE ROOM CONDITIONS:	64.8 °F dry bulb 63 % RH

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 64.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	50.0	64.0	-14.0	-515
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	50.0	64.0	-14.0	-1,160
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	71.6	64.0	7.6	1,334
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	71.6	64.0	7.6	441
EAST	Door C21	7.2	3.0	21.5	0.448	71.6	64.0	7.6	73
FLOOR (See Note)	[illegible]								
CEILING (See Note)	[illegible]								
					TOTAL TRANSMISSION LOAD =				172

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

TOTAL ROOM SENSIBLE LOAD: 172

STEADY STATE ROOM CONDITIONS:	64.0 °F dry bulb

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 59.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	50.0	59.8	-9.8	-361
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	50.0	59.8	-9.8	-812
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	64.8	59.8	5.0	878
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	64.8	59.8	5.0	336
WEST	Door C25	7.2	3.0	21.5	0.448	64.8	59.8	5.0	48
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				89

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

TOTAL ROOM SENSIBLE LOAD: 89

STEADY STATE ROOM CONDITIONS:	59.8 °F dry bulb

This page replaced by Revision 20.

7.12 NORMAL OPERATION (WINTER)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	3,267	71.6	0.0084	27.4	233,917
COMMUNICATION ROOM (692.0' - C9)	3,388	74.8	0.0084	28.5	253,422
MECHANICAL EQUIP. ROOM WEST (C1)	6,884	68.4	0.0084	57.8	470,866
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	8,602	71.6	0.0084	72.3	615,903
COMPUTER ROOM (708.0' - C3)	6,677	69.8	0.0084	56.1	466,055
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	9,268	64.8	0.0084	77.8	600,534
OUTSIDE AIR	2,420	60.0	0.0003	0.7	145,200
TOTAL	Vreturn = 40,506			320.6	2,785,897

Return Air Temperature from MCR spaces: SUM (cfm X °F) / Vreturn: Treturn = 68.8 °F
Return Air Humidity Ratio from MCR spaces: Wreturn = 0.0079 # MOIST / # DRY AIR

7.12 NORMAL OPERATION (WINTER)

The table below summarizes results from AIRCOOL runs performed on pages 7.12.26 to 7.12.55 which established AHU leaving coil air temperatures at various air flow rates.

Fbp = flow bypass, cfm
Fc = flow through coil, cfm
F_T = total flow through AHU, cfm

Tbp = bypass air temperature, °F
Tc = leaving coil air temperature, °F
Tmix = final air mixture temperature, °F

F_T = Fbp + Fc = 20,252.8 CFM
Thus Fbp = F_T -Fc

Tmix = (Fbp x Tbp + Tc x Fc) / (Fbp + Fc)
Substituting Fbp = (F_T - Fc) into the equation →
Tmix = [(F_T -Fc) x Tbp] + Tc x Fc) / [(F_T - Fc) + Fc]
Tmix = Tbp + Fc (Tc - Tbp) / 20,252.75

AHU bypass damper controller setpoint is set @ 68°F , thus Tbp = 68°F.
Tmix = 68 + Fc (Tc - 68) / 20,252.75

AIRCOOL RUNS SUMMARY

AHU 1 (216 GPM) (See pg. 7.12.26 to 7.12.40)				AHU 2 (284 GPM) (See pg. 7.12.41 to 7.12.55)				
FLOW RATE THROUGH COIL (CFM)	Tc (DEG F)	Tmix (DEG F)	BYPASS FLOW RATE (CFM)	FLOW RATE THROUGH COIL (CFM)	Tc (DEG F)	Tmix (DEG F)	BYPASS FLOW RATE (CFM)	FINAL Tmix (DEG F)
10000	43.55	55.9	10,252.8	10000	43.39	55.8	10,252.8	55.9
10500	43.68	55.4	9,752.8	10500	43.51	55.3	9,752.8	55.3
11000	43.91	54.9	9,252.8	11000	43.61	54.8	9,252.8	54.8
11500	44.15	54.5	8,752.8	11500	43.74	54.2	8,752.8	54.3
12000	44.27	53.9	8,252.8	12000	43.86	53.7	8,252.8	53.8
12500	44.40	53.4	7,752.8	12500	44.09	53.2	7,752.8	53.3
13000	44.53	52.9	7,252.8	13000	44.32	52.8	7,252.8	52.9
13500	44.66	52.4	6,752.8	13500	44.43	52.3	6,752.8	52.4
14000	44.79	52.0	6,252.8	14000	44.56	51.8	6,252.8	51.9
14500	44.91	51.5	5,752.8	14500	44.67	51.3	5,752.8	51.4
15000	45.04	51.0	5,252.8	15000	44.78	50.8	5,252.8	50.9
15500	45.15	50.5	4,752.8	15500	44.90	50.3	4,752.8	50.4
16000	45.28	50.1	4,252.8	16000	45.01	49.8	4,252.8	49.9

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:26:51 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:26:51 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:26:51 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	10000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.18	43.55
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1747.50	7.65
Clean Pressure Drop (psi):	33.29	Not Calculated
Fouled Pressure Drop (psi):	39.82	Not Calculated
Velocity (ft/s and ft/min):	9.93	285.71

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 344845/ 272575/ 72270 Btu/hr
Average Overall Heat Transfer Coefficient: 6.32 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.55 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:34:37 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	10500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.31	43.68
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1748.13	7.88
Clean Pressure Drop (psi):	33.29	Not Calculated
Fouled Pressure Drop (psi):	39.81	Not Calculated
Velocity (ft/s and ft/min):	9.93	300.00

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 359004/ 284671/ 74333 Btu/hr
Average Overall Heat Transfer Coefficient: 6.45 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.68 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:36:08 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	11000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.42	43.91
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1749.22	8.11
Clean Pressure Drop (psi):	33.28	Not Calculated
Fouled Pressure Drop (psi):	39.81	Not Calculated
Velocity (ft/s and ft/min):	9.93	314.29

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 370499/ 295515/ 74985 Btu/hr
Average Overall Heat Transfer Coefficient: 6.41 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.91 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:37:15 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	11500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.52	44.15
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1750.20	8.33
Clean Pressure Drop (psi):	33.28	Not Calculated
Fouled Pressure Drop (psi):	39.80	Not Calculated
Velocity (ft/s and ft/min):	9.93	328.57

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 381527/ 306208/ 75318 Btu/hr
Average Overall Heat Transfer Coefficient: 6.38 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.15 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:38:08 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	12000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.64	44.27
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1750.83	8.55
Clean Pressure Drop (psi):	33.28	Not Calculated
Fouled Pressure Drop (psi):	39.80	Not Calculated
Velocity (ft/s and ft/min):	9.93	342.86

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 394800/ 317903/ 76897 Btu/hr
Average Overall Heat Transfer Coefficient: 6.51 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.27 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:38:40 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	12500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.75	44.40
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1751.41	8.76
Clean Pressure Drop (psi):	33.27	Not Calculated
Fouled Pressure Drop (psi):	39.79	Not Calculated
Velocity (ft/s and ft/min):	9.93	357.14

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 407555/ 329302/ 78254 Btu/hr
Average Overall Heat Transfer Coefficient: 6.63 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.40 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:40:57 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	13000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.87	44.53
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1752.04	8.97
Clean Pressure Drop (psi):	33.27	Not Calculated
Fouled Pressure Drop (psi):	39.79	Not Calculated
Velocity (ft/s and ft/min):	9.93	371.43

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 420223/ 340828/ 79395 Btu/hr
Average Overall Heat Transfer Coefficient: 6.74 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.53 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:41:21 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	13500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.98	44.66
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1752.59	9.18
Clean Pressure Drop (psi):	33.27	Not Calculated
Fouled Pressure Drop (psi):	39.79	Not Calculated
Velocity (ft/s and ft/min):	9.93	385.71

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 432362/ 351837/ 80525 Btu/hr
Average Overall Heat Transfer Coefficient: 6.85 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.66 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:41:42 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	14000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	46.09	44.79
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1753.12	9.38
Clean Pressure Drop (psi):	33.26	Not Calculated
Fouled Pressure Drop (psi):	39.78	Not Calculated
Velocity (ft/s and ft/min):	9.93	400.00

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 444139/ 362862/ 81277 Btu/hr
Average Overall Heat Transfer Coefficient: 6.94 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.79 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:42:01 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	14500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	46.20	44.91
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1753.70	9.58
Clean Pressure Drop (psi):	33.26	Not Calculated
Fouled Pressure Drop (psi):	39.78	Not Calculated
Velocity (ft/s and ft/min):	9.93	414.29

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 456171/ 373967/ 82204 Btu/hr
Average Overall Heat Transfer Coefficient: 7.05 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.91 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:42:26 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	15000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	46.31	45.04
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1754.25	9.78
Clean Pressure Drop (psi):	33.26	Not Calculated
Fouled Pressure Drop (psi):	39.77	Not Calculated
Velocity (ft/s and ft/min):	9.93	428.57

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 467710/ 384855/ 82855 Btu/hr
Average Overall Heat Transfer Coefficient: 7.15 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.04 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:42:51 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	15500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	46.41	45.15
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1754.81	9.98
Clean Pressure Drop (psi):	33.25	Not Calculated
Fouled Pressure Drop (psi):	39.77	Not Calculated
Velocity (ft/s and ft/min):	9.93	442.86

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 479201/ 395750/ 83451 Btu/hr
Average Overall Heat Transfer Coefficient: 7.25 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.15 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:43:35 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	16000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	46.51	45.28
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1755.36	10.17
Clean Pressure Drop (psi):	33.25	Not Calculated
Fouled Pressure Drop (psi):	39.76	Not Calculated
Velocity (ft/s and ft/min):	9.93	457.14

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 490107/ 406395/ 83712 Btu/hr
Average Overall Heat Transfer Coefficient: 7.33 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.28 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:45:58 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:45:58 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:45:58 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	10000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.45	43.39
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2192.77	7.65
Clean Pressure Drop (psi):	54.22	Not Calculated
Fouled Pressure Drop (psi):	64.84	Not Calculated
Velocity (ft/s and ft/min):	13.05	285.71

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 348543/ 274537/ 74006 Btu/hr
Average Overall Heat Transfer Coefficient: 6.43 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.39 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:46:17 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	10500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.55	43.51
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2193.38	7.88
Clean Pressure Drop (psi):	54.21	Not Calculated
Fouled Pressure Drop (psi):	64.83	Not Calculated
Velocity (ft/s and ft/min):	13.05	300.00

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 363369/ 287041/ 76327 Btu/hr
Average Overall Heat Transfer Coefficient: 6.57 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.51 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:46:37 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	11000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.65	43.61
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2193.94	8.11
Clean Pressure Drop (psi):	54.21	Not Calculated
Fouled Pressure Drop (psi):	64.83	Not Calculated
Velocity (ft/s and ft/min):	13.05	314.29

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 377646/ 298997/ 78649 Btu/hr
Average Overall Heat Transfer Coefficient: 6.71 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.61 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:46:58 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	11500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.75	43.74
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2194.54	8.33
Clean Pressure Drop (psi):	54.20	Not Calculated
Fouled Pressure Drop (psi):	64.82	Not Calculated
Velocity (ft/s and ft/min):	13.05	328.57

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 391608/ 311001/ 80607 Btu/hr
Average Overall Heat Transfer Coefficient: 6.82 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.74 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:47:26 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	12000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.85	43.86
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2195.13	8.54
Clean Pressure Drop (psi):	54.20	Not Calculated
Fouled Pressure Drop (psi):	64.81	Not Calculated
Velocity (ft/s and ft/min):	13.06	342.86

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 405435/ 322951/ 82484 Btu/hr
Average Overall Heat Transfer Coefficient: 6.94 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 43.86 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:47:49 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	12500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.92	44.09
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2196.20	8.76
Clean Pressure Drop (psi):	54.20	Not Calculated
Fouled Pressure Drop (psi):	64.81	Not Calculated
Velocity (ft/s and ft/min):	13.06	357.14

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 416048/ 333430/ 82619 Btu/hr
Average Overall Heat Transfer Coefficient: 6.88 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.09 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:48:08 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	13000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	44.99	44.32
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2197.13	8.97
Clean Pressure Drop (psi):	54.19	Not Calculated
Fouled Pressure Drop (psi):	64.80	Not Calculated
Velocity (ft/s and ft/min):	13.06	371.43

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 426307/ 343730/ 82577 Btu/hr
Average Overall Heat Transfer Coefficient: 6.84 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.32 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:48:26 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	13500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.08	44.43
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2197.67	9.18
Clean Pressure Drop (psi):	54.19	Not Calculated
Fouled Pressure Drop (psi):	64.80	Not Calculated
Velocity (ft/s and ft/min):	13.06	385.71

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 439172/ 355126/ 84046 Btu/hr
Average Overall Heat Transfer Coefficient: 6.96 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.43 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:48:44 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	14000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.17	44.56
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2198.24	9.38
Clean Pressure Drop (psi):	54.18	Not Calculated
Fouled Pressure Drop (psi):	64.79	Not Calculated
Velocity (ft/s and ft/min):	13.06	400.00

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 451675/ 366675/ 85001 Btu/hr
Average Overall Heat Transfer Coefficient: 7.05 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.56 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:49:04 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	14500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.25	44.67
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2198.78	9.58
Clean Pressure Drop (psi):	54.18	Not Calculated
Fouled Pressure Drop (psi):	64.79	Not Calculated
Velocity (ft/s and ft/min):	13.06	414.29

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 464154/ 377959/ 86195 Btu/hr
Average Overall Heat Transfer Coefficient: 7.16 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.67 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:49:25 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	15000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.34	44.78
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2199.30	9.78
Clean Pressure Drop (psi):	54.17	Not Calculated
Fouled Pressure Drop (psi):	64.78	Not Calculated
Velocity (ft/s and ft/min):	13.06	428.57

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 476290/ 388940/ 87349 Btu/hr
Average Overall Heat Transfer Coefficient: 7.27 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.78 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:49:56 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	15500.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.42	44.90
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2199.83	9.98
Clean Pressure Drop (psi):	54.17	Not Calculated
Fouled Pressure Drop (psi):	64.78	Not Calculated
Velocity (ft/s and ft/min):	13.06	442.86

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 488029/ 399953/ 88076 Btu/hr
Average Overall Heat Transfer Coefficient: 7.36 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 44.90 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 3:50:22 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 05
DATE: 08-24-04
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	284.00	16000.00
Inlet Temperature (degrees F):	42.00	68.80
Outlet Temperature (degrees F):	45.50	45.01
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2200.37	10.17
Clean Pressure Drop (psi):	54.17	Not Calculated
Fouled Pressure Drop (psi):	64.77	Not Calculated
Velocity (ft/s and ft/min):	13.06	457.14

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 499878/ 410982/ 88896 Btu/hr
Average Overall Heat Transfer Coefficient: 7.47 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.01 deg F

7.13 LOOP CONDITION (WINTER)

LOOP CONDITION (WINTER) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 3
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- LOOP CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.8
- 13°F PRESSURIZING AIR (144 KW HEATER NOT ENERGIZED)
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- LATENT LOADS DUE TO PERSONNEL CONSERVATIVELY NOT CONSIDERED

This spreadsheet (see pg. 7.13.2 to 7.13.24) and AIRCOOL model (see pg.7.13.25 to 7.13.30) were iterated until the mixed return air temperature (both dry and wet bulb) to the EBR AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL program were approximately equal. This equates to approximately 57°F which is significantly lower than the controller setpoint of 68°F. Unlike the normal winter operating condition evaluated in Section 7.14, the bypass damper will be fully open during this operating condition. Since the face dampers were removed, a significant portion of the return air flow will continue through the EBR AHU coils. A trial and error solution based on the relative pressure drop associated with the flow through the coil and around the coil through the bypass damper was performed and documented in Appendix 7. Results indicate that approximately 30% of the total flow will continue go through the coil, and the remaining 70% will flow through the bypass damper. In this flow contition, calculated EBR AHU supply temperature Ts:

LAT = 42.3 °F (average temperature based on AIRCOOL results for 57°F EAT; see pg. 7.13.27 & 7.13.30)

Tr = 57.0 °F (based on the weighted average; see pg. 7.13.24)

Total return flow to one AHU Q = 20,252.8 cfm (see Appendix 3)

Considered that 30% of the total flow passes through the coils,

Tz = ([0.3Q x LAT) + (0.7Q x Treturn)]/Q

Tz = 52.6 °F (weighted average temperature downstream of coil/damper)

q = 98435 Btuh (see Section 7.2)

Ts =Tz + q / (1.08 x Q) = 57.1 °F

Since the computer room & communications room supplemental AHUs are not safety-related, they will not be energized during this LOOP scenario. Also see Assumption 4.1.10.

Duct heaters are not operating; see Methodology, Section 6.9, item # 8.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 56.6 °F Design Rm Temp °F: 62

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	50.0	56.6	-6.6	-277
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	56.6	-6.6	-310
NORTH	692.0' -Ground	23.0	NA	NA	1.000	50.0	56.6	-6.6	-152
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	60.0	56.6	3.4	193
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	60.0	56.6	3.4	57
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	57.5	56.6	0.9	89
EAST	Door C2	8.0	7.2	57.6	0.448	57.5	56.6	0.9	23
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	53.1	56.6	-3.5	-108
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	56.6	-6.6	-339
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	40.0	56.6	-16.6	-12,321
					TOTAL TRANSMISSION LOAD =				-13,143

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 6,215

TOTAL INTERNAL: 6,215

Total Sensible Load = (Trans + Other Sensible) = -13,143 + 6,215 = -6,928

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	5586	1298
Temperature, °F	57.5	57.1

Total flow = 6,884 cfm
Supply air temperature: 57.4 °F

ROOM TEMPERATURE (Tr) = (Ts 57.4) + (Q -6,928 /(1.08 x CFM 6,884) = 56.5 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	5586	1298
Humidity ratio	0.0069	0.0069

Total flow = 6,884 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 56.6 °F dry bulb

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 57.5 °F Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	56.6	57.5	-0.9	-90
WEST	Door C2	7.2	8.0	57.6	0.448	56.6	57.5	-0.9	-23
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	58.0	57.5	0.5	110
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	57.4	57.5	-0.1	-5
SOUTH	Door C3	7.2	8.0	57.6	0.448	57.4	57.5	-0.1	-3
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	53.1	57.5	-4.4	-495
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	60.0	57.5	2.5	73
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	60.0	57.5	2.5	134
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	50.0	57.5	-7.5	-193
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	62.0	57.5	4.5	1,357
					TOTAL TRANSMISSION LOAD =				865

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 865 + 0 = 865

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
20	0	13,682	57.1	0	57.1
(See Sect. 7.6)					

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	5167	419
Temperature, °F	57.4	57.1

Total flow = 5,586 cfm
Supply air temperature: 57.4 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.4	) + (	865	/(1.08 x	5,586	) =	57.5 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	5167	419
Humidity ratio	0.0069	0.0069

Total flow = 5,586 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 57.5 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 57.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 58.0 °F Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	57.4	58.0	-0.6	-132
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	57.5	58.0	-0.5	-110
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	57.4	58.0	-0.6	-85
SOUTH	Door C4	7.2	3.7	26.6	0.448	57.4	58.0	-0.6	-7
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	60.0	58.0	2.0	46
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	60.0	58.0	2.0	97
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	58.0	-8.0	-161
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	62.0	58.0	4.0	947
					TOTAL TRANSMISSION LOAD =				595

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 595 + 0 = 595

ROOM TEMPERATURE (Tr) = (Ts 57.4) + (Q 595) / (1.08 x CFM 990) = 58.0 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM TEMPERATURE: 58.0 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 3,297 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.4 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	57.4	57.4	0.0	0
SOUTH	Door C5	7.2	6.3	45.2	0.448	57.4	57.4	0.0	0
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	60.0	57.4	2.6	202
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	57.5	57.4	0.1	22
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	58.0	57.4	0.6	132
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	50.0	57.4	-7.4	-162
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	62.0	57.4	4.6	1,182
					TOTAL TRANSMISSION LOAD =				1,376

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 1,376 + 0 = 1,376

ROOM TEMPERATURE (Tr) = Ts 57.1 + Q 1,376 / (1.08 x CFM 3297) = 57.5 °F

LATENT LOAD: Q latent
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 3297) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.4 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 3,190 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.5 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	57.4	57.5	-0.1	-17
SOUTH	Door C6	7.2	6.3	45.2	0.448	57.4	57.5	-0.1	-2
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	60.0	57.5	2.5	159
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	60.0	57.5	2.5	61
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	57.9	57.5	0.4	88
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	57.4	57.5	-0.1	-22
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	50.0	57.5	-7.5	-186
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	63.1	57.5	5.6	1,308
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	62.0	57.5	4.5	261
					TOTAL TRANSMISSION LOAD =				1,650

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 1,650 + 0 = 1,650

ROOM TEMPERATURE (Tr) = Ts 57.1 + Q 1,650 / (1.08 x CFM 3190) = 57.5 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 3190) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.5 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 57.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.9 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	57.4	57.9	-0.5	-71
SOUTH	Door C7	7.2	3.7	26.5	0.448	57.4	57.9	-0.5	-6
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	60.0	57.9	2.1	131
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	60.0	57.9	2.1	19
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	57.5	57.9	-0.4	-88
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	57.5	57.9	-0.4	-88
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	57.9	-7.9	-159
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	57.4	57.9	-0.5	-43
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	63.1	57.9	5.2	834
					TOTAL TRANSMISSION LOAD =				530

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 530 + 0 = 530

ROOM TEMPERATURE (Tr) = (Ts 57.4) + (Q 530 /(1.08 x CFM 990) = 57.9 °F

LATENT LOAD: Q latent
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM TEMPERATURE:	57.9 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 57.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.5 °F Design Rm Temp °F: 64

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	57.4	57.5	-0.1	-6
SOUTH	Door C8	7.2	3.7	26.5	0.448	57.4	57.5	-0.1	-1
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	60.0	57.5	2.5	87
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	57.2	57.5	-0.3	-66
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	57.9	57.5	0.4	88
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	50.0	57.5	-7.5	-73
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	57.4	57.5	-0.1	-14
					TOTAL TRANSMISSION LOAD =				14

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 14 + 0 = 14

ROOM TEMPERATURE (Tr) = (Ts 57.4) + (Q 14 / (1.08 x CFM 440) = 57.4 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = 0.0069

STEADY STATE ROOM TEMPERATURE:	57.5 °F dry bulb

7.13 LOOP CONDITION (WINTER)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 1,100 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.2 °F Design Rm Temp °F: 64

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	57.4	57.2	0.2	21
SOUTH	Door C9	7.2	3.7	26.5	0.448	57.4	57.2	0.2	2
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	60.0	57.2	2.8	155
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	57.1	57.2	-0.1	-14
EAST (ABOVE C12)	692.0' - ATTIC, 8' RMW	33.3	5.5	183.2	0.455	57.3	57.2	0.1	8
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	57.5	57.2	0.3	66
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	50.0	57.2	-7.2	-112
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	57.4	57.2	0.2	37
					TOTAL TRANSMISSION LOAD =				164

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 164 + 0 = 164

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 57.1 + 164 / (1.08 x 1,100) = 57.2 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 1,100) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.2 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 57.2 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	57.1	57.2	-0.1	-14
WEST (ATTIC C12)	692.0" - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	57.3	57.2	0.1	8
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	63.2	57.2	6.0	602
EAST	Door C11	7.2	8.0	57.4	0.448	63.2	57.2	6.0	154
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	57.4	57.2	0.2	28
SOUTH	Door C10	7.2	8.0	57.4	0.448	57.4	57.2	0.2	5
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	53.5	57.2	-3.7	-439
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	60.0	57.2	2.8	172
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	60.0	57.2	2.8	198
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	50.0	57.2	-7.2	-268
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	57.4	57.2	0.2	87
					TOTAL TRANSMISSION LOAD =				534

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL ROOM SENSIBLE LOAD: 0
SUPPLEMENTAL AIR HANDLING UNIT: 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 534 + 0 = 534

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	1353	2035
Temperature, °F	57.1	57.1

Total flow = 3,388 cfm
Supply air temperature: 57.1 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.1	) + (	534	/(1.08 x	3,388	) =	57.2 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	1353	2035
Humidity ratio	0.0069	0.0069

Total flow = 3,388 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 0 /(4840 x 3,388) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.2 °F dry bulb

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 3,267 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 63.2 °F Design Rm Temp °F: 60

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	50.0	63.2	-13.2	-554
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	63.2	-13.2	-620
NORTH	692.0' - Ground	22.0	NA	NA	1.000	50.0	63.2	-13.2	-290
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	60.0	63.2	-3.2	-207
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	60.0	63.2	-3.2	-39
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	57.2	63.2	-6.0	-596
WEST	Door C11	8.0	7.2	57.6	0.448	57.2	63.2	-6.0	-155
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	53.5	63.2	-9.7	-299
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	63.2	-13.2	-677
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	40.0	63.2	-23.2	-17,220
					TOTAL TRANSMISSION LOAD =				-20,658

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT 42,590

TOTAL INTERNAL: 42,590

Total Sensible Load = (Trans + Other Sens.) = -20,658 + 42,590 = 21,932

ROOM TEMPERATURE (Tr) = Ts 57.1 + Q 21,932 / (1.08 x CFM 3267) = 63.3 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 3267) = 0.0069

STEADY STATE ROOM TEMPERATURE: 63.2 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR

Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 57.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	50.0	57.4	-7.4	-1,339
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	57.5	57.4	0.1	5
NORTH	Door C3	7.2	8.0	57.4	0.448	57.5	57.4	0.1	3
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	58.0	57.4	0.6	85
NORTH	Door C4	7.2	3.7	26.5	0.448	58.0	57.4	0.6	7
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	57.4	57.4	0.0	0
NORTH	Door C5	7.2	6.3	45.2	0.448	57.4	57.4	0.0	0
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	57.5	57.4	0.1	17
NORTH	Door C6	7.2	6.3	45.2	0.448	57.5	57.4	0.1	2
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	57.9	57.4	0.5	71
NORTH	Door C7	7.2	3.7	26.5	0.448	57.9	57.4	0.5	6
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	57.5	57.4	0.1	6
NORTH	Door C8	7.2	3.7	26.5	0.448	57.5	57.4	0.1	1
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	57.2	57.4	-0.2	-21
NORTH	Door C9	7.2	3.7	26.5	0.448	57.2	57.4	-0.2	-2
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	57.1	57.4	-0.3	-11
NORTH	Door C13	7.2	3.0	21.5	0.448	57.1	57.4	-0.3	-3
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	57.3	57.4	-0.1	-3
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	57.2	57.4	-0.2	-27
NORTH	Door C10	7.2	8.0	57.4	0.448	57.2	57.4	-0.2	-5
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	53.5	57.4	-3.9	-168
EAST	Door C12	7.2	3.0	21.5	0.448	53.5	57.4	-3.9	-38
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	53.1	57.4	-4.3	-185
WEST	Door C1	7.2	3.0	21.5	0.448	53.1	57.4	-4.3	-41
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	50.0	57.4	-7.4	-279
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	62.0	57.4	4.6	763
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.376	56.9	57.4	-0.5	-59
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	57.4	57.4	0.0	0
					TOTAL TRANSMISSION LOAD =				-1,214

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0
TOTAL INTERNAL:	0

Total Sensible Load = (Trans + Other Sensible) = -1,214 + 0 = -1,214

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	3297	3190	1100
Temperature, °F	57.4	57.5	57.2

Total flow = 7,587 cfm
Supply air temperature: 57.4 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.4	) + (	-1,214	/(1.08 x	7,587	) =	57.3 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	3297	3190	1100
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 7,587 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 57.4 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 1,353 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.1 °F Design Rm Temperature: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	57.2	57.1	0.1	14
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	57.2	57.1	0.1	14
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	57.4	57.1	0.3	11
SOUTH	Door C13	7.2	3.0	21.5	0.448	57.4	57.1	0.3	3
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	60.0	57.1	2.9	44
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	60.0	57.1	2.9	17
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	50.0	57.1	-7.1	-68
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	57.3	57.1	0.2	24
					TOTAL TRANSMISSION LOAD =				58

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 58 + 0 = 58

ROOM TEMPERATURE (Tr) = Ts 57.1 + Q 58 / (1.08 x CFM 1,353) = 57.1 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 1,353) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.1 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 57.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	57.2	57.3	-0.1	-8
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	57.2	57.3	-0.1	-8
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	57.4	57.3	0.1	3
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	60.0	57.3	2.7	25
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	60.0	57.3	2.7	9
FLOOR	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	57.1	57.3	-0.2	-24
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	57.4	57.3	0.1	11
					TOTAL TRANSMISSION LOAD =				8

STEADY STATE ROOM TEMPERATURE:	57.3 °F dry bulb

7.13 LOOP CONDITION (WINTER)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 53.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	56.6	53.1	3.5	96
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	53.1	-3.1	-809
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	57.5	53.1	4.4	495
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	57.4	53.1	4.3	185
EAST	Door C1	7.2	3.0	21.5	0.448	57.4	53.1	4.3	41
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	53.1	-3.1	-12
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	-4

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: -4

STEADY STATE ROOM TEMPERATURE: 53.1 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 53.5 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	57.4	53.5	3.9	168
WEST	Door C12	7.2	3.0	21.5	0.448	57.4	53.5	3.9	38
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	53.5	-3.5	-914
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	57.2	53.5	3.7	439
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	63.2	53.5	9.7	266
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	53.5	-3.5	-13
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		-16

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: -16

STEADY STATE ROOM TEMPERATURE:	53.5 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 8,602 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 62.0 °F Design Rm Temp: 63

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	40.0	62.0	-22.0	-6,905
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	54.7	62.0	-7.3	-1,281
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	60.0	62.0	-2.0	-61
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	60.0	62.0	-2.0	-44
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	60.0	62.0	-2.0	-36
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	60.0	62.0	-2.0	-424
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	60.0	62.0	-2.0	-113
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	60.0	62.0	-2.0	-113
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	56.9	62.0	-5.1	-288
EAST	Door C22	7.2	6.00	43.0	0.448	56.9	62.0	-5.1	-98
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	63.1	62.0	1.1	296
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	40.0	62.0	-22.0	-3,360
WEST	Door C20	7.3	3.50	25.6	0.448	40.0	62.0	-22.0	-252
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	54.7	62.0	-7.3	-423
WEST	Door C21	7.2	3.00	21.5	0.448	54.7	62.0	-7.3	-70
FLOOR	692.0' - C2, 18" CI			989.0	0.305	57.5	62.0	-4.5	-1,357
FLOOR	692.0' - C3, 18" CI			775.9	0.305	58.0	62.0	-4.0	-947
FLOOR	692.0' - C4, 18" CI			842.5	0.305	57.4	62.0	-4.6	-1,182
FLOOR	692.0' - C5, 18" CI			189.8	0.305	57.5	62.0	-4.5	-261
FLOOR	692.0' - C11, 18" CI			544.0	0.305	57.4	62.0	-4.6	-763
CEILING	729.0 - C1, 18" CI			3341.2	0.376	60.0	62.0	-2.0	-2,513
					TOTAL TRANSMISSION LOAD =				-20,196

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 65,468

TOTAL INTERNAL **65,468**

Total Sensible Load = (Trans + Other Sensible) = -20,196 + 65,468 = 45,272

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10	0	8,602	57.1	0	57.1
(See Sect. 7.7)			(See Notes for this Section)		

ROOM TEMPERATURE (Tr) = (Ts 57.1) + (Q 45,272 /(1.08 x CFM 8,602) = 61.9 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: ***0***

ROOM HUMIDITY RATIO (Wr):
Wr = 0.0069 + 0 /(4840 x 8,602) = **0.0069**

STEADY STATE ROOM TEMPERATURE: 62.0 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. - 708.0' - C2
ROOM NAME: CORRIDOR

Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 56.9 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	57.4	56.9	0.5	28
EAST	Door C24	7.2	6.0	43.0	0.448	57.4	56.9	0.5	10
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	62.0	56.9	5.1	288
WEST	Door C22	7.2	6.0	43.0	0.448	62.0	56.9	5.1	98
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	40.0	56.9	-16.9	-2,936
SOUTH	Door C26	7.2	3.4	24.4	0.448	40.0	56.9	-16.9	-185
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	63.1	56.9	6.2	2,224
NORTH	Door C23	7.2	6.0	43.0	0.448	63.1	56.9	6.2	119
FLOOR	692.0' - C11, 18" CI			312.0	0.376	57.4	56.9	0.5	59
CEILING	729.0 - C1, 18" CI			312.0	0.305	60.0	56.9	3.1	295
					TOTAL TRANSMISSION LOAD =				1

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0
TOTAL ROOM SENSIBLE LOAD:	1

STEADY STATE ROOM CONDITIONS:	56.9 °F dry bulb

7.13 LOOP CONDITION (WINTER)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 63.1 °F Design Rm Temp °F: 63

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	56.9	63.1	-6.2	-2,224
SOUTH	Door C23	7.2	6.0	43.0	0.448	56.9	63.1	-6.2	-119
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	60.0	63.1	-3.1	-100
NORTH	713.0' - Ion, fltr rm, 36"	39.0	16.0	624.0	0.236	60.0	63.1	-3.1	-457
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	57.4	63.1	-5.7	-1,851
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	62.0	63.1	-1.1	-357
FLOOR	692.0' - C5, 18" CI			765.9	0.305	57.5	63.1	-5.6	-1,308
FLOOR	692.0' - C6, 18" CI			526.1	0.305	57.9	63.1	-5.2	-834
CEILING	729.0 - C1, 18" CI			1292.0	0.376	60.0	63.1	-3.1	-1,506
					TOTAL TRANSMISSION LOAD =				-8,756

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 54,444

TOTAL ROOM SENSIBLE LOAD: **54,444**

Total Sensible Load = (Trans + Other Sensible) = -8,756 + 54,444 = 45,688

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.8)	0	6,677	57.1	0	57.1

(See Notes for this Section)

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	6677	0
Temperature, °F	57.1	0.0

Total flow = 6,677 cfm
Supply air temperature: 57.1 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.1	) + (	45,688	/(1.08 x	6,677	) =	63.4 °F

LATENT LOAD: Q latent

PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	6677	0.0
Humidity ratio	0.0069	0.0000

Total flow = 6,677 cfm
Wr' = 0.0069 # moist / # dry air
Wr = 0.0069 + 0 /(4840 x 6,677) = 0.0069

STEADY STATE ROOM TEMPERATURE: **63.1 °F dry bulb**

7.13 LOOP CONDITION (WINTER)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 9,268 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 57.4 °F Design Rm Temperature: 62

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	40.0	57.4	-17.4	-6,014
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	51.8	57.4	-5.6	-983
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	60.0	57.4	2.6	90
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	60.0	57.4	2.6	56
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	60.0	57.4	2.6	47
NORTH	713.0' - Ion, fltr rm, 36"	42.0	15.00	630.0	0.236	60.0	57.4	2.6	387
NORTH	713'-AB Gen Area, 36" CI	48.0	14.50	696.0	0.236	60.0	57.4	2.6	427
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	63.1	57.4	5.7	1,917
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	56.9	57.4	-0.5	-28
WEST	Door C24	7.2	6.0	43.0	0.448	56.9	57.4	-0.5	-10
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	40.0	57.4	-17.4	-2,763
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	51.8	57.4	-5.6	-325
EAST	Door C25	7.2	3.0	21.5	0.448	51.8	57.4	-5.6	-54
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.376	57.9	57.4	0.5	43
FLOOR	692.0' - C11, 18" CI	75.9	8.0	607.2	0.376	57.4	57.4	0.0	0
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.376	57.5	57.4	0.1	14
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.305	57.2	57.4	-0.2	-37
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	57.3	57.4	-0.1	-11
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.305	57.2	57.4	-0.2	-87
CEILING	729.0 - C1, 18" CI			3610.9	0.305	60.0	57.4	2.6	2,863
					TOTAL TRANSMISSION LOAD =				-4,466

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
EQUIPMENT 6,311

TOTAL ROOM SENSIBLE LOAD: 6,311

Total Sensible Load = (Trans + Other Sensible) = -4,466 + 6,311 = 1,845

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.9)	0	9,268	57.1 (See Notes for this Section)	0	57.1

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 57.1 + 1,845 / (1.08 x 9,268) = 57.3 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 9,268) = 0.0069

STEADY STATE ROOM TEMPERATURE: 57.4 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 54.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	40.0	54.7	-14.7	-541
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	40.0	54.7	-14.7	-1,218
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	62.0	54.7	7.3	1,281
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	62.0	54.7	7.3	423
EAST	Door C21	7.2	3.0	21.5	0.448	62.0	54.7	7.3	70
FLOOR (See Note)	[illegible]								
CEILING (See Note)	[illegible]								
					TOTAL TRANSMISSION LOAD =				16

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 16

STEADY STATE ROOM TEMPERATURE: 54.7 °F dry bulb

This page replaced by Revision 20.

7.13 LOOP CONDITION (WINTER)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 51.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	40.0	51.8	-11.8	-434
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	40.0	51.8	-11.8	-977
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	57.4	51.8	5.6	983
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	57.4	51.8	5.6	377
WEST	Door C25	7.2	3.0	21.5	0.448	57.4	51.8	5.6	54
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1

Note: No transmission through the filor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 1

STEADY STATE ROOM TEMPERATURE:	51.8 °F dry bulb

7.13 LOOP CONDITION (WINTER)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	3,267	63.2	0.0069	22.5	206,474
COMMUNICATION ROOM (692.0' - C9)	3,388	57.2	0.0069	23.4	193,794
MECHANICAL EQUIP. ROOM WEST (C1)	6,884	56.6	0.0069	47.5	389,634
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	8,602	62.0	0.0069	59.4	533,324
COMPUTER ROOM (708.0' - C3)	6,677	63.1	0.0069	46.1	421,319
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	9,268	57.4	0.0069	63.9	531,955
OUTSIDE AIR	2,420	13.0	0.0003	0.7	31,460
TOTAL	Vreturn = 40,506			263.5	2,307,960

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 57.0 °F

Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0065 # MOIST / # DRY AIR

This page replaced by Revision 20.

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 09, 2010 at 12:31:22 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 09, 2010 at 12:31:22 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Monday, August 09, 2010 at 12:31:22 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 6
DATE: 30-30-03
PROCEDURE: EBR LOCA WINTER

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	65.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	6095.00
Inlet Temperature (degrees F):	42.00	57.00
Outlet Temperature (degrees F):	42.77	42.27
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2363.57	5.74
Clean Pressure Drop (psi):	64.22	Not Calculated
Fouled Pressure Drop (psi):	76.80	Not Calculated
Velocity (ft/s and ft/min):	14.34	174.14

Air Flow Zones:	1	2
Air Flow Percentage:	50.00	50.00

Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 120882/ 99289/ 21592 Btu/hr
Average Overall Heat Transfer Coefficient: 5.06 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 42.27 deg F

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PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, August 13, 2010 at 12:22:38 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, August 13, 2010 at 12:22:38 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Friday, August 13, 2010 at 12:22:38 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 03
DATE: 08-24-04
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	65.00
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	6095.00
Inlet Temperature (degrees F):	42.00	57.00
Outlet Temperature (degrees F):	43.01	42.30
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1886.09	5.74
Clean Pressure Drop (psi):	39.64	Not Calculated
Fouled Pressure Drop (psi):	47.41	Not Calculated
Velocity (ft/s and ft/min):	10.94	174.14

Air Flow Zones:	1	2
Air Flow Percentage:	50.00	50.00

Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 120475/ 99083/ 21392 Btu/hr
Average Overall Heat Transfer Coefficient: 5.00 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 42.30 deg F

8.0 SUMMARY OF RESULTS AND CONCLUSIONS (Note)

8.1 NORMAL PLANT OPERATION - SUMMER

Case 1 (Maximum Room Temperatures and Minimum AHU Cooling Capability)

Table 8.1-1 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.8. Design values reflect the current normal maximum EDD temperatures.

TABLE 8.1-1 (Temperature & Relative Humidity - Normal Summer - Case 1)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	31,295		86	77	20-60	43
MECHANICAL EQUIPMENT ROOM (C2)	8,471		86	75	20-60	47
250V BATTERY ROOM 1 (C3)	3,882		90	77	18-65	44
250V BATTERY BOARD ROOM 1 (C4)	41,165		90	73	18-65	51
250V BATTERY BOARD ROOM 2 (C5)	42,132		90	72	18-65	51
250V BATTERY ROOM 2 (C6)	2,558		90	76	18-65	45
24V & 48V BATTERY ROOM (C7)	742		90	75	18-65	47
24V & 48V BATTERY BOARD ROOM (C8)	13,739		90	75	18-65	47
COMMUNICATION ROOM (C 9)	29,583	400	90	77	18-65	47
MECHANICAL EQUIPMENT ROOM EAST (C10)	68,503		86	81	20-60	38
CORRIDOR (C 11)	5,150			73		
SECONDARY ALARM STATION (C12)	28,962	200	90	81	18-65	38
ATTIC (above C12)	841			75		
WEST STAIRWELL (STAIR C1)	187			73		
EAST STAIRWELL (STAIR C2)	785			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	162,056	400	90	78	40-60	41
CORRIDOR (C 2)	309			89		
COMPUTER ROOM (C3)	121,742	400	74	69	40-70	54
UNIT # 2 AUX INSTRUMENT ROOM (C4)	105,865	200	90	71	40-70	54
WEST STAIRWELL (STAIR C1)	84			91		
EAST STAIRWELL (STAIR C2)	254			85		
SUMMARY:	668,305	1,600				

As shown in Table 8.1-1, calculated temperatures and relative humidities in each room are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.1-1A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (summer) cooling scenario.

TABLE 8.1-1A (Cooling Loads & AHU Heat Duty - Normal Summer - Case 1)

Cooling Load Name	Final Cooling Load	Computer Room AHU **	AHU A-A (216 gpm) AIRCOOL *	AHU B-A (216 gpm) AIRCOOL *	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	668,305	79,460	426,751	426,751	932,962
Latent	1,600	-	48,584	48,584	97,168
Total	669,905	79,460	475,335	475,335	1,030,130

* For Heat Duty see pg. 7.8.27
** For Heat Duty see pg. 7.8.30

See page 8.7 for evaluation of chiller capacity.

Note: See Section 6.0 in Appendix 11 for the summary of results and conclusions for dual unit operation.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

8.1 NORMAL PLANT OPERATION - SUMMER

Case 2 (Minimum Room Temperatures and Maximum AHU Cooling Capability)

Table 8.1-2 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.9. Design values reflect the current normal maximum EDD temperatures.

TABLE 8.1-2 (Temperature & Relative Humidity - Normal Summer - Case 2)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	32,439		86	76	20-60	45
MECHANICAL EQUIPMENT ROOM (C2)	7,426		86	74	20-60	48
250V BATTERY ROOM 1 (C3)	3,425		90	76	18-65	43
250V BATTERY BOARD ROOM 1 (C4)	40,033		90	73	18-65	49
250V BATTERY BOARD ROOM 2 (C5)	40,757		90	72	18-65	49
250V BATTERY ROOM 2 (C6)	2,050		90	75	18-65	45
24V & 48V BATTERY ROOM (C7)	529		90	74	18-65	46
24V & 48V BATTERY BOARD ROOM (C8)	13,018		90	74	18-65	46
COMMUNICATION ROOM (C 9)	28,096	400	90	77	18-65	47
MECHANICAL EQUIPMENT ROOM EAST (C10)	68,194		86	81	20-60	36
CORRIDOR (C 11)	3,794			73		
SECONDARY ALARM STATION (C12)	28,690	200	90	82	18-65	37
ATTIC (above C12)	765			74		
WEST STAIRWELL (STAIR C1)	94			73		
EAST STAIRWELL (STAIR C2)	719			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	173,159	400	90	75	40-60	44
CORRIDOR (C 2)	108			88		
COMPUTER ROOM (C3)	125,439	400	74	66	40-70	58
UNIT # 2 AUX INSTRUMENT ROOM (C4)	117,641	200	90	67	40-70	59
WEST STAIRWELL (STAIR C1)	-53			89		
EAST STAIRWELL (STAIR C2)	163			83		
SUMMARY:	686,487	1,600				

As shown in Table 8.1-2, calculated temperatures and relative humidities in each room are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.1-2A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (summer) cooling scenario.

TABLE 8.1-2A (Cooling Loads & AHU Heat Duty - Normal Summer - Case 2)

Cooling Load Name	Final Cooling Load	Computer Room AHU ***	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	686,487	98,333	472,197	478,665	1,049,195
Latent	1,600	-	157,703	164,249	321,952
Total	688,087	98,333	629,900	642,914	1,371,147

* For Heat Duty see pg. 7.9.27
** For Heat Duty see pg. 7.9.30
*** For Heat Duty see pg. 7.9.33

See page 8.7 for evaluation of chiller capacity.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

8.2 LOCA CONDITION - SUMMER - NO CONCURRENT LOOP

Case 1 (Maximum Room Temperatures and Minimum AHU Cooling Capability)

Table 8.2-1 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.10. Design values reflect the current maximum LOCA EDD temperatures.

TABLE 8.2-1 (Temperature & Relative Humidity - LOCA Summer - Case 1)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	35,698		89	80	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	10,631		83	77	NA	NA
250V BATTERY ROOM 1 (C3)	4,847		88	80	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	43,781		85	74	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	44,923		85	73	NA	NA
250V BATTERY ROOM 2 (C6)	3,495		88	78	NA	NA
24V & 48V BATTERY ROOM (C7)	1,062		90	77	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	14,957		85	76	NA	NA
COMMUNICATION ROOM (C 9)	34,888	400	88	79	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	73,955		87	83	NA	NA
CORRIDOR (C 11)	7,933			75		
SECONDARY ALARM STATION (C12)	29,738	200	82	82	NA	NA
ATTIC (above C12)	408			78		
WEST STAIRWELL (STAIR C1)	1			74		
EAST STAIRWELL (STAIR C2)	637			73		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	239,274	400	89	89	NA	NA
CORRIDOR (C 2)	-77			96		
COMPUTER ROOM (C3) [2]	122,386	400	82	78	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	158,858	200	87	77	NA	NA
WEST STAIRWELL (STAIR C1)	-181			102		
EAST STAIRWELL (STAIR C2)	140			93		
SUMMARY:	827,353	1,600				

As shown in Table 8.2-1, calculated temperatures in each room are less or equal than values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.2-1A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOCA (summer) cooling scenario.

TABLE 8.2-1A (Cooling Loads & AHU Heat Duty - LOCA Summer - Case 1)

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (216 gpm) AIRCOOL *	AHU B-A (216 gpm) AIRCOOL *	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	827,353	N/A	554,868	554,868	1,109,736
Latent	1,600	N/A	-	-	-
Total	828,953	N/A	554,868	554,868	1,109,736

* For Heat Duty see pg. 7.10.27.

See page 8.7 for evaluation of chiller capacity.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

8.2 LOCA CONDITION - SUMMER - NO CONCURRENT LOOP

Case 2 (Minimum Room Temperatures and Maximum AHU Cooling Capability)

Table 8.2-2 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.11. Design values reflect the current maximum LOCA EDD temperatures.

TABLE 8.2-2 (Temperature & Relative Humidity - LOCA Summer - Case 2)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	39,395		89	75	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	11,695		83	72	NA	NA
250V BATTERY ROOM 1 (C3)	5,264		88	75	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	44,442		85	69	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	44,166		85	68	NA	NA
250V BATTERY ROOM 2 (C6)	3,105		88	73	NA	NA
24V & 48V BATTERY ROOM (C7)	1,186		90	72	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	15,253		85	71	NA	NA
COMMUNICATION ROOM (C 9)	35,994	400	88	74	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	77,397		87	79	NA	NA
CORRIDOR (C 11)	9,692			70		
SECONDARY ALARM STATION (C12)	29,939	200	82	77	NA	NA
ATTIC (above C12)	621			73		
WEST STAIRWELL (STAIR C1)	72			72		
EAST STAIRWELL (STAIR C2)	781			71		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	245,090	400	89	84	NA	NA
CORRIDOR (C 2)	175			93		
COMPUTER ROOM (C3)	142,009	400	82	65	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	164,907	200	87	73	NA	NA
WEST STAIRWELL (STAIR C1)	-36			99		
EAST STAIRWELL (STAIR C2)	282			90		
SUMMARY:	871,430	1,600				

As shown in Table 8.2-2, calculated temperatures in each room are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.2-2A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOCA (summer) cooling scenario.

TABLE 8.2-2A (Cooling Loads & AHU Heat Duty - LOCA Summer - Case 2)

Cooling Load Name	Final Cooling Load	Computer Room AHU***	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	871,430	82,805	551,989	556,832	1,191,626
Latent	1,600	-	82,312	87,153	169,465
Total	873,030	82,805	634,301	643,985	1,361,091

* For Heat Duty see pg. 7.11.30
** For Heat Duty see pg. 7.11.27
*** For Heat Duty see pg. 7.11.33

See page 8.7 for evaluation of chiller capacity.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

8.3 NORMAL PLANT OPERATION - WINTER

Table 8.3 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.12. Design values reflect the current normal minimum EDD temperatures.

TABLE 8.3 (Temperature & Relative Humidity - Normal Winter)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	-5,812		66	68	20-60	56
MECHANICAL EQUIPMENT ROOM (C2)	1,408		66	72	20-60	51
250V BATTERY ROOM 1 (C3)	1,193		70	73	18-65	48
250V BATTERY BOARD ROOM 1 (C4)	35,027		70	73	18-65	50
250V BATTERY BOARD ROOM 2 (C5)	35,672		70	73	18-65	48
250V BATTERY ROOM 2 (C6)	744		70	73	18-65	49
24V & 48V BATTERY ROOM (C7)	-509		70	71	18-65	52
24V & 48V BATTERY BOARD ROOM (C8)	10,689		70	72	18-65	50
COMMUNICATION ROOM (C 9)	17,792	0	70	75	18-65	48
MECHANICAL EQUIPMENT ROOM EAST (C10)	31,591		66	72	20-60	50
CORRIDOR (C 11)	-4,666			72		
SECONDARY ALARM STATION (C12)	26,536		70	81	18-65	39
ATTIC (above C12)	1,247			70		
WEST STAIRWELL (STAIR C1)	130			59		
EAST STAIRWELL (STAIR C2)	621			59		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	90,777	0	64	72	40-60	51
CORRIDOR (C 2)	197			66		
COMPUTER ROOM (C3)	83,952	0	65	70	40-70	53
UNIT # 2 AUX INSTRUMENT ROOM (C4)	30,726	0	64	65	40-70	63
WEST STAIRWELL (STAIR C1)	172			64		
EAST STAIRWELL (STAIR C2)	89			60		
SUMMARY:	357,576	0				

As shown in Table 8.3, calculated temperatures in each room are greater than currently shown on the applicable EDDs (Ref. 5.5 through 5.7). Relative humidity levels are within the limits as shown on EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.3.1, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (winter) cooling scenario.

TABLE 8.3.1 (Cooling Loads & AHU Heat Duty - Normal Winter)

Cooling Load Name	Final Cooling Load (Btu/h)	Computer Room AHU (Btu/h)	AHU A-A (216 gpm) AIRCOOL* (Btu/h)	AHU B-A (284 gpm) AIRCOOL** (Btu/h)	TOTAL three (3) AHUs (Btu/h)
Sensible	357,576	-	329,302	333,430	662,732
Latent	0	-	78,254	82,619	160,873
Total	357,576	-	407,556	416,049	823,605

* For Heat Duty see pg. 7.12.33

** For Heat Duty see pg. 7.12.48

See page 8.7 for evaluation of chiller capacity.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

8.4 LOOP CONDITION - WINTER (minimum room temperatures at maximum AHU capability)

Table 8.4 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 7.13. Design values reflect the current minimum LOCA EDD temperatures.

TABLE 8.4 (Temperature & Relative Humidity - LOOP Winter)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	-6,928		55	57	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	865		55	58	NA	NA
250V BATTERY ROOM 1 (C3)	595		55	58	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	1,376		55	57	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	1,650		55	58	NA	NA
250V BATTERY ROOM 2 (C6)	530		55	58	NA	NA
24V & 48V BATTERY ROOM (C7)	14		55	58	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	164		55	57	NA	NA
COMMUNICATION ROOM (C 9)	534	0	55	57	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	21,932		55	63	NA	NA
CORRIDOR (C 11)	-1,214			57		
SECONDARY ALARM STATION (C12)	58		55	57	NA	NA
ATTIC (above C12)	8			57		
WEST STAIRWELL (STAIR C1)	-4			53		
EAST STAIRWELL (STAIR C2)	-16			54		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	45,272	0	60	62	NA	NA
CORRIDOR (C 2)	1			57		
COMPUTER ROOM (C3)	45,688	0	55	63	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	1,845	0	55	57	NA	NA
WEST STAIRWELL (STAIR C1)	16			55		
EAST STAIRWELL (STAIR C2)	1			52		
SUMMARY:	112,386	0				

As shown in Table 8.4, calculated temperatures in each room are greater than currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.4.1, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOOP (winter) cooling scenario.

TABLE 8.4.1 (Cooling Loads & AHU Heat Duty - LOOP Winter)

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	112,386	-	105,006	99,289	204,295
Latent	0	-	28,076	21,592	49,668
Total	112,386	-	133,082	120,881	253,963

* For Heat Duty see pg. 7.13.30
** For Heat Duty see pg. 7.13.27

See page 8.7 for evaluation of chiller capacity.

8.0 SUMMARY OF RESULTS AND CONCLUSIONS

CONCLUSION

Chiller capacity (see Section 2.2) = 1,807,200 Btu/h or 151 tons

Maximum computed total AHU heat duty for normal and post LOCA are as follows:

Table 8.1-2A: 1,371,147 Btu/h (normal)
Table 8.2-2A: 1,361,091 Btu/h (LOCA)

Note: Normal considers both EBR AHUs plus the computer room AHU.
LOCA considers both EBR AHUs plus the computer room AHU since a concurrent LOOP is not postulated.

NORMAL OPERATION :

Largest total cooling load (see Table 8.1-2A) : 688,087 Btu/h
or
57.3 tons

Total AHU heat duty = (1371147.0) / 12000 = 114 tons
114 tons > Total cooling load = 57.3 tons

Chilled water pump load = 2.975 tons (see Section 7.8)

Chiller capacity = 151 tons > Total heat duty (w/pump) = 117 tons

LOCA CONDITION:

Largest total cooling load (see Table 8.2-2A) : 873,030 Btu/h
or
72.8 tons

Total AHU heat duty = (1361091.0) / 12000 = 113 tons
113 tons > Total cooling load = 72.8 tons

Chilled water pump load = 2.975 tons (see Section 7.8)

Chiller capacity = 151 tons > Total heat duty (w/pump) = 116 tons

SINCE EACH EBR CHILLER HAS A TOTAL CAPACITY OF 151 TONS, EACH HAS AN EXCESS CAPACITY OF APPROXIMATELY:

151 tons
117 tons
34 tons or 408,000 Btu/h

This page replaced by Revision 20.

CALC. EPMMCP071689
ATTACHMENT 1 SH. 1
Page 1-0-4-102

TVA 10697 (DNE 6-86) **QA Record**

DNE CALCULATIONS

TITLE COOLING & HEATING LOAD ANALYSIS - CONTROL BUILDING - ELECTRICAL BOARD ROOMS	PLANT/UNIT WBNP / 1 & 2
PREPARING ORGANIZATION SARGENT & LUNDY ENGRS	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) HVAC CONT BLDG COOLING & HEATING LOAD CALCULATION

BRANCH/PROJECT IDENTIFIERS	Rev	(for RIMS' use)	RIMS accession number
WBN-31-D053 EPM-MCP-071689	R0	900806E0017	B26 '90 0726 258
APPLICABLE DESIGN DOCUMENT(S) N3-30CB-4002	R1	910509B0017	B26 '91 0409 206
	R_		
SAR SECTION(S) 9.4 / UNID SYSTEM(S) 31	R_		

Each time these calculations are issued, preparers must ensure that the original (RO) RIMS accession number is filled in.

	Revision 0	R1	R2	R3
ECN No. (or indicate Not Applicable)	N/A	N/A		
Prepared	[signature] 6-27-90	P.W. Barnett 3/25/91		
Checked	S.S. Kiga 6.27.90	[signature]		
Reviewed	S.S. Kiga 6.27.90	[signature]		
Approved	[signature]	[signature]	[signature] 10/21/92	
Date	7/26/90	4/5/91	PL 10/26/92	
List all pages added by this revision.		See Rev Log		
List all pages deleted by this revision.		See Rev Log		
List all pages changed by this revision.		See Rev Log		

Use form TVA 10534 if more space required.

Safety-related? Yes ☒ No ☐

Statement of Problem

CALCULATE & SUMMARIZE TOTAL SPACE/ROOM COOLING and HEATING LOADS FOR BOTH NORMAL AND ACCIDENT (LOCA) MODES. CALCULATED HEAT LOADS WILL BE USED IN THE ANALYSIS OF EQUIPMENT/COMPONENTS PERFORMANCE CALC. EPM-MCP-090189.

ORIGINAL

INFORMATION ONLY

Abstract

These calculations contain an unverified assumption(s) that must be verified later. Yes ☐ No ☒

ORIGINAL

USING ASHRAE VALUES, EQUATIONS & CALCULATION METHODS AND APPLICABLE SARGENT & LUNDY ENGINEERS' CALCULATION GUIDELINES, THE COOLING AND HEATING LOADS WERE DETERMINED. OTHER U-FACTORS WERE OBTAINED FROM CALC. NO EPM-JTB-061289, RIMS B26890727553 (Heat Transmission Coefficients).

FROM SECTION 6.9 OF THIS CALC., THE CALCULATED TOTAL HEAT LOADS ARE:-

	COOLING		HEATING	
NORMAL MODE -	1,233,755	BTUH	5,965	BTUH
ACCIDENT MODE	1,052,763	BTUH	58,217	BTUH

R1

RIMS, ETSLE28P-K

THIS SHEET REPLACED ON Rev 1.

R2 10/21/92 PL 10/26/92

☐ Microfilm and store calculations in RIMS Service Center. Microfilm and destroy. ☐

☒ Microfilm and return calculations to DCRM-WBN Address TSOB-WBN

TVA 10697 (DNE-6-86) **QA Record** DNE CALCULATIONS SHEET 1a OF ~~166~~ 244

TITLE: COOLING AND HEATING LOAD ANALYSIS - CONTROL BUILDING - ELECTRICAL BOARD ROOMS					PLANT/UNIT 1 & 2 WATTS BAR NUCLEAR PLANT
PREPARING ORGANIZATION DNE, EBASCO, MECHANICAL	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) MEB. HVAC CONTROL BUILDING COOLING AND HEATING LOAD CALCULATION				
BRANCH/PROJECT IDENTIFIERS WBN-31-D053 EPM-MCP-071689	Each time these calculations are issued, preparer must ensure that the original (RO) RIMS accession number is filled in. Rev. (for RIMS' use)				RIMS accession number
	RO	900806E0017			B26900726258
APPLICABLE DESIGN DOCUMENT(S) N3-30CB-4002, DCN S09714-A, DCN 06202, DCN 11807	R2	NOV 10 1992 (20)			B18 '92 1031 269
	R3	(121)			B18 '93 0305 269
SAR SECTION(S) 9-4 / UNID SYSTEM(S) 31	R				
REVISION 0	R1	R2	R3		Safety-related? YES [X] NO [ ]
ECN NO.(or Indicate Not Applicable) SEE SHEET 1	SEE SHEET 1	N/A	N/A		Statement of Problem
Prepared: SEE SHEET 1	SEE SHEET 1	J.Paris 10/21/92	J. PARIS 3/5/93		Calculate and summarize total space/room cooling and heating loads and space conditions for both normal and accident modes of operation.
Checked/Verified: SEE SHEET 1	SEE SHEET 1	R MADRIGAL 10/26/92	R MADRIGAL 3/5/93		
Reviewed: SEE SHEET 1	SEE SHEET 1	J.K.BACALAKIS	AJ Ugelow		ORIGINAL
Approved: SEE SHEET 1	SEE SHEET 1	[signature] 10/30/92	[signature] 3-5-93 R Lolito		CALC ID EPMMCP071689 LEGIBILITY EVALUATED and ~~ATTACHMENT~~ for issue. 2 SHEET 2
Date: 7/26/90	SEE SHEET 1	10/30/92	3/5/93		[signature] 10/30/92 Signature Date
USE FORM TVA 10534 IF MORE SPACE REQUIRED — List all pages added by this revision	SEE REV LOG	SEE REV LOG			
List all pages deleted by this revision	SEE REV LOG	SEE REV LOG			
List all pages changed by this revision	SEE REV LOG	SEE REV LOG			

Calculation contains special requirements or limiting conditions? Yes [ ] No [X]

INFORMATION ONLY

Abstract: These calculations contain an unverified assumption(s) that must be verified later. Yes [ ] No [X]

This calculation determines cooling and heating loads and space conditions in the Electrical Board Rooms in the Control Building, for normal and accident (LOCA) modes of operation. THE COOLING AND HEATING LOADS WERE DETERMINED IN ORDER TO CALCULATE ROOM TEMPERATURES.
ASHRAE method and design space conditions from 47E-235 environmental drawings were used for determination of the cooling and heating load as well as space conditions. Calculated cooling and heating loads and space conditions are listed in the summary sheets.

THE RESULTS OF THE CALCULATION SHOW THAT ALL ROOMS MEET ENVIRONMENTAL CRITERIA FOR NORMAL AND LOCA MODES. ~~EXCEPT THE COMMUNICATIONS RM DURING NORMAL COOLING AND THE UNIT 1 AUX. INSTRUMENT RM DURING NORMAL HEATING.~~ JP 3/5/93 PS 3/5/93

JP R3 3/5/93 PS 3/5/93

[ ] Microfilm and store calculations in RIMS Service Center [ ] Microfilm and destroy.

[X] Microfilm and return calculations to: Calculation Library Address: CCC IOB-A WBNP

EB-ME-
cc: RIMS, SL 26 C-K; A Ugelow, Trailer E-5, WBNP D Kilgore, Trailer E-7, WBNP MCB

CHLA.CVR

THIS SHEET IS ADDED BY REV. 2

TVA 10697 (DNE-6-86) QA Record

DNE CALCULATIONS

CALC ID EPM MCP 071689

ATTACHMENT 1 SHEET 3

SHEET ~~1b of 111~~

TITLE: COOLING AND HEATING LOAD ANALYSIS - CONTROL BUILDING - ELECTRICAL BOARD ROOMS				PLANT/UNIT WATTS BAR NUCLEAR PLANT/#1 & 2
PREPARING ORGANIZATION DNE, EBASCO, MECHANICAL	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) MEB, HVAC CONTROL BUILDING COOLING AND HEATING LOAD CALCULATION			
BRANCH/PROJECT IDENTIFIERS WBN-31-D053 EPM-MCP-071689	Each time these calculations are issued, preparer must ensure that the original (R0) RIMS accession number is filled in. Rev. (for RIMS' use)			RIMS accession number
	R0	900806E0017		B26900726258
APPLICABLE DESIGN DOCUMENT(S) N3-30CB-4002, DCN S09714-A, DCN 06202, DCN 11807	R4	JUN 2 4 1993 (124) B18 '93		0617 273
	R5	DEC 0 1 1993 (129) B18 '93		1124 255
SAR SECTION(S) 9-4 / UNID SYSTEM(S) 31	R6	B26		950712 336
REVISION 0	R4	R5	R6	Safety-related? YES [X] NO [ ]
ECN NO.(or Indicate Not Applicable) See Sheet 1	DCN M-11410-A	NA	DCN S-37195-A	Statement of Problem
Prepared: See Sheet 1	Kadir Karakus / KADIR KARAKUS	R. Rodriguez	D.T. Soko	Calculate and summarize total space/room cooling and heating loads ans space conditions for both normal and accident modes of operation.
Checked: See Sheet 1	H A JALIL	A. Stern	B.O. Cingill	
Reviewed: See Sheet 1	Vincent Rubano	11/23/93	B.O. Cingill	
Approved: See Sheet 1	[signature] 6/17/93 L.E.	11/23/93	[signature]	CALCULATION REVISION: REV. 6.
Date: 7/26/90	6/17/93	11/23/93	7/12/95	___ ENTIRE CALC. X Selected Pages
USE FORM TVA 10534 IF MORE SPACE REQUIRED — List all pages added by this revision.	See Rev. Log	SEE REV. LOG	SEE REV. LOG	
List all pages deleted by this revision.	See Rev. Log	SEE REV. LOG	SEE REV. LOG	
List all pages changed by this revision.	See Rev. Log	SEE REV. LOG	SEE REV. LOG	ORIGINAL

Abstract: These calculations contain an unverified assumption(s) that must be verified later. Yes [ ] No [X]

Calculation contains special requirements or limiting conditions. Yes [ ] No [X]

~~Revision 4 is a Revision Log change. This revision must be used in conjunction with Revision 3 to establish the complete calculation.~~ R4
KK 6-17-93

SEE SHEET 1a

INFORMATION ONLY

LEGIBILITY EVALUATED and ACCEPTED for issue.

[signature] 6/17/93

Signature Date

[ ] Microfilm and store calculations in RIMS Service Center
[X] Microfilm and return calculations to: Calc Control Center

Microfilm and destroy. [ ]
Address: CCC, IOBA, WBNP

cc: RIMS, SL 26 C-K; V F Rubano, Trailer E-4, WBNP D Kilgore, Trailer E-6, WBNP
EB-ME-1836

MEB

WP51/CALCS/COVSHT.KK/Debra

TVA 10697 (DNE-6-86)

DNE CALCULATIONS **QA Record**

SHEET 1c OF

CALC ID EPM MCP071689 ATTACHMENT 1 SHEET 4 310

TITLE: COOLING AND HEATING LOAD ANALYSIS- CONTROL BUILDING - ELECTRICAL BOARD ROOMS					PLANT/UNIT WATTS BAR NUCLEAR PLANT UNITS 1 & 2
PREPARING ORGANIZATION NE-GILBERT/COMMONWEALTH- MECHANICAL	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) MEB, HVAC CONTROL BUILDING COOLING AND HEATING LOAD CALC				
BRANCH/PROJECT IDENTIFIERS WBN-31-D053 ~~EMP~~-MCP-071689 EPM	Each time these calculations are issued, preparer must ensure that the original (R0) RIMS accession number is filled in. Rev.	(for RIMS' use)			RIMS accession number
	R0	9008006E0017			B26900726258
APPLICABLE DESIGN DOCUMENT(S)	R7				B26 '950908
See Sheet 1a	R8	B26 981208 300			
SAR SECTIONS(S) 9-4 / UNID SYSTEM(S) 31	R9	B26 000207 468			
REVISION 0	R7	R8	R9		Safety-related? YES [X] NO [ ]
ECN NO. (or Indicate Not Applicable)	DCN S-37939-A	DCN M-39911-A	DCN D50479		Statement of Problem See Sheet 1a
Prepared: *	Donald T. Sokol (signature)	M.J. MATANI (signature)	GA SILVER (signature)		
Checked/Verified: *	A PINEDA (signature)	Dan Rosse (signature)	GA Trotter (signature)		Calculation Revision: R7, R8 X Entire Calculation R9 X Selected Pages
Reviewed: *	(signature)	Dan Rosse (signature)	(signature)		Quality Related? YES [X] NO [ ]
Approved: *	(signature) for PS SMITH	(signature)	(signature)		Microfiche Generated? YES [ ] NO [X] Number SAR Affected? YES [ ] NO [X]
Date: *	9/8/95	12/8/98	02/07/2000		**ORIGINAL**
USE FORM TVA 10534 IF MORE SPACE REQUIRED — List all pages added by this revision	See Rev Log		See Rev. Log		Calculation Classification: Essential
List all pages deleted by this revision	See Rev Log		See Rev. Log		
List all pages changed by this revision	See Rev Log		See Rev. Log		These calculations contain a design output attachment? YES [ ] NO [X]

INFORMATION ONLY

Abstract: These calculations contain an unverified assumption(s) that must be verified later. Yes [ ] No [X]

This calculation contains special requirements or limiting conditions. Yes [ ] No [X]

For Abstract see page 1a

Note:

Revision 7 is a Revision Log Change. This calculation must be worked in conjunction with revision 5 and 6 to establish the complete calculation. Revision 5 is the latest revision which issued the entire calculation. R7

Revision 8 of this calculation has no impact on temperature in Rooms 692-C4 (Batt. Bd Rm 1) 708-C1 (Aux. Instrument) & 708-C3 (Computer Rm) and has no adverse affect on the capacity of Electric Board Rooms HVAC system. R8

* See original signatures on sheet 1.

[ ] Microfilm and store calculations in RIMS Service Center

[X] Microfilm and return calculations to: Calculation Library

Microfilm and destroy. [ ]

Address: NQA Building

cc: RIMS, SL 26 C-K;

CALC ID EPM MCP 071689
ATTACHMENT 1 SHEET 5

TVAN CALCULATION COVERSHEET/CCRIS UPDATE

CALC ID	TYPE	PLANT	BRANCH	NUMBER	REV
	CN	WBN	MEB	EPM-MCP-071689	12

BLDG	ROOM	ELEV	COORD/AZIM	FIRM	Print Report Yes ☐

CATEGORIES E

KEY NOUNS (A-add, D-delete)

ACTION (A/D)	KEY NOUN	A/D	KEY NOUN

CROSS-REFERENCES (A-add, C-change, D-delete)

ACTION (A/C/D)	XREF CODE	XREF TYPE	XREF PLANT	XREF BRANCH	XREF NUMBER	XREF REV
D	S	CN	WBN	MEB	EPMMCP090189	
A	P	PR	WBN	MEB	PER98016345	
D	P	TR	WBN	MEB	TDN950714	
D	P	TR	WBN	MEB	TD950707	
D	P	DW	WBN	MEB	47W2006	
D	S	CN	WBN	MEB	EPMJAL121890	
A	P	CN	WBN	NTB MEB	WBNOSG4145	
A	S	CN	WBN	MEB	EPMBDW121285	
A	S	CN	WBN	MEB	EPMRCT121490	

INFORMATION ONLY

CCRIS ONLY UPDATES:
Following are required only when making keyword/cross reference CCRIS updates and page 1 of form NEDP-2-1 is not included:

T COLLINS / PREPARER SIGNATURE	DATE	M MATANI CHECKER SIGNATURE	DATE
PREPARER PHONE NO. 365-1988	EDMS ACCESSION NO.		

CA [illegible]

TVAN CALCULATION COVERSHEET **ORIGINAL**

Title	Plant	Page
COOLING AND HEATING LOAD ANALYSIS-CONTROL BUILDING - ELECTRICAL BOARD ROOMS	WBN Unit 1 & 2	1d

Preparing Organization	Key Nouns (For EDM)
NE-GILBERT/COMMONWEALTH-MECHANICAL	MEB, HVAC CONTROL BUILDING COOLING AND HEATING LOAD CALC

Calculation Identifier

WBN-31-D053
EPM-MCP-071689

Each time these calculations are issued, preparer must ensure that the original (R0) RIMS/EDM accession number is filled in.

Rev	(for EDM use)	EDM Accession Number
R0	9008006E0017	B26900726258
R10		B26 000329 499
R11		B26 000505 405
R12		

Applicable Design Document(s)

See Sheet 1a

UNID System(s)

31

	R0	R10	R11	R12	R13
DCN, EDC, NA		D50451A	D50301A		
Prepared See Sheet 1					
Checked See Sheet 1					
Design Verified See Sheet 1					
Approved See Sheet 1					
Approval Date 07/26/90		3/28/2000	5/8/2000		
SAR Affected?		Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☐	Yes ☐ No ☐
Revision applicability		Entire calc ☒ Selected pgs ☐	Entire calc ☒ Selected pgs ☐	Entire calc ☐ Selected pgs ☐	Entire calc ☐ Selected pgs ☐

see Page 1f 4/16/01

	Yes	No
Quality Related?	☒	☐
Safety related? If yes, mark Quality Related yes	☒	☐
These calculations contain unverified assumption(s) that must be verified later?	☐	☒
These calculations contain special requirements and/or limiting conditions?	☐	☒
These calculations contain a design output attachment?	☐	☒
Microfiche generated	☐	☒

Calculation Classification: Essential

Number

Statement of Problem

See Sheet 1a

CALC ID EPMMCP071689
ATTACHMENT 1 SHEET 6

Abstract

For Abstract see page 1a, and Revision Block Page 2h

INFORMATION ONLY

LEGIBILITY EVALUATED and ACCEPTED for issue. all rev. 10

[illegible] for BGB 3/29/00
Signature Date

SEE REVISION BLOCK PAGE 2i FOR DISCUSSION OF R11

R11

☒ Microfilm and return calculation to Calculation Library.

Address: ~~NQA Building~~ EQB 1M-WBN

☐ Microfilm and destroy.

☐ Microfilm and return calculation to:

LEGIBILITY EVALUATED and ACCEPTED for issue. Rev 11

[illegible] for BGB 5/8/00
Signature Date

STATEMENT OF PROBLEM/ABSTRACT (CON'T)

Cooling - LOCA Conditions: All rooms, during LOCA cooling mode, are maintained below the maximum temperatures as shown on the Environmental Data Drawings **except** for the Mechanical Equipment Room C2, 24V & 48V Battery Board Room C8, Secondary Alarm Station C12 on EL 692, and U1 Aux Instrument Room C1 on EL 708. Since the calculated room temperatures are based on theoretical loads, the calculated room temperatures are artificially high. However, walkdown package # WDP-WBN-O-LMN-008 is being prepared to measure the temperatures (supply, return, transfer air temperatures), along with a work order to measure the airflow rates so that the actual cooling loads can be computed for both normal and LOCA conditions. Subsequently this calculation will be revised to determine the actual room temperatures which are expected to be lower.

During Cooling Mode (LOCA Conditions), the coils are adequate since the Aircool Program determined that the coils can achieve an AHU leaving air temperature of 53.06 °F as compared to the iterated leaving AHU of 53 °F while maintaining all rooms within the temperature limits of the Environmental Data Drawings, except C2, C8 and C12 on EL 692, and C1 on EL 708 which are above the temperature limits (See Chart above "Cooling Load - LOCA Operation).

Comparing both AHUs total capacity of 1,578,658 BTUH to the total cooling load 1,087,377 BTUH, the coils have more than adequate capacity.

Heating - Normal Conditions: All rooms, during the normal heating mode, are maintained above the minimum temperature and humidity limits as shown on the Environmental Data Drawings. This is based on the modulating face and bypass dampers in full bypass position (full heating). The calculated return air temperature is 77.1 °F. The return air temperature controller is set for 75 °F. Therefore, since the calculated return air temperature is greater than 75 °F, the face and bypass dampers will modulate to cool the rooms to a lower temperature until the return air temperature is 75 °F. This will lower the calculated room temperatures slightly, however all are expected to remain above the minimum values shown on the applicable Environmental Data Drawings. The computed relative humidity for rooms C4, C5, C8 and C12 on EL 692, and C3 on EL 708 are slightly below the values shown on the Environmental Data Drawings.

Heating - LOCA/LOOP Conditions: All rooms, during the LOCA heating mode, are maintained above the minimum temperatures limits as shown on the Environmental Data Drawings. This is based on the modulating face and bypass dampers in the full bypass position (full heating). The calculated return air temperature is 76.3 °F. The return air temperature controller is set for 75 °F. Therefore, since the calculated return air temperature is greater than 75 °F, the face and bypass damper will modulate to cool the rooms to a slightly lower temperature until the return air temperature is 75 °F. This will lower the calculated room temperatures slightly, but they are expected to remain above the minimum values shown on the Environmental Data Drawings.

INFORMATION ONLY

CALC ID EPMMCP071689

ATTACHMENT 1 SHEET 8

TVAN CALCULATION COVERSHEET/CCRIS UPDATE

REV 0 EDMS/RIMS NO.	EDMS TYPE:	EDMS ACCESSION NO (N/A for REV. 0)
9008006E0017 / B26900726258	calculations(nuclear)	TV1 010509 800

Calc Title: COOLING AND HEATING LOAD ANALYSIS AND EQUIPMENT/COMPONENT PERFORMANCE ANALYSIS - ELECTRICAL BOARD ROOMS ELs 692.0 & 708.0 - CONTROL BUILDING

CALC ID	TYPE	PLANT	BRANCH	NUMBER	CUR REV	NEW REV	REVISION APPLICABILITY
CURRENT	CN	WBN	MEB	EPM-MCP-071689	11	12	Entire calc ☒ Selected pages ☐
NEW	CN						

ACTION							
	NEW ☐ REVISION ☒	DELETE ☐ RENAME ☐	SUPERSEDE ☐ DUPLICATE ☐	CCRIS UPDATE ONLY ☒ (D. V. & Approval Signatures Not Required)	No CCRIS Changes ☐ (For calc revision, CCRIS been reviewed and no CCRIS changes required)

UNITS	SYSTEMS	UNIDS
1 & 2	031	NA

DCN,EDC,N/A	APPLICABLE DESIGN DOCUMENT(S)	CLASSIFICATION
NA	N3-30CB-4002	E

QUALITY RELATED?	SAFETY RELATED? (If yes, QR = yes)	UNVERIFIED ASSUMPTION	SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS?	DESIGN OUTPUT ATTACHMENT?	SAR/TS AFFECTED
Yes ☒ No ☐	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

PREPARER PHONE NO	PREPARING ORG (BRANCH)	DESIGN VERIFICATION METHOD
423 365-1988	WBN/MEB	DESIGN REVIEW

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
T. COLLINS /	5/7/01	M. MATANI	05/07/01
DESIGN VERIFIER SIGNATURE	**DATE**	**APPROVER SIGNATURE**	**DATE**
M. MATANI	05/07/01		5/8/2001

STATEMENT OF PROBLEM/ABSTRACT

This calculation determines the cooling and heating loads, room steady state conditions (temperature and humidity) in the Electrical Board Rooms, Mechanical Equip Rms C1 & C10, Communication Room, Corridor C11, Stairwells (East & West) Central Alarm Station and Battery Rooms on El 692.0, and Aux Instrument Rooms 1 & 2, Computer Room, Corridor C2, and Stairwells (East & West) on EL 708.0. It also analyzes the adequacy of the HVAC equipment/components associated with the Electrical Board Rooms sub-system.

Using the ASHRAE method to determine the heat transfer from equipment and structures, the steady-state room temperatures and the room humidities were determined. Rooms' steady state temperatures and humidity results were compared with the 47B [illegible] Series Environmental Data Drawings to determine whether the rooms meet the design parameters as defined in the Environmental Data Drawings.

INFORMATION ONLY

The resultant data are as follows:

Cooling - Normal Conditions: All rooms, during the normal cooling mode, are maintained below the maximum temperatures and humidities as shown on the Environmental Data Drawings **except** for the Computer Room C3 on EL 708, which has calculated relative humidity of 25.94%. This is below the minimum relative humidity of 40% relative humidity currently shown on the applicable Environmental Data Drawings.

During Cooling Mode (Normal Conditions), the cooling coils are adequate since the Aircool Program determined that the coils can achieve a lower AHU leaving air temperature of 52.56 °F than the iterated leaving AHU air temperature of 55 °F while maintaining the rooms within the design temperature limits of the Environmental Data Drawings (See chart above "Cooling Load, Normal Operation"). Comparing both AHUs total capacity of 1,409,457 BTUH to the total cooling load of 961,470 BTUH, the coils have more than adequate capacity.

See next page for continuation

MICROFICHE/EFICHE Yes ☐ No ☒ FICHE NUMBER(S)

☐ LOAD INTO EDMS AND DESTROY

☒ LOAD INTO EDMS AND RETURN CALCULATION TO CALCULATION LIBRARY. ADDRESS: WBN EQB-1M

☐ LOAD INTO EDMS AND RETURN CALCULATION TO:

LEGIBILITY EVALUATED and ACCEPTED for issue.

All pages Rev - 12

Signature Date 5/8/01

CALC ID EPMMCP071689
ATTACHMENT 1 SHEET 9

TVAN CALCULATION COVERSHEET/CCRIS UPDATE

CALC ID	TYPE	PLANT	BRANCH	NUMBER	REV
	CN	WBN	MEB	EPM-MCP-071689	13

BLDG	ROOM	ELEV	COORD/AZIM	FIRM	Print Report Yes ☐

KEY NOUNS (A-add, D-delete)

ACTION (A/D)	KEY NOUN	A/D	KEY NOUN

CROSS-REFERENCES (A-add, C-change, D-delete)

ACTION (A/C/D)	XREF CODE	XREF TYPE	XREF PLANT	XREF BRANCH	XREF NUMBER	XREF REV
~~A~~	~~P~~	~~CN~~	~~WBN~~	~~MEB~~	~~MDQ00000312001006S~~	

INFORMATION ONLY

CCRIS ONLY UPDATES:
Following are required only when making keyword/cross reference CCRIS updates and page 1 of form NEDP-2-1 is not included:

T COLLINS / PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
PREPARER PHONE NO. 365-1988	EDMS ACCESSION NO.		

CALC ID EPMMCP071689
ATTACHMENT 1 SHEET 10

TVAN CALCULATION COVERSHEET/CCRIS UPDATE

REV 0 EDMS/RIMS NO.	EDMS TYPE:	EDMS ACCESSION NO (N/A for REV. 0)
9008006E0017 / B26900726258	calculations(nuclear)	T71 020207 802

Calc Title: COOLING AND HEATING LOAD ANALYSIS AND EQUIPMENT/COMPONENT PERFORMANCE ANALYSIS - ELECTRICAL BOARD ROOMS ELs 692.0 & 708.0 - CONTROL BUILDING

CALC ID	TYPE	PLANT	BRANCH	NUMBER	CUR REV	NEW REV	REVISION APPLICABILITY
CURRENT	CN	WBN	MEB	EPM-MCP-071689	12	13	Entire calc ☒ Selected pages ☐
NEW	CN						

ACTION								No CCRIS Changes ☐ (For calc revision, CCRIS been reviewed and no CCRIS changes required)
	NEW ☐ REVISION ☒	DELETE ☐ RENAME ☐	SUPERSEDE ☐ DUPLICATE ☐	CCRIS UPDATE ONLY ☒ (D. V. & Approval Signatures Not Required)				

UNITS	SYSTEMS	UNIDS
1 & 2	031	NA

DCN,EDC,N/A	APPLICABLE DESIGN DOCUMENT(S)	CLASSIFICATION
DCN D-50409-A	N3-30CB-4002	E

QUALITY RELATED?	SAFETY RELATED? (If yes, QR = yes)	UNVERIFIED ASSUMPTION	SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS?	DESIGN OUTPUT ATTACHMENT?	SAR/TS AFFECTED
Yes ☒ No ☐	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

PREPARER PHONE NO	PREPARING ORG (BRANCH)	DESIGN VERIFICATION METHOD
423 365-1988	WBN/MEB	DESIGN REVIEW

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
T. COLLINS / T C Collins	2/6/02	S Nichols	2/6/02
DESIGN VERIFIER SIGNATURE	**DATE**	**APPROVAL SIGNATURE**	**DATE**
S Nichols	2/6/02	[signature]	2/6/02

STATEMENT OF PROBLEM/ABSTRACT

This calculation determines the cooling and heating loads, room steady state conditions (temperature and humidity) in Control Building ELs 692.0 and 708.0 served by Electrical Board Room HVAC system. It analyzes the adequacy of the HVAC equipment/components associated with the Electrical Board Rooms sub-system.

This calculation determines the steady state temperatures for the temperature transmitters' set point (baseline) of 75 ^{0}F.

In support of DCN D-50409-A this calculation also determines the EBR AHU return air temperature transmitters' set point, during the normal cooling mode, such that the Unit 1 Auxiliary Instrument Room temperature will remain at 68 ^{0}F. It determines the room temperatures during the LOCA cooling, normal heating/cooling, and LOCA/LOOP heating/cooling modes.

Using the ASHRAE method to determine the heat transfer from equipment and structures, the steady state room temperatures and the room humidity were calculated. Room steady state temperatures and humidity results were compared with the 47E235 - Series Environmental Data Drawings to determine whether the rooms meet the design parameters as defined in the Environmental Data Drawings.

INFORMATION ONLY

MICROFICHE/EFICHE Yes ☐ No ☒ FICHE NUMBER(S)

☐ LOAD INTO EDMS AND DESTROY
☒ LOAD INTO EDMS AND RETURN CALCULATION TO CALCULATION LIBRARY. ADDRESS: WBN EQB-1M
☐ LOAD INTO EDMS AND RETURN CALCULATION TO:

ATTACHMENT 2

(ATTACHMENT 2 NOT USED)

ATTACHMENT 3

(ATTACHMENT 3 NOT USED)

ATTACHMENT B 4
Page 1 of 2
COMMUNICATIONS RM SUPPLEMENTAL A/C UNIT
SHEET 183 OF 186

Carrier

Single-Package Cooling Units

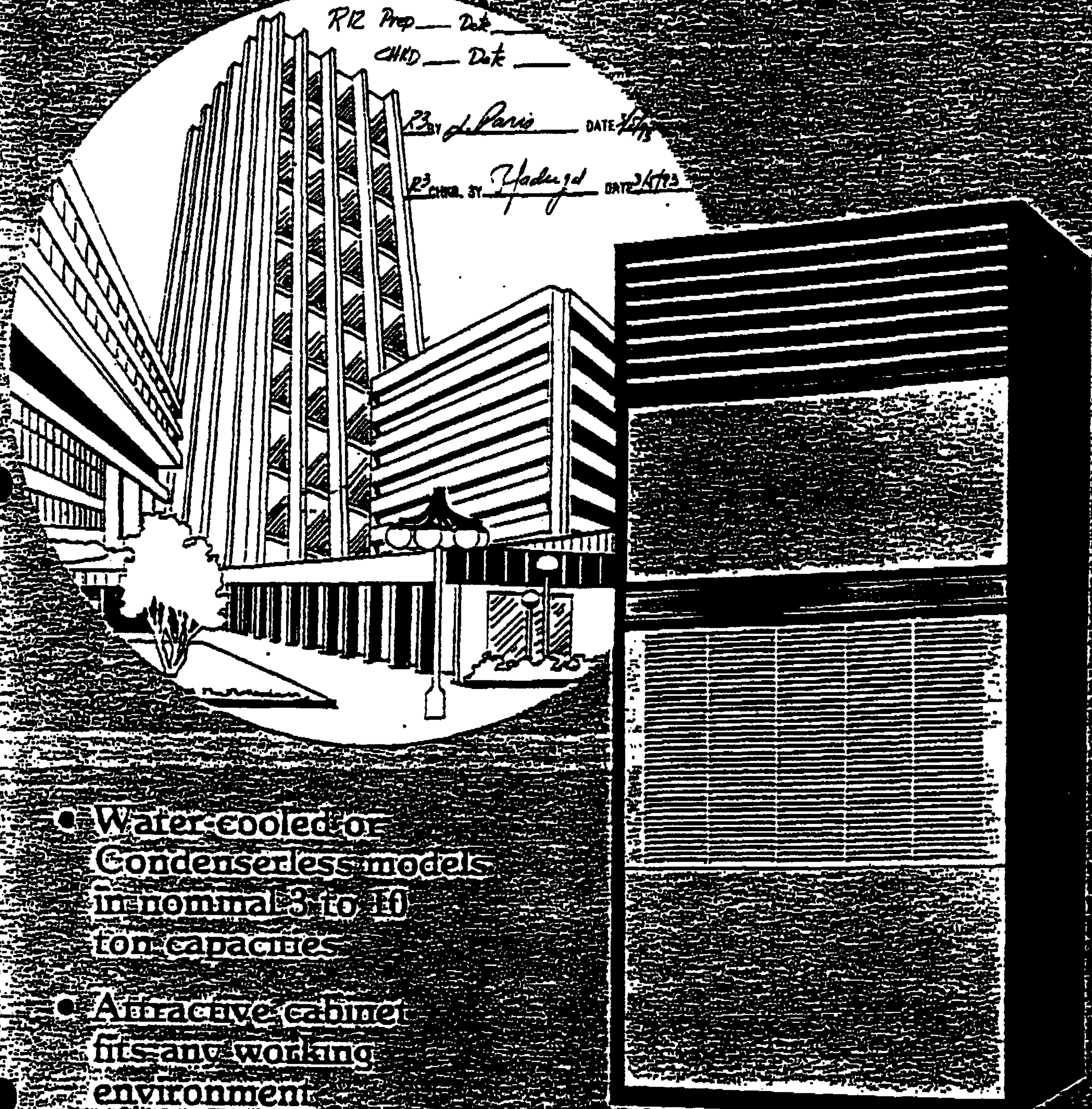
50BT,BU

Capacities 36,000 to 120,000 Btuh

R2 BY ______ DATE 10/24/92

R2 CHKD. BY ______ DATE 10/26/92

R12 Prep ___ Date ___
CHKD ___ Date ___
R3 BY ______ DATE ______
R3 CHKD. BY ______ DATE 3/5/93



- Water-cooled or Condenserless models in nominal 3 to 10 ton capacities
- Attractive cabinet fits any working environment
- Ductwork or free-blow arrangement

Carrier

Performance data (cont)

ATTACHMENT 54

1R12

GROSS COOLING CAPACITIES
Water-Cooled Units

COMMUNICATIONS RM SUPPLEMENTAL AIR UNIT

R12 Prep — Date — SHEET ~~104~~ ~~104~~ OF ~~104~~ 186

CHKD — Dat — Page 2 of 2

ARI RATINGS

MODEL	BTUH	KW	EER
50BT004	36,000	4.1	8.8
50BT006	60,000	6.0	10.0
50BT008	90,000	8.5	10.6
50BT012	120,000	11.5	10.4
50BU004/9AB4	34,000	4.5	7.5
50BU006/9AB6	58,000	8.0	7.4
50BU008/9AB8	91,000	9.0	10.1
50BU012/9AB12	114,000	12.4	9.2

EER — Energy Efficiency Ratio

ARI ratings are net ratings and total system kw in accordance with ARI Standard 210-81.

EER's are for 3-phase units.

R2 BY J. Paris DATE 10/2

R2 CHKD. BY Hodges DATE 10/2

R3 BY J. Paris DATE 3/17

R3 CHKD. BY Hodges DATE 3/17

1 50BT004

ENT WATER TEMP (F)	GPM	PRESSURE DROP (ft)	PRESSURE DROP (psi)		Evap Air — Cfm/Bf: 900/.13 — Evap Air Ewb Temp (F) 72	67	62	1200/.16 — 72	67	62	1500/.18 — 72	67	62
85	9	9.2	4.0	TC	43	39	35	47	43	38	49	44	39
				SHC	21	25	30	23	29	35	28	33	38
				KW	2.9	2.8	2.8	3.0	2.9	2.9	3.0	2.9	2.9
75	7	11.8	5.1	TC	41	37	33	44	40	36	46	41	37
				SHC	20	25	29	22	28	34	25	34	37
				KW	3.2	3.1	3.0	3.2	3.1	3.0	3.3	3.2	3.1
75	5	7.2	3.1	TC	41	36	33	43	38	35	46	40	36
				SHC	20	24	28	22	28	33	24	31	36
				KW	3.3	3.2	3.1	3.3	3.2	3.1	3.4	3.3	3.2
85	7	11.8	5.1	TC	40	36	32	42	38	34	44	39	35
				SHC	20	24	28	22	28	33	24	31	35
				KW	3.4	3.3	3.2	3.5	3.4	3.3	3.5	3.4	3.3
85	5	9.2	4.0	TC	39	35	31	41	37	33	43	38	34
				SHC	20	24	28	22	28	33	24	31	34
				KW	3.6	3.4	3.3	3.6	3.5	3.4	3.7	3.6	3.4
95	4	5.1	2.2	TC	37	34	30	40	36	32	41	37	33
				SHC	18	23	27	21	27	32	23	30	33
				KW	3.7	3.6	3.4	3.7	3.6	3.5	3.8	3.7	3.5
90	6	9.2	4.0	TC	37	34	30	40	36	32	41	37	33
				SHC	18	23	27	21	27	32	23	30	33
				KW	3.7	3.6	3.4	3.7	3.6	3.5	3.8	3.7	3.5

2 50BT006

ENT WATER TEMP (F)	GPM	PRESSURE DROP (ft)	PRESSURE DROP (psi)		Evap Air — Cfm/Bf: 1500/.07 — Evap Air Ewb Temp (F) 72	67	62	2000/.09 — 72	67	62	2500/.12 — 72	67	62
85	11	13.2	5.7	TC	72	66	59	76	69	62	79	71	64
				SHC	31	39	46	34	43	56	36	47	59
				KW	4.1	4.0	3.9	4.1	4.0	3.9	4.1	4.0	3.9
75	11	13.2	5.7	TC	68	61	55	72	65	58	75	67	61
				SHC	30	37	44	33	42	55	35	46	58
				KW	4.5	4.4	4.3	4.5	4.4	4.3	4.5	4.4	4.3
75	8	7.5	3.3	TC	67	60	54	69	63	56	72	65	59
				SHC	29	36	43	32	41	54	34	45	57
				KW	4.7	4.6	4.5	4.7	4.6	4.5	4.8	4.8	4.5
85	18	23.0	14.3	TC	67	60	54	69	63	56	72	65	59
				SHC	29	36	43	32	41	54	34	45	57
				KW	4.7	4.6	4.5	4.7	4.6	4.5	4.8	4.8	4.5
95	15	23.2	10.0	TC	65	59	53	68	62	56	71	64	58
				SHC	28	36	42	31	40	53	33	44	56
				KW	4.8	4.7	4.6	4.9	4.7	4.6	4.9	4.7	4.6
85	11	13.2	5.7	TC	64	58	52	68	62	55	70	63	57
				SHC	28	36	42	31	40	53	33	44	56
				KW	4.9	4.8	4.7	5.0	4.8	4.7	5.0	4.8	4.7
90	14	20.3	8.8	TC	63	57	51	66	60	54	68	62	56
				SHC	27	35	41	31	39	51	33	43	55
				KW	5.1	5.0	4.9	5.2	5.0	4.8	5.2	5.0	4.9
90	10	10.9	4.7	TC	61	55	50	64	58	52	67	60	54
				SHC	27	34	40	31	39	51	33	43	54
				KW	5.2	5.1	5.0	5.4	5.2	5.0	5.4	5.2	5.1

LEGEND

BF	— Bypass Factor	Kw	— Compressor Motor Power Input (Kilowatts)
Ewb	— Entering Wet-Bulb	SHC	— Sensible Heat Capacity (1000 Btuh)
GPM	— Gallons Per Minute	TC	— Total Capacity (1000 Btuh)

COMPUTER RM SUPPLEMENTAL A/C UNIT

ATTACHMENT 5 Page 1 of 2 — SHEET 185 OF 186

REF/CONT. #		PROC REQUEST #		TAG #	MU7A373-103
REF #		PROC ACTIVITY #		QUANTITY	1 Ea
ITEM #		CONST ACTIVITY #		UNID #	NA
SCHEDULE #		MAHS #			

A) FUNCTION: COMPUTER RM COOLING

B) GENERAL DATA:
1. Assy S.P. In. WG TSP = 2.5
2. Min. Operating CFM 8000
3. Air Flow: Orient/Argmt VERT/DRAW
4. FAN RPM = 1280

C) COOLING:
5. Entering Air °F db/wb 75 DBE
6. Lvg Air °F Max db/Min wb 60.1 DBL
7. Min. Capacity BTUH 127910 SH
8. Refrigerant CHILLED WATER
9. Entering Water: °F/GPM 44/82
10. Water Pressure Drop 4.9 FT
11. Refrig. Evap. Temp. °F NA
12.

D) HOUSING DETAILS:
13. Housing Mat'l STEEL
14. Refrig. Conn. Location RIGHT
15. Discharge Location —
16. Max Discharge Dim., WxL —
17. Intake Location —
18. Max Intake Dim., WxL —
19. OA Length or Depth —
20. OA Height —
21. OA Width —
22. Special Construction —
23. Max Sect Dim, LxHxW —
24. Motor Location RIGHT-1

E) FAN DATA:
25. Fan Type CNTFGL
26. Max. Outlet Vel. FPM 1350
27. Drive Type/S.F. BELT/2
28. Impeller: Shape/Mat'l BT/STL or AL
29. Rotation/Discharge
30. Inlet Vane/Operator NA
31. Max BHP 7½

F) FAN MOTOR:
32. Type A/C DRIP PROOF
33. Motor Duty/RPM CONT / 1750
34. Power Supply V/PH/HZ 460/3/60
35. Motor Shaft Orientation HORIZ
36.

G) UNIT ACCESSORIES:
37. Filters/Type 2" THROW AWAY
38.
39.

H) REFERENCE DATA:
40. Instrument Data Sheet
41. Assy. Data Dwg.
42. System Design Criteria WB-DC-40-31.1
43. IEEE Class NON-1E
44. ASME Code/Class NA
45. Seismic Design Criteria CAT I(L)
46. Location: Bldg/Elevation CB/EL 708
47. Bldg Column Line NP C6 C8
48.

J) UNIT ENVIRONMENTAL CONDITIONS:
49. Temp. °F db Max/Min 104 / 60
50. R.H. % Max/Min 90 / 10
51. Amb. Pressure Max/Min ATM (+)
52. Radiation Dose Total Rads <1X10⁴ RAD
53. Air Quality CLEAN
54.

K) MOTOR ENVIRONMENTAL CONDITIONS:
55. Temp. °F db Max/Min 104 / 60
56. R.H. % Max/Min 90/10
57. Amb. Pressure Max/Min ATM (+)
58. Radiation Dose Total Rads <1X10⁴ RAD
59. Air Quality CLEAN
60.

L) VENDOR SUPPLIED DATA:
61. Fan Motor Max KVA Input
62. Fan Motor Rated HP
63.
64.

M) MEB DOCUMENT CONTROL DATA:
65. General Requirements-TVA Spec # 3-14
66. Technical Spec-TVA Spec # 3-33
67. Motor Spec-TVA Spec #
68. Applic. Seismic Criteria
69. Applicable QA Attachment

Comments: REFERENCE: AIR HANDLING UNIT ITEM NO 143. YCN UNIQ NO. 1VC-MAHU-126-A WITH RELIANCE 7.5 HP ELECTRIC MOTOR SERIAL NO. 51YF882801-A1

Rev	Change Ref.	Date	DFTR	CHKR	DSGNR	SUPVR	APPD	APPD		
3										
2										
1										
0	YCN FM4M7271	4-11-90	RFL	NA	RFL	RM	NA	WDF		

AIR HANDLING UNIT DATA SHEET

TENNESSEE VALLEY AUTHORITY

PROJECT WATTS BAR CB/COMPUTER ROOM HVAC

DWG. NO. 47W930-1

ENGINEER TN. DATE: 4-11-90

ESM 47A373-26

R3 — RL — DATE 10/21/92

R2 Prep ___ Date ___ Chkd ___ Date ___

COMPUTER RM SUPPLEMENTAL A/C UNIT

RELEASE 1.3
10-18-85

ATTACHMENT 5 Page 2 of 2

SHEET 11 OF 12

R2 BY J. Paris DATE 10/21/92
R2 CHKD. BY Z. Madrigal DATE 10/26/92
R3 BY J. Paris DATE 3/5/93
R3 CHKD. BY Madrigal DATE 3/5/93

INFORMATION ONLY

~~R1Z Prep ___ Date ___ CHKD ___ Date~~

DATE: 02-15-1990

CUSTOMER ID = 141 & 143

PROGRAM ID = WATER COIL SENSIBLE RATING

APPLICATION + COOLING

	-RATING-
CFM	8,000
DBE	75.0
DBL	60.1 DRY BULB LEAVING
SH	128,895
WE/WL	44.0 / 55.8
GPM	22.0
WV	2.9
WPD	4.9
FV	632.1
APD	0.47

CH = 30.000 CL = 60.000 FFO = .000 FFI = .000
FMS = CU YF = .010 TMS = CU TT = .049

COIL MODEL NUMBER 3W20 - 60.0-5,608T - 12.7-0.500

WBEP - 0767T

Attachment 6
Sheet 1 of 2

EPM-MCP-071689
R12

TRANE

Knoxville Sales Area
The Trane Company

5220 Middlebrook Pike
P. O. Box 10026
Knoxville, TN 37939
TEL 865 588 0607
FAX 865 588 0600

Felix Wilson
Area Manager
Commercial Sales

FAX TRANSMISSION

DATE: 2/8/01

TO: TERRY COLLINS

FROM: JOHN NELSON

SUBJECT: COOLING COIL

REMARKS:

TERRY,
PLEASE SKETCH EXACTLY WHAT
YOU ARE LOOKING FOR.
THANKS
JOHN

Number of Pages Being Transmitted: 2
(Including cover sheet)

FAX NUMBER BEING CALLED: 423-367-1750

If you do not receive all pages, please call the above number

Coil Performance:

The coil will be evaluated using "AIRCOOL" to predict the performance of the cooling coil. A serial number of a typical cooling coil in use in the Electrical Board Room AHU is K93F38061. The following information is required as input per coil to the "Aircool Program":

PARAMETERS	Coil Data	
Flow Rate - CFM	10,418 cfm/per coil	
Flow Rate - GPM	90 gpm/per coil	
Inlet Water Temp	42 °F	
Outlet Water Temp	52 °F	
Inlet Air Temp DB	82.7 °F DB	
Inlet Air Temp WB	63.9 °F WB	
Outlet Air Temp DB	50.9 °F DB	
Outlet Air Temp WB	49.0 °F WB	
Coil tube dia	5/8" OD	
Coil tube wall thickness	.049"	
Coil tube material	Copper	
Tube Spacing Transverse (Vert)	????	1 1/2
Tube Spacing In-line (Horz)	????	1 1/2
Fin Material	AL	
Fin Thickness	.008	
Fins per Inch	9	
Length of Exposed Tubes	105	
# of Tubes per Row	????	16
Turbulator Coil Wire Thickness	????	N/A
Fin Style (Flat Plate, Spiral, Super Fin	????	FLAT PLATE - SIGNA FLOW
# of Rows	8	
Serpentine Coil Type	????	FULL

TRANE

Attachment 7
Sheet 1 of 4

EDM-MCP-07629
R12

Knoxville Sales Area
The Trane Company

5220 Middlebrook Pike
P. O. Box 10026
Knoxville, TN 37939
TEL 865 588 0607
FAX 865 588 0600

Felix Wilson
Area Manager
Commercial Sales

FAX TRANSMISSION

DATE: 2/6/01

TO: TERRY COLLINS

FROM: JOHN NELSON -0607

E Mail
JOHN_Nelson
@Trane.Com

SUBJECT: COOLING COIL

REMARKS:

TERRY,
PLEASE SKETCH EXACTLY WHAT
YOU ARE LOOKING FOR.
THANKS
JOHN

Number of Pages Being Transmitted: 4
(Including cover sheet)

FAX NUMBER BEING CALLED: 423-365-1750

If you do not receive all pages, please call the above number

Attachement 7
Sheet 2 of 4

TRANE
A division of American Standard Inc.

EPM-MCP-071689 R12

NET 30	LEXINGTON F/A	2	KNZ-E507A PREPAID

DD COILS P.O. 132815

CALL: EXT.
ATTN:
HOURS BEFORE DELIVERY

Order Date	Customer Order Number	Customer Account No.
93/05/25	132815	NZ-63-3266-2

ELLIS & WATTS
34400 GLEN WILLOW LAKE LANE
BATAVIA, OH 45103

HOLD AT SHIP DOCK
FOR CREDIT APPROVAL

☒ COOLING COILS 01 ☐ HEATING COILS ☐ PROCESS COILS

COIL DATA

Item	Qty	Coil Tag	Fin Area Wide	Fin Area Long																	
A	4		24	105	DD	08	SF	158	AL	N	035 CU.	HR								Y	N
B	4		24	105	DD	08	SF	158	AL	N	035 CU.	HR								Y	N

QCycle

CAPACITY DATA

Item	Coil Tag	SCFM	MBH	Entering Air Temp	Leaving Air Temp	GPM PSIG				

KNZ-E507A

OR SOONER

F4C4AC1 05507

CINCINNATI	CINCINNATI	CINCINNATI
SCOTT CRA 36.000%	W. SCHRIN 54.000%	CHARLES B 10.000%
NZ -806	NZ -806	NZ -814

KNZ-E507A

1 of 1

JUN 24 1993 894

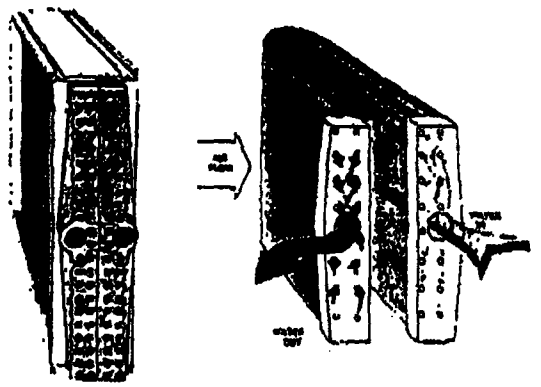
38.173-0 (5/88) 13-SPECIFICATIONS

Attachment 7
Sheet 3 of 4

EPM-MCP-071629 Rev 12

- direct expansion applications
- chilled water applications

TYPE DD WD



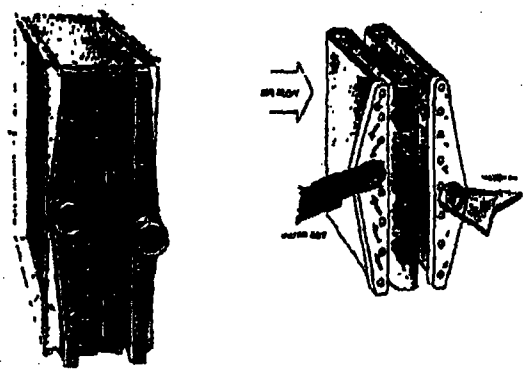
DRAINABLE WATER COILS
DOUBLE ROW SERPENTINE
Completely drainable double row serpentine coils for high gpm, low water temperature rise applications. U-bends at opposite end.

DD
- 4, 8, and 12-row same-end connections. 6 and 10-row opposite end.
- Fin spacings — Aluminum: 80 through 168 fins per ft
  — Copper: 80 through 144 fins per ft.
- Finned widths — 18", 24", 30" and 33".
- Finned lengths — 18" to 144".

Maximum standard operating limits: 200 psi and 220 F. Higher temperature and pressure service available as special.

WD
- Same end connections. 6, 8, 10 and 12 rows drainable for freeze protection when installed level.

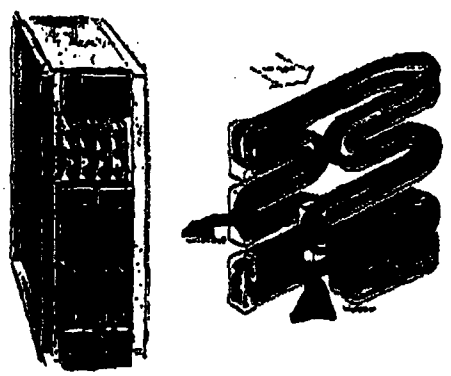
TYPE K



CLEANABLE AND DRAINABLE WATER COIL
Use whenever tubes require periodic cleaning. Each tube is readily accessible without piping disconnect. Single row serpentine. Removable headers at opposite end.
- 2, 4, 6, 8, 10 and 12-rows with same-end connections. 3-row opposite end.
- Fin spacings — Aluminum: 80 through 168 fins per ft.
  Copper: 80 through 144 fins per ft.
- Finned widths — 12", 18", 24", 30" and 33".
- Finned lengths — 12" to 144"

Maximum standard operating limits: 200 psi and 220 F.

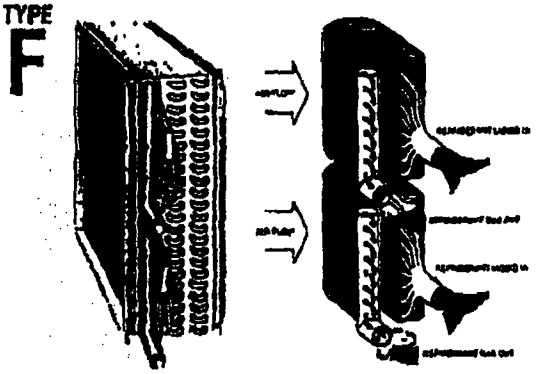
TYPE P8



TYPE "P8" — Eight-tubes fed with water.
4 and 8-rows available.
- Fin spacings — Aluminum: 80 through 168 fins per ft.
  Copper: 80 through 144 fins per ft.
- Finned widths — 18", 24" and 30".

Maximum standard operating limits for P2, P4 and P8 coils: 200 psi and 220 F. Higher temperature and pressure service available as special.

TYPE F



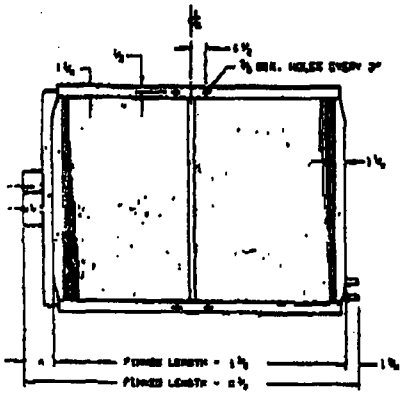
REFRIGERANT COIL
Direct expansion refrigerant coils for use with refrigerants R-12 and R-22. Unique thermal counterflow circuiting arrangement for maximum capacity. One-piece, multi-circuit distributors assure uniform refrigerant distribution to all tube circuits.
- 2, 3, 4, 6 and 8 rows available. Suction header located at entering airside for proper superheat control on all 4, 6 and 8-row coils.
- Fin spacings — Aluminum: 80 through 168 fins per ft.
  — Copper: 80 through 144 fins per ft.
- Finned widths — 12", 18", 24", 30" and 33".
- Finned lengths — 12" to 144".

Distributor tubes of ½" (Type "S"), or $^{3}/_{16}$" (Type "L") diameter are provided as required in selection. Maximum standard operating limits: 300 psi.

Attachment 7
Sheet 4 of 4

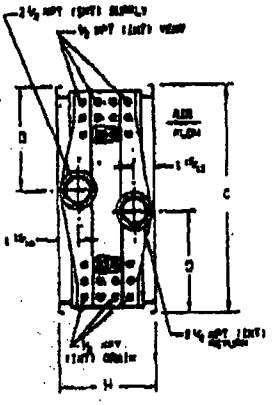
EPM-MCP-07K89 R1:

TYPE D

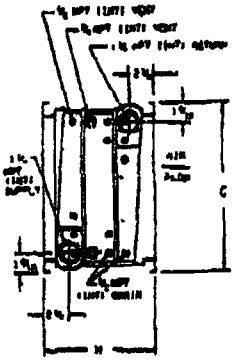


3, 4, 6, 8, 10 & 12 ROW COILS
18", 24", 30" & 33" FINNED WIDTHS

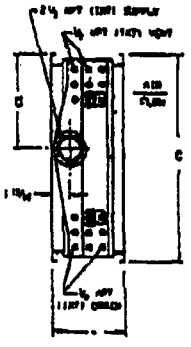
18", 24", 30" & 33" FINNED WIDTHS



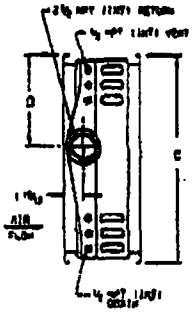
12" FINNED WIDTHS



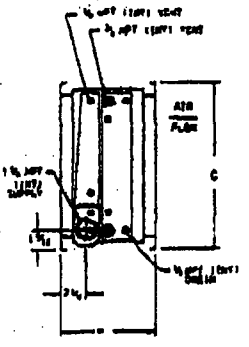
4, 6, 8, 10 & 12 ROW COILS
12" FINNED WIDTH



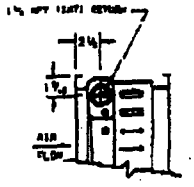
3 ROW — SUPPLY



3 ROW — RETURN



3 ROW — SUPPLY



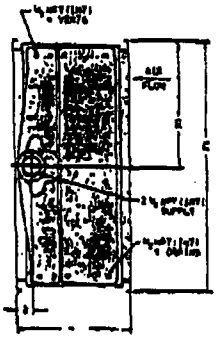
3 ROW — RETURN

TABLE 59-1 — Type D Coil Dimensions

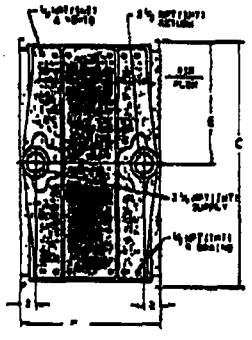
FINNED WIDTH	C	D	H						K
			3 ROW	4 ROW	6 ROW	8 ROW	10 ROW	12 ROW	
12	13½	—	8	9⅛	12½	16⅛	16½	21⅛	2
18	19⅛	8⅛							3½
24	25⅛	11⅛							
30	31⅛	14⅛							
33	34⅛	15⅛							

NOTE: All dimensions approximate. Submittals on request.

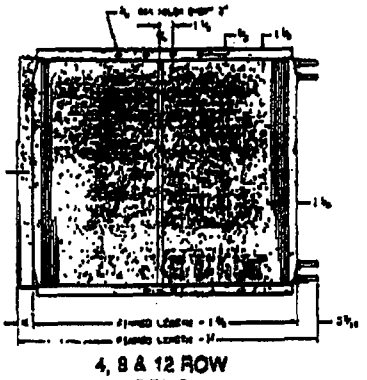
TYPE DD



6 & 10 ROW SUPPLY

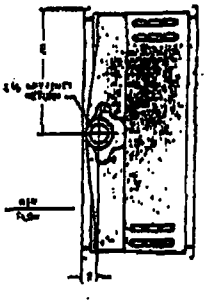


4, 6 & 12 ROW SUPPLY



4, 6 & 12 ROW COILS

6 & 10 ROW COILS



6 & 10 ROW RETURN

TABLE 59-2 — Type DD Coil Dimensions

FINNED WIDTH	C	E	H					K	W	
			4 ROW	6 ROW	8 ROW	10 ROW	12 ROW		A, 6 & 12 ROW	6 & 10 ROW
18	19⅛	9⅜	9⅛	12⅛	15⅛	16⅛	21⅛	2	5	5⅛
24	25⅛	12¾								
30	31⅛	15⅜						2½		
33	34⅛	17⅛								

NOTE: All dimensions approximate. Submittals on request.

ATTACHMENT 8 EDM-MCR07K89

1-OF-5

No. 35-83119 - 2

TENNESSEE VALLEY AUTHORITY

GUARANTEED DATA

The bidder hereby guarantees that performance and characteristics of equipment bid upon will be as stated in following tabulation. In case of conflict between data furnished below and any other data furnished with bid, that furnished below shall govern.

TVA considers this information so material to its decision on whether or not a bid meets specifications that omission of any of it could make impossible such decision and cause the bid to be nonresponsive. A bidder leaves any space blank at his own risk. If omission of information renders a bid nonresponsive, such bid will be rejected. The same restrictions apply to errors in data submitted in a bid.

Schedule I - Packaged Chillers

General	Item 1
Minimum capacity at specified conditions, tons	155
Maximum leaving condenser water temperature, F	95°F
Maximum leaving chilled water temperature, F	42°F
Do units meet seismic qualification requirements?	Yes
Compressor	
Rated capacity, tons	155
Suction temperature, F	35
Condensing temperature, F	106.3
Capacity reduction, steps	Variable Slide Valve
Brake horsepower	174
Compressor Motors	
Rated horsepower	250

RC 4/9/01

PROJECT No.: 8573-05
CALC. NO.: EPM-MCP-090189, REV. 0
~~Page 100 of 64~~
Prepared: ~~LIS~~ Date: 6-27-90
Reviewed: ~~MM~~ Date: 6-28-90

24 23 31193
20 20
3/5/93 11/9/92
DB 2/3/93

EPM-MCP-071689

ATTACHMENT 8

2-OF-5 4/9/01

GUARANTEED DATA (Continued)

Schedule I - Packaged Chillers (Continued)

Condensers	**Item 1**
Head loss at specified gpm, ft	4 ft.
Rated capacity at specified gpm at 85 F entering water temperature, tons	195
Water side test, psi	150#
Refrigerant side test, psi	300#
Velocity of water in tubes, fps	4.5
Water side fouling factor, (hr)(F)(sq ft)/Btu	.002
Coolers	
Head loss at specified gpm, ft	7 ft.
Rated capacity at specified gpm at 50 F entering, tons	155
Water side test, psi	150#
Refrigerant side test, psi	200#
Water side fouling factor, (hr)(F)(sq ft)/Btu	.0005
Water Regulating Valve	
Pressure drop at specified conditions, ft	28 ft.
Does valve meet seismic qualification requirements?	Yes

RC 04/09/01

~~PROJECT No.: 8573-05~~
~~CALC. NO.: EPM-MCP-090189, REV. 0~~
~~Page 10 of~~
~~Prepared: Date: 6-27-90~~
~~Reviewed: Date: 6-28-90~~

R3 12/3/92

Dunham-Bush, Inc.
Bidder

ATTACHMENT ~~7~~ 8 EPM-MCP-071689

3-OF-5

No. 35-63119 - 2

TENNESSEE VALLEY AUTHORITY

EQUIPMENT DATA

Each copy of proposal shall be accompanied by manufacturer's complete specifications for equipment included in proposal, and these specifications, upon award, will be incorporated in contract.

The manufacturer's specifications shall include but not be restricted to following:

a. Drawings or cuts in sufficient detail to permit a clear understanding of size and construction of equipment, and proportions of its principal parts. Drawings for equipment furnished in two or more subassemblies requiring field erection shall be in sufficient detail to enable TVA to estimate assembly or erection costs. Instructions shall be furnished in the form of a sequential tabulation of all operations necessary for field erection of each chiller, such as setting in place; alignment; bolting together; wiring; component addition; air, oil, or water piping connections; and refrigerant charging. These estimated additional erection costs will be considered with base bids in awarding contract.

b. Detailed data as follows:

Schedule I - Packaged Chillers

General	Item 1
Manufacturer	Dunham-Bush
Model No.	PCX 230-0-0
Overall length	180
Overall width	60
Overall height	95
Additional length required for tube removal	175
Can tubes be removed from either end?	Yes
Refrigerant	R-22
Normal refrigerant charge	660
Type and thickness of insulation used	1" Armaflex
Gross weight	14,875

RC 4/9/01

PROJECT No.: 8573-05
CALC. NO.: EPM-MCP-090189, REV. 0 R4 11/5/93
~~Page 138 of 64~~ R3 dP 11/9/92 12/3/92
Prepared: [signature] Date: 6-27-90
Reviewed: [signature] Date: 6-28-90

ATTACHMENT ~~7~~ 8 EPM-MCP-071689
4-OF-5
RC 4/9/01

EQUIPMENT DATA (Continued)

Schedule I - Packaged Chillers (Continued)

	Item 1
Compressor	
Manufacturer	Dunham-Bush
Model No.	2010
Type of capacity reduction	Variable Slide Valve
Percent of step unloading	100% - 10%
Full load, rpm	3600
Compressor Motor	
Manufacturer	General Electric
Full-load current, amperes, at 460 volts, 3 phase	284
Locked-rotor current, amperes, at 460 volts, 3 phase	1825 Max.
Locked-rotor withstand time in seconds	
At rated operating temperature	12 - 15
At ambient temperature	20 - 25
Stall time at 100 percent rated voltage	12 - 15
Condenser	
Manufacturer	Dunham-Bush
Model No.	CDS 316A
Water inlet, size and type	8" 150# ASA Flange
Water outlet, size and type	8" 150# ASA Flange
Number of tubes	262
Length of tubes	153
Tube material	Copper

RC 4/9/01

PROJECT No.: 8573-05
CALC. NO.: EPM-MCP-090189, REV. 0
Page ~~109 of 64~~
Prepared: [signature] Date: 6-27-90
Reviewed: [signature] Date: 6-28-90

ATTACHMENT ~~7~~ 8

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EPM-MCP-07K89

RNC 4/9/01

EQUIPMENT DATA (Continued)

Schedule I - Packaged Chillers (Continued)

Condenser, continued	Item 1
Tube size	.075" O.D.
Tube wall thickness	.035
Number of passes	2
Condensing temperature, F	106.3

Water Cooler

Manufacturer	Dunham-Bush
Model No.	CHR 20125
Water inlet, size and type	8" 150# ASA Flange
Water outlet, size and type	8" 150# ASA Flange
Number of tubes	333
Length of tubes	176"
Tube material	Copper
Tube size	.075" O.D.
Tube wall thickness	.035
Gallons of water cooler will hold	75.5 Gal.

Water Regulating Valve

Manufacturer	Metrex
Model No.	MDF 3100-FL-2W
Size and type of connections	4"

PROJECT No.: 8573-05
CALC. NO.: EPM-MCP-090189, REV. 0
~~Page 11 of 64~~
Prepared: LI Date: 6-27-90
Reviewed: MP Date: 6-28-90

R2 JD 3/5/93; R3 11/9/92; R2 12/3/92; R4 3/5/93

Dunham-Bush, Inc.
Bidder

Attachment 9. sheet 1 of 11.

EDM-MCP-071689. R12

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(11)

SCALING AND SETPOINT DOCUMENT
LOOP COVER SHEET

Loop Name: Elec Board Room AHU B-A Temperature Control

Applicable Tech Specs: None

Loop Components	Location
0-FCO-31-336	692, C2-P
0-TC-31-336	692, C2-P
0-TE-31-336	692, C2-P
0-TT-31-336	692, C2-P

Associated Drawings: None

Remarks: (1) DCN W-07542-B issued NE SSD
(2) DCN P-03623-B added plant supply directly to FCO and revised plant drawings to depict.

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

Attachment 9.

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Sheet 2 of 11

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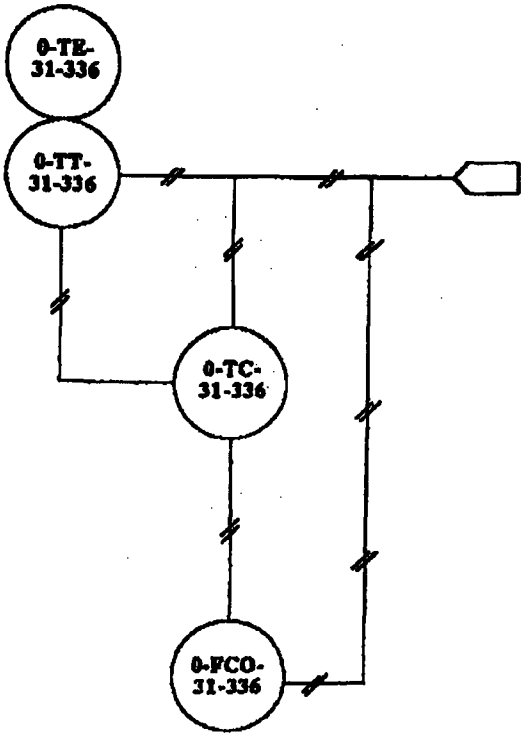
REVISION 03

SCALING AND SETPOINT DOCUMENT
LOOP DRAWING

LOOP NAME: ELEC BD RM AHU B-A TEMPERATURE CONTROL



REVIEWED BY R.D. MURR APPROVED BY ED HALL EH DATE 8-21-95

EDM-MCP-071689 R12 Attachment 9. Sheet 3 of 11

SCALING AND SETPOINT DOCUMENT
SIGNAL PATH SHEET

Function: Elec Board Room AHU B-A Temperature Control

Signal Path # 01

Signal Source: 0-TE-31-336

Signal Termination: 0-FCD-31-336

Input: 60-90 Deg F

Output: 100-0% Open

Setpoint: 75 Deg F (2)

Transfer Function: N/A

Tolerance: N/A

Remarks: (1) Determination of whether HIGH ALLOWABLE VALUE has been exceeded will not be made by performance of this loop calibration. 1-TRI-30-1 ensures that temp readings are taken each shift and this is acceptable validation.
(2) HIGH ALLOWABLE VALUE is 93.25 Deg F.

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

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SCALING AND SETPOINT DOCUMENT
PROCESS CONTROL VALVES AND CONTROL DEVICES

Instrument No.: 0-FCO-31-336 Mfrr: Honeywell Model: MP 904 A

Vendor ID No: N/A Contract No: 821350

Function: CO

Valve Action: Air to Open

Positioner Mfrr: N/A Model No.: N/A Cam Type: N/A

Calibrated Ranges:		
Input: 3-13 PSIG	Document: MIG
Output: N/A	Document: N/A
Stroke: 0-100% Closed	Document: MIG
Accuracy: +/- 5%	Document: MIG

Associated Interlock: None

Associated Drawings: None

Remarks: None

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

EDM-MCP-071689 R12 Attachment 9. Sheet 5 of 11

SCALING AND SETPOINT DOCUMENT
CONTROL DEVICES

Instrument No.: 0-TC-31-336 Mfrr: Honeywell Model: RP 908A

Vendor ID No: N/A Contract No: B21350

Function: Controller

Action: Direct

Calibrated Ranges:	Input:	3-13 PSIG (1)	Document: NE SSD 0-T-31-336
	Indicator Output:	N/A	Document: N/A
	Accuracy:	N/A	Document: N/A
	Control Output:	3-13 PSIG	Document: NE SSD 0-T-31-336
	Accuracy:	(2)	Document: NE SSD 0-T-31-336
Settings:	Setpoint:	8 PSIG (75 Deg F)	Document: NE SSD 0-T-31-336
	Proportional Band:	25% (3)	Document: MIG
	Reset:	N/A	Document: N/A
	Rate:	N/A	Document: N/A
	Other: N/A		Document: N/A

Matching Controller: N/A Lead Required: N/A

Governing Equation: N/A

Associated Drawings: None

Remarks: (1) Adjustable range, dependent on proportional band.
(2) Accuracy: As Found +/- 2.65 PSIG
As Left +/- 0.50 PSIG
(3) Initial value, may be adjusted for optimum control.
(4) DCN W-07542-S issued NE SSD.
(5) Pressure Regulator: 0-PREG-31-336 Setting: 20 +/- 2 PSIG

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

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SCALING AND SETPOINT DOCUMENT
TRANSMITTERS

Instrument No.: 0-TT-31-336 Mfrr: Honeywell Model: TP970A

Vendor ID No: N/A Contract No: 821350

Action: Direct

Instrument Ranges: Input: (1) Output: (1)

Calibrated Ranges: Input: (1) Document: NE SSD 0-T-31-336

Output: (1) Document: NE SSD 0-T-31-336

Accuracy: (2) Document: NE SSD 0-T-31-336

Assumptions: None

Head Suppression Data: N/A

Governing Equation: N/A

Associated Drawings: None

Remarks: (1) Adjustable range is 60-90 Deg F, setpoint is 75 Deg F and will provide 8 PSIG output at setpoint. When input increases above setpoint, output increases towards 13 PSIG, when input decreases below setpoint, output decreases towards 3 PSIG.
(2) Accuracy: As Found +/- 2.65 PSIG
As Left +/- 0.4 PSIG
(3) DCN W-07542-B issued NE SSD.

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

Attachment 9.

EDM-MCP-071689 R/2

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INSTRUMENT LOOP CALIBRATION RECORD

WID NO:

LOOP COMPONENTS

ID: 0-TE-31-336 | INSTRUMENT NO: 0-TT-31-336 (1)

HEAD: N/A
MATE:

MATE:

TEST POINT	INPUT (Deg F)	REQUIRED (PSIG)	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1	<75(2)	3.00	N/A		N/A	N/A		N/A
2	75	8.00	5.35		10.65	7.60		8.40
3	>75(3)	13.00	N/A		N/A	N/A		N/A
4								
5								
6								
7								
8								
9								

INSTRUMENT NO:

MATE:

TEST POINT	REQUIRED ( )	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1							
2							
3							
4							
5							
6							
7							
8							
9							

Remarks: (1) Verification of xmtr and element must be done in thermotron.
(2) With input < setpoint, xmtr will drive towards 3 PSIG.
(3) With input > setpoint, xmtr will drive towards 13 PSIG.

CREW NO	OOT ( ) YES ( ) NO	PC ( ) YES ( ) NO	
PERFORMED BY/DATE	REVIEWED BY/DATE (SIMF)	INSTRUCTION NO.	REV. NO.

Function: Elec Board Room AHU B-A Temperature Control

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

Attachment 9.

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Sheet 8 of 11

INSTRUMENT LOOP CALIBRATION RECORD

WID NO:

LOOP COMPONENTS	
ID: 0-TC-31-336	INSTRUMENT NO: 0-TC-31-336
HEAD: N/A M&TE:	M&TE:

TEST POINT	INPUT (PSIG)	REQUIRED (POS/PSIG)	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1	< 8	(1)	N/A		N/A	N/A		N/A
2	8	8.0(3)	5.35		10.65	7.50		8.50
3	> 8	(2)	N/A		N/A	N/A		N/A
4								
5								
6								
7								
8								
9								

INSTRUMENT NO:
M&TE:

TEST POINT	REQUIRED ( )	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1							
2							
3							
4							
5							
6							
7							
8							
9							

Remarks: (1) Ensure damper drives towards open. SAT [ ]
(2) Ensure damper drives towards closed. SAT [ ]
(3) Output of 0-TC-31-336

PERFORMED BY/DATE	REVIEWED BY/DATE (SIMF)

Function: Elec Board Room AHU B-A Temperature Control

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

EPM-MCP-07/C89 R12 Attachment 9. Sheet 9 of 11

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REVISION 03

INSTRUMENT CALIBRATION RECORD

Instrument No: 0-FCO-31-336

HEAD: N/A

WID NO:

TEST POINT	INPUT (PSIG)	OUTPUT (% Open)	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1	3	Dyp=100	95		100	95		100
2	8	50	N/A		N/A	N/A		N/A
3	13	0	0		0	0		0
4	8	50	N/A		N/A	N/A		N/A
5	3	0	95		100	95		100
6								
7								
8								
9								

BISTABLES/SWITCHES

SWITCH ID.	ACTION		REQUIRED ( )	LO LIMIT	AS FOUND	HI LIMIT	LO LIMIT	AS LEFT	HI LIMIT
		SET.PT							
		RESET							
		SET.PT							
		RESET							

TEST EQUIPMENT	TVA TAG NO.	CAL DUE DATE

Remarks: None

CREW NO	OOT ( ) YES ( ) NO	PC ( ) YES ( ) NO	
PERFORMED BY/DATE	REVIEWED BY/DATE (SIMF)	INSTRUCTION NO.	REV. NO.

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

Attachment 9

EPM-MCP-07K89
R12

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REVISION 03

INSTRUMENT CALIBRATION RECORD

Instrument No: 0-TC-31-336

HEAD: N/A

WID NO:

TEST POINT	INPUT (PSIG)	OUTPUT (PSIG)	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1	6.75	3.00	0.35		5.65	2.50		3.50
2	8.00	8.00	5.35		10.65	7.50		8.50
3	9.25	13.00	10.35		15.65	12.50		13.50
4	8.00	8.00	5.35		10.65	7.50		8.50
5	6.75	3.00	0.35		5.65	2.50		3.50
6								
7								
8								
9								

BISTABLES/SWITCHES

SWITCH ID.	ACTION		REQUIRED ( )	LO LIMIT	AS FOUND	HI LIMIT	LO LIMIT	AS LEFT	HI LIMIT
		SET.PT							
		RESET							
		SET.PT							
		RESET							

TEST EQUIPMENT	TVA TAG NO.	CAL DUE DATE

Remarks: (1) Record "As Found" controller settings:
SP _____ PB _____
(2) Calibration settings: PB = 25% Setpoint = 8 PSIG
(3) Return controller settings to "As Found" settings or process settings & record final settings on controller card.

CREW NO	QDT ( ) YES ( ) NO	PC ( ) YES ( ) NO	
PERFORMED BY/DATE	REVIEWED BY/DATE (SIMF)	INSTRUCTION NO.	REV. NO.

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr

Approved by: Ed Hall EH

Date: 08/21/95

EDM-MCP-07K89 R12

Attachment 9

Sheet 11 of 11

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REVISION 03

INSTRUMENT CALIBRATION RECORD

Instrument No: 0-TT-31-336

HEAD: N/A

WID NO:

TEST POINT	INPUT (Deg F)	OUTPUT (POS/PSIG)	AS FOUND LO LIMIT	AS FOUND AS FOUND	AS FOUND HI LIMIT	AS LEFT LO LIMIT	AS LEFT AS LEFT	AS LEFT HI LIMIT
1	<75(2)	3.00	N/A		N/A	N/A		N/A
2	75	8.00	5.35		10.65	7.60		8.40
3	>75(3)	13.00	N/A		N/A	N/A		N/A
4								
5								
6								
7								
8								
9								

BISTABLES/SWITCHES

SWITCH ID.	ACTION		REQUIRED ( )	LO LIMIT	AS FOUND	HI LIMIT	LO LIMIT	AS LEFT	HI LIMIT
		SET.PT							
		RESET							
		SET.PT							
		RESET							

TEST EQUIPMENT	TVA TAG NO.	CAL DUE DATE

Remarks: (1) TE is integral part of the transmitter.
(2) With input below setpoint, transmitter will drive towards 3 PSIG. SAT [ ]
(3) With input above setpoint, transmitter will drive towards 13 PSIG. SAT [ ]

CREW NO	OOT ( ) YES ( ) NO	PC ( ) YES ( ) NO	
PERFORMED BY/DATE	REVIEWED BY/DATE (SIMF)	INSTRUCTION NO.	REV. NO.

Function: Elec Board Room AHU B-A Temperature Control

Location: EL 692, COL C2-P

Reviewed by: R.D. Murr Approved by: Ed Hall EH Date: 08/21/95

Attachment 10 EDM-MCP-07689 R12

Sheet 1 of 1

TVA 64 (OS-6-85)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

B44 '85 1125 016

TO : J. K. Hannifin, Mechanical Project Engineer, P-109 SB-K

FROM : G. P. Cooper, Group Head, W7 B90 C-K

DATE : NOV 25 1985

SUBJECT: WATTS BAR NUCLEAR PLANT - REDUCED CAPACITY OF HVAC COOLING EQUIPMENT - ERCW SYSTEMS EQUIPMENT FLOW REQUALIFICATION - QUALITY DESIGN INFORMATION

References:

1. TVA 45D from M. D. Davis to G. A. Silver dated June 26, 1985 (MDD-259) - Information Request
2. Informal memorandum from H. R. Corbett to J. K. Hannifin dated May 31, 1985, Watts Bar Nuclear Plant Units 1 and 2 - ERCW System (67) - Equipment Flow Requalification.
3. TROI Item WBN-CTR-E227R1

The following information was requested in references 1 and 2 above in order to resolve reference 3.

The reduced capacities of the affected cooling equipment at reduced ERCW flow rates are as follows:

Equipment	Reduced ERCW Flow Rate	Reduced Capacity
CCW and AFW Room Cooler	102 gpm	592.6 MBH
CS Pump Room Cooler	28 gpm	162.2 MBH
Lower Compartment Cooler	306 gpm	2,262.4 MBH
Electrical Board Room Chiller	370 gpm	150.6 tons
MCR Chiller	350 gpm	150.2 tons

AT DESIGN AIRFLOW ONLY

This information was obtained from the equipment manufacturers and is available in the respective contract documentation files and RIMS.

Prepared by: B.F. Crosslin

Checked by: [signature]

Reviewed by: [signature]

Approved by: [signature]

BFC:EWL

cc: C. A. Chandley, W7 C126 C-K
H. R. Corbett, W7 D224 C-K
J. P. Little, W7 C135 C-K

CAC:EWL

cc: RIMS, SL 26 C-K
J. C. Standifer, P-104 SB-K

WBEP

NOV 27 '85

JCS		JKH	
CDW		BRC	
LCS	X	MDD	
RAD		JJN	
		EWS	
RHC		RBY	
TCC		RRR	
RTK		JLS	
DEA		JAP	
JHM		CRL	
		PEN	
JPT		NEW	
DMW			
PDM			
DGP		SB	
		File	

BPW DTS — WDE

Principally Prepared By: B. F. Crosslin, Extension 6720
G55324.06

EDM-MCP-071689 R13

Attachment 11
Page 1 of 4

Transfer contract

TENNESSEE VALLEY AUTHORITY
TRANSFER
~~PURCHASE~~ REQUISITION

Requisition Number 75746A

Commodity Code

Requisition Date APR 14 1990

Account Number 8804-N0... -XERB... -18X

Accounting Office Power

Ship To: TENNESSEE VALLEY AUTHORITY

Watts Bar Nuclear Plant - Const. Whse.

Near Spring City, TN

Shipping Notice To: J. R. Gorum

Ship By TVA Truck   Date Wanted 04/...

...ation Spring City, TN

...ject Watts Bar Nuclear Plant

...anization Power

...uisitioner N3WM-455

...Ref. No. DCN P-05297-A

...EM	ARTICLES OR SERVICES (GIVE COMPLETE DESCRIPTION OR CATALOG NUMBER)	QUANTITY	UNIT	UNIT PRICE	AMOUNT
2	WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 AIR HANDLING UNITS FOR CONTROL BAY COMPUTER ROOM				
	Please transfer the equipment identified on the attached schedule of prices from the Hartsville Distribution Center to Watts Bar Nuclear Plant.				
	Equipment shall be transferred QA level I. Equipment shall be stored ANSI N45.2.2, level C, or better. Electric motors on equipment shall be stored ANSI N45.2.2, level B, or better.				
	Procurement request W-6472 R0				
	Procurement item No. FXER9--5595--.				
	Acquisition cost				$7,252*
	*These units are currently owned by WBN. Acquisition cost provided for transfer of funds to denoted account No., if required.				
	Prepared by: Dennis W. Schulte 4/14/90				
	Technical Review by: Satish C. Rao 04/14/90				
	Reviewed by: [signature] for FAK				
	Contact Person: D. W. Schulte, x1258, WBN				

RECEIVED
APR 16 1990

90 1397

SEND BIDS FOR RECOMMENDATION AND ONE COPY OF ALL CONTRACT RELATED CORRESPONDENCE TO: New Projects Engineering Manager, C106 IOB WBN

THIS CONTRACT WILL BE PAID WITH: (RE "R TO ACCOUNTING MEMORANDUM 144)

POWER FUNDS: 100%   APPROPRIATE FUNDS: 0%   OTHER FUNDS: 0%

Occupational Health and Safety Requirements of the TVA Occupational Health and Safety Manual: [] are required and referenced [] are not required NA

Material Safety Data Sheet for Hazardous Materials Requested: [] Yes [] No NA

If yes, indicate item number

[signature] for WSR 4/14/90
Requisitioner

COPY DISTRIBUTION:

No. I/Bs ___ No. Contracts ___

Authorized (Title)

Does Quality Assurance Apply? Yes[X] No[ ]

~~Does 10CFR... Notice Apply? Yes[ ] No[ ]~~

N/A DW Schulte 4/14/90
Validated (Budget Supervisor)

[signature]
Approved (Quality Assurance Staff)

Approved (Purchasing)

TVA 201

Attachment 11
Page 2 of 4

EDM-MCP-071639
RB

SCHEDULE OF PRICES

NO. 75746A
PAGE NO. 1

ITEM NO.	ARTICLES OR SERVICES (GIVE DESCRIPTION OR CATALOG NUMBER)	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Air Handling Units and Electric Motors. This equipment was originally purchased on contract 79K36-625328, NBM-109. Yellow Creek Control				
1	Air handling unit shall be contract item No. 141, YCN UNID No. 1VC-MAHU-127-B, and shall include Reliance 7.5 HP electric motor serial number 22YF882801-A1.	1	EA	1,626	1,626
2	Air handling unit shall be contract item No. 143, YCN UNID No. 1VC-MAHU-126-A, and shall include Reliance 7.5 HP electric motor serial number 51YF882801-A1.	1	EA	1,626	1,626
				TOTAL	[illegible]

All QA documentation for these air handling units and motors that is available at the Hartsville Distribution Center shall be shipped with the equipment.

NOTE: These air handling units were originally furnished with 5.0 HP motors. The denoted 7.5 HP motors will be used on the air handling units at WBN. The referenced DCN will evaluate the use of the larger motors.

TOA-505I

BIDDER _____

[illegible] ATTACHMENT · PAGE : OF : APPENDIX ______ SHEET __ OF __
[illegible] CONT. # ______ PROC REQUEST # ______ MARK # 47A373-102
[illegible] # ______ PROC ACTIVITY # ______ QUANTITY 1 ONLY
[illegible] # ______ CONST ACTIVITY # ______ UNID # NA
[illegible] DULE # ______ MAMS # ______

A) FUNCTION: COMPUTER RM COOLING
B) GENERAL DATA:
1. Assy ~~T.S.P.~~ In. WG TSP = 2.5
2. Min. Operating CFM 8000
3. Air Flow: Orient/Argmt VERT/DRAW
4. FAN RPM = 1280
C) COOLING:
5. Entering Air °F db/wb 75 DBE
6. Lvg Air °F Max db/Min wb 60.1 DBL
7. Min. Capacity BTUH 127920 SH
8. Refrigerant CHILLED WATER
9. Entering Water: °F/GPM 44 / 22
10. Water Pressure Drop 4.9
11. Refrig. Evap. Temp. °F NA
12.
D) HOUSING DETAILS:
13. Housing Mat'l STEEL
14. Refrig. Conn. Location LEFT
15. Discharge Location —
16. Max Discharge Dim., WxL —
17. Intake Location —
18. Max Intake Dim., WxL —
19. OA Length or Depth —
20. OA Height —
21. OA Width —
22. Special Construction —
23. Max Sect Dim, LxHxW —
24. Motor Location LEFT · 1
E) FAN DATA:
25. Fan Type CNTFGL
26. Max. Outlet Vel. FPM 1450
27. Drive Type/S.F. BELT / 2
28. Impeller: Shape/Mat'l BT/STL OR AL
29. Rotation/Discharge
30. Inlet Vane/Operator NA
31. Max BHP 7½
F) FAN MOTOR:
32. Type A/C DRIP PROOF
33. Motor Duty/RPM CONT / 1750
34. Power Supply V/PH/HZ 460 / 3 / 60
35. Motor Shaft Orientation HORIZ
36.

G) UNIT ACCESSORIES:
37. Filters/Type 2" THROW AWAY
38.
39.
H) REFERENCE DATA:
40. Instrument Data Sheet
41. Assy. Data Dwg.
42. System Design Criteria WB-DC-40-36.1
43. IEEE Class NON-IE
44. ASME Code/Class NA
45. Seismic Design Criteria CATEGORY I
46. Location: Bldg/Elevation CB/EL708
47. Bldg Column Line N, P, C4, C8
48.
J) UNIT ENVIRONMENTAL CONDITIONS:
49. Temp. °F db Max/Min 104 / 60
50. R.H. % Max/Min 90 / 10
51. Amb. Pressure Max/Min ATM(+)
52. Radiation Dose Total Rads < 1 X 10⁴ RAD
53. Air Quality CLEAN
54.
K) MOTOR ENVIRONMENTAL CONDITIONS:
55. Temp. °F db Max/Min 104 / 60
56. R.H. % Max/Min 90 / 10
57. Amb. Pressure Max/Min ATM(+)
58. Radiation Dose Total Rads < 1 X 10⁴ RAD
59. Air Quality ~~MILD~~ CLEAN RPL 4-13-90
60.
L) VENDOR SUPPLIED DATA:
61. Fan Motor Max KVA Input
62. Fan Motor Rated HP
63.
64.
M) MEB DOCUMENT CONTROL DATA:
65. General Requirements-TVA Spec # 5714
66. Technical Spec-TVA Spec # 3735
67. Motor Spec-TVA Spec #
68. Applic. Seismic Criteria
69. Applicable QA Attachment

Comments: REFERENCE (1) AIR HANDLING UNIT item NO 141 (YCN UNID NO 1VC-MAHU-127-B WITH RELIANCE 7.5 HP ELECTRIC MOTOR SERIAL NO. 22 YE 882801-A1.

3								AIR HANDLING UNIT DATA SHEET
								TENNESSEE VALLEY AUTHORITY
								PROJECT WATTS BAR
								CB/COMPUTER ROOM
								HVAC
DCN								DWG. NO. 47W930-1
0	F-05297-A	4-11-90	RPL	NA	RBL	[illegible]	NB	KNOXVILLE, TN · DATE: 4-11-90
REV	Change Ref.	Date	DSGN	CHKR	DSGNRVWR	APPR	APPD	ESIM 47A373-25

EDM-MCP-071689 R13

Attachment 11 Page 4 of 4

[redacted] ATTACHMENT 4 PAGE 1 OF 2 APPENDIX ____ SHEET ___ OF ___

[redacted]/CONT. # ____ PROC REQUEST # ____ MARK # 47A373-103

[redacted] # ____ PROC ACTIVITY # ____ QUANTITY 1 EACH

[redacted] # ____ CONST ACTIVITY # ____ UNID # NA

[redacted] MAMS # ____

A) FUNCTION: COMPUTER RM COOLING

B) GENERAL DATA:

1. Assy ~~Esp~~. In. WG TSP = 2.5
2. Min. Operating CFM 8000
3. Air Flow: Orient/Argmt VERT/DRAW
4. FAN RPM = 1280

C) COOLING:

5. Entering Air °F db/wb 75 DBE
6. Lvg Air °F Max db/Min wb 60.1 DBE
7. Min. Capacity BTUH 127910 SH
8. Refrigerant CHILLED WATER
9. Entering Water: °F/GPM 44/22
10. Water Pressure Drop 4.9 FT
11. Refrig. Evap. Temp. °F NA
12. ____

D) HOUSING DETAILS:

13. Housing Mat'l STEEL
14. Refrig. Conn. Location RIGHT
15. Discharge Location —
16. Max Discharge Dim., WxL —
17. Intake Location —
18. Max Intake Dim., WxL —
19. OA Length or Depth —
20. OA Height —
21. OA Width —
22. Special Construction —
23. Max Sect Dim, LxHxW —
24. Motor Location RIGHT-1

E) FAN DATA:

25. Fan Type CNTFGL
26. Max. Outlet Vel. FPM 1350
27. Drive Type/S.F. BELT / 2
28. Impeller: Shape/Mat'l BT/STL OR AL
29. Rotation/Discharge ____
30. Inlet Vane/Operator NA
31. Max BHP 7½

F) FAN MOTOR:

32. Type A/C DRIP PROOF
33. Motor Duty/RPM CONT / 1750
34. Power Supply V/PH/HZ 460/3/60
35. Motor Shaft Orientation HORIZ
36. ____

G) UNIT ACCESSORIES:

37. Filters/Type 2" THROW AWAY
38. ____
39. ____

H) REFERENCE DATA:

40. Instrument Data Sheet ____
41. Assy. Data Dwg. ____
42. System Design Criteria WB-DC-40-36.1
43. IEEE Class NON-IE
44. ASME Code/Class NA
45. Seismic Design Criteria CATAGORY I
46. Location: Bldg/Elevation CB / EL 732'
47. Bldg Column Line NP, C6, C8
48. ____

J) UNIT ENVIRONMENTAL CONDITIONS:

49. Temp. °F db Max/Min 104 / 60
50. R.H. % Max/Min 90 / 10
51. Amb. Pressure Max/Min ATM (+)
52. Radiation Dose Total Rads $< 1 \times 10^4$ RAD
53. Air Quality ~~MILD~~ CLEAN PER 4.1.3.90
54. ____

K) MOTOR ENVIRONMENTAL CONDITIONS:

55. Temp. °F db Max/Min 104 / 60
56. R.H. % Max/Min 90 / 10
57. Amb. Pressure Max/Min ATM (+)
58. Radiation Dose Total Rads $< 1 \times 10^4$ RAD
59. Air Quality CLEAN
60. ____

L) VENDOR SUPPLIED DATA:

61. Fan Motor Max KVA Input ____
62. Fan Motor Rated HP ____
63. ____
64. ____

M) MEB DOCUMENT CONTROL DATA:

65. General Requirements-TVA Spec # 3714
66. Technical Spec-TVA Spec # 33
67. Motor Spec-TVA Spec # ____
68. Applic. Seismic Criteria ____
69. Applicable QA Attachment ____

Comments: REFERENCE : AIR HANDLING UNIT ITEM NO 143, YCN UNID NO. IVC-MAHU-126-A WITH RELIANCE 7.5 HP ELECTRIC MOTOR SERIAL NO. 51YF682801-A1

REV	Change Ref	Date	DFTR	CHKR	DSGNR	PVLP	APPD	APPD	APPD
3									
2									
1									
0	FCS2978	4-11-90	RPL	NA	RPL	KWS	NA	WOF	SCL

AIR HANDLING UNIT DATA SHEET

TENNESSEE VALLEY AUTHORITY

PROJECT WATTS BAR

CB / COMPUTER RCOM

HVAC

DWG. NO. 47W930-1

KNOXVILLE, TN. DATE: 4-11-90

EDM 47A373-26

ISSUE RIMS T56 930203 921

CLOSURE RIMS T56 941221 829

1 DCN TYPE M [X] S [ ] F [ ] W [ ] Q [ ]	DESIGN CHANGE NOTICE	2 DCN NO. 02693-A 3 PAGE 1

PART I REQUESTED CHANGE

4 PLANT/UNIT WATTS BAR NUCLEAR PLANT UNIT - 0	5 REASON CODE NONE
6 AREA/BLDG LOC CB / EL 692'-0"	7 EQUIP ID NO (S)/SYS CODE(S) SEE ATTACHMENT A / 31Q RIP 1/30/93
8 AUTHORIZING DOCUMENTS NONE	9 REFERENCE DOCUMENTS 47W866-4, DSR-21
10 DESCRIPTION SUMMARY EBR AHU FAN DRIVE SYSTEM AND DAMPER FAILURES.	11 REMARKS NONE

12 DESCRIPTION OF PROBLEM/REQUESTED CHANGE

ADVANCED AUTHORIZATION REQUESTED YES [ ] NO [X]

REPEATED FAILURES OF FAN BEARINGS, FAN SHAFTS, V-BELTS ABNORMALLY HIGH VIBRATION (AS MONITORED BY MECHANICAL TEST UNIT), FILTER FAILURES, AND DAMPER LINKAGE FAILURES. ALSO THERE ARE NUMEROUS FAILURES (STAYING OPEN OR NOT OPENING FULL OPEN) OF THEIR DOWNSTREAM BACKDRAFT DAMPER. SEE PROPOSED MODIFICATION (ATTACHED B).

13 JUSTIFICATION/REASON FOR CHANGE THE AVAILIABILITY OF THESE UNITS ARE REQUIRED FOR MAINTAINING TEMPERATURE IN THE COMPUTER AND AUXILLARY INSTRUMENT ROOMS (TS 3.7.13).

14 REQUESTED BY	ORGANIZATION	EXT	DATE	NEED DATE	14A ORIGINATOR'S SUPV	DATE
SEE PAGE 2	SEE PAGE 2	SEE PAGE 2	SEE PAGE 2	SEE PAGE 2	NR	NR

15 REVIEWED BY RLE	DISCIPLINE ASSIGNMENT	DATE	15A PROJECT MANAGER APPROVAL	PWL No.	DATE
SEE PAGE 2	SEE PAGE 2	SEE PAGE 2	B Hannah for WDStevens	BN	1/28/93
			15B ENGINEERING APPROVAL TO INITIATE		DATE 1-22-93

PART II APPROVED CHANGE

16 PROBLEM SOLUTION/APPROVED CHANGE (INCLUDE BASIS FOR APPROVAL)

SEE PAGE 10

ADVANCE AUTHORIZATION APPROVED YES [ ] NO [ ]

AUTHORIZING ENGINEER CPP 1/29/93 DATE

REPLACEMENT ORIGINAL

INITIALS CPP DATE 1/30/93

17 TE R.J. PEREZ	DATE 1/22/93	22 DESIGN VERIFIER FDMENACHEAY FDMenachem FDM 1/30/93	DATE 1/30/93
18 OTHER CIVIL-ESQ	DATE 1/29/93	23 RLE MAS 2/1/93	DATE 2/1/93
19 OTHER I&C	DATE 2-1-93	24 EM RKWilson for WLE	DATE 2/1/93
20 OTHER NOT REQUIRED	DATE	25 WORK COMPLETION See MWCS	DATE
21 QA NOT REQUIRED	DATE	26 FINAL WORK TRACK. CLOSURE Bobby R. Atkins for MAW	DATE 12-21-94

KL 1-31-93

Design Change Notice Closure

ATT. 12

PAGE 2 OF 33

FILING INSTRUCTIONS

File DCN Closure Verification sheets for DCN No. M-02693-A

as sheet numbers 30 behind sheet number 29

Replace DCN cover sheet AND 4 ℓ

P E Collins
Signature

T E Collins
Print Name

Dec 17 1994
Date

Total pages in this DCN now equals 110 + 1 = 111

TVA

REVISION LOG

Title: DCN No. M-02693-A.

Revision No.	DESCRIPTION OF REVISION	Date Approved
A	10) F-28767-A INCORPORATION INSTRUCTIONS 1. File DCN No. F-28767-A pages in base DCN No. M-02693-A as indicated below. (All page numbers referred to in items 2 & 3 are base DCN page numbers) 2. Insert new pages: 4i, 18a-18i, 19a-19c, 23a-23d 3. Replaces existing pages: 7,7d,16,16a-16c,18,20,22,23 (including 2A-2E) 4. File pages 2 to 104 with Cover sheet of DCN F-28767-A. Total Number of Pages = ~~110~~ 113 BRA 12-21-94 O/C. Including pages: 1 thru 29, 2a, 4a-4i, 7a-7d, 11a, 11b, 16a-16c, 17a-17c, 18a-18i, 19a-19c, 23a-23d, 26a-26x, 28a-28s	11/17/94

ATT. 12 PAGE 4 OF 33

APPENDIX I
Page 1 of 1

DCN/PMEN No. M-02693-A
Page 30

DCN CLOSURE/RETURN-TO-SERVICE VERIFICATION

F Return to Service (PMEN) (Complete only items 1-7 below)
or
(F) DCN Closure (Complete all items)

YES	NO	N/A	
		✓	1) Primary and/or critical drawings (Cat. 1) revised and issued to incorporate the change. This requirement is not applicable for DCNs affecting systems prior to SPAE Phase I.
✓			2) DCN is in INSTV or PINSV status and all DCAs are posted against affected drawings in DCCM. DCAs are in "UNC" or "INEMS" status and for M or W type DCNs where their DCAs have predecessors, those predecessor DCAs are also in "UNC" or "INEMS" status or the affected drawings are revised.
		✓	3) All unverified assumptions in any calculation supporting the DCN have been resolved per Section 5.9.2.c.
		✓	4) Special requirements listed in the 10CFR50.59 SA/SE required to support basis of design are met.
✓			5) All affected drawings/documents identified, included in the DCN as appropriate, and documents revised.
✓			6) All F-DCNs issued and interfiled F-DCNs are reflected on the index sheets or base DCN revision log.
		✓	7) EQ/MEQ change supplements have been issued to the EQ Binders or Lists in accordance with EAI-7.05 and EAI-7.07.
		✓	8) Punchlist items have been closed or have been issued as exceptions in accordance with SSP-9.54.
✓			9) DCCM reflects the DCN package contents and status. Current revision of DCA is reflected in DCCM.
		✓	10) Mini-calculations have been rolled into the parent calculation.
		✓	11) FSAR text changes, TS and TRM changes have been received by Site Licensing.

COMMENTS: ______________________

Verified: P E Callen (signature) 12/17/94
TE Date

Approved: D R Rost (signature) 12/17/94
RLE Date

[ ] PMEN # _____ Rev _____
[ ] STATUS DATE _____
[X] FULL DCN CLOSURE Rev 0
[ ] STAGE # _____ Rev _____

(Page 1 of 2) PG 1 CONT'D ON PG 2
ECN (DCN) M-02693-A
(CIRCLE ONE)

MODIFICATION WORK COMPLETION STATEMENT

PART I. IMPLEMENTED DRAWINGS

RESPONSIBLE ENGINEER: LIST THE DRAWINGS AND REVISION LEVELS WHICH WERE IMPLEMENTED FOR THE SCOPE OF THIS ECN/DCN. IF A DRAWING WAS ONLY PARTIALLY IMPLEMENTED FOR THE SCOPE OF THIS DCN, INDICATE "YES" IN "PART ?" BLOCK, AND ATTACH A MARKED-UP COPY TO THIS WORK COMPLETION STATEMENT.

PART ? YES/NO	DRAWING/REV		
NO	DCA-M02693-01	R/0	
	02		*
	03		
	04		
	05		
	06		
	07		
	08		
	09		*
	10		
	11		
	13		
	14		
NO	DCA-M02693-15	R/0	

LIST THE FDCNs/PCRs IMPLEMENTED IN CONJUNCTION WITH THIS ECN/DCN:

~~F-27533-A~~ ~~F-28768-A~~ ~~F-28840-A~~ ~~F-28983-A~~
~~F-28764-A~~ ~~F-28769-A~~ ~~F-28841-A~~ ~~F-30188-A~~
~~F-28765-A~~ ~~F-28770-A~~ ~~F-28980-A~~
~~F-28766-A~~ ~~F-28838-A~~ ~~F-28984-A~~
AA F-28767-A ~~F-28839-A~~ ~~F-28982-A~~

LIST THE WIDs WHICH IMPLEMENTED THIS ECN/DCN:

D-02693-01 through 27

PART II. WORK COMPLETION VERIFICATION

A. IS TESTING REQUIRED PER SSP-8.03? YES [ ] NO [X]
IF YES, THEN COMPLETE RETEST CONTROL FORM.

RESPONSIBLE ENGINEER 09-07-94 DATE

DCS REVIEWER 9/9/94 DATE

ATT. 12 PAGE 6 OF 33

M-02693-A
PAGE 32

APPENDIX H
Page 2 of 2

(Page 2 of 2)
PG 2 CONT'D ON PG END
ECN/DCN NO M-02693-A
(CIRCLE ONE)

MODIFICATION
WORK COMPLETION STATEMENT
CONTINUATION PAGE

PART I. IMPLEMENTED DRAWINGS (CONTINUED)

PART 7 YES/NO	DRAWING/REVISION	
NO	DCA-M02693-17	R/0
	18	R/1
	19	R/1
	20	R/0
	21	
	22	
	23	
NO	DCA-M02693-24	R/0

NR [illegible] 09-07-94

PART III. COMMENTS

COMMENTS:

* DCA's revised by FDCN's Listed on Pg 1, to marked DCCM.

[illegible] 09-07-94

APPENDIX C
Page 1 of 5

RIMS ______

AI-8.14
Revision 0
Page 15 of 20

DESIGN CHANGE NOTICE
DIVISION OF NUCLEAR ENGINEERING

DCN NO. 1 M-02693-A	PAGE 2	REASON CODE 4 V, T	
PLANT/PROJECT AND UNIT 3 WATTS BAR NUCLEAR PLANT UNIT- 0			
E.O.NO. 5 821350	AREA/BLDG LOC. 6 Control Bldg. EL 692	EQUIP.I.D.NO.(S)/SYS.CODE(S) 7 See Attachment A	
REFERENCE DOCUMENTS 8 47W866-4, DSR-21		SUPPLIER (OR SUBSUPPLIER) NAME 9 Ellis and Watts	
DESCRIPTION SUMMARY 10 EBR AHU Fan Drive System and damper failures		REMARKS 11 NONE	

DESCRIPTION OF PROBLEM/REQUESTED CHANGE

12 Repeated failures of fan bearings, fan shafts, V-belts, abnormally high vibration (as monitored by mechanical test unit), filter failures, and damper linkage failures. Also there are numerous failures (staying open or not opening full open) of their downstream backdraft damper. See proposed modification (attached B). CGP 1/22/93

JUSTIFICATION/REASON FOR CHANGE 13 The availability of these units are required for maintaining temperatures in the computer and auxillary instrument Rooms (TS 3.7.13)

CCB APPROVAL ______ DATE ______ 13A

REQUESTED BY	ORGANIZATION	EXT.	DATE	NEED DATE	REVIEWED BY	DATE
14 [signature]	CFS-M	8911	12/1/88	6/1/89	15 M [signature]	12/21/88

PROBLEM SOLUTION/APPROVED CHANGE (INCLUDE BASIS FOR APPROVAL) CW 12/10/88

16 CGP 1/22/93

AFFECTED DOCUMENT NOS. 17	TYPE	STATUS
CGP 1/22/93		

DB IMPACT: SEISMIC? 18 ☐ YES ☐ NO	ENVIRONMENTAL? 19 ☐ YES ☐ NO	APPENDIX R IMPACT? 20 ☐ YES ☐ NO
SAFETY RELATED? 21 ☐ YES ☐ NO	SAR CHANGE? 22 ☐ YES ☐ NO	NUREG 0612 IMPACT? 23 ☐ YES ☐ NO
ANSWERED BY (RESP.ENGR.) 24	DATE 30	
RESP. LEAD ENGR. 25	DATE 31 CGP 1/22/93	
OTHER 26	DATE	DESIGN VERIFICATION 32 / DATE
OTHER 27	DATE	WORK COMPLETION 33 N/A ☐ / DATE
EA OR QA 28	DATE	INSP REPORT NO./SIG 34 / DATE
PROJ. ENGR. 29	DATE	FINAL WORK TRACKING CLOSURE / DATE

STATUS
CI-Committed ... Incorporated
... [illegible]

ATTACHMENT A

EQUIPMENT ID NUMBERS

0-AHU-031-030B-A	ELECTRICAL BOARD ROOM AHU A-A
0-AHU-031-030D-A	ELECTRICAL BOARD ROOM AHU B-A
0-AHU-031-031B-B	ELECTRICAL BOARD ROOM AHU C-B
0-AHU-031-031D-B	ELECTRICAL BOARD ROOM AHU D-B
0-FCO-031-0335	ELECTRICAL BOARD ROOM AHU A-A FLOW CONTROL DAMPER
0-FCO-031-0336	ELECTRICAL BOARD ROOM AHU B-A FLOW CONTROL DAMPER
0-FCO-031-0337	ELECTRICAL BOARD ROOM AHU C-B FLOW CONTROL DAMPER
0-FCO-031-0338	ELECTRICAL BOARD ROOM AHU D-B FLOW CONTROL DAMPER
0-FCO-031-0030	ELECTRICAL BOARD ROOM AHU C-A FLOW CONTROL DAMPER
0-FCO-031-0031	ELECTRICAL BOARD ROOM AHU D-B FLOW CONTROL DAMPER
0-BKD-031-2001A	ELECTRICAL BOARD ROOM AHU A-A BACKDRAFT DAMPER
0-BKD-031-2001B	ELECTRICAL BOARD ROOM AHU B-A BACKDRAFT DAMPER
0-BKD-031-3972	ELECTRICAL BOARD ROOM AHU C-A BACKDRAFT DAMPER
0-BKD-031-3973	ELECTRICAL BOARD ROOM AHU D-B BACKDRAFT DAMPER
SYSTEM:	031Q
SYSTEM FLOW DIAGRAM:	47W866-4

ATT. 12

PAGE 9 OF 33

ATTACHEMENT B

CONTROL BUILDING ELECTRICAL BOARD ROOM AHU FAN / MOTOR DRIVE SYSTEM:

PROBLEMS / REQUESTED CHANGES

(A) DESCRIPTION OF PROBLEMS

1 DISINTEGRATION OF FILTER MATERIAL CAUSING CLOGGING IN COOLING COIL AND EXCESSIVE FILTER FAILURES.

2 EXCESSIVE SHEAVE BEARING FAILURES AND HIGH VIBRATIONS.

3 DAMPER OPERATIONAL DIFFICULTIES.

4 EXCESSIVE FOULING OF COOLING COIL, HIGH AIR PRESSURE DROP, RESULTING IN LOW AIR FLOW THROUGH AHU.

(B) REQUESTED CHANGES

1 RECTIFICATION / REPLACEMENT OF FILTERS.

2 REPLACEMENT OF TWO-PIECE ROTOR SHAFT BY ONE-PIECE SHAFT AND ELIMINATION OF THIRD (SHEAVE) BEARING.

3 DAMPER BLADE AND AXLE FASTENING RECTIFICATION.

4 RECTIFICATION OF FOULING PROBLEMS BY COIL REPAIR OR REPLACEMENT.

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PAGE 10 OF 33

Title: DCN # 02693-A		REVISION LOG
Revision No.	DESCRIPTION OF REVISION	Date Approved
A	INITIAL ISSUE	2/1/93

DCN PACKAGE INDEX

DCN # 02693-A
Page 5

DCN Contents	Included Y	Included N	Page
1. DCN Coversheet	☒	☐	1
2. Revision Log	☒	☐	4
3. Index Sheet	☒	☐	5
3a. Cover sheet continuation (Block 16)	☒	☐	10
4. Changes/Additions to Design Basis Documents	☒	☐	12
5. Installation and Testing Requirements	☒	☐	14
6. DCAs and EMS Data Sheets	☒	☐	15
7. ALARA Review Checklist	☒	☐	29
8. Other Documents	☐	☒	NR
	☐	☒	NR
1/20/93	☐	☒	NR
	☐	☒	NR
Total Pages in DCN (INCLUDING 2a; 11a; 11b; 26a; 26b; 26c; 26d; 26e; 26f; 26g; 26h; 26i, 28a)			42

DCN PACKAGE INDEX

DCN # 02693-A
Page 6

Design Impacts	YES	NO	RIMS # IF REQUIRED
1. Civil Issues (e.g., equipment seismic, pipe rupture, structural, attachments, piping analysis)	☒	☐	NR
2. Environmental Equipment Qualification (EQ) Program on Mechanical Equipment QualificationProgram. Does the DCN involve any cable or devices within these programs ? See EAI-7.05 and 7.07.	☐	☒	T80 930122 800
3. 10CFR50 Appendix R (Fire protection analysis) See EAI-7.02.	☐	☒	T80 930122 801
4. Nuclear Safety Related	☒	☐	NR
5. Quality Related	☒	☐	NR
6. SAR Change Will the change require a revision to the Final Safety Analysis Report (FSAR). Issue a change request for Licensing Document per SSP-4.02 when a change is required.	☐	☒	NR
7. ALARA Impact See SSP-5.02, DS-M18-7-1, R0	☐	☒	NR
8. Change Review Checklist for Electrical	☐	☒	NR
9. Human Factors Engineering	☐	☒	NR
10 Radiological Impact Evaluation	☐	☒	NR
11. Containment Inventory of Aluminium or Zinc	☐	☒	NR

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APPENDIX D
Page 3 of 6

DCN PACKAGE INDEX

DCN # 02693-A
Page 7

DCAs/Drawings issued with the package.

(1) Type	(1) Status	DCA/Drawing	Rev	Unit	Base Drawing (DCA Only)	Type of Dwg	(2) Rev of Base Dwg
DCA	CI	01	0	0	47W930-12	AD	*
DCA	CI	02	0	0	47W930-12	AD	*
DCA	CI	03	0	0	47W930-12	AD	*
DCA	CI	04	0	0	47W930-13	AD	*
DCA	CI	05	0	0	47W930-13	AD	*
DCA	CI	06	0	0	47W930-13	AD	*
DCA	CI	07	0	0	47W930-13	AD	*
DCA	CI	08	0	0	47W930-13	AD	*
DCA	CI	09	0	0	47W930-13	AD	*
DCA	CI	10	0	0	26D2 CONT#821350	AD	902
DCA	CI	11	0	0	26D CONT#821350	AD	903
DCA	CI	12	0	0	47W930-13	AD	*
DCA	CN	13	0	0	47W930-12	AD	*
DCA	CN	14	0	0	47W930-13	AD	*
DCA	CN	15	0	0	26D CONT#821350	AD	903
DCA	CI	16	0	0	47W930-13	AD	*
DCA	CI	17	0	Ø	92QL031	AD	*

(1) See Appendix P for type and status codes. RJB/30/93
(2) Enter * for revision of anticipated drawings and add category of anticipated drawing (*/2).

DCN PACKAGE INDEX

DCN # 02693-A
Page 8

Other documents issued / included with the package (not including DCAs and drawings)

Document Issued	(1) Type	(1) Status	Page Number
WB-DC-40-36.1	DC	CI	12

(1) See Appendix P for type and status codes.

DCN PACKAGE INDEX

DCN # 02693-A
Page 9

Related drawings / documents (Referenced but not included in the package

Drawing / Document	(1) Type	Status
W-6995, R0	PDOC	RL
WCG-ACQ-0097, R1	CA	RL
EPM-AKB-011393, R0	CA	RL
DSR-021	~~MISC~~ WW	RL
W-7010, R02	PDOC	RL
45W1748-6	DW	RL
45W1748-7	DW	RL
1-47W866-4	DW	RL
W-8036, R0	PDOC	RL
W-8038, R0	PDOC	RL
W-8039, R0	PDOC	RL
W-8062, R0	PDOC	RL
DCN M-09609-A	DCN	RL

(1) See Appendix P for type and status codes.

BLOCK 16 CONTINUATION

PROBLEM SOLUTION/ APPROVED CHANGE (INCLUDE BASIS FOR APPROVAL)

(1) FILTERS:

(A) PROBLEM SOLUTION

DISCONTINUE USING BAG TYPE FILTERS AND REPLACE THE PRESSURE DROP INDICATORS FOR THE FILTERS.

(B) APPROVED CHANGES

THE EXISTING FILTERS SHALL BE REPLACED BY NEW FILTERS RIGA FL XL AS MANUFACTURED BY FARR COMPANY OR EQUAL. THE PRESSURE DROP INDICATORS SHALL BE REPLACED BY DWYER MAGNEHELIC GAUGE MODEL 2002 ASF OR EQUAL. SEE DCA-02693-07 FOR LOCATION AND MOUNTING DETAILS FOR THE GAUGE AND DCA-02693-12 FOR INSTALLATION OF NEW FILTERS.

(C) BASIS FOR APPROVAL

TO MAINTAIN TROUBLE FREE OPERATION OF THE AHU'S AND TO AVOID FURTHER CLOGGING OF THE COILS, THE BAG FILTERS SHALL BE REPLACED BY THE ABOVE MENTIONED FILTERS.

SUPPORTING DOCUMENTS:
- WATTS BAR NUCLEAR PLANT DESIGN STUDY REQUEST (DSR) NO. 021, INVESTIGATION HVAC.
- CIVIL CALCULATION NO. WCG - ACQ - 0097 REV.1

(2) FAN BEARING

(A) PROBLEM SOLUTION

THE END PANEL, THAT HAS FAN MOTOR BEARING SHALL BE STIFFENED TO ELIMINATE WEAK SUPPORT FOR THIS BEARING. THE FLANGE MOUNTED BEARING SHALL BE REPLACED WITH A PILLOW BLOCK AND HEAVIER DUTY SPHERICAL ROLLER BEARINGS.

(B) APPROVED CHANGES

DETAILS FOR THE STIFFINING AHU END PANEL WITH NEW PILLOW BLOCK BEARING ARE PROVIDED IN DCA - 02693-04, -05, AND -06.

(C) BASIS FOR APPROVAL

THE PROPOSED MODIFICATION OF PANELS CARRYING THIRD BEARING AND PROVIDE RIGID SUPORT FOR THE MOTOR. THIS MODIFCATION ALSO EXTENDS THIRD BEARING BY USING HEAVIER DUTY BEARING WITH A PILLOW BLOCK. QUALIFICATION FOR THIS MODIFICATION REFER TO CIVIL CALCULATION WCG - ACQ - 0097 REV.1.

BLOCK 16 CONTINUATION

PROBLEM SOLUTION/ APPROVED CHANGE (INCLUDE BASIS FOR APPROVAL)

(3) DAMPERS:

(A) PROBLEM SOLUTION

WITH THE USE AND PASSAGE OF TIME, THE LINKAGE OF DAMPERS TEND TO BUILD UP RUST, THAT CAUSES THE BIND IN THE DAMPER'S MOVEMENT. FURTHER THE BLADE/AXLE FASTENING ARRANGEMENT HAVE LOST ITS GRIP AT VARIOUS LOCATIONS. THE SOLUTION OF THE PROBLEM IS TO PROVIDE A POSITIVE FASTENING ARRANGEMENT AND PERIODIC LINKAGE MAINTENANCE.

EQUIPMENT FAILURES: RIMS NO. T15 860219 842.

(B) APPROVED CHANGES

DCA - 02693 - 8 AND -9 PROVIDE DETAILS FOR THE CHANGES FOR THE BYPASS DAMPERS ONLY. PROVIDING LONGER SHAFT ACROSS THE ENTIRE LENGTH OF DAMPER BLADES IT WILL GIVE MORE UNIFORM MOVEMENT OF DAMPER BLADES. WITH LUBRICATION OF THE BEARING IN A TIMELY MANNER, RUST FORMATION WILL BE MINIMIZED AND DAMPER BLADES SHOULD FUNCTION PROPERLY. THE FACE DAMPER'S BLADES SHALL BE REMOVED. ALL THE AXLE (SHAFT) SHALL BE REMOVED EXCEPT THE MAIN POWER SHAFT AND THE HOLES SHALL BE COVERED AS SHOWN IN THE DCA - 02693 - 02.

(C) BASIS FOR APPROVAL

THE PROPOSED FASTENING WILL PROVIDE A LASTING FASTENING AND WILL NOT TEND TO LOOSE THE GRIP WITH PROLONGED USE.

SUPPORTING DOCUMENTS:
- DSR 021
- CIVIL CALCULATION NO. WCG - ACQ - 0097 REV.1

(4) COOLING COILS:

(A) THE EXISTING COOLING COILS CANNOT BE PERIODICALLY CLEANED FOR MAINTENANCE, IT IS AGED AND CLOGGED TO THE EXTENT THAT IT'S ORIGINAL PERFORMANCE CANNOT BE RESTORED BY CHEMICAL CLEANING. THEREFORE THE PROPOSED SOLUTION IS TO REPLACE THE EXISTING COILS WITH IDENTICAL COILS BEFORE START-UP TESTING IS PERFORMED.

(B) DCA-02693-15 PROVIDES DETAILS FOR REPLACING THE EXISTING COOLING COILS WITH IDENTICAL COOLING COILS BEFORE START-UP TESTING IS PERFORMED.

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BLOCK 16 CONTINUATION

PROBLEM SOLUTION/ APPROVED CHANGE (INCLUDE BASIS FOR APPROVAL)

- A CONSTRUCTABILITY REVIEW WAS PERFORMED BY EBASCO ENINEERING / DESIGN PERSONEL ON 01 / 23 / 93.
- MATERIAL REQUIRED FOR THIS MODIFICATION ARE PROCURED UNDER THE FOLLOWING PROCUREMENT REQUES:

  W - 6995 R1

  W - 7010 R2

  W - 8036 R0

  W - 8038 R0

  W - 8039 R0

  W - 8062 R0

COOLING COILS. X1388

- A RADIOLOGICAL IMPACT EVALUATION IS PERFORMED PER SSP 5.02 WITH NO IMPACT RESULTING.
- FIRE PROTECTION CHECKLIST WAS PREPARED FOR THIS DCN. RIMS NO. T80 930122 801.
- AN ENVIRONMENTAL QUALIFICATION CHANGE REVIEW CHECKLIST WAS PREPARED FOR THIS DCN. RIMS NO. T80 930122 800.
- A HUMAN FACTORS ENGINEERING CHECKLIST WAS COMPLETED PER FIGURE OF EE-1-22.1-6 WAS WITH NO IMPACT RESULTING.
- A MODIFICATION REVIEW FOR SOURCES AND QUANTITIES OF ALUMINUM AND ZINC INSIDE CONTAINMENT PER EAI-7.03, APPENDIX A IS NOT REQUIRED FOR THIS DCN.
- DCCM WAS SCREENED FOR PREDECESSORS AFFECTING THE CHANGE ON 1 / 28 / 93 AND DCN M-09609-A WAS FOUND TO HAVE IMPACT.
- A 90 % DCIP MEETING HELD ON 01 / 23 / 93 AND ALL COMMENTS RESOLVED. (RESOLUTION OF COMMENTS INVOLVED CHANGES TO VARIOUS DCA's. REVISED DCA's WERE SUBMITTED TO ~~CORE GROUP~~ THE DCIP CORE GROUP). RSG 1/30/93

DCN NO. M-02693-A

PAGE 11 dr of

BLOCK 16 (Cont'd)

RJP 1/30/93

PROBLEM SOLUTION/APPROVED CHANGE

Equipment Seismic Qualification:

The modifications to Air Handling Units 0-AHU-031-30B-A, 0-AHU-031-30D-A, 0-AHU-031-31B-B, 0-AHU-031-31D-B per this DCN have been seismically qualified in Calc. WCG-ACQ-0097, Rev. 1 (RIMS NO.B18930130800) and Appendix A of EAI-8.07 has been approved and incorporated into reference calculation.

TVA

33

REVISION LOG

WB-DC-40-36.1

Title: THE CLASSIFICATION OF HEATING, VENTILATING AND AIR CONDITIONING SYSTEM

Revision No.	Description of Revision	Date Approved
DCN S-21210-A	DCN RIMS NO. T56 93 0121 905 This revision incorporates the change into Seismic Category I(L) of the ductwork and other associated components of the Shutdown and Auxiliary Board Rooms Pressurizing Air Supply Sub-System. Revised Table 3.3-1, B. Auxiliary Building, by modifying item 9 and adding item 9a. Revised Pages: 27, 28 Added Pages: viiic Deleted Pages: None	1-20-93
DCN M-12088-B	DCN RIMS NO. T56 93 0124 986 Revise Section 3.4 to delete the following statement: "The use of Pilot-Operated (water actuated) temperature control valves in safety-related applications that use ERCW on air conditioning chillers designed or modified after July 1, 1990, is prohibited". Pages Replaced: viiic, 3	1-23-93
DCN M-02693-A DJB 2/1/93	DCN RIMS NO. T56 930203 921 Revise Table 3.3-1 to revise seismic category I to I (L) for Main Control Room Air-Conditioning, Electrical Board Room Air Conditioning, and Battery Room Exhaust Systems filters. Pages Replaced: viiic, 31	2-1-93

THE CLASSIFICATION OF HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM	WB-DC-40-36.1

TABLE 3.3-1 (Continued)

System	System/Component Subsection	Safety Class ANS 18.2, 1970	TVA Cl/Spec. (See Notes 1,2,15)	Seismic (See Note 3)	IEEE Class
C. CONTROL BUILDING					
1. Main Control Room Air-Conditioning, Electrical Board Room, Air Conditioning, and Battery Room Exhaust Systems	Fans	2b	AMCA 99	I	1E
	Air Handling Units	2b	Industrial Standards	I	1E
	Ductwork, Dampers, Fittings, etc.	2b (Note 25)	Q or S	I	NA
	Motor-Operated(*) Dampers	2b (Note 25)	Industrial Standards	I	1E
	Filters	2b	UL 900 (Class I)	I(L)	NA
	Refrigerant and Chilled Water Piping, Valves, etc.	2b	M and ANSI B9.1 (See note 29)	I	NA
	Chilled Water Pumps	2b	Industrial Standards	I	1E
	Water Chillers	2b	ARI 450-69 TEMA 1968	I	1E
	Condenser Water Piping, Valves, etc. (ERCW)	See Ref. 6.2.7	See Ref. 6.2.7	See Ref. 6.2.7	NA
	Duct Heaters (Electric)	None	UL 573, 1025 1096	I(L) (Note 24)	Non-1E
	Fire Dampers	None	(See Ref. 6.2.22 and Note 26)	I(L)	NA
	Battery Room Exhaust Louvers	None	V	I(L)	NA

DCN M-02693-A

* For Main Control Room Habitability System (MCRHS), Isolation Dampers closure time, see Table 3.3-2.

TEST SPECIFICATION FORM

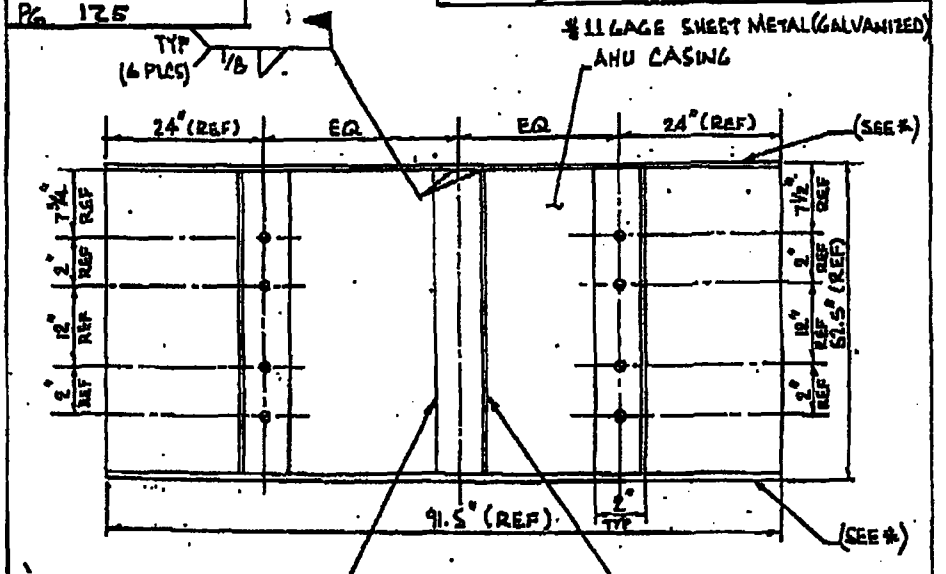
DCN 02693-A
Unit(s) 0 -
Page 14

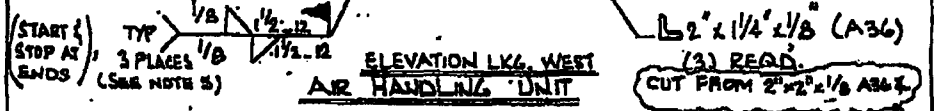
	SITE ENGINEERING TESTING REQUIREMENTS	Site Eng Review of Test Instructions?	Site Eng Review of Test Results?
	THE PILLOW BLOCK BEARING	Y (N)	(Y) N
	ALIGNMENT SHALL BE CHECKED		
	WITH FAN ALIGNMENT TO ENSURE		
	THE ENTIRE ASSEMBLY IS		
	PROPERLY ALIGNED. USE SHIM		
	UNDER PILLOW BLOCK BEARING		
	AS REQUIRED. AFTER		
	COMPLETION OF MODIFICATION,		
	VIBRATION TESTING SHALL BE		
	CONDUCTED.		

DRAWING CHANGE AUTHORIZATION (DCA) 8/8/2/99 EAI-3.05

F-28767-A
Pg. 125

DCN NO. W_02693_A PAGE 20





ELEVATION LKG. WEST
AIR HANDLING UNIT

EAST SIDE PANEL (O_AHU_031_30B_A)
AND (O_AHU_031_31D_B)

F-28767-M REV.

NOTE:—

1. FIELD TO DRILL HOLES IN (2) ANGLES TO SUIT EXISTING HOLES (SIZE AND LOCATION.) FOR EXISTING BOLTED CONNECTION ON AHU CASING.
2. DETAIL IS TYPICAL (OPPOSITE HAND) FOR O_AHU_031_30D_A & O_AHU_031_31B_B WEST SIDE PANEL (CASING)
3. FOR GENERAL NOTES SEE DCA_02693_02
4. DIMENSIONAL TOL. ±1/8"
5) IF REQUIRED, THE LENGTH OF WELD AT ENDS MAY BE INCREASED TO TERMINATE WELD AT THE END OF JOINT.

WBNP UNIT 0

DWG. 47W930_13 REV [*] Q

TITLE: MECHANICAL HEATING, VENTILATION AND AIR CONDITIONING

DCA - 02693_06 CI

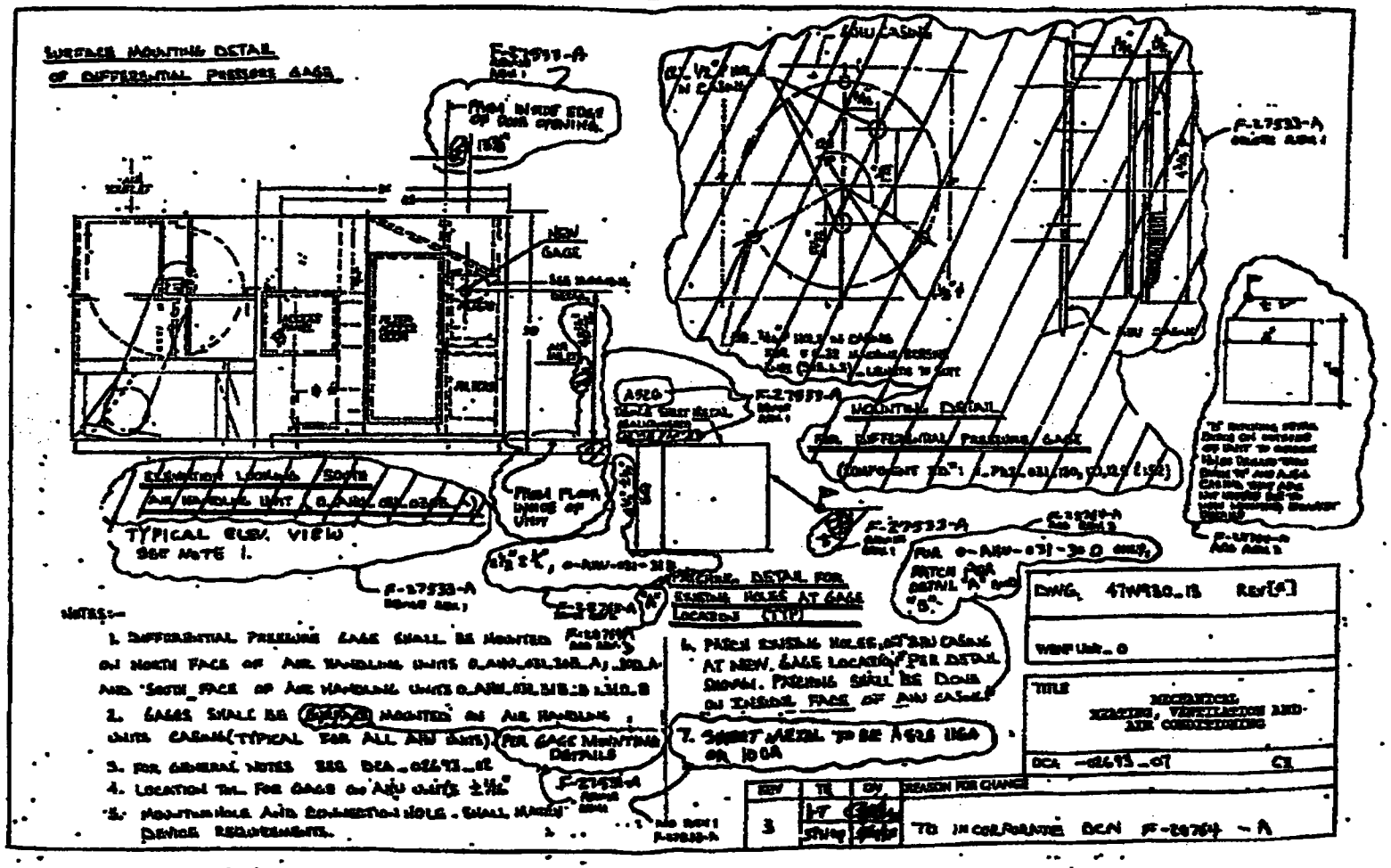
REV	TE	DV	REASONS FOR CHANGE
1	11/10/99	11/19/99	TO INCORPORATE DCN F-28767-A

TVDCA-M

DCN NO. : F-[illegible]-A
PAGE : 33

DCN NO. : [illegible]
PAGE : 31

DRAWING CHANGE AUTHORIZATION (DCA)

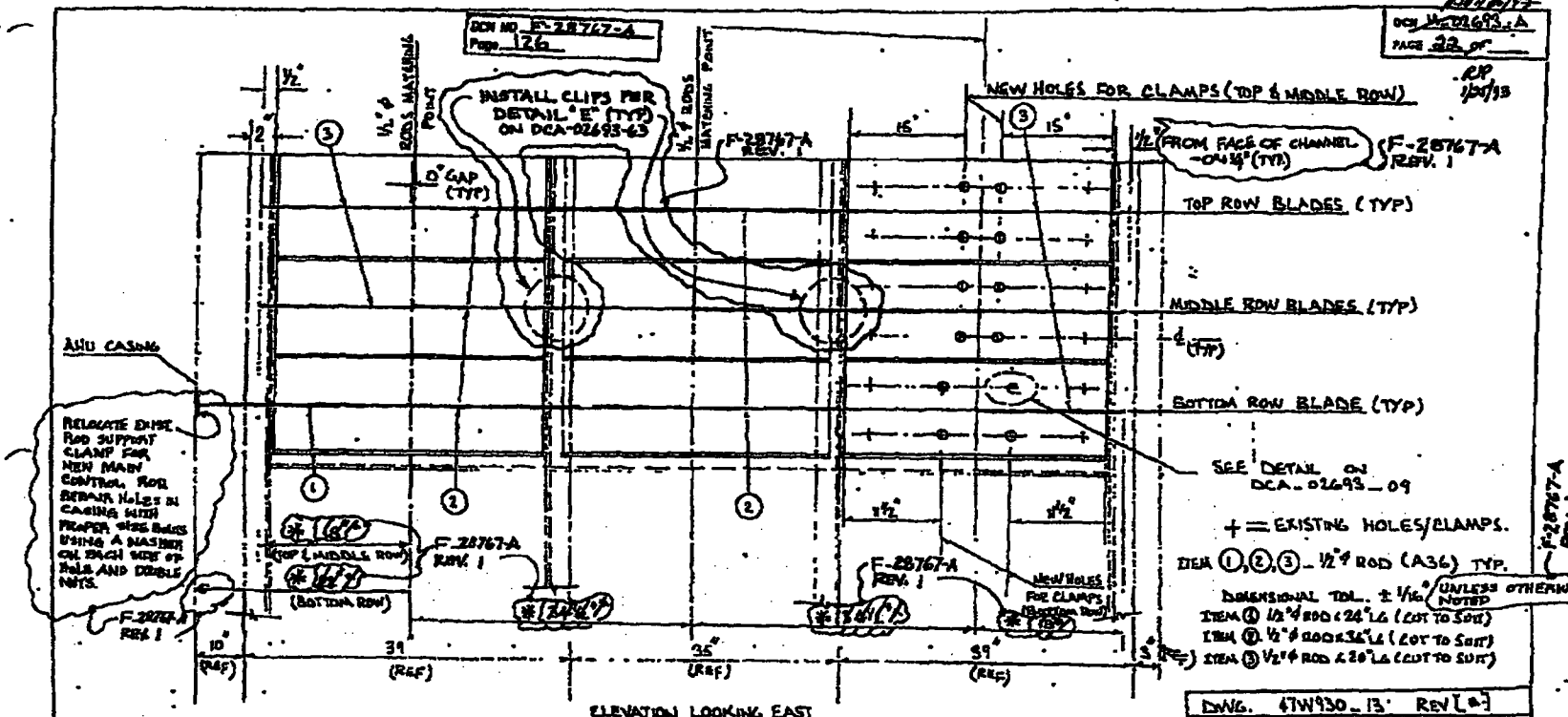


ATT. 12 PAGE 24 OF 33

DRAWING CHANGE AUTHORIZATION (DCA)

DCN NO F-28767-A Page 126

DCA D-02693-A PAGE 22 OF



ELEVATION LOOKING EAST

BYPASS DAMPERS

FOR D-AHU-031-031D-B

F-28767-A REV. 1

NOTES:

1. DETAIL SHOWN IS FOR ONE SECTION OF BYPASS DAMPER BLADES ON UNIT D-AHU-031-031D-B, AND IS APPLICABLE TO ALL (3) SECTION OF BYPASS DAMPER BLADES AND COVERS LISTS D-AHU-031-B-B; D-AHU-031-030B-A ; D-AHU-031-030D-A ALSO.
2. FOR GENERAL NOTES SEE DCA-02693-02
3. WORK WITH DCA-02693-09
4. ✱ = NEW ½"ϕ ROD-LENGTH DIMENSIONS CUT TO SUIT. F-28767-A REV. 1

NOTES CONT.:

5. MATCHING POINT OF NEW RODS TO BE CENTERLINE OF DAMPER BLADES 1½"

DWG. 47W930-13 REV [8]

WBNP Unit 0 Q

TITLE: MECHANICAL HEATING, VENTILATION AND AIR CONDITIONING

DCA - 02693-08 C1

REV	TE	DV	REASON FOR CHANGE
1	[illegible]	[illegible]	TO INCORPORATE DCN F-28767-A

Att. 12 Page 25 of 33

DRAWING CHANGE AUTHORIZATION (DCA) RJB 1/25/93 EAI-3.05

DCN NO. M-02693-A PAGE 24

ADD NOTE ON ELLIS AND WATTS DRAWING D98437-26D2, CONTRACT NO. 77K38-821350:

SEE DRAWING NO. 47W930 SHT 12 & 13 FOR ADDITIONAL DETAILS

WBNP UNIT-0	CONTRACT NO. 821350
DWG. 26D2	REV 902
TITLE: MAIN ASSEMBLY AIR HANDLING UNIT ACH 751	
DCA - 02693-10	CI

REV	TE	DV	REASONS FOR CHANGE
0	H. BOUNSE 1/24/93	R. BASU 1/24/93	AIR HANDLING UNIT MODIFICATION

TVADCA-F

R 13 BY [illegible] DATE 2/6/02
CHECKED: [illegible] DATE 2/6/02

Computer Room Supplemental AHUs

The AHUs (chilled water coil) were originally purchased for Yellow Creek Nuclear Plant (YCN) under contract 79K36-825328. They were transferred to Watts Bar Nuclear Plant, transfer contract 75746A, for use as supplemental AHUs for the Computer Room, EL 708, in the Control Building. The original YCN UNID #'s were 1VC-MAHU-126-A for item #143 and 1VC-MAHU-127-B for item # 141 under the original contract 79K36-825328. They were tagged with Mark #'s 47A373-102 and 103 for use in the Computer room at Watts Bar.

American Air Filter's coil division was purchase by the M°Quay. The Replacement Parts division of M°Quay (phone 763-553-5403) faxed all the information for that particular coil part number AFF part # 20-60-3W5-8 (See Attachment 11). The part number was obtained from the transfer contract 75746A vendor drawing R107D1189398-D corresponding to YCN AHU UNID numbers 1VC-MAHU-126-A and 1VC-MAHU-127-B.

The following coil data were derived from (1) Page 2 of 2 of this attachment, (2) Watts Bar Transfer Contract Vendor drawing R107D1189398-D, (3) field walk down on 01/15/02, and (4) AFF Nuclear Division (Ben Franklin 1-800-501-3146)

Description:	Tube Data:	Reference:	
# of Tube Rows	3 Rows	(1)	
# of Tubes per Row	20 Tubes/row	(1)	
Length of Finned Tubes exposed to Air Flow	60 inches	(1)	
Coil Type (serpentine)	half	(4)	
Tube Outside Diameter	5/8 inch	(1)	
Tube Wall Thickness	.049 inch	(2)	
Tube Material	copper	(4)	
Tube Spacing Transverse to Air Flow (bottom to top)	1.5 inch	(1)	
Tube Spacing In-Line with Air Flow	1.5 inch	(4)	
Fin Material	Copper	(3)	
Fin Thickness	.010 inch	(2)	
# of Fins per Inch	8 Fins/inch	(1)	
Fin Style	Flat Plate	(3)	
Turbulator (wire thickness)	None	(4)	
Fouling factor	0.001 1/Btu/hr/sq ft/F	Typical for chilled water	

Part number = 20-60-3W5-8 (See page 2 of 2 of this attachment) where:

- 20 = # of Tubes
- 60 = Coil Face Length
- 3 = Tube Rows
- W = Water Coil
- 5 = Tube Diameter in Eights of inch.
- 8 = Fins/inch

SERVICE PARTS BULLETIN

MC Quad 2 Coils
Phone 763-553-540.

AAF Steam Heating Coils

- Type "DT" Steam Distributing. 1"od condensing tube @ 3"c/c, 5/8"od steam distributing tube, seamless copper; rated 200psi working pressure @ +400f. Steel headers. Galvanized steel casing.

e.g. 16 - 60 - 1 S H DT 12 A

- Fin material: A = Aluminum, C = Copper
- Fins per inch
- Coil type
- Air Flow: H = Horizontal, V = Vertical
- Tapping location end: S =Same, O =Opposite
- No. of rows
- Coil face length in inches
- No. of tubes wide [x 3"c/c = 48" wide coil face]

- Type "S" Standard Steam. Rated: 30psi max operating pressure. 5/8"od seamless copper tube @ 1.5"c/c. Heavy duty seamless drawn copper header with steel MPT connections.

e.g. 16 - 60 - 2 S 5 8 A

- Fin material: A = Aluminum, C = Copper
- Fins per inch
- Tube diameter in eighths of inch
- Coil type - Standard Steam
- No. of rows
- Coil face length in inches
- No. of tubes wide [x 1.5"c/c = 24" wide coil face]

AAF Heating and Cooling Water Coils

- Type "W" Hot / Chilled Water. Rated: +275f max; 200psi max operating pressure. 5/8"od seamless copper tube @ 1.5"c/c. Seamless drawn copper header with steel MPT connections.

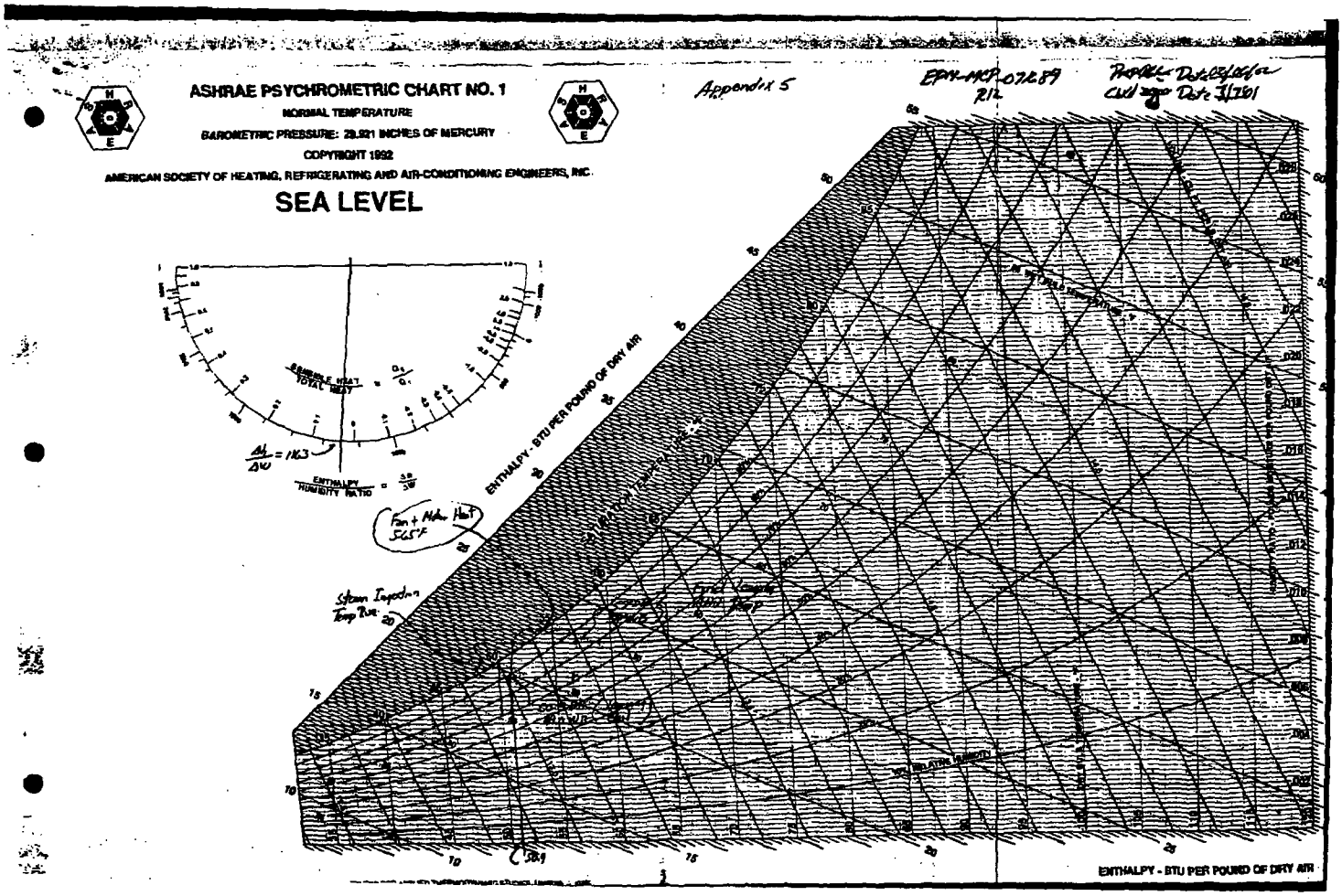
e.g. 20 - 66 - 6 W 5 8 A

- Fin material: A = Aluminum, C = Copper
- Fins per inch
- Tube diameter in eighths of inch
- Coil type - Water
- No. of rows
- Coil face length in inches
- No. of Tubes per row [x 1.5"c/c = 30" wide coil face]

- Type "CW" Cleanable Tube Hot / Chilled Water. Rated: +225f max; 200psi max operating press. 5/8"od seamless copper tube @ 1.5"c/c. Seamless drawn copper header with steel MPT connections.

e.g. 20 - 66 - 6 CW 5 8 A

- Fin material: A = Aluminum, C = Copper
- Fins per inch
- Tube diameter in eighths of inch
- Coil type - Cleanable Tube Water
- No. of rows
- Coil face length in inches
- No. of Tubes per row [x 1.5"c/c = 30" wide coil face]


ASHRAE PSYCHROMETRIC CHART NO. 1
NORMAL TEMPERATURE
BAROMETRIC PRESSURE: 29.921 INCHES OF MERCURY
COPYRIGHT 1992
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
SEA LEVEL
Appendix 5
EPA-AKP-07289
212
ENTHALPY - BTU PER POUND OF DRY AIR

EPM-MCP-071689
APPENDIX 6
PAGE 1 OF 3

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Tuesday, September 10, 2002 at 10:45:15 AM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

EPM-MCP-071689
APPENDIX G
PAGE 20F3

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Tuesday, September 10, 2002 at 10:45:15 AM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

EPM-MCP-071689
APPENDIX G
PAGE 3 OF 3

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Tuesday, September 10, 2002 at 10:45:15 AM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 10
DATE: __-__-__
PROCEDURE: EBR LOCA WINTER

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	35.31
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	180.00	20835.00
Inlet Temperature (degrees F):	42.00	82.70
Outlet Temperature (degrees F):	51.28	49.11
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1528.17	11.82
Clean Pressure Drop (psi):	23.95	Not Calculated
Fouled Pressure Drop (psi):	28.64	Not Calculated
Velocity (ft/s and ft/min):	8.28	595.29

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 836543/ 738023/ 98520 Btu/hr
Average Overall Heat Transfer Coefficient: 7.60 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 49.11 deg F

APPENDIX 7

LOCA / LOOP CONDITION (WINTER)

Determine the ratio of air flowing through the bypass damper to the air which will continue to flow through the coil during this condition. This is a trial and error solution.

Assume 25% of the total flow through the AHU passes through the coil and the remaining passes through the bypass damper when it is in full open position. The pressure drop through each flow path will be computed and the iteration process continued until each is approximately equal.

Total flow rate for this scenario is: 40506 cfm per train (see Appendix 3) , or 20253.0 cfm per AHU.

25% of AHU flow rate Q: 5063 cfm

A = 35 ft^2 (coil cross-sectional area from calc. EPM-MCP-090589 R3, pg. 23 - copy included in this Appendix)

V = Q / A = 145 ft/min

Attachment 5 to calc. EPM-MCP-090589 provides coil pressure drop as a function of coil face velocity. Since the chart only ranges from 300 to 800 fpm, a ΔP at 143 fpm was linearly extrapolated based on available data:

Velocity (fpm)	ΔP / 2 rows
300	0.060
400	0.092
145	X

$$X = 0.060 - \frac{(0.092 - 0.060)}{(400 - 300)} (300 - 145) = 0.0104 \text{ in w.g.}$$

ΔP = 0.0104 x 4 (8 rows total) = 0.042 in w.g. or 0.04 in w.g.

Thus ΔP across coil = 0.04 in w.g.

Now look at ΔP associated with the remaining 75% flow passing through bypass damper.

Use Section 7-7 of ASHRAE Chapter 33, Appendix B "Damper, Rectungular, Opposed Blades" (copy included in this Appendix).

L / R = NW / 2 (H + W)
where

H = 18 "
W = 108 "
N = 3

See Dwg. SDC-73-08 Contract75K35-83119-01 (page 6 of this Appendix)

Thus L / R = 1.29

APPENDIX 7

$\Pi = 0^{\circ}$ (damper is wide open)

Co = 0.52 for all valves of L / R if $\Pi = 0^{\circ}$

$\Delta P_t = Co \times p_{VO}$ where

Co = local loss coefficient

Δ_{Pt} = fitting pressure loss, in.w.g

p_{VO} = velocity pressure loss of section, in.w.g

75% of AHU flow rate Q_1: 15190 cfm

$$A_1 = \frac{(18 \times 108)}{144}$$

$A_1 = 13.5\ ft^2$

$V_1 = Q_1 / A_1 =$ 1125.2 fpm

$p_{VO} = (V_1/4005)^2 =$ 0.079 in w.g.

$\Delta P_t = Co \times p_{VO} =$ 0.0410 in w.g.

Calculating pressure loss associated with change in direction of air flowing through the unit and bypassing the coil.
From ASHRAE Table 5-1 "Local Loss Coefficient, Transitions (Converging Flow)" (included in this Appendix)

$\Pi = 180^{\circ}$

H' = 66 "

W' = 108 "

A' = 49.5 ft^2

A' / A_1 = 3.67 ; use 4 for conservatism ⟶ Co' = 0.41

$\Delta P_t' = Co \times p_{VO} =$ 0.0324 in w.g.

Total pressure drop associated with 75% of the total flow passing through the bypass damper in the full open position:

0.0410 + 0.0324 = 0.0734 in w.g. (damper)

0.0734 $\neq$ 0.04
(damper) (coil)

Thus, greater flow will exist through the coil.

APPENDIX 7

Try 30% of total flow.

30% of AHU flow rate Q: 6076 cfm

A = 35 ft^2 (see pg.1 of the Appendix)

V = Q / A = 174 ft/min

Velocity (fpm)	ΔP / 2 rows
300	0.060
400	0.092
174	X

$$X = 0.060 - \frac{(0.092 - 0.060)}{(400 - 300)} (300 - 174) = 0.0197 \text{ in w.g.}$$

ΔP = 0.0197 x 4 (8 rows total) = 0.079 in w.g. or 0.08 in w.g.

Thus ΔP across coil = 0.079 in w.g.

Damper:

70% of AHU flow rate Q_1: 14177 cfm

A_1 = 13.5 ft^2 (see pg. 2 of this Appendix)

$V_1 = Q_1 / A_1$ = 1050 fpm

$p_{VO} = (V_1/4005)^2$ = 0.0688 in w.g.

Co = 0.52 (see pg.2 of this Appendix)

$\Delta P_t = Co \times p_{VO}$ = 0.036 in w.g.

ΔP associated with contraction of flow:

Co' = 0.41 (see pg. 2 of this Appendix)

p_{VO} = 0.0688

$\Delta P_t' = Co \times p_{VO}$ = 0.0282 in w.g.

Total pressure drop associated with 75% of the total flow passing through the bypass damper in the full open position:

0.0358 + 0.0282 = 0.0639 in w.g. (damper)

0.0639 (damper) approximately equal to 0.0787 (coil)

This indicates that slightly greater than 70% of the total flow will pass through the bypass damper. Using 70% is conservative for purposes of evaluating a LOOP wintertime condition.

Static Pressure

The term ($Pg_c/\varrho g$) is static head; P is static pressure.

Velocity Pressure

The term ($V^2/2g$) is known as velocity head, and the term ($\varrho V^2/2g_c$) is velocity pressure. Although velocity head is independent of fluid density, velocity pressure calculated by Eq. (12) is not.

$$p_v = \varrho(V/1097)^2 \tag{12}$$

where

p_v = velocity pressure, in. H_2O
V = fluid mean velocity, fpm

For air at standard conditions (0.075 lb/ft^3), Eq. (12) becomes:

$$p_v = (V/4005)^2 \tag{13}$$

Velocity is calculated by Eq. (14) and (15).

$$V = 144\,Q/A \tag{14}$$

where

Q = airflow rate, cfm
A = cross-sectional area of duct, in.^{2}

$$V = Q/A \tag{15}$$

where

A = cross-sectional area of duct, ft^2

For a tabulation of velocity pressure based on standard air and as a function of velocity, see Table A-1.

Total Pressure

Total pressure is the sum of static pressure and velocity pressure:

$$p_t = p + \varrho V^2/2g_c \tag{16}$$

or

$$p_t = p + p_v \tag{17}$$

where

p_t = total pressure, in. H_2O
p = static pressure, in. H_2O

Instruments

Instruments for measuring pressure and velocity are discussed in Chapter 13, with respect to range, precision and limitations. The manometer is a simple and useful means for measuring partial vacuum and low pressure. It is a primary instrument and often is used as a standard for calibrating other instruments. The static, velocity and total pressures in a duct system relative to the atmospheric pressure are measured with a Pitot tube connected to a manometer. Pitot tube construction and locations for traversing round and rectangular ducts are presented in Chapter 13.

SYSTEM ANALYSIS

The pressure losses for each section of a duct system are calculated by Eq. (18). Generally, sections of ductwork are from *node-to-node* (see example 5), where a node is an entry, junction (e.g., tees, wyes), piece of equipment (e.g., fan inlet, fan discharge) or an exit.

$$\Delta p_t = \sum_{i=1}^{n} \Delta p_i + \sum_{j=1}^{m} \Delta p_j \tag{18}$$

where

Δp_t = total pressure loss for a section of ductwork, in. H_2O
Δp_i = duct or fitting total pressure loss, in. H_2O
n = number of ducts and fittings within a section of ductwork
Δp_j = equipment (e.g., coil, fire damper) total pressure loss, in. H_2O
m = number of pieces of equipment within a section of ductwork

To determine the fan total pressure requirement for a system, use Eq. (19). This equation includes the fan system effect factors (see Fan/System Interface section) and stack effect when significant.

$$P_t = \overline{\Delta p}_t + SEF_i + SEF_o - p_{st} \tag{19}$$

where

P_t = fan total pressure, in. H_2O
$\overline{\Delta p}_t$ = path in a system with maximum resistance to flow in terms of total pressure, in. H_2O
SEF_i = system effect factor caused by fan inlet conditions, in. H_2O
SEF_o = system effect factor caused by fan outlet conditions, in. H_2O

Pressure Changes in a System

Figure 2 shows total and static pressure changes in a fan/duct system consisting of a fan with both supply and return air ductwork. Also shown are the total and static pressure gradients referenced to atmospheric pressure.

For all constant-area sections, the total and static pressure losses are equal. At diverging sections 3 and 7, the velocity pressure decreases, the absolute total pressure decreases and the absolute static pressure can increase. The static pressure increase at these sections is known as *static regain*.

At converging sections 2 and 6, the velocity pressure increases in the direction of air flow, and the absolute total and absolute static pressures decrease.

At the exit, section 8, total pressure loss depends on the shape of the fitting and the flow characteristics. Exit loss coefficients can be greater than, less than or equal to one (see Table B-2). The total and static pressure grade lines for the various coefficients are shown in Fig. 2. Note that for a loss coefficient less than one, static pressure upstream of the exit is less than atmospheric pressure (negative). The static pressure just upstream of the discharge fitting can be calculated by substracting the upstream velocity pressure from the upstream total pressure.

At section 1, the total pressure loss depends on the shape of the entry. The total pressure immediately downstream of the entrance equals the difference between the upstream pressure, which is zero (atmospheric pressure), and the loss through the fitting. The static pressure of the ambient air is zero; several diameters downstream, static pressure is negative, algebraically equal to the total pressure (negative) and the velocity pressure (always positive).

System resistance to airflow is noted by the total pressure grade line in Fig. 2. The fan inlet and outlet system effect factors caused by the fan and system interactions are not shown; only system resistances are shown. To obtain the *fan static pressure* requirement for fan selection where the fan total pressure is known, use:

$$P_s = P_t - p_{v,o} \tag{20}$$

where

P_s = fan static pressure, in. H_2O
P_t = fan total pressure, in. H_2O
$p_{v,o}$ = fan outlet velocity pressure, in. H_2O

$$\Delta p_{f,} = 0.0245\ L\ K \left(\frac{P}{4A}\right)^{1.22} \left(\frac{V}{1000}\right)^{1.9} \quad (35)$$

where

$\Delta p_{f,}$ = oval duct friction loss in terms of total pressure, in. H_2O
P = perimeter of oval duct, in. [see Eq. (34)]
A = cross-sectional area of oval duct, in.^{2} [see Eq. (33)]
K = correction factor for nonstandard air, dimensionless [see Eq. (24) and (25)]

Frictional Losses for Duct Liners

Swim[10] conducted tests on duct liners of varying densities, surface treatments, transverse joints (workmanship) and methods of attachment to sheet metal ducts. As a result of these tests, Swim recommends for design the absolute roughness values in Table 2, 0.015 ft for spray-coated liners and 0.005 ft for liners with a facing material cemented onto the air side. In both cases, the roughness factor includes the resistance offered by mechanical fasteners and assumes good joints. Liners cut too long and fastened to the duct cause much more loss than a liner cut too short; therefore, any fabrication error in liner length should be on the short side. Liner density does not significantly influence flow resistance.

Frictional Losses for Fibrous Glass Ducts

Based on limited manufacturers' data, rigid fibrous glass duct is in the *medium rough* category (see Table 2). More extensive data are necessary to establish the range of absolute roughness factors for various fibrous glass boards commercially available.

DYNAMIC LOSSES

Dynamic losses result from flow disturbances caused by fittings that change the airflow path's direction and/or area. These fittings include entries, exits, transitions and junctions.

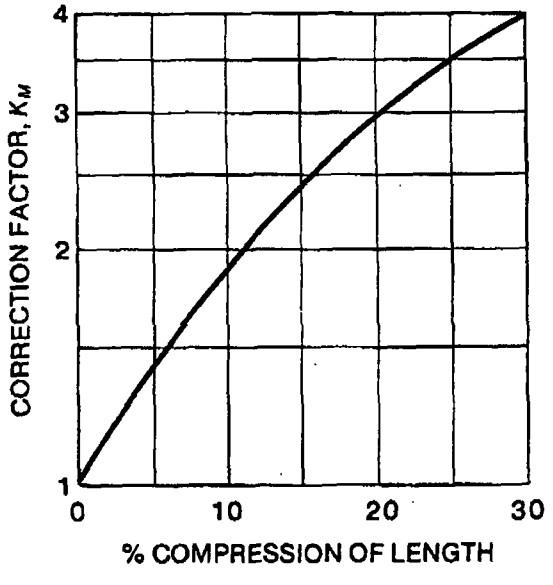


Fig. 4 Correction Factor for Unextended Flexible Duct

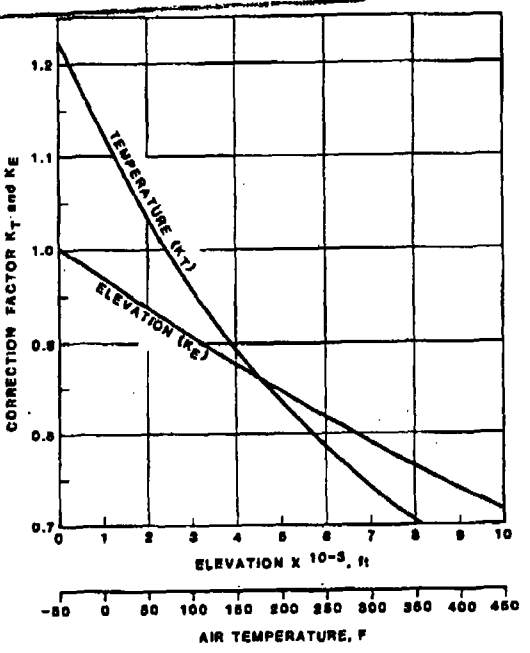


Fig. 5 Friction Chart Correction Factors for Elevation and Temperature

Reference 11 discusses parameters affecting fluid resistance of fittings and presents loss coefficients in both curve form and equations.

Local Loss Coefficients

The following dimensionless coefficient is used for fluid resistance, since this coefficient has the same value in dynamically similar streams, i.e., streams with geometrically similar stretches, equal values of Reynolds number and equal values of other criteria necessary for dynamic similarity. The fluid resistance coefficient represents the ratio of total pressure loss to velocity pressure at the referenced cross section o.

$$C_o = \frac{\Delta p_t}{\varrho (V/1097)_o^{\,2}} = \frac{\Delta p_t}{p_{v,o}} \quad (36)$$

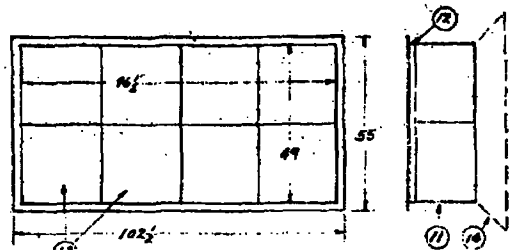
where

C_o = local loss coefficient for section o, dimensionless
Δp_t = fitting total pressure loss, in. H_2O
ϱ = density, lb_m/ft^3
V = velocity at section o, fpm
$P_{v,o}$ = velocity pressure at section o, in. H_2O

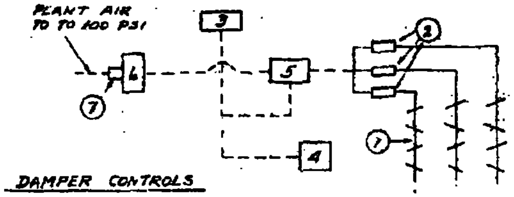
Dynamic losses occur along a duct length and cannot be separated from frictional losses. For ease of calculation, dynamic losses are assumed to be concentrated at a section (local) and to exclude friction. Frictional losses must be considered only for relatively long fittings. Generally, fitting friction losses are accounted for by measuring duct lengths from the centerline of one fitting to that of the next fitting. For fittings closely coupled (less than six hydraulic diameters apart), the flow pattern entering subsequent fittings differs from the flow pattern used to determine loss coefficients. Adequate data for these situations are unavailable.

CALC. EPM-MCP-071689 R14

APPENDIX 7
SHEET 6 OF 10

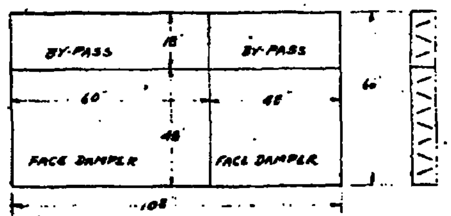


(10) FILTER ASSEMBLY



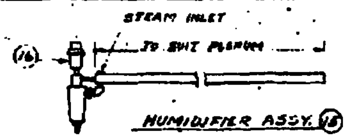
DAMPER CONTROLS

NOTES:
A. DAMPER CONSTRUCTION-OPPOSED BLADES.
#16 GA. MIN. GALVANIZED STEEL, ½" DIA. SHAFT.
B. DAMPER MOTOR- CABINET MOUNTED, FIELD ADJUSTABLE, PNEUMATIC PISTON OPERATED, JOHNSON #C-3153 OR EQUAL.
C. TEMPERATURE TRANSMITTER, WALL MOUNTED, RANGE 50° TO 100°F, SET AT 75°F, JOHNSON T-5002 OR EQUAL.
D. REMOTE RECEIVER CONTROLLER, RANGE 50° TO 100°F, JOHNSON T-5502 OR EQUAL.
E. REMOTE RECEIVER CONTROLLER ACTUATOR. JOHNSON T-5312 OR EQUAL.
F. PRESSURE REDUCER-REGULATOR-FILTER, IN-75 TO 100 PSIG, OUT-20 PSIG, FISHER #67-FR OR EQUAL.



(1) DAMPER ASSEMBLY

QTY.	DAMPER SIZE
1	60×48
1	48×48
1	60×18
1	48×18



HUMIDIFIER ASSY. (15)

HUMIDIFIER NOTES:
I HUMIDIFIER-ARMSTRONG MODEL EMR-33D-M CAPACITY AT 7 PSI -135 LBS./HR.(R-22) OR EQUAL.
II HUMIDIFIER OPERATOR-HONEYWELL M445A, 25W AT 24V.
III HUMIDISTAT TO BE FURNISHED BY TVA, HONEYWELL MODEL H134 OR EQUAL.

FIND NO.	DESCRIPTION	QTY.	PART NO.	COMMENTS
16	HUMIDIFIER OPERATOR	1	73-831	
15	HUMIDIFIER ASSY	1	73-830	
14	TRANSITION	—		
13	FILTERS	2	73-704	
12	FILTER BANK FRAME	1	73-703	
11	FILTER ACCESS DOORS	2	73-701	
10	FILTER ASSEMBLY	1	73-700	TVA
9				
8				
7	FITTING	1	73-607	
6	REGULATOR	1	73-606	SEE NOTE F
5	RECEIVER ACTUATOR	1	73-605	SEE NOTE E
4	RECEIVER	1	73-604	SEE NOTE D
3	TRANSMITTER	1	73-603	SEE NOTE C
2	DAMPER MOTOR	3	73-602	SEE NOTE B
1	DAMPER ASSEMBLY	1	73-600	SEE NOTE A

PARTS LIST

CONTRACT NO. 75K35-833119-1

SPACE DYNAMICS CORP.
CINCINNATI, OHIO, 45206

DATE: 10-9-75
DRN. BY: RSP
APPD. BY:

DAMPER-FILTER-HUMIDIFIER

SIZE: C
DWG. NO. SDC-73-08
SCALE: NONE
SHEET: 1

CALC ID EPM-MCP-071689
APPENDIX 7 SHEET 7 of 10

EBASCO SERVICES INCORPORATED

PREPARED S S Bajaj 7/21/92
CHECKED Pfadrigd 7/23/92
ENG'R NR
SUP'VR NR

6.6.2 PRESSURE LOSS CALCULATION

SHEET 23 OF 29

SYSTEM 31
CALC. NO. WBN-31-D053 EPM-MCP-090589
REV. NO. 2

PROJECT TVA
WBNP # 1 & 2
OFS NO NR DATE NR

DUCT SECTION	ITEM	SIZE W X H OR DIA (INCHES)	AREA (SQ FT)	AIR VOLUME ACTUAL (CFM)	VELOCITY (FT/MIN)	VELOCITY HEAD (IN. W.G.)	FITTING LOSS COEFF.	DUCT LENGTH (FT)	DUCT FRICT. COEFF. (IN. W.G./100 FT)	ITEM LOSS (IN. W.G.)	3.449 SUB-TOTALS ~~2.452~~	REMARKS AND REFERENCES
45	PLENUM			~~34000~~ 36,400						.22		6.3.1, P32.51, FITT # 7.7 L = .75D, Co = .22
				18,200								
46	FILTER			~~17000~~						.32		6.3.12, ATTACHMENT N. SHT # 2
				18,200	520							
47	COIL		35	~~17,000~~	~~486~~					.5		6.3.17, ATTACHMENT-5, SHT-4 PR. DROP = ~~.122~~ .132 × 4 = .488 ≈ .5
				18,200								
48	CASING			~~17,000~~						.22		SAME AS PLENUM Item No 45.
											4.709 ~~4.712~~	

11/3-74

THIS SHEET ADDED BY REV. 2

APPLICABLE TABLE & GRAPHS

ATTACHMENT - 5

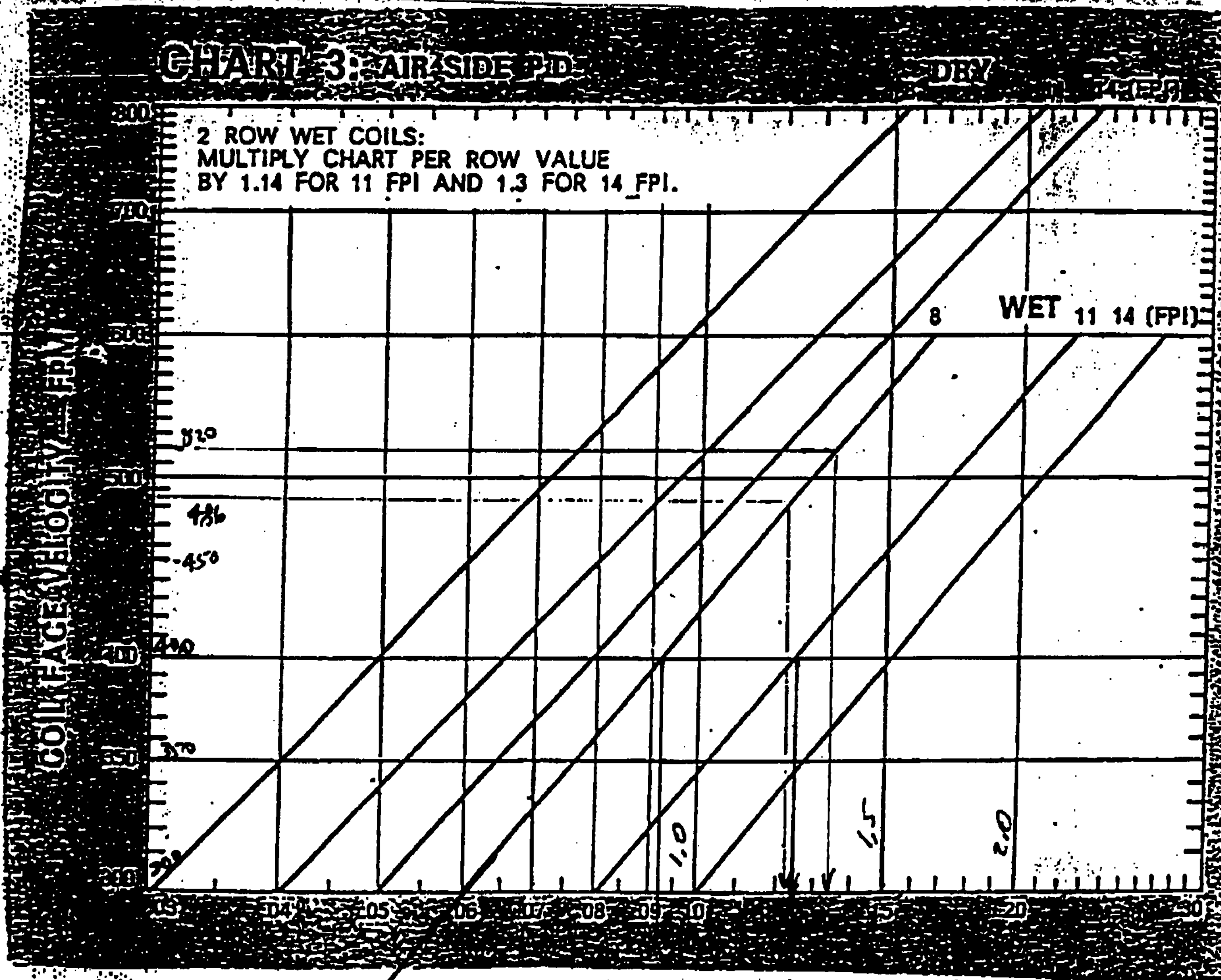
CALC # EPM-MCP-090589 R-2
WBN-31-D053

SHT 4 of

R2 BY S.P. Bajaj DATE 7/

CALC ID EPM-MCP-071689
APPENDIX 7 SHEET 8 OF 10

CHKD BY [illegible] DATE 7/



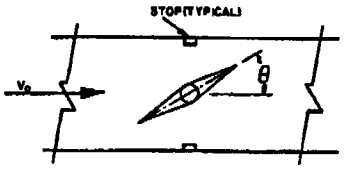
SOURCE: AMERICAN AIR FILTERS - CHILLED WATER COILS AHU-1-113

200 →

160

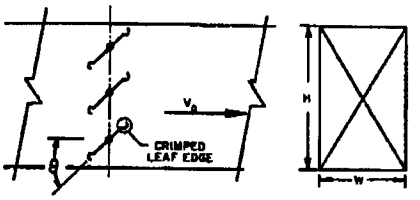
3 SHEET ADDED BY REV. 2

7-5 Damper, Butterfly, Airfoil Blade, Rectangular[1]



θ, deg	0	10	20	30	40	50	60
C_o	0.50	0.65	1.6	4.0	9.4	24	67

7-6 Damper, Rectangular, Parallel Blades[14]



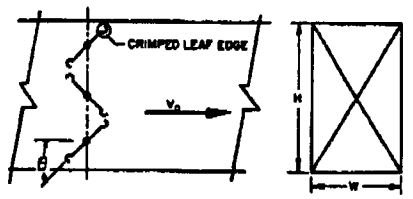
$$L/R = \frac{NW}{2(H+W)}$$

where

N = number of damper blades
W = duct dimension parallel to blade axis, in.
L = sum of damper blade lengths, in.
R = perimeter of duct, in.

	C_o								
$\frac{L}{R}$	θ, degrees								
	80	70	60	50	40	30	20	10	0
0.3	116	32	14	9.0	5.0	2.3	1.4	0.79	0.52
0.4	152	38	16	9.0	5.0	2.4	1.5	0.85	0.52
0.5	188	45	18	9.0	5.0	2.4	1.5	0.92	0.52
0.6	245	45	21	9.0	5.4	2.4	1.5	0.92	0.52
0.8	284	55	22	9.0	5.4	2.5	1.5	0.92	0.52
1.0	361	65	24	10	5.4	2.6	1.6	1.0	0.52
1.5	576	102	28	10	5.4	2.7	1.6	1.0	0.52

7-7 Damper, Rectangular, Opposed Blades[14]

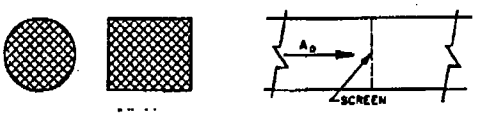


$$L/R = \frac{NW}{2(H+W)}$$

See Fitting 7-6 for definition of terms.

	C_o								
$\frac{L}{R}$	θ, degrees								
	80	70	60	50	40	30	20	10	0
0.3	807	284	73	21	9.0	4.1	2.1	0.85	0.52
0.4	915	332	100	28	11	5.0	2.2	0.92	0.52
0.5	1045	377	122	33	13	5.4	2.3	1.0	0.52
0.6	1121	411	148	38	14	6.0	2.3	1.0	0.52
0.8	1299	495	188	54	18	6.6	2.4	1.1	0.52
1.0	1521	547	245	65	21	7.3	2.7	1.2	0.52
1.5	1654	677	361	107	28	9.0	3.2	1.4	0.52

7-8 Obstruction, Screen in Duct, Round, and Rectangular[1]



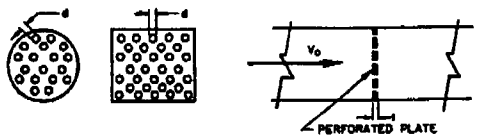
$$n = A_{or}/A_o$$

where

n = free area ratio of screen, dimensionless
A_{or} = total flow area of screen, in.^{2}
A_o = area of duct, in.^{2}

n	0.30	0.40	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.90	1.0
C_o	6.2	3.0	1.7	1.3	0.97	0.75	0.58	0.44	0.32	0.14	0

7-9 Obstruction, Perforated Plate, Thick, Round and Rectangular[1]



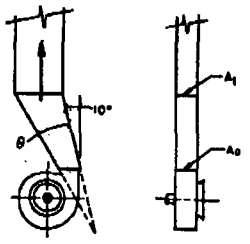
$t/d \geq 0.015$
$A_{or} = \pi d^2/4$
$n = \Sigma A_{or}/A_o$

where

A_o = area of duct, in.^{2}
A_{or} = orifice area, in.^{2}
d = diameter of perforated hole, in.
n = free area ratio of plate, dimensionless
t = plate thickness, in.

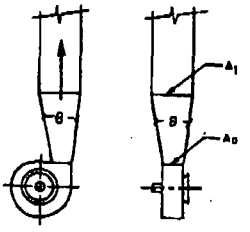
	C_o								
	n								
t/d	0.20	0.25	0.30	0.40	0.50	0.60	.70	0.80	0.90
0.015	52	30	18	8.2	4.0	2.0	0.97	0.42	0.13
0.2	48	28	17	7.7	3.8	1.9	0.91	0.40	0.13
0.4	46	27	17	7.4	3.6	1.8	0.88	0.39	0.13
0.6	42	24	15	6.6	3.2	1.6	0.80	0.36	0.13

4-11 Plane Asymmetric Diffuser at Fan Outlet with Ductwork[1]



	C_o					
	A_1/A_o					
θ, deg	1.5	2.0	2.5	3.0	3.5	4.0
10	0.11	0.13	0.14	0.14	0.14	0.14
15	0.13	0.15	0.16	0.17	0.18	0.18
20	0.19	0.22	0.24	0.26	0.28	0.30
25	0.29	0.32	0.35	0.37	0.39	0.40
30	0.36	0.42	0.46	0.49	0.51	0.51
35	0.44	0.54	0.61	0.64	0.66	0.66

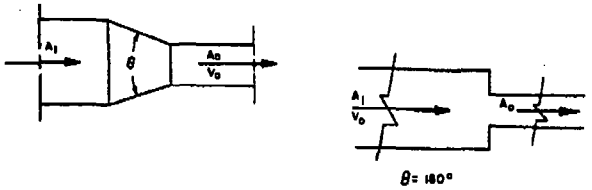
4-12 Pyramidal Diffuser at Fan Outlet with Ductwork[1]



	C_o					
	A_1/A_o					
θ, deg	1.5	2.0	2.5	3.0	3.5	4.0
10	0.10	0.18	0.21	0.23	0.24	0.25
15	0.23	0.33	0.38	0.40	0.42	0.44
20	0.31	0.43	0.48	0.53	0.56	0.58
25	0.36	0.49	0.55	0.58	0.62	0.64
30	0.42	0.53	0.59	0.64	0.67	0.69

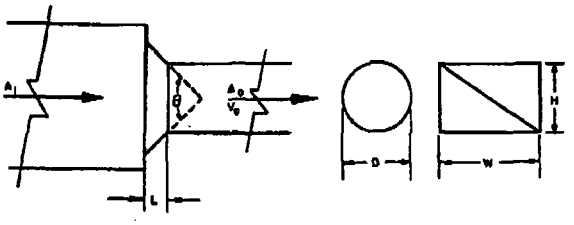
Table B-5 Local Loss Coefficients, TRANSITIONS (Converging Flow)

5-1 Contraction, Round & Rectangular[1]



	C_o						
	θ, degrees						
A_o/A_1	10	15-40	50-60	90	120	150	180
2	0.05	0.05	0.06	0.12	0.18	0.24	0.26
4	0.05	0.04	0.07	0.17	0.27	0.35	0.41
6	0.05	0.04	0.07	0.18	0.28	0.36	0.42
10	0.05	0.05	0.08	0.19	0.29	0.37	0.43

5-2 Contraction, Conical, Round and Rectangular[1]

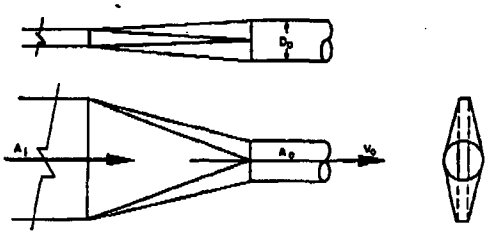


Rectangular: $D = 2HW/(H + W)$
θ = major angle

$C_o = K C_o'$

	C_o'								
	θ, degrees								
L/D	0	10	20	30	40	60	100	140	180
0.025	0.50	0.47	0.45	0.43	0.41	0.40	0.42	0.45	0.50
0.05	0.50	0.45	0.41	0.36	0.33	0.30	0.35	0.42	0.50
0.075	0.50	0.42	0.35	0.30	0.26	0.23	0.30	0.40	0.50
0.10	0.50	0.39	0.32	0.25	0.22	0.18	0.27	0.38	0.50
0.10	0.50	0.39	0.32	0.25	0.22	0.18	0.27	0.38	0.50
0.15	0.50	0.37	0.27	0.20	0.16	0.15	0.25	0.37	0.50
0.60	0.50	0.27	0.18	0.13	0.11	0.12	0.23	0.36	0.50

5-3 Contraction, Rectangular Slot to Round[1]



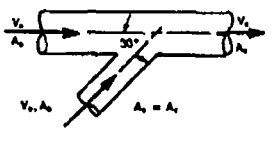
$A_o < A_1$

Re • 10^{-4}	1	2	4	6	8	10	20	≥40
C_o	0.27	0.25	0.20	0.17	0.14	0.11	0.04	0

To calculate Re, See Note 4.

Table B-6 Local Loss Coefficients, JUNCTIONS (Tees, Wyes)

6-1 Converging Wye (30°), Round[1]



PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Tuesday, November 19, 2002 at 3:41:56 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Tuesday, November 19, 2002 at 3:41:56 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPROOM.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Tuesday, November 19, 2002 at 3:41:56 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: comp1
DATE: 01-15-02
PROCEDURE: Baseline

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.00
Outlet Relative Humidity (%):	Not Required	80.40
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	44.00	75.00
Outlet Temperature (degrees F):	54.69	61.22
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	709.69	12.03
Clean Pressure Drop (psi):	2.12	Not Calculated
Fouled Pressure Drop (psi):	2.52	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 118186/ 118186/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 7.79 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 55.18 deg F

LOCA CONDITION (SUMMER - CASE 1) WITH 70% DESIGN AIR FLOW) CONSIDERS THE FOLLOWING PARAMETERS:

- METHODOLOGY FOR LOCA-SUMMER 1 AS DESCRIBED ON PG 7.10.1
- AIR FLOW RATES AS SHOWN IN THE APPENDIX 9. BASICALLY ALL FLOW RATES ASSOCIATED
- WITH EBR AHUs REDUCED TO 70% WITH THE EXCEPTION OF EACH BATTERY ROOM WHICH
- ASSUMES 110% DESIGN FLOW TO MAXIMIZE THE AMOUNT OF OUTSIDE AIR THAT WAS
- BROUGHT IN (CONSERVATIVE APPROACH)
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7)
- MINIMUM CHILLED WATER FLOW RATES OF 216 GPM FOR EACH AHU
- MAXIMUM CHILLED WATER SUPPLY TEMPERATURE OF 48F
- LOCA CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN TABLE 6.6
- 95F PRESSURIZING AIR TEMP AND STEAM INJECTION IN SERVICE (SEE SECTION 7.5)

This case conservatively minimizes the cooling capability of the EBR AHUs by modeling the minimum chilled water flow rate concurrent with maximum chilled water temperature. This case also conservatively maximizes the predicted room temperatures by assuming no concurrent LOOP. The EXCEL spreadsheet (see pg. 2 to 25) and AIRCOOL model (see pg. 26) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equtes to approximately 88.4°F (see pg. 24) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$Tz =$ 49.91 °F (estimated air side outlet temperature for each EBR AHU based on the AIRCOOL model; see pg. 28)

$\Delta t =$ 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.5)

$Ts = Tz + \Delta t =$ 56.0 °F

Since the computer room supplemental AHUs are not safety-related and this case is predicting maximum LOCA room temperatures, these were not credited. For this scenario, the computer room is only cooled by air supplied by EBR AHUs as reflected in the spreadsheet.

Appendix 9

ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 85.4 °F Design Rm Temp °F: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	85.4	-17.4	-731
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	85.4	-17.4	-818
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	85.4	-17.4	-400
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	119.0	85.4	33.6	1,911
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	85.4	18.6	314
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	81.5	85.4	-3.9	-387
EAST	Door C2	8.0	7.2	57.6	0.448	81.5	85.4	-3.9	-101
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	75.7	85.4	-9.7	-299
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	85.4	-17.4	-893
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	85.4	34.6	20,832
					TOTAL TRANSMISSION LOAD =				19,428

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	11,356
TOTAL ROOM SENSIBLE LOAD:					**30,784**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	2185	688.8
Temperature, °F	81.5	56.0

Total flow = 2,874 cfm
Supply air temperature: 75.4 °F

	Ts		Q	CFM		
ROOM TEMPERATURE (Tr) =	(75.4	) + (	30,784	/(1.08 x 2,874)	=	85.3 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	2185	688.8
Humidity ratio	0.0069	0.0069

Total flow = 2,874 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 85.4 °F dry bulb

Appendix 9

ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 81.5 °F Design Rm Temp °F: 83

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	85.4	81.5	3.9	391
WEST	Door C2	7.2	8.0	57.6	0.448	85.4	81.5	3.9	101
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	83.7	81.5	2.2	483
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	79.1	81.5	-2.4	-122
SOUTH	Door C3	7.2	8.0	57.6	0.448	79.1	81.5	-2.4	-62
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	75.7	81.5	-5.8	-652
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	81.5	22.5	658
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	81.5	22.5	1,203
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	81.5	-13.5	-347
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	94.4	81.5	12.9	3,891
					TOTAL TRANSMISSION LOAD =				5,543

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,467
TOTAL ROOM SENSIBLE LOAD:					**10,010**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	2006.8	179
Temperature, °F	79.1	56.0

Total flow = 2,185 cfm
Supply air temperature: 77.2 °F

ROOM TEMPERATURE (Tr) = (Ts 77.2) + (Q 10,010 / (1.08 x CFM 2,185) = 81.5 °F

LATENT LOAD: Q latent

PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	2006.8	179
Humidity ratio	0.0069	0.0069

Total flow = 2,185 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 81.5 °F dry bulb

This page replaced by Revision 20.

Appendix 9

ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 79.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 83.7 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	77.7	83.7	-6.0	-1,318
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	81.5	83.7	-2.2	-483
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	79.1	83.7	-4.6	-651
SOUTH	Door C4	7.2	3.7	26.6	0.448	79.1	83.7	-4.6	-55
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	83.7	20.3	468
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	83.7	20.3	986
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	83.7	-15.7	-317
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	94.4	83.7	10.7	2,532
					TOTAL TRANSMISSION LOAD =				1,162

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**4,985**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	79.1	) + (	4,985	/(1.08 x	990	) =	83.8 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS: 83.7 °F dry bulb

Appendix 9

ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 1,890 cfm (Supply from AHU)
AHU Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 77.7 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	79.1	77.7	1.4	205
SOUTH	Door C5	7.2	6.3	45.2	0.448	79.1	77.7	1.4	28
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	77.7	26.3	2,045
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	76.8	77.7	-0.9	-198
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	83.7	77.7	6.0	1,318
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	77.7	-9.7	-212
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	94.4	77.7	16.7	4,291
					TOTAL TRANSMISSION LOAD =				7,478

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	36,558
TOTAL ROOM SENSIBLE LOAD:					**44,036**

ROOM TEMPERATURE (Tr) = (Ts 56.0) + (Q 44,036 / (1.08 x CFM 1,890)) = 77.6 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 1890) = **0.0069**

STEADY STATE ROOM CONDITIONS: 77.7 °F dry bulb

Appendix 9

ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2,030 cfm (Supply from AHU)
AHU Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 76.8 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	79.1	76.8	2.3	388
SOUTH	Door C6	7.2	6.3	45.2	0.448	79.1	76.8	2.3	47
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	76.8	27.2	1,731
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	76.8	27.2	669
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	82.3	76.8	5.5	1,208
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	77.7	76.8	0.9	198
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	76.8	-8.8	-219
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	84.6	76.8	7.8	1,822
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	94.4	76.8	17.6	1,019
					TOTAL TRANSMISSION LOAD =				6,863

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	38,540
TOTAL ROOM SENSIBLE LOAD:					45,403

ROOM TEMPERATURE (Tr) = (Ts 56.0) + (Q 45,403 / (1.08 x CFM 2,030) = 76.7 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2030) = **0.0069**

STEADY STATE ROOM CONDITIONS: 76.8 °F dry bulb

Appendix 9

ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 79.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 82.3 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	79.1	82.3	-3.2	-453
SOUTH	Door C7	7.2	3.7	26.5	0.448	79.1	82.3	-3.2	-38
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	82.3	21.7	1,354
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	82.3	21.7	200
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	81.2	82.3	-1.1	-242
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	76.8	82.3	-5.5	-1,208
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	82.3	-14.3	-288
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.305	80.4	82.3	-1.9	-133
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	84.6	82.3	2.3	369
					TOTAL TRANSMISSION LOAD =				-440

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					**3,383**

ROOM TEMPERATURE (Tr) = (Ts 79.1) + (Q 3,383 / CFM (1.08 x 990)) = 82.3 °F

LATENT LOAD:

					Q latent
PEOPLE	0 X	200			0
TOTAL ROOM LATENT LOAD:					**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS: 82.3 °F dry bulb

Appendix 9

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 79.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 81.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	79.1	81.2	-2.1	-131
SOUTH	Door C8	7.2	3.7	26.5	0.448	79.1	81.2	-2.1	-25
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	81.2	22.8	792
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	81.2	81.2	0.0	0
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	82.3	81.2	1.1	242
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	81.2	-13.2	-129
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.305	80.4	81.2	-0.8	-92
					TOTAL TRANSMISSION LOAD =				657

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	373
TOTAL ROOM SENSIBLE LOAD:					1,030

ROOM TEMPERATURE (Tr) = (Ts 79.1) + (Q 1,030 / (1.08 x CFM 440) = 81.3 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200			0
TOTAL ROOM LATENT LOAD:					0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = 0.0069

STEADY STATE ROOM CONDITIONS: 81.2 °F dry bulb

Appendix 9

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 507 cfm (Supply from AHU)
AHU Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 81.2 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	79.1	81.2	-2.1	-224
SOUTH	Door C9	7.2	3.7	26.5	0.448	79.1	81.2	-2.1	-25
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	81.2	22.8	1,262
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	87.3	81.2	6.1	832
EAST (ABOVE C12	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	81.7	81.2	0.5	42
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	81.2	81.2	0.0	0
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	81.2	-13.2	-206
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	80.4	81.2	-0.8	-146
					TOTAL TRANSMISSION LOAD =				1,534

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	12,248
TOTAL ROOM SENSIBLE LOAD:					**13,782**

ROOM TEMPERATURE (Tr) = (Ts 56.0) + (Q 13,782 / (1.08 x CFM 507)) = 81.2 °F

LATENT LOAD:

					Q latent
PEOPLE	0	X	200		0
TOTAL ROOM LATENT LOAD:					**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 507) = **0.0069**

STEADY STATE ROOM CONDITIONS: 81.2 °F dry bulb

Appendix 9

ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 82.8 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	87.3	82.8	4.5	614
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	81.7	82.8	-1.1	-92
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	87.2	82.8	4.4	442
EAST	Door C11	7.2	8.0	57.4	0.448	87.2	82.8	4.4	113
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	79.1	82.8	-3.7	-514
SOUTH	Door C10	7.2	8.0	57.4	0.448	79.1	82.8	-3.7	-95
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	74.4	82.8	-8.4	-998
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	111.0	82.8	28.2	1,734
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	111.0	82.8	28.2	1,994
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	82.8	-14.8	-551
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	80.4	82.8	-2.4	-1,048
					TOTAL TRANSMISSION LOAD =				1,599

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:						
	PEOPLE	2	X	250	=	500
	ELECTRICAL LOAD				=	31,261
TOTAL ROOM SENSIBLE LOAD:						**33,360**
SUPPLIMENTAL AIR HANDLING UNIT:						**0**
NET ROOM SENSIBLE LOAD:						**33,360**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

	Room	C12	AHU
	cfm	861	1295
	Temperature, °F	87.3	56.0

Total flow = 2,156 cfm
Supply air temperature: 68.5 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	68.5	) + (	33,360	/(1.08 x	2,156	) =	82.8 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

	Room	C12	AHU
	cfm	861	1295
	Humidity ratio	0.0069	0.0069

Total flow = 2,156 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 /(4840 x 2,156) = **0.0070**

STEADY STATE ROOM CONDITIONS: 82.8 °F dry bulb

Appendix 9

ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,079 cfm (Supply from AHU)
AHU Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 87.2 °F Design Rm Temp °F: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqf	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	87.2	-19.2	-806
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	87.2	-19.2	-902
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	87.2	-19.2	-422
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	119.0	87.2	31.8	2,053
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	111.0	87.2	23.8	293
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	82.8	87.2	-4.4	-437
WEST	Door C11	8.0	7.2	57.6	0.448	82.8	87.2	-4.4	-114
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	74.4	87.2	-12.8	-394
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	87.2	-19.2	-985
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	87.2	32.8	19,748
					TOTAL TRANSMISSION LOAD =				18,032

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0	X 250	=	0
	ELECTRICAL LAOD			=	52,014
TOTAL ROOM SENSIBLE LOAD:					**70,046**

ROOM TEMPERATURE (Tr) = (Ts 56.0) + (Q 70,046 / CFM (1.08 x 2,079)) = 87.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2079) = **0.0069**

STEADY STATE ROOM CONDITIONS: 87.2 °F dry bulb

Appendix 9

ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 79.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	79.1	-11.1	-2,009
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	81.5	79.1	2.4	123
NORTH	Door C3	7.2	8.0	57.4	0.448	81.5	79.1	2.4	62
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	83.7	79.1	4.6	652
NORTH	Door C4	7.2	3.7	26.5	0.448	83.7	79.1	4.6	55
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	77.7	79.1	-1.4	-205
NORTH	Door C5	7.2	6.3	45.2	0.448	77.7	79.1	-1.4	-28
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	76.8	79.1	-2.3	-388
NORTH	Door C6	7.2	6.3	45.2	0.448	76.8	79.1	-2.3	-47
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	82.3	79.1	3.2	453
NORTH	Door C7	7.2	3.7	26.5	0.448	82.3	79.1	3.2	38
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	81.2	79.1	2.1	131
NORTH	Door C8	7.2	3.7	26.5	0.448	81.2	79.1	2.1	25
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	81.2	79.1	2.1	224
NORTH	Door C9	7.2	3.7	26.5	0.448	81.2	79.1	2.1	25
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	87.3	79.1	8.2	289
NORTH	Door C13	7.2	3.0	21.5	0.448	87.3	79.1	8.2	79
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	81.7	79.1	2.6	72
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	82.8	79.1	3.7	492
NORTH	Door C10	7.2	8.0	57.4	0.448	82.8	79.1	3.7	95
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	74.4	79.1	-4.7	-202
EAST	Door C12	7.2	3.0	21.5	0.448	74.4	79.1	-4.7	-45
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	75.7	79.1	-3.4	-146
WEST	Door C1	7.2	3.0	21.5	0.448	75.7	79.1	-3.4	-33
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	79.1	-11.1	-418
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	94.4	79.1	15.3	2,539
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	100.1	79.1	21.0	1,998
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.305	80.4	79.1	1.3	235
					TOTAL TRANSMISSION LOAD =				4,064

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

Appendix 9

ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:					**6,972**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	1890	2030	506.8
Temperature, °F	77.7	76.8	81.2

Total flow = 4,427 cfm
Supply air temperature: 77.7 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(77.7	) + (	6,972	/(1.08 x	4,427	) =	79.1 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	1890	2030	506.8
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 4,427 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 79.1 °F dry bulb

Appendix 9

ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 861 cfm (Supply from AHU)
AHU Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 87.3 °F Design Rm Temperature: 79

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	82.8	87.3	-4.5	-614
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	81.2	87.3	-6.1	-832
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	79.1	87.3	-8.2	-289
SOUTH	Door C13	7.2	3.0	21.5	0.448	79.1	87.3	-8.2	-79
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	87.3	16.7	255
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	111.0	87.3	23.7	136
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	87.3	-19.3	-184
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	81.7	87.3	-5.6	-677
					TOTAL TRANSMISSION LOAD =				-2,284

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	31,069
TOTAL ROOM SENSIBLE LOAD:					**29,035**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	56.0	) + (	29,035	/(1.08 x	861	) =	87.2 °F

LATENT LOAD: Q latent

PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 861) = **0.0069**

STEADY STATE ROOM CONDITIONS: 87.3 °F dry bulb

Appendix 9

ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 81.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	82.8	81.7	1.1	92
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	81.2	81.7	-0.5	-42
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	79.1	81.7	-2.6	-72
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	81.7	22.3	208
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	111.0	81.7	29.3	102
FLOOR	692.0' C12	11.0	33.3	366.3	0.330	87.3	81.7	5.6	677
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	80.4	81.7	-1.3	-145
					TOTAL TRANSMISSION LOAD =				821

STEADY STATE ROOM CONDITIONS:	81.7 °F dry bulb

Appendix 9

ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 75.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	85.4	75.7	9.7	266
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	75.7	-7.7	-2,010
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	81.5	75.7	5.8	652
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	79.1	75.7	3.4	146
EAST	Door C1	7.2	3.0	21.5	0.448	79.1	75.7	3.4	33
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	75.7	-7.7	-29
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-942

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								41

STEADY STATE ROOM CONDITIONS:	75.7 °F dry bulb

Appendix 9

ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 74.4 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	79.1	74.4	4.7	202
WEST	Door C12	7.2	3.0	21.5	0.448	79.1	74.4	4.7	45
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	74.4	-6.4	-1,670
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	82.8	74.4	8.4	998
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	87.2	74.4	12.8	350
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	74.4	-6.4	-24
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				-99

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**884**

STEADY STATE ROOM CONDITIONS: 74.4 °F dry bulb

Appendix 9

ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 5,474 cfm
Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 94.4 °F Design Rm Temp: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	120.0	94.4	25.6	8,035
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	107.4	94.4	13.0	2,282
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	104.0	94.4	9.6	295
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	104.0	94.4	9.6	210
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	104.0	94.4	9.6	170
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	118.0	94.4	23.6	5,008
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	112.0	94.4	17.6	997
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	113.0	94.4	18.6	1,054
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	100.1	94.4	5.7	322
EAST	Door C22	7.2	6.00	43.0	0.448	100.1	94.4	5.7	110
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	84.6	94.4	-9.8	-2,637
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	120.0	94.4	25.6	3,910
WEST	Door C20	7.3	3.50	25.6	0.448	120.0	94.4	25.6	293
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	107.4	94.4	13.0	754
WEST	Door C21	7.2	3.00	21.5	0.448	107.4	94.4	13.0	125
FLOOR	692.0' - C2, 18" Cl	[illegible]	[illegible]	989.0	0.305	81.5	94.4	-12.9	-3,891
FLOOR	692.0' - C3, 18" Cl	[illegible]	[illegible]	775.9	0.305	83.7	94.4	-10.7	-2,532
FLOOR	692.0' - C4, 18" Cl	[illegible]	[illegible]	842.5	0.305	77.7	94.4	-16.7	-4,291
FLOOR	692.0' - C5, 18" Cl	[illegible]	[illegible]	189.8	0.305	76.8	94.4	-17.6	-1,019
FLOOR	692.0' - C11, 18" Cl	[illegible]	[illegible]	544.0	0.305	79.1	94.4	-15.3	-2,539
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3341.2	0.305	116.0	94.4	21.6	22,012
					TOTAL TRANSMISSION LOAD =				28,666

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	197,026
TOTAL ROOM SENSIBLE LOAD:					**226,192**

	Ts		Q	CFM		
ROOM TEMPERATURE (Tr) = (	56.0	) + (	226,192	/(1.08 x 5,474)	=	94.3 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

Room humidity ratio Wr = 0.0069 + 400 /(4840 x 5.474) = **0.0069**

STEADY STATE ROOM CONDITIONS: 94.4 °F dry bulb

Appendix 9

ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 100.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	80.4	100.1	-19.7	-1,113
EAST	Door C24	7.2	6.0	43.0	0.448	80.4	100.1	-19.7	-380
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	94.4	100.1	-5.7	-322
WEST	Door C22	7.2	6.0	43.0	0.448	94.4	100.1	-5.7	-110
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	120.0	100.1	19.9	3,457
SOUTH	Door C26	7.2	3.4	24.4	0.448	120.0	100.1	19.9	217
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	84.6	100.1	-15.5	-5,560
NORTH	Door C23	7.2	6.0	43.0	0.448	84.6	100.1	-15.5	-299
FLOOR	692.0' - C11, 18" CI			312.0	0.305	79.1	100.1	-21.0	-1,998
CEILING	729.0 - C1, 18" CI			312.0	0.305	116.0	100.1	15.9	1,513
					TOTAL TRANSMISSION LOAD =				-4,594

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	Does not operate during this LOCA case(Computer Rm Supplement.Cooling)						0
	PEOPLE	0	X	250			=	0
	LIGHTING	1,085.0	X	3.413	X	100%	=	3,703
	EQUIPMENT	217.0	X	3.413	X	100%	=	741
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**-151**

STEADY STATE ROOM CONDITIONS:	100.1 °F dry bulb

Appendix 9

ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 84.6 °F Design Rm Temp °F: 82

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	100.1	84.6	15.5	5,560
SOUTH	Door C23	7.2	6.0	43.0	0.448	100.1	84.6	15.5	299
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	84.6	19.4	625
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	118.0	84.6	33.4	4,919
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	80.4	84.6	-4.2	-1,364
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	94.4	84.6	9.8	3,182
FLOOR	692.0' - C5, 18" CI			765.9	0.305	76.8	84.6	-7.8	-1,822
FLOOR	692.0' - C6, 18" CI			526.1	0.305	82.3	84.6	-2.3	-369
CEILING	729.0 - C1, 18" CI			1292.0	0.305	116.0	84.6	31.4	12,374
					TOTAL TRANSMISSION LOAD =				23,404

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:						
PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	91,816
TOTAL ROOM SENSIBLE LOAD:					**115,720**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	3756.9	0
Temperature, °F	56.0	0.0

Total flow = 3,757 cfm
Supply air temperature: 56.0 °F

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 56.0 + 115,720 / (1.08 x 3,757) = 84.5 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	3,756.9	0.0
Humidity ratio	0.0069	0.0000

Total flow = 3,757 cfm
Wr' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 3,757) = **0.0069**

STEADY STATE ROOM CONDITIONS: 84.6 °F dry bulb

Appendix 9

ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 5,898 cfm (Supply from AHU)
Supply Air Temp: 56.0 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 80.4 °F Design Rm Temperature: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	120.0	80.4	39.6	13,686
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	95.5	80.4	15.1	2,650
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	80.4	23.6	819
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	111.0	80.4	30.6	657
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	111.0	80.4	30.6	556
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	118.0	80.4	37.6	5,963
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	118.0	80.4	37.6	6,815
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	84.6	80.4	4.2	1,413
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	100.1	80.4	19.7	1,113
WEST	Door C24	7.2	6.0	43.0	0.448	100.1	80.4	19.7	380
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	120.0	80.4	39.6	6,287
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	95.5	80.4	15.1	875
EAST	Door C25	7.2	3.0	21.5	0.448	95.5	80.4	15.1	146
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.305	82.3	80.4	1.9	133
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.305	79.1	80.4	-1.3	-235
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.305	81.2	80.4	0.8	92
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.305	81.2	80.4	0.8	146
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	81.7	80.4	1.3	145
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	82.8	80.4	2.4	1,048
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3595.7	0.305	116.0	80.4	35.6	39,042
					TOTAL TRANSMISSION LOAD =				81,731

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	72,818
TOTAL ROOM SENSIBLE LOAD:					**154,799**

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	56.0 +	154,799 / (1.08 x	5,898)	=	80.3 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) =	0.0069	+	200 / (4840 x	5,898) =	**0.0069**

STEADY STATE ROOM CONDITIONS: 80.4 °F dry bulb

Appendix 9

ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 107.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" Cl	8.0	19.5	156.0	0.236	120.0	107.4	12.6	464
SOUTH	708.0' - TB/T1, 36" Cl	18.0	19.5	351.0	0.236	120.0	107.4	12.6	1,044
NORTH	708.0' - C1, 8" Cl	18.0	19.5	351.0	0.500	94.4	107.4	-13.0	-2,282
EAST*	708.0' - C1, 8" Cl	8.0	19.5	134.5	0.431	94.4	107.4	-13.0	-754
EAST	Door C21	7.2	3.0	21.5	0.448	94.4	107.4	-13.0	-125
FLOOR (See Note)									
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		-1,653

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**-670**

STEADY STATE ROOM CONDITIONS: 107.4 °F dry bulb

Appendix 9

ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 95.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	95.5	24.5	902
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	95.5	24.5	2,029
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	80.4	95.5	-15.1	-2,650
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	80.4	95.5	-15.1	-1,015
WEST	Door C25	7.2	3.0	21.5	0.448	80.4	95.5	-15.1	-146
FLOOR (See Note)									
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	-879

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								103

STEADY STATE ROOM CONDITIONS:	95.5 °F dry bulb

Appendix 9

7.10 LOCA CONDITION (SUMMER CASE 1)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,673	87.2	0.0069	18.4	233,086
COMMUNICATION ROOM (692.0' - C9)	2,772	82.8	0.0070	19.3	229,522
MECHANICAL EQUIP. ROOM WEST (C1)	4,558	85.4	0.0069	31.4	389,211
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	7,038	94.4	0.0069	48.7	664,387
COMPUTER ROOM (708.0' - C3)	5,367	84.6	0.0069	37.2	454,048
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7,236	80.4	0.0069	50.0	581,734
OUTSIDE AIR	3,000	95.0	0.0133	39.9	285,000
EXFILTRATION (for balancing purpose only)	-580				
TOTAL	Vreturn = 32,063			244.9	2,836,987

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = **88.5 °F**

Return Air Humidity Ratio from EBR spaces: Wreturn = **0.0076 # MOIST / # DRY AIR**

Appendix 9

Summary of Cooling Loads and Room Temperatures for LOCA Summer Case 1 with 70% Design Air Flow

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	30,784		89	85	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	10,010		83	82	NA	NA
250V BATTERY ROOM 1 (C3)	4,985		88	84	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	44,036		85	78	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	45,403		85	77	NA	NA
250V BATTERY ROOM 2 (C6)	3,383		88	82	NA	NA
24V & 48V BATTERY ROOM (C7)	1,030		90	81	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	13,782		85	81	NA	NA
COMMUNICATION ROOM (C 9)	33,360	400	88	83	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	70,046		87	87	NA	NA
CORRIDOR (C 11)	6,972			79		
SECONDARY ALARM STATION (C12)	29,035	200	82	87	NA	NA
ATTIC (above C12)	821			82		
WEST STAIRWELL (STAIR C1)	41			76		
EAST STAIRWELL (STAIR C2)	884			74		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	226,192	400	89	94	NA	NA
CORRIDOR (C 2)	-151			100		
COMPUTER ROOM (C3) [2]	115,720	400	82	85	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	154,799	200	87	80	NA	NA
WEST STAIRWELL (STAIR C1)	-670			107		
EAST STAIRWELL (STAIR C2)	103			96		
SUMMARY:	790,566	1,600				

Cooling Loads & AHU Heat Duty - LOCA Summer - Case 1 with 70% Design Flow Rate

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (216 gpm) AIRCOOL *	AHU B-A (216 gpm) AIRCOOL *	TOTAL three (3) AHUs	Chiller Capacity (See Section 2.2)
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h
Sensible	790,566	N/A	480,122	480,122	960,244	N/A
Latent	1,600	N/A	6,597	6,597	13,194	N/A
Total	792,166	N/A	486,719	486,719	973,438	1,807,200

* For Heat Duty see pg. 28.

This page replaced by Revision 20.

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:17:59 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:17:59 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Thursday, August 18, 2011 at 4:17:59 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: 02
DATE: 10-25-04
PROCEDURE: EBR LOCA App. 9

CONVERGENCE TOLERANCE: 0.5 %

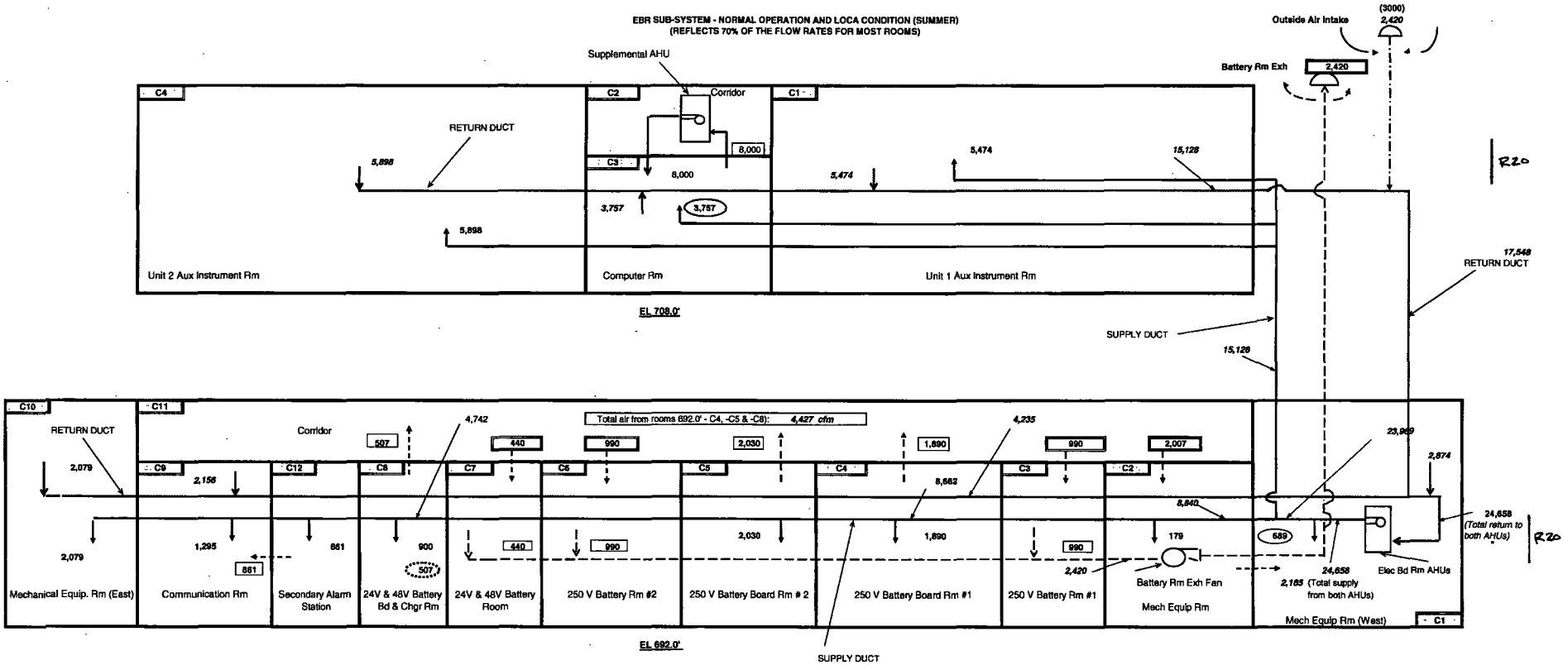
PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	27.12
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	11933.00
Inlet Temperature (degrees F):	48.00	88.40
Outlet Temperature (degrees F):	52.50	49.91
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1823.81	8.41
Clean Pressure Drop (psi):	32.87	Not Calculated
Fouled Pressure Drop (psi):	39.31	Not Calculated
Velocity (ft/s and ft/min):	9.93	340.94

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 486719/ 480122/ 6597 Btu/hr
Average Overall Heat Transfer Coefficient: 6.24 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 49.91 deg F

APPENDIX 9

EBR SUB-SYSTEM - NORMAL OPERATION AND LOCA CONDITION (SUMMER)
(REFLECTS 70% OF THE FLOW RATES FOR MOST ROOMS)



Notes:

1. This measured flow rate in response to stage 3 of DCN 51656 is less than 90% of the design value and is used for the summertime cases.

LEGEND:

AHU SUPPLY COOLED AIR		2,430	SUPPLY AIR (90% DESIGN FLOW RATE)
RETURN AIR		2,430	ESTIMATED VALUE (RETURN / TRANSFER AIR FLOW = SUPPLY AIR FLOW)
TRANSFER AIR		5,940	CALCULATED AIR FLOW
EXHAUST AIR		440	TRANSFER / EXHAUST AIR (110% DESIGN FLOW)
OUTSIDE AIR SUPPLY		984	PREOP VALUE
C1	ROOM NUMBER	(3000)	OUTSIDE FLOW RATE FOR LOCA (CRI MODE)
	MEASURED FLOW (SEE NOTE 1)		

Checking the air flow balancing:	Normal	LOCA
Air flow in (Outside air supply):	2,420 cfm	3000 cfm
Air flow out:		
Battery room exhaust fan :	(2,420) cfm	(2,420) cfm
Exfiltration (for balancing purpose only:	- cfm	(580) cfm
Summary of in / out air flow:	0 cfm	0 cfm

EVALUATION OF THE INTERIM CONDITION FOR DCN D51656A (PRIOR TO COMPLETION OF STAGE 3)

This Appendix is deleted since Stage 3 is implemented and interim configuration ceased to exist.

APPENDIX 11 – Dual Unit Operation Analysis

1. PURPOSE

The purpose of this Appendix is:

- Determination of the steady state room temperatures and humidity for dual unit operation. As part of the WBN Unit 2 Construction Completion Project, electrical heat load calculations referenced by this calculation were revised not only to reflect Dual Unit Operation (newly energized cables, lights, and equipment) but also to more accurately reflect actual electrical heat loads during different normal and off-normal conditions. The heat load from electrical heat load calculations (Ref. 3.1, 3.2 and 3.3) are directly used as design input in this appendix.

- To determine potential impact for completing stage 3 of DCN 51656 for dual unit operation. Calculation EPMMCP071689 Rev.016 assesses the proposed changes to be performed by DCN 51656. Stage 3 of this DCN was not completed since Systems Engineering was unable to get the air flows adjusted to within the G-37 requirements. Section 6.5 of Appendix 11 provides the potential impact on the EQ design room temperatures if the air flow to the Secondary Alarm Station was reduced from 695 cfm to 200 cfm.

The detailed updated electrical load calculations used in Appendix 11 are listed in Section 3.

2. Assumption

2.1 Justified Assumption

2.1.1 For dual unit operation, 90% of current design flow rates based on the flow diagram was used for the summertime normal plant operation and a LOCA, while 110% of current design flow rates was used for the wintertime normal plant operation and a DBE LOOP. Table 1 in Appendix 11, Page 9, lists the 90% of current design flow rate and 110% of current design flow rates, respectively.

Technical Justification: Currently, the Stage 3 of DCN 51656 has not been implemented yet. Using the flows listed in Table 1 is conservative since lower airflow rates in summertime will result in higher room temperature while higher airflow rates will reduce the room temperature in winter time.

The other justified assumptions for this appendix are identical to that in Section 4.1.

2.2 Unverified Assumption

2.2.1 Stage 3 of DCN 51656 will be cancelled for dual unit operation. According to preliminary analysis, the implementation of Stage 3 of DCN 51656 will result in very high room temperature in Secondary Alarm Station (EL.692-C12) which is over 104 °F.

The other DCNs and Unit 1 civil and mechanical drawings associated with previous revisions of this calculation have been reviewed and determined to not merit the inclusion of an unverified assumption for the purpose of dual unit operation.

3. Reference

3.1 WBN-EEB-MS-TI09-0022, Rev.13, "Heat Generation in the Control Building on EL 692.0, 708.0 and 755.0".

3.2 WBN-EEB-MS-TI09-0042, Rev.14, "Electrical Heat Generation in the Control Building Main Control Room, EL.708.0' (rooms C1 and C4), and 729.0 (room C1)".

3.3 WBN-EEB-MS-TI09-0058, Rev.9, "Electrical Heat Generation in the Control Building 692.0 (C11, C12), 708.0 (C2), 755.0 (C2, C3, C5, C7, C9, C10, C14, C16, C17, C18, C19, C20)".

4. Heat loads

Sections 4.1 to 4.6 detail the electrical heat loads under different operating conditions for dual unit operation.

4.1 Room Internal Load Summary (Normal Operation - Summer)

(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM DESCRIPTION	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES
ROOMS AT FLOOR ELEVATION 692.0'			
MECHANICAL EQUIP. ROOM WEST (C1)		9,027	Appendix 11, Ref. 3.1
MECHANICAL EQUIPMENT ROOM (C2)		4,468	Appendix 11, Ref. 3.1
250V BATTERY ROOM 1 (C3)		3,823	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 1 (C4)		74,642	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 2 (C5)		79,977	Appendix 11, Ref. 3.1
250V BATTERY ROOM 2 (C6)		3,823	Appendix 11, Ref. 3.1
24V & 48V BATTERY ROOM (C7)		2,041	Appendix 11, Ref. 3.1
24V & 48V BATTERY BOARD ROOM (C8)		20,683	Appendix 11, Ref. 3.1
COMMUNICATION ROOM (C 9) (1)	2	103,424	Appendix 11, Ref. 3.1
MECHANICAL EQUIP. ROOM EAST (C10)		21,304	Appendix 11, Ref. 3.1
CORRIDOR (C 11)		2,908	Appendix 11, Ref. 3.3
SECONDARY ALARM STATION (C12) (1)	1	19,570	Appendix 11, Ref. 3.3
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6
ROOMS AT FLOOR ELEVATION 708.0'			

This page is added by Rev.016

UNIT # 1 AUX INSTRUMENT ROOM (C1) (1)	2	229,272	Appendix 11, Ref. 3.2
CORRIDOR (C 2)		5,638	Appendix 11, Ref. 3.3
COMPUTER ROOM (C3) (1)	2	46,236	Appendix 11, Ref. 3.1
UNIT # 2 AUX INSTRUMENT ROOM (C4) (1)	1	201,162	Appendix 11, Ref. 3.2
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6

NOTES:

1. See Assumption 4.1.9

4.2 Room Internal Load Summary (Normal Operation - Summer)

(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES
ROOMS AT FLOOR ELEVATION 692.0'			
MECHANICAL EQUIPMENT ROOM WEST (C1)		9,027	Appendix 11, Ref. 3.1
MECHANICAL EQUIPMENT ROOM (C2)		4,468	Appendix 11, Ref. 3.1
250V BATTERY ROOM 1 (C3)		3,823	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 1 (C4)		74,642	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 2 (C5)		79,977	Appendix 11, Ref. 3.1
250V BATTERY ROOM 2 (C6)		3,823	Appendix 11, Ref. 3.1
24V & 48V BATTERY ROOM (C7)		2,041	Appendix 11, Ref. 3.1
24V & 48V BATTERY BOARD ROOM (C8)		20,683	Appendix 11, Ref. 3.1
COMMUNICATION ROOM (C 9)	2	103,424	Appendix 11, Ref. 3.1
MECHANICAL EQUIPMENT ROOM EAST (C10)		21,304	Appendix 11, Ref. 3.1
CORRIDOR (C 11)		2,908	Appendix 11, Ref. 3.3
SECONDARY ALARM STATION (C12)	1	19,570	Appendix 11, Ref. 3.3
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6
ROOMS AT FLOOR ELEVATION 708.0'			
UNIT # 1 AUX INSTRUMENT ROOM (C1)	2	229,272	Appendix 11, Ref. 3.2
CORRIDOR (C 2)		5,638	Appendix 11, Ref. 3.3
COMPUTER ROOM (C3)	2	46,236	Appendix 11, Ref. 3.1
UNIT # 2 AUX INSTRUMENT ROOM (C4)	1	201,162	Appendix 11, Ref. 3.2
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6

4.3 Room Internal Load Summary (Loca Condition - Summer)

(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES
ROOMS AT FLOOR ELEVATION 692.0'			
MECHANICAL EQUIP. ROOM WEST (C1)		9,027	Appendix 11, Ref. 3.1
MECHANICAL EQUIPMENT ROOM (C2)		4,468	Appendix 11, Ref. 3.1
250V BATTERY ROOM 1 (C3)		3,823	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 1 (C4)		74,642	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 2 (C5)		79,977	Appendix 11, Ref. 3.1
250V BATTERY ROOM 2 (C6)		3,823	Appendix 11, Ref. 3.1
24V & 48V BATTERY ROOM (C7)		2,041	Appendix 11, Ref. 3.1
24V & 48V BATTERY BOARD ROOM (C8)		20,683	Appendix 11, Ref. 3.1
COMMUNICATION ROOM (C 9) (1)	2	103,424	Appendix 11, Ref. 3.1
MECHANICAL EQUIP. ROOM EAST (C10)		21,304	Appendix 11, Ref. 3.1
CORRIDOR (C 11)		2,908	Appendix 11, Ref. 3.3
SECONDARY ALARM STATION (C12) (1)	1	19,570	Appendix 11, Ref. 3.3
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6
ROOMS AT FLOOR ELEVATION 708.0'			
UNIT # 1 AUX INSTRUMENT ROOM (C1) (1)	2	229,272	Appendix 11, Ref. 3.2
CORRIDOR (C 2) (2)		5,638	Appendix 11, Ref. 3.3
COMPUTER ROOM (C3) (1) (2)	2	46,236	Appendix 11, Ref. 3.1
UNIT # 2 AUX INSTRUMENT ROOM (C4) (1)	1	201,162	Appendix 11, Ref. 3.2
WEST STAIRWELL (STAIR C1) (WATTS)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2) (WATTS)		288	See Assumption 4.1.6

NOTES:

1. See Assumption 4.1.9.
2. Supplemental AHU cooling is credited in the LOCA summer case number 2, Section 7.11. See Note 19, Section 6.9.

This page is added by Rev.016

4.4 Room Internal Load Summary (Loca Condition - Summer)
(ELEC LOAD INCLUDES EQUIPMENT, CABLES, AND LIGHTS)

ROOM	PEOPLE	ELEC LOAD (BTU/HR)	REFERENCE & NOTES
ROOMS AT FLOOR ELEVATION 692.0'			
MECHANICAL EQUIP. ROOM WEST (C1)		9,027	Appendix 11, Ref. 3.1
MECHANICAL EQUIPMENT ROOM (C2)		4,468	Appendix 11, Ref. 3.1
250V BATTERY ROOM 1 (C3)		3,823	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 1 (C4)		74,642	Appendix 11, Ref. 3.1
250V BATTERY BOARD ROOM 2 (C5)		79,977	Appendix 11, Ref. 3.1
250V BATTERY ROOM 2 (C6)		3,823	Appendix 11, Ref. 3.1
24V & 48V BATTERY ROOM (C7)		2,041	Appendix 11, Ref. 3.1
24V & 48V BATTERY BOARD ROOM (C8)		20,683	Appendix 11, Ref. 3.1
COMMUNICATION ROOM (C 9)	2	103,424	Appendix 11, Ref. 3.1
MECHANICAL EQUIP. ROOM EAST (C10)		21,304	Appendix 11, Ref. 3.1
CORRIDOR (C 11)		2,908	Appendix 11, Ref. 3.3
SECONDARY ALARM STATION (C12)	1	19,570	Appendix 11, Ref. 3.3
WEST STAIRWELL (STAIR C1)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2)		288	See Assumption 4.1.6
ROOMS AT FLOOR ELEVATION 708.0'			
UNIT # 1 AUX INSTRUMENT ROOM (C1)	2	229,272	Appendix 11, Ref. 3.2
CORRIDOR (C 2)		5,638	Appendix 11, Ref. 3.3
COMPUTER ROOM (C3)	2	46,236	Appendix 11, Ref. 3.1
UNIT # 2 AUX INSTRUMENT ROOM (C4)	1	201,162	Appendix 11, Ref. 3.2
WEST STAIRWELL (STAIR C1)		288	See Assumption 4.1.6
EAST STAIRWELL (STAIR C2)		288	See Assumption 4.1.6

4.5 Room Internal Load Summary (Normal Operation - Winter)

ROOM	THEORETICAL NORMAL						ELECTRICAL LOAD TO BE USED BTU/HR	NOTES
	PEOPLE NOTE 2	LIGHTING (WATTS)	EQUIPMENT (WATTS)	CABLE TRAYS (WATTS)	REFERENCE & NOTES	TOTAL BTU/HR		
ROOMS AT FLOOR ELEVATION 692.0'								
MECHANICAL EQUIPMENT ROOM WEST (C1)		0.0	1,441.0		Appendix 11, Ref. 3.1	4,918	4,918	NOTE 1
MECHANICAL EQUIPMENT ROOM (C2)		0.0	535.0		Appendix 11, Ref. 3.1	1,826	1,826	NOTE 1
250V BATTERY ROOM 1 (C3)		0.0	604.0		Appendix 11, Ref. 3.1	2,061	2,061	NOTE 1
250V BATTERY BOARD ROOM 1 (C4)		0.0	20,886.0	210.0	Appendix 11, Ref. 3.1	72,001	72,001	NOTE 1
250V BATTERY BOARD ROOM 2 (C5)		0.0	21,871.0	788	Appendix 11, Ref. 3.1	77,335	77,335	NOTE 1
250V BATTERY ROOM 2 (C6)		0.0	604.0		Appendix 11, Ref. 3.1	2,061	2,061	NOTE 1
24V & 48V BATTERY ROOM (C7)		0.0	340.0		Appendix 11, Ref. 3.1	1,160	1,160	NOTE 1
24V & 48V BATTERY BOARD ROOM (C8)		0.0	5,024.0		Appendix 11, Ref. 3.1	17,147	17,147	NOTE 1
COMMUNICATION ROOM (C 9)	0	0.0	27,551.0		Appendix 11, Ref. 3.1	94,032	94,032	NOTE 1
MECHANICAL EQUIPMENT ROOM EAST (C10)		0.0	4,866.0		Appendix 11, Ref. 3.1	16,608	16,608	NOTE 1
CORRIDOR (C 11)		0.0	142.0		Appendix 11, Ref. 3.3	485	485	NOTE 1
SECONDARY ALARM STATION (C12)		0.0	4,627.0		Appendix 11, Ref. 3.3	15,792	15,792	NOTE 1
WEST STAIRWELL (STAIR C1)		0.0	0.0		NOTE 3	0	0	NOTE 3
EAST STAIRWELL (STAIR C2)		0.0	0.0		NOTE 3	0	0	NOTE 3
ROOMS AT FLOOR ELEVATION 708.0'								
UNIT # 1 AUX INSTRUMENT ROOM (C1)	0	0.0	56,856.0		Appendix 11, Ref. 3.2	194,050	194,050	NOTE 1
CORRIDOR (C 2)		0.0	217.0		Appendix 11, Ref. 3.3	741	741	NOTE 1
COMPUTER ROOM (C3)	0	0.0	9,373.0	648.0	Appendix 11, Ref. 3.1	34,202	34,202	NOTE 1
UNIT # 2 AUX INSTRUMENT ROOM (C4)	0	0.0	45,490.0		Appendix 11, Ref. 3.2	155,257	155,257	NOTE 1
WEST STAIRWELL (STAIR C1)		0.0	0.0		NOTE 3	0	0	NOTE 3
EAST STAIRWELL (STAIR C2)		0.0	0.0		NOTE 3	0	0	NOTE 3

NOTES:
(1) The electrical load to be used is 100% of the total load.
(2) Latent cooling load due to personnel was not considered; conservative.
(3) Considered "zero" for this operational condition; conservative.

This page is added by Rev.016

4.6 Room Internal Loads Summary (Loop Condition - Winter)

ROOM	THEORETICAL LOCA/LOOP					REFERENCE & NOTES	TOTAL LOAD BTU/HR	ELECTRICAL LOAD CREDITED	
	PEOPLE (NOTE 2)	LIGHTING (WATTS)	LIGHTING BTU/HR	EQUIPMENT (WATTS)	CABLE TRAYS (WATTS)			BTU/HR	NOTES
ROOMS AT FLOOR ELEVATION 692.0'									
MECHANICAL EQUIPMENT ROOM WEST (C1)		1204	4109	1,441.0		Appendix 11, Ref. 3.1	9,027	4,918	NOTE 1
MECHANICAL EQUIPMENT ROOM (C2)		774	2642	535.0		Appendix 11, Ref. 3.1	4,468	0	NOTE 1
250V BATTERY ROOM 1 (C3)		516	1761	604.0		Appendix 11, Ref. 3.1	3,823	0	NOTE 1
250V BATTERY BOARD ROOM 1 (C4)		774	2642	20,886.0	210.0	Appendix 11, Ref. 3.1	74,642	0	NOTE 1
250V BATTERY BOARD ROOM 2 (C5)		774	2642	21,871.0	788	Appendix 11, Ref. 3.1	79,977	0	NOTE 1
250V BATTERY ROOM 2 (C6)		516	1761	604.0		Appendix 11, Ref. 3.1	3,823	0	NOTE 1
24V & 48V BATTERY ROOM (C7)		258	881	340.0		Appendix 11, Ref. 3.1	2,041	0	NOTE 1
24V & 48V BATTERY BOARD ROOM (C8)		1036	3536	5,024.0		Appendix 11, Ref. 3.1	20,683	0	NOTE 1
COMMUNICATION ROOM (C 9)	0	2752	9393	27,551.0		Appendix 11, Ref. 3.1	103,424	0	NOTE 1
MECHANICAL EQUIPMENT ROOM EAST (C10)		1376	4696	4,866.0		Appendix 11, Ref. 3.1	21,304	16,608	NOTE 1
CORRIDOR (C 11)		710	2423	142.0		Appendix 11, Ref. 3.3	2,908	0	NOTE 1
SECONDARY ALARM STATION (C12)		1107	3778	4,627.0		Appendix 11, Ref. 3.3	19,570	0	NOTE 1
WEST STAIRWELL (STAIR C1)		0	0	0.0		NOTE 3	0	0	NOTE 3
EAST STAIRWELL (STAIR C2)		0	0	0.0		NOTE 3	0	0	NOTE 3
ROOMS AT FLOOR ELEVATION 708.0'									
UNIT # 1 AUX INSTRUMENT ROOM (C1)	0	10320	35222	56,856.0		Appendix 11, Ref. 3.2	229,272	194,050	NOTE 1
CORRIDOR (C 2)		1085	3703	217.0		Appendix 11, Ref. 3.3	4,444	0	NOTE 1
COMPUTER ROOM (C3)	0	3526	12034	9,373.0	648.0	Appendix 11, Ref. 3.1	46,236	34,202	NOTE 1
UNIT # 2 AUX INSTRUMENT ROOM (C4)	0	13450	45905	45,490.0		Appendix 11, Ref. 3.2	201,162	155,257	NOTE 1
WEST STAIRWELL (STAIR C1)		0		0.0		NOTE 3	0	0	NOTE 3
EAST STAIRWELL (STAIR C2)		0		0.0		NOTE 3	0	0	NOTE 3

NOTES:

1. The normal load minus the theoretical lighting load was assigned to the two mechanical equipment rooms which contain HVAC equipment that will continue to run during the LOCA/LOOP scenario. The auxiliary instrument room and computer room loads were conservatively set to the normal load minus the theoretical lighting load by using the same methodology with Ref.39. (Attachment B). The emergency lighting loads were not considered due to the conservative purpose. See Assumption 4.1.10 for other rooms.
2. Latent cooling load due to personnel was not considered; conservative.
3. Electrical loads for the stairwells is specified in Assumption 4.1.6. It is powered form non-safety related source and considered "ZERO" for this mode of operation.

This page is added by Rev.016

5. Calculation and Analysis

See the detailed design input and methodology in Section 6.0 in the main body of this calculation. The detailed calculation process is listed in Section 7.0 of the main body of this calculation. In this appendix, only the heat loads for different operating scenarios have been used to evaluate the room temperature for dual unit operation.

5.1 Normal Operation (Summer Case 1, Maximum Room Temperatures and Minimum AHU Cooling Load Capability)

See Appendix 11, Page 10 to 39.

5.2 Normal Operation (Summer Case 2, Minimum Room Temperatures and Maximum AHU Cooling Load Capability)

See Appendix 11, Page 40 to 72.

5.3 LOCA Conditions (Summer Case 1, Maximum Room Temperatures and Minimum AHU Cooling Load Capability)

See Appendix 11, Page 73 to 99.

5.4 LOCA Conditions (Summer Case 2, Minimum Room Temperatures and Maximum AHU Cooling Load Capability)

See Appendix 11, Page 100 to 132.

5.5 Normal Condition (Winter)

See Appendix 11, Page 133 to 157.

5.6 LOOP Condition (Winter, Minimum Room Temperature at Maximum AHU Capability)

See Appendix 11, Page 158 to 187.

ROOM NAME & TOTAL FLOW RATE	CURRENT DESIGN FLOW RATE(3)		NEW ANALYTICAL DESIGN SUPPLY FLOW RATES (CFM)	NEW DESIGN FLOW RATES ROUNDED OFF (CFM)	90% OF NEW DESIGN FLOW RATES (CFM)	110% OF NEW DESIGN FLOW RATES (CFM)	PREOP TEST FLOW RATES (CFM)	USED SUMMER CASES FLOW RATES (CFM)	USED WINTER CASES FLOW RATES (CFM)
	SUPPLY (CFM)	EXHAUST (CFM)							
EL. 692.0 ROOM NAME									
MECH EQPT RM NO. 1 (WEST)	1180	N/A	1180	1180	1062	1298	984	984	1298
MECH EQPT RM (BATT RM EXH FAN RM)	245	N/A	245	245	221	270	273	221	270
250V BATT RM NO. 1		900				990			990
250V BATT BD RM NO. 1	2660	N/A	2660	2660	2394	2926	2777	2394	2926
250V BATT BD RM NO. 2	2800	N/A	2800	2800	2520	3080	3106	2520	3080
250V BATT RM NO. 2		900				990			990
24V AND 48V BATT RM		400				440			440
24V AND 48V BATT BD AND CHARGE RM	970	N/A	970	970	873	1067	1088	873	1067
SECONDARY ALARM STATION	695		695	695	626	765	814	626	765
COMMUNICATIONS RM	2975		2975	2975	2678	3273	2699	2678	3273
MECH EQPT RM NO. 2 (EAST)	2560		2560	2560	2304	2816	2854	2304	2816
TOTAL BRANCH SUPPLY FLOW RATE (3)	12905		12905	12905	11615	14196	13611	11615	14196
TOTAL EXHAUST FLOW RATE (A-A,B-B)		2200				2420			2420
EL. 708.0 ROOM NAME									
UNIT 1 AUX. INSTR. ROOM	7820	N/A	7820	7820	7038	8602	6691	6691	8602
COMPUTER ROOM	6070		6070	6070	5463	6677	5367	5367	6677
UNIT 2 AUX. INSTR. ROOM	8425		8425	8425	7583	9268	8425	7583	9268
TOTAL BRANCH SUPPLY FLOW RATE	22315		22315	22315	20084	24547	20483	20084	24547
TOTAL EBR AHU SUPPLY FLOW RATE	36400		36400	36400	32760	40040	35078	32760	40040

NOTES:

(1) MIN PREOP FLOW RATE; REF. 5.1, APPENDIX A, TDN # 95-0714

(2) THIS MIN FLOW RATE USED IN EVALUATION OF BOTH NORMAL & LOCA SUMMER OPERATING CONDITIONS.

(2) SEE APPENDIX DETAIL SCHEMATIC DESIGN FLOW DIAGREAM

NORMAL OPERATION (SUMMER CASE 1)

NORMAL OPERATION (SUMMER - CASE 1) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- MINIMUM CHILLED WATER FLOW RATES OF 216 GPM TO EACH EBR AHU
- MAXIMUM CHILLED WATER SUPPLY TEMPERATURE OF 48°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD IN PAGE 2 IN APPENDIX 11
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU RUNNING

This case conservatively minimizes the cooling capability of the EBR AHUs by modeling the minimum chilled water flow rate concurrent with maximum chilled water temperature. This case also conservatively maximizes the predicted room temperatures. The EXCEL spreadsheet (see pg.11 to 33) and AIRCOOL models (see pg.34 to 39) were iterated until the mixed return air temperature (both dry and wet bulb) to the AHU coils calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equtes to approximately Tr = 83.3oF(see pg.33) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

T_z = 51.48 °F (estimated air side outlet temperature for each EBR AHU based on the AIRCOOL model; see pg.36)

Δt = 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.4)

$T_s = T_z + \Delta t$ = 56.8 °F

Since the computer room supplemental AHU is also credited in this normal cooling mode, an AIRCOOL model of this unit is included in this section (see pg.37 to 39). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet.

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 83.5 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (FT)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	83.5	-15.5	-651
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	83.5	-15.5	-729
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	83.5	-15.5	-357
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	104.0	83.5	20.5	1,166
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	83.5	20.5	347
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	84.8	83.5	1.3	129
EAST	Door C2	8.0	7.2	57.6	0.448	84.8	83.5	1.3	34
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.3	83.5	-11.2	-345
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	83.5	-15.5	-796
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	83.5	26.5	15,955
					TOTAL TRANSMISSION LOAD =				14,753

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	9,027
TOTAL ROOM SENSIBLE LOAD:					23,781

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
Flow Rate (cfm)	3588	984
Temperature, °F	84.8	56.8

Total flow = 4,572 cfm
Supply air temperature: 78.8 °F

ROOM TEMPERATURE (Tr) = (Ts 78.8) + (Q 23,781 /(1.08 x CFM 4,572) = 83.6 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
Flow Rate (cfm)	3588	984
Humidity ratio	0.0084	0.0084

Total flow = 4,572 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 83.5 °F dry bulb
34 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 84.8 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	83.5	84.8	-1.3	-130
WEST	Door C2	7.2	8.0	57.6	0.448	83.5	84.8	-1.3	-34
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	88.2	84.8	3.4	747
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	85.0	84.8	0.2	10
SOUTH	Door C3	7.2	8.0	57.6	0.448	85.0	84.8	0.2	5
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.3	84.8	-12.5	-1,406
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	84.8	19.2	561
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	84.8	19.2	1,026
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	84.8	-16.8	-432
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	90.0	84.8	5.2	1,569
					TOTAL TRANSMISSION LOAD =				1,916

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,468
TOTAL ROOM SENSIBLE LOAD:					**6,384**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
Flow Rate (cfm)	3367	221
Temperature, °F	85.0	56.8

Total flow = 3,588 cfm
Supply air temperature: 83.3 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	83.3	) + (	6,384	/(1.08 x	3,588	) =	84.9 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
Flow Rate (cfm)	3367	221
Humidity ratio	0.0084	0.0084

Total flow = 3,588 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **84.8 °F dry bulb**
33 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 85.0 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 88.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	86.3	88.2	-1.9	-417
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	84.8	88.2	-3.4	-747
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	85.0	88.2	-3.2	-453
SOUTH	Door C4	7.2	3.7	26.6	0.448	85.0	88.2	-3.2	-38
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	88.2	15.8	364
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	88.2	15.8	767
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	88.2	-20.2	-407
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	90.0	88.2	1.8	426
					TOTAL TRANSMISSION LOAD =				-506

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0 X	250	=	0
ELECTRICAL LOAD			=	3,823
TOTAL ROOM SENSIBLE LOAD:				3,317

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	85.0	) + (	3,317	/(1.08 x	990	) =	88.1 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = 0.0084

STEADY STATE ROOM CONDITIONS:	88.2 °F dry bulb 30 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2394 cfm (Supply from the AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 86.3 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	85.0	86.3	-1.3	-190
SOUTH	Door C5	7.2	6.3	45.2	0.448	85.0	86.3	-1.3	-26
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	86.3	17.7	1,377
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	85.0	86.3	-1.3	-286
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	88.2	86.3	1.9	417
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	86.3	-18.3	-401
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	90.0	86.3	3.7	951
					TOTAL TRANSMISSION LOAD =				1,842

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 74,642
TOTAL ROOM SENSIBLE LOAD: 76,484

	Ts	Q	CFM	
ROOM TEMPERATURE (Tr) = (	56.8) + (	76,484	/(1.08 x 2,394) =	86.4 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 = 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2394) = 0.0084

STEADY STATE ROOM CONDITIONS:	86.3 °F dry bulb 31 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2520 cfm (Supply from the AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 85.0 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	85.0	85.0	0.0	0
SOUTH	Door C6	7.2	6.3	45.2	0.448	85.0	85.0	0.0	0
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	85.0	19.0	1,209
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	85.0	19.0	467
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	85.8	85.0	0.8	176
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	86.3	85.0	1.3	286
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	85.0	-17.0	-422
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.376	67.2	85.0	-17.8	-5,126
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	90.0	85.0	5.0	289
					TOTAL TRANSMISSION LOAD =				-3,121

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	79,977
TOTAL ROOM SENSIBLE LOAD:					**76,855**

ROOM TEMPERATURE (Tr) = (Ts 56.8) + (Q 76,855 / (1.08 x CFM 2,520) = 85.0 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2520) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**85.0 °F dry bulb**
	33 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 85.0 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 85.8 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	85.0	85.8	-0.8	-113
SOUTH	Door C7	7.2	3.7	26.6	0.448	85.0	85.8	-0.8	-10
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	85.8	18.2	1,136
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	85.8	18.2	168
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	86.7	85.8	0.9	198
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	85.0	85.8	-0.8	-176
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	85.8	-17.8	-359
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	84.7	85.8	-1.1	-95
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.376	67.2	85.8	-18.6	-3,680
					TOTAL TRANSMISSION LOAD =				-2,931

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: 892

ROOM TEMPERATURE (Tr) = (Ts 85.0) + (Q 892 / (1.08 x CFM 990) = 85.8 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = 0.0084

STEADY STATE ROOM CONDITIONS:	85.8 °F dry bulb 32 % RH

NORMAL OPERATION (SUMMER CASE 1)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 85.0 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 86.7 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	85.0	86.7	-1.7	-106
SOUTH	Door C8	7.2	3.7	26.5	0.448	85.0	86.7	-1.7	-20
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	86.7	17.3	601
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	81.8	86.7	-4.9	-1,077
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	85.6	86.7	-0.9	-198
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	86.7	-18.7	-183
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	84.7	86.7	-2.0	-283
					TOTAL TRANSMISSION LOAD =				-1,266

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,041
TOTAL ROOM SENSIBLE LOAD:					775

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) = (	85.0	) + (	775	/(1.08 x	440	) =	86.6 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**86.7 °F dry bulb**
	31 % RH

NORMAL OPERATION (SUMMER CASE 1)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 873 cfm (Supply from the AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 81.8 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	85.0	81.8	3.2	341
SOUTH	Door C9	7.2	3.7	26.5	0.448	85.0	81.8	3.2	38
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	81.8	22.2	1,228
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	84.8	81.8	3.0	409
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.1	81.8	-7.7	-642
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	86.7	81.8	4.9	1,077
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	66.0	81.8	-13.8	-215
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	84.7	81.8	2.9	654
					TOTAL TRANSMISSION LOAD =				2,890

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	20,683
TOTAL ROOM SENSIBLE LOAD:					23,573

ROOM TEMPERATURE (Tr) = (Ts 56.8) + (Q 23,573 / (1.08 x CFM 873) = 81.8 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 873) = 0.0084

STEADY STATE ROOM CONDITIONS:	81.8 °F dry bulb 36 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 18-60
Steady State Temperature: 89.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	84.8	89.2	-4.4	-600
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.1	89.2	-15.1	-1,258
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	75.0	89.2	-14.2	-1,426
EAST	Door C11	7.2	8.0	57.4	0.448	75.0	89.2	-14.2	-365
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	85.0	89.2	-4.2	-583
SOUTH	Door C10	7.2	8.0	57.4	0.448	85.0	89.2	-4.2	-108
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	71.9	89.2	-17.3	-2,054
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	104.0	89.2	14.8	910
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	104.0	89.2	14.8	1,046
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	89.2	-21.2	-789
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	84.7	89.2	-4.5	-1,965
					TOTAL TRANSMISSION LOAD =				-7,193

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	103,424
TOTAL ROOM SENSIBLE LOAD:					**96,731**
SUPPLIMENTAL AIR HANDLING UNIT:	Not credited in consideration of room temp				**0**
NET ROOM SENSIBLE LOAD:					**96,731**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
Flow Rate (cfm)	626	2678
Temperature, °F	84.8	56.8

Total flow = 3,303 cfm
Supply air temperature: 62.1 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	62.1	) + (	96,731	/(1.08 x	3,303	) =	89.2 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200	400
TOTAL ROOM LATENT LOAD:			**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
Flow Rate (cfm)	626	2678
Humidity ratio	0.0085	0.0084

Total flow = 3,303 cfm
Wr ' = 0.0084 # moist / # dry air
Wr = 0.0084 + 400 /(4840 x 3,303) = 0.0084

STEADY STATE ROOM CONDITIONS: 89.2 °F dry bulb, 29 % RH

This page replaced by Revision 016.

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2304 cfm (Supply from AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 75.0 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	75.0	-7.0	-294
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	75.0	-7.0	-329
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	75.0	-7.0	-154
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	104.0	75.0	29.0	1,872
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	104.0	75.0	29.0	357
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	89.2	75.0	14.2	1,411
WEST	Door C11	8.0	7.2	57.6	0.448	89.2	75.0	14.2	366
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	71.9	75.0	-3.1	-95
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	75.0	-7.0	-359
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	75.0	35.0	21,072
					TOTAL TRANSMISSION LOAD =				23,846

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	21,304
TOTAL ROOM SENSIBLE LOAD:					45,150

ROOM TEMPERATURE (Tr) = (Ts 56.8) + (Q 45,150 /(1.08 x CFM 2,304) = 74.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2304) = 0.0084

STEADY STATE ROOM CONDITIONS:	75.0 °F dry bulb 45 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 85.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	85.0	-17.0	-3,077
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	84.8	85.0	-0.2	-10
NORTH	Door C3	7.2	8.0	57.4	0.448	84.8	85.0	-0.2	-5
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	88.2	85.0	3.2	453
NORTH	Door C4	7.2	3.7	26.5	0.448	88.2	85.0	3.2	38
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	86.3	85.0	1.3	190
NORTH	Door C5	7.2	6.3	45.2	0.448	86.3	85.0	1.3	26
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	85.0	85.0	0.0	0
NORTH	Door C6	7.2	6.3	45.2	0.448	85.0	85.0	0.0	0
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	85.8	85.0	0.8	113
NORTH	Door C7	7.2	3.7	26.5	0.448	85.8	85.0	0.8	10
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	86.7	85.0	1.7	106
NORTH	Door C8	7.2	3.7	26.5	0.448	86.7	85.0	1.7	20
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	81.8	85.0	-3.2	-341
NORTH	Door C9	7.2	3.7	26.5	0.448	81.8	85.0	-3.2	-38
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	84.8	85.0	-0.2	-7
NORTH	Door C13	7.2	3.0	21.5	0.448	84.8	85.0	-0.2	-2
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	74.1	85.0	-10.9	-300
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	89.2	85.0	4.2	558
NORTH	Door C10	7.2	8.0	57.4	0.448	89.2	85.0	4.2	108
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	71.9	85.0	-13.1	-563
EAST	Door C12	7.2	3.0	21.5	0.448	71.9	85.0	-13.1	-126
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.3	85.0	-12.7	-546
WEST	Door C1	7.2	3.0	21.5	0.448	72.3	85.0	-12.7	-122
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	85.0	-17.0	-640
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	90.0	85.0	5.0	830
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	89.3	85.0	4.3	409
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	84.7	85.0	-0.3	-67
					TOTAL TRANSMISSION LOAD =				-2,983

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	29,076
TOTAL ROOM SENSIBLE LOAD:					**29,093**

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8.

Room	C4	C5	C8
Flow Rate (cfm)	2394	2520	873
Temperature, °F	86.3	85.0	81.8

Total flow = 5,787 cfm
Supply air temperature: 85.1 °F

		Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(	85.1	) + (	26,093	/(1.08 x	5,787	) =	89.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
Flow Rate (cfm)	2394	2520	873
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 5,787 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: **85.0 °F dry bulb**

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 626 cfm (Supply from AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 84.8 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	89.2	84.8	4.4	600
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	81.8	84.8	-3.0	-409
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	85.0	84.8	0.2	7
SOUTH	Door C13	7.2	3.0	21.5	0.448	85.0	84.8	0.2	2
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	84.8	19.2	293
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	104.0	84.8	19.2	110
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	84.8	-16.8	-160
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	74.1	84.8	-10.7	-1,293
					TOTAL TRANSMISSION LOAD =				-851

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	19,570
TOTAL ROOM SENSIBLE LOAD:					**18,970**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	56.8	) + (	18,970	/(1.08 x	626	) =	84.9 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 626) = **0.0085**

STEADY STATE ROOM CONDITIONS:	**84.8 °F dry bulb**
	33 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - N/A
Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: ATTIC (above C12)

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 74.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	89.2	74.1	15.1	1,258
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	81.8	74.1	7.7	642
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	85.0	74.1	10.9	300
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	74.1	29.9	279
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	104.0	74.1	29.9	105
FLOOR	692.0 - C12	11.0	33.3	366.3	0.330	84.8	74.1	10.7	1,293
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	84.7	74.1	10.6	1,184
					TOTAL TRANSMISSION LOAD =				5,061

STEADY STATE ROOM CONDITIONS: 74.1 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 72.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	83.5	72.3	11.2	307
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.3	-4.3	-1,122
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	84.8	72.3	12.5	1,406
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	85.0	72.3	12.7	546
EAST	Door C1	7.2	3.0	21.5	0.448	85.0	72.3	12.7	122
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.3	-4.3	-16
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		1,243

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							2,226

STEADY STATE ROOM CONDITIONS:	72.3 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 71.9 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	85.0	71.9	13.1	563
WEST	Door C12	7.2	3.0	21.5	0.448	85.0	71.9	13.1	126
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	71.9	-3.9	-1,018
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	89.2	71.9	17.3	2,054
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	75.0	71.9	3.1	85
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	71.9	-3.9	-15
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,796

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**2,779**

STEADY STATE ROOM CONDITIONS: 71.9 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 6691 cfm (Supply from AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 90.0 °F Design Rm Temp: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	110.0	90.0	20.0	6,277
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	91.3	90.0	1.3	228
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	104.0	90.0	14.0	430
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	104.0	90.0	14.0	306
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	104.0	90.0	14.0	249
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	104.0	90.0	14.0	2,971
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	104.0	90.0	14.0	793
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	104.0	90.0	14.0	793
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	89.3	90.0	-0.7	-40
EAST	Door C22	7.2	6.00	43.0	0.448	89.3	90.0	-0.7	-13
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	67.2	90.0	-22.8	-6,136
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	110.0	90.0	20.0	3,055
WEST	Door C20	7.3	3.50	25.6	0.448	110.0	90.0	20.0	229
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	91.3	90.0	1.3	75
WEST	Door C21	7.2	3.00	21.5	0.448	91.3	90.0	1.3	13
FLOOR	692.0' - C2, 18" Cl	[redacted]	[redacted]	989.0	0.305	84.8	90.0	-5.2	-1,569
FLOOR	692.0' - C3, 18" Cl	[redacted]	[redacted]	775.9	0.305	88.2	90.0	-1.8	-426
FLOOR	692.0' - C4, 18" Cl	[redacted]	[redacted]	842.5	0.305	86.3	90.0	-3.7	-951
FLOOR	692.0' - C5, 18" Cl	[redacted]	[redacted]	189.8	0.305	85.0	90.0	-5.0	-289
FLOOR	692.0' - C11, 18" Cl	[redacted]	[redacted]	544.0	0.305	85.0	90.0	-5.0	-830
CEILING	729.0 - C1, 18" Cl	[redacted]	[redacted]	3341.2	0.305	95.0	90.0	5.0	5,095
					TOTAL TRANSMISSION LOAD =				10,261

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	229,272
TOTAL ROOM SENSIBLE LOAD:					240,032

ROOM TEMPERATURE (Tr) = (Ts 56.8) + (Q 240,032 / (1.08 x CFM 6,691) = 90.0 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				400

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 400 / (4840 x 6,691) = 0.0084

STEADY STATE ROOM CONDITIONS:	90.0 °F dry bulb 28 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 89.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	84.7	89.3	-4.6	-260
EAST	Door C24	7.2	6.0	43.0	0.448	84.7	89.3	-4.6	-89
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	90.0	89.3	0.7	40
WEST	Door C22	7.2	6.0	43.0	0.448	90.0	89.3	0.7	13
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	110.0	89.3	20.7	3,596
SOUTH	Door C26	7.2	3.4	24.4	0.448	110.0	89.3	20.7	226
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	67.2	89.3	-22.1	-7,928
NORTH	Door C23	7.2	6.0	43.0	0.448	67.2	89.3	-22.1	-426
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	312.0	0.305	85.0	89.3	-4.3	-409
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	312.0	0.305	95.0	89.3	5.7	542
							TOTAL TRANSMISSION LOAD =		-4,694

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	5,638.0	X	3.413	X	100%	=	19,242
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								18,188

STEADY STATE ROOM CONDITIONS: 89.3 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity: 40-60
Steady State Temperature: 67.2 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	89.3	67.2	22.1	7,928
SOUTH	Door C23	7.2	6.0	43.0	0.448	89.3	67.2	22.1	426
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	67.2	36.8	1,185
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	104.0	67.2	36.8	5,419
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	84.7	67.2	17.5	5,682
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	90.0	67.2	22.8	7,403
FLOOR	692.0' - C5, 18" CI	[redacted]	[redacted]	765.9	0.376	85.0	67.2	17.8	5,126
FLOOR	692.0' - C6, 18" CI	[redacted]	[redacted]	526.1	0.376	85.8	67.2	18.6	3,680
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	1292.0	0.305	95.0	67.2	27.8	10,955
							TOTAL TRANSMISSION LOAD =		47,804

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	46,236
TOTAL ROOM SENSIBLE LOAD:					**94,540**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5367	8000	
Temperature, °F	56.8	63.5	(See below)

Total flow = 13,367 cfm
Supply air temperature: 60.8 °F

Note: Calculated temperature from the AIRCOOL program (see pg..30): 59.22 °F
Temperature rise due to motor (see Section 7.7): 2.6 °F
Supplemental AHU supply temperature : 60.82) + (2.63) = 61.85 °F

ROOM TEMPERATURE (Tr) = (Ts 60.8) + (Q 94,540 / (1.08 x CFM 13,367) = 67.3 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5,367	8,000	
Humidity ratio	0.0084	0.0080	← See pg. .30

Total flow = 13,367 cfm
Wr' = 0.0082 # moist / # dry air
Wr = 0.0082 + 400 / (4840 x 13,367) = **0.0082**

STEADY STATE ROOM CONDITIONS: **67.2 °F dry bulb**
58 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7583 cfm (Supply from AHU)
AHU Supply Air Temp: 56.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 84.7 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	110.0	84.7	25.3	8,744
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	85.2	84.7	0.5	88
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	84.7	19.3	670
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	104.0	84.7	19.3	414
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	104.0	84.7	19.3	351
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	104.0	84.7	19.3	3,061
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	104.0	84.7	19.3	3,498
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	67.2	84.7	-17.5	-5,887
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	89.3	84.7	4.6	260
WEST	Door C24	7.2	6.0	43.0	0.448	89.3	84.7	4.6	89
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	110.0	84.7	25.3	4,017
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	85.2	84.7	0.5	29
EAST	Door C25	7.2	3.0	21.5	0.448	85.2	84.7	0.5	5
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.376	85.8	84.7	1.1	95
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.376	85.0	84.7	0.3	67
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.376	86.7	84.7	2.0	283
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.376	81.8	84.7	-2.9	-654
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	74.1	84.7	-10.6	-1,184
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	89.2	84.7	4.5	1,965
CEILING	729.0 - C1, 18" Cl	[redacted]		3595.7	0.305	95.0	84.7	10.3	11,296
						TOTAL TRANSMISSION LOAD =			27,206

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250		=	250
ELECTRICAL LOAD					=	201,162
TOTAL ROOM SENSIBLE LOAD:						228,618

	Ts	Q	CFM
ROOM TEMPERATURE (Tr) = (	56.8) + (	228,618	/(1.08 x 7,583) = 84.7 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				200

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 7,583) = 0.0084

STEADY STATE ROOM CONDITIONS:	84.7 °F dry bulb 33 % RH

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 91.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	91.3	18.7	688
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	91.3	18.7	1,549
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	90.0	91.3	-1.3	-228
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	90.0	91.3	-1.3	-75
EAST	Door C21	7.2	3.0	21.5	0.448	90.0	91.3	-1.3	-13
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,921

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING (See page 45)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								2,904

STEADY STATE ROOM CONDITIONS:	91.3 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 85.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	85.2	24.8	913
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	85.2	24.8	2,054
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	84.7	85.2	-0.5	-88
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	84.7	85.2	-0.5	-34
WEST	Door C25	7.2	3.0	21.5	0.448	84.7	85.2	-0.5	-5
FLOOR (See Note)									
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	2,841

Note: No transmission through the flior & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

	PEOPLE	0	X	250			=	0
	LIGHTING (See page 46)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								3,824

STEADY STATE ROOM CONDITIONS:	85.2 °F dry bulb

NORMAL OPERATION (SUMMER CASE 1)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

ROOM	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2304	75.0	0.0084	19.4	172,800
COMMUNICATION ROOM (692.0' - C9)	3303	89.2	0.0084	27.9	294,628
MECHANICAL EQUIP. ROOM WEST (C1)	4572	83.5	0.0084	38.4	381,720
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	6691	90.0	0.0084	56.3	602,190
COMPUTER ROOM (708.0' - C3)	5367	67.2	0.0082	43.8	360,662
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7583	84.7	0.0084	63.7	642,238
OUTSIDE AIR	2420	95.0	0.0133	32.2	229,900
TOTAL	Vreturn = 32,239			281.7	2,684,138

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn:

Treturn =	83.3 °F

Return Air Humidity Ratio from EBR spaces:

Wreturn =	0.0087 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:06 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:06 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:06 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_1
DATE: 10-14-09
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	35.92
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	216.00	16119.50
Inlet Temperature (degrees F):	48.00	83.30
Outlet Temperature (degrees F):	53.44	51.48
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1830.63	10.13
Clean Pressure Drop (psi):	32.85	Not Calculated
Fouled Pressure Drop (psi):	39.28	Not Calculated
Velocity (ft/s and ft/min):	9.93	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 588721/ 540599/ 48122 Btu/hr
Average Overall Heat Transfer Coefficient: 7.13 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 51.48 deg F

This page is added by Rev.016

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:40 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:40 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:40 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_1
DATE: 10-14-09
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	57.57
Outlet Relative Humidity (%):	Not Required	76.27
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	48.00	67.20
Outlet Temperature (degrees F):	54.29	59.22
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	721.05	12.08
Clean Pressure Drop (psi):	2.11	Not Calculated
Fouled Pressure Drop (psi):	2.52	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 69442/ 69442/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 7.11 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 51.80 deg F

This page is added by Rev.016

NORMAL OPERATION (SUMMER CASE 2)

NORMAL OPERATION (SUMMER - CASE 2) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTIONS 6.9 & 7.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD IN PAGE 3 IN APPENDIX 11
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU RUNNING
- HEATERS 0-HTR-31-83 (SUPPLY AIR TO ROOMS @ EL. 692) AND 0-HTR-31-85 (COMPUTER ROOM) ARE RUNNING. THE PRELIMINARY ANALYSIS INDICATED THAT TEMPERATURE IN ROOM C3, EL. 708.0 WILL FALL BELOW THE TEMPERATURE SWITCHES SETPOINTTEMPERATURE OF 68 °F, THUS HE HEATER FOR COMPUTER ROOM WILL BE RUNNING. THE HEATR FOR EL.692 ARE CONSIDERED AS RUNNING FOR CONSERVATIVE PURPOSE.

This case conservatively maximizes the cooling capability of the EBR AHUs by modeling the maximum chilled water flow rate concurrent with minimum chilled water temperature. This case was performed to conservatively predict the maximum load on the chillers during normal summer time operation since this value is reported in the system description (Ref. 5.1) Table 9.6.

The EXCEL spreadsheet (see pg.41 to 63) and AIRCOOL models (see pg. 64 to 72) were iterated until the return mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equates to approximately Tr = 81.5°F (see pg.63) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$T_{Z(B-A)}$ = 46.48 °F (estimated air side outlet temperature for EBR AHU B-A based on the AIRCOOL model; see pg.69)

$T_{Z(A-A)}$ = 46.85 °F (estimated air side outlet temperature for EBR AHU A-A based on the AIRCOOL model; see pg.66)

Tz = 46.7 °F (calculated average air temperature just downstream of coil)

Δt = 6.1 °F (total air temperature rise thru AHU including fan/motor and steam injection temperature rise; see Section 7.4)

Ts = Tz + Δt = 52.8 °F

Since the computer room supplemental AHU is also credited in this normal cooling mode, an AIRCOOL model of this unit is included in this section (see pg.70 to 72). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet.

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 82.9 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (FT)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	82.9	-14.9	-626
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	82.9	-14.9	-700
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	82.9	-14.9	-343
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	104.0	82.9	21.1	1,200
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	82.9	21.1	357
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	85.0	82.9	2.1	209
EAST	Door C2	8.0	7.2	57.6	0.448	85.0	82.9	2.1	54
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.2	82.9	-10.7	-330
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	82.9	-14.9	-765
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	82.9	27.1	16,316
					TOTAL TRANSMISSION LOAD =				15,372

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	9,027
TOTAL ROOM SENSIBLE LOAD:					**24,400**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
Flow Rate (cfm)	3588	984
Temperature, °F	85.0	52.8

Total flow = 4,572 cfm
Supply air temperature: 78.1 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	78.1	) + (	24,400	/(1.08 x	4,572	) =	83.0 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
Flow Rate (cfm)	3588	984
Humidity ratio	0.0084	0.0084

Total flow = 4,572 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 82.9 °F dry bulb, 44 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 85.0 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	82.9	85.0	-2.1	-211
WEST	Door C2	7.2	8.0	57.6	0.448	82.9	85.0	-2.1	-54
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	88.2	85.0	3.2	703
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	85.4	85.0	0.4	20
SOUTH	Door C3	7.2	8.0	57.6	0.448	85.4	85.0	0.4	10
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.2	85.0	-12.8	-1,440
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	85.0	19.0	555
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	85.0	19.0	1,016
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	85.0	-17.0	-437
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	87.2	85.0	2.2	664
					TOTAL TRANSMISSION LOAD =				826

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,468
TOTAL ROOM SENSIBLE LOAD:					5,294

DUCT HTR (KW)	% Htr Opr	FLOW RATE	SUP. TEMP	HTR BTUR	SUPPLY TEMP
20 (See Sect. 7.6)	100	11,615	52.8	68260	58.2

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU	
Flow Rate (cfm)	3367	221	
Temperature, °F	85.4	58.2	(after heater)
Total flow =	3,588 cfm		
Supply air temperature:	83.7 °F		

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	83.7	) + (	5,294	/(1.08 x	3,588	) =	85.1 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
Flow Rate (cfm)	3367	221
Humidity ratio	0.0084	0.0084
Total flow =	3,588 cfm	
Wr =	0.0084 # moist / # dry air	

STEADY STATE ROOM CONDITIONS:	85.0 °F dry bulb
	33 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 85.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 88.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	87.2	88.2	-1.0	-220
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	85.0	88.2	-3.2	-703
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	85.4	88.2	-2.8	-396
SOUTH	Door C4	7.2	3.7	26.6	0.448	85.4	88.2	-2.8	-33
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	88.2	15.8	364
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	88.2	15.8	767
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	88.2	-20.2	-407
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	87.2	88.2	-1.0	-237
					TOTAL TRANSMISSION LOAD =				-865

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: 2,957

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	85.4	) + (	2,957	/(1.08 x	990	) =	88.2 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = 0.0084

STEADY STATE ROOM CONDITIONS:	88.2 °F dry bulb 30 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2394 cfm (Supply from the AHU)
AHU Supply Air Temp: 58.2 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 87.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	85.4	87.2	-1.8	-263
SOUTH	Door C5	7.2	6.3	45.2	0.448	85.4	87.2	-1.8	-36
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	87.2	16.8	1,307
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	85.7	87.2	-1.5	-330
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	88.2	87.2	1.0	220
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	87.2	-19.2	-421
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	87.2	87.2	0.0	0
					TOTAL TRANSMISSION LOAD =				476

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	74,642
TOTAL ROOM SENSIBLE LOAD:					**75,119**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	58.2	) + (	75,119	/(1.08 x	2,394	) =	87.3 °F

LATENT LOAD:			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2394) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**87.2 °F dry bulb**
	31 % RH

This page replaced by Revision 016.

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2520 cfm (Supply from the AHU)
AHU Supply Air Temp: 58.2 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 85.7 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	85.4	85.7	-0.3	-51
SOUTH	Door C6	7.2	6.3	45.2	0.448	85.4	85.7	-0.3	-6
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	85.7	18.3	1,164
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	85.7	18.3	450
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	85.6	85.7	-0.1	-22
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	87.2	85.7	1.5	330
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	85.7	-17.7	-440
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.376	63.9	85.7	-21.8	-6,278
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	87.2	85.7	1.5	87
					TOTAL TRANSMISSION LOAD =				-4,766

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 79,977
TOTAL ROOM SENSIBLE LOAD: 75,211

ROOM TEMPERATURE (Tr) = (Ts 58.2) + (Q 75,211) / (1.08 x CFM 2,520) = 85.8 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2520) = 0.0084

STEADY STATE ROOM CONDITIONS: 85.7 °F dry bulb, 32 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 85.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 85.6 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	85.4	85.6	-0.2	-28
SOUTH	Door C7	7.2	3.7	26.5	0.448	85.4	85.6	-0.2	-2
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	85.6	18.4	1,148
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	85.6	18.4	170
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	86.5	85.6	0.9	198
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	85.7	85.6	0.1	22
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	85.6	-17.6	-355
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	81.8	85.6	-3.8	-328
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.376	63.9	85.6	-21.7	-4,293
					TOTAL TRANSMISSION LOAD =				-3,469

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: 353

ROOM TEMPERATURE (Tr) = (Ts 85.4) + (Q 353 / (1.08 x CFM 990) = 85.7 °F

LATENT LOAD:
Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = 0.0084

STEADY STATE ROOM CONDITIONS:	85.6 °F dry bulb 32 % RH

NORMAL OPERATION (SUMMER CASE 2)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 85.4 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 86.5 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	85.4	86.5	-1.1	-69
SOUTH	Door C8	7.2	3.7	26.5	0.448	85.4	86.5	-1.1	-13
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	86.5	17.5	608
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	82.2	86.5	-4.3	-945
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	85.6	86.5	-0.9	-198
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	86.5	-18.5	-181
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	81.8	86.5	-4.7	-665
					TOTAL TRANSMISSION LOAD =				-1,462

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,041
TOTAL ROOM SENSIBLE LOAD:					579

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	85.4	) + (	579	/(1.08 x	440	) =	86.6 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = 0.0084

STEADY STATE ROOM CONDITIONS:	86.5 °F dry bulb 31 % RH

NORMAL OPERATION (SUMMER CASE 2)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 873 cfm (Supply from the AHU)
AHU Supply Air Temp: 58.2 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 82.2 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	85.4	82.2	3.2	341
SOUTH	Door C9	7.2	3.7	26.5	0.448	85.4	82.2	3.2	38
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	82.2	21.8	1,206
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	85.8	82.2	3.6	491
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.4	82.2	-8.8	-733
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	86.5	82.2	4.3	945
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	82.2	-14.2	-221
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	81.8	82.2	-0.4	-90
					TOTAL TRANSMISSION LOAD =				1,976

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0 X	250	=	0
ELECTRICAL LOAD			=	20,683
TOTAL ROOM SENSIBLE LOAD:				22,659

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(58.2	) + (	22,659	/(1.08 x	873	) =	82.2 °F

LATENT LOAD:

		Q latent
PEOPLE	0 X 200	0
TOTAL ROOM LATENT LOAD:		0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 873) = 0.0084

STEADY STATE ROOM CONDITIONS:	82.2 °F dry bulb 36 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 18-60
Steady State Temperature: 89.9 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	85.8	89.9	-4.1	-559
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.4	89.9	-16.5	-1,375
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	75.9	89.9	-14.0	-1,406
EAST	Door C11	7.2	8.0	57.4	0.448	75.9	89.9	-14.0	-360
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	85.4	89.9	-4.5	-625
SOUTH	Door C10	7.2	8.0	57.4	0.448	85.4	89.9	-4.5	-116
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	72.0	89.9	-17.9	-2,126
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	104.0	89.9	14.1	867
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	104.0	89.9	14.1	997
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	89.9	-21.9	-815
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	81.8	89.9	-8.1	-3,538
					TOTAL TRANSMISSION LOAD =				-9,055

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	103,424
TOTAL ROOM SENSIBLE LOAD:					**94,869**

SUPPLIMENTAL AIR HANDLING UNIT: Not credited in consideration of room temp **0**

NET ROOM SENSIBLE LOAD: **94,869**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU	
Flow Rate (cfm)	626	2678	
Temperature, °F	85.8	58.2	(See supply temperature for room C2)

Total flow = 3,303 cfm
Supply air temperature: 63.4 °F

ROOM TEMPERATURE (Tr) = (Ts 63.4) + (Q 94,869) / (1.08 x CFM 3,303) = 90.0 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
Flow Rate (cfm)	626	2678
Humidity ratio	0.0085	0.0084

Total flow = 3,303 cfm
Wr ' = 0.0084 # moist / # dry air
Wr = 0.0084 + 400 / (4840 x 3,303) = **0.0084**

STEADY STATE ROOM CONDITIONS: **89.9 °F dry bulb**
28 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2304 cfm (Supply from AHU)
AHU Supply Air Temp: 58.2 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 75.9 °F Design Rm Temp °F: 86

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	75.9	-7.9	-332
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	75.9	-7.9	-371
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	75.9	-7.9	-174
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	104.0	75.9	28.1	1,814
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	104.0	75.9	28.1	346
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	89.9	75.9	14.0	1,391
WEST	Door C11	8.0	7.2	57.6	0.448	89.9	75.9	14.0	361
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	72.0	75.9	-3.9	-120
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	75.9	-7.9	-405
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	110.0	75.9	34.1	20,531
					TOTAL TRANSMISSION LOAD =				23,040

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	21,304
TOTAL ROOM SENSIBLE LOAD:					**44,343**

ROOM TEMPERATURE (Tr) = (Ts 58.2) + (Q 44,343 / (1.08 x CFM 2,304) = 76.0 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2304) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**75.9 °F dry bulb**
	44 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 85.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	85.4	-17.4	-3,149
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	85.0	85.4	-0.4	-20
NORTH	Door C3	7.2	8.0	57.4	0.448	85.0	85.4	-0.4	-10
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	88.2	85.4	2.8	397
NORTH	Door C4	7.2	3.7	26.5	0.448	88.2	85.4	2.8	33
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	87.2	85.4	1.8	263
NORTH	Door C5	7.2	6.3	45.2	0.448	87.2	85.4	1.8	36
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	85.7	85.4	0.3	51
NORTH	Door C6	7.2	6.3	45.2	0.448	85.7	85.4	0.3	6
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	85.6	85.4	0.2	28
NORTH	Door C7	7.2	3.7	26.5	0.448	85.6	85.4	0.2	2
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	86.5	85.4	1.1	69
NORTH	Door C8	7.2	3.7	26.5	0.448	86.5	85.4	1.1	13
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	82.2	85.4	-3.2	-341
NORTH	Door C9	7.2	3.7	26.5	0.448	82.2	85.4	-3.2	-38
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	85.8	85.4	0.4	14
NORTH	Door C13	7.2	3.0	21.5	0.448	85.8	85.4	0.4	4
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	73.4	85.4	-12.0	-330
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	89.9	85.4	4.5	598
NORTH	Door C10	7.2	8.0	57.4	0.448	89.9	85.4	4.5	116
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	72.0	85.4	-13.4	-576
EAST	Door C12	7.2	3.0	21.5	0.448	72.0	85.4	-13.4	-129
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.2	85.4	-13.2	-568
WEST	Door C1	7.2	3.0	21.5	0.448	72.2	85.4	-13.2	-127
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	85.4	-17.4	-655
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	87.2	85.4	1.8	299
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	87.5	85.4	2.1	200
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	81.6	85.4	-3.6	-801
					TOTAL TRANSMISSION LOAD =				-4,617

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:					-1,709

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8.

Room	C4	C5	C8
Flow Rate (cfm)	2394	2520	873
Temperature, °F	87.2	85.7	82.2

Total flow = 5,787 cfm
Supply air temperature: 85.8 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	85.8	) + (	-1,709	/(1.08 x	5,787	) =	85.5 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
Flow Rate (cfm)	2394	2520	873
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 5,787 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 85.4 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 626 cfm (Supply from AHU)
AHU Supply Air Temp: 58.2 °F (See supply temperature for room C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 85.8 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	89.9	85.8	4.1	559
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	82.2	85.8	-3.6	-491
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	85.4	85.8	-0.4	-14
SOUTH	Door C13	7.2	3.0	21.5	0.448	85.4	85.8	-0.4	-4
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	85.8	18.2	278
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	104.0	85.8	18.2	104
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	85.8	-17.8	-170
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	73.4	85.8	-12.4	-1,499
					TOTAL TRANSMISSION LOAD =				-1,236

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	19,570
TOTAL ROOM SENSIBLE LOAD:					18,584

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	58.2	) + (	18,584	/(1.08 x	626	) =	85.7 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				200

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 200 / (4840 x 626) = 0.0085

STEADY STATE ROOM CONDITIONS:	85.8 °F dry bulb 32 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12)

Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 73.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	89.9	73.4	16.5	1,375
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	82.2	73.4	8.8	733
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	85.4	73.4	12.0	330
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	73.4	30.6	285
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	104.0	73.4	30.6	107
FLOOR	692.0 - C12	11.0	33.3	366.3	0.330	85.8	73.4	12.4	1,499
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	81.8	73.4	8.4	938
					TOTAL TRANSMISSION LOAD =				5,268

STEADY STATE ROOM CONDITIONS:	73.4 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 72.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	82.9	72.2	10.7	293
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.2	-4.2	-1,096
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	85.0	72.2	12.8	1,440
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	85.4	72.2	13.2	568
EAST	Door C1	7.2	3.0	21.5	0.448	85.4	72.2	13.2	127
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.2	-4.2	-16
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,316

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							2,299

STEADY STATE ROOM CONDITIONS: 72.2 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 72.0 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	85.4	72.0	13.4	576
WEST	Door C12	7.2	3.0	21.5	0.448	85.4	72.0	13.4	129
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.0	-4.0	-1,044
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	89.9	72.0	17.9	2,126
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	75.9	72.0	3.9	107
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.0	-4.0	-15
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,879

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							2,862

STEADY STATE ROOM CONDITIONS:	72.0 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 6691 cfm (Supply from AHU)
AHU Supply Air Temp: 52.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 87.2 °F Design Rm Temp: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	110.0	87.2	22.8	7,156
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	89.1	87.2	1.9	333
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	104.0	87.2	16.8	516
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	104.0	87.2	16.8	368
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	104.0	87.2	16.8	298
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	104.0	87.2	16.8	3,565
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	104.0	87.2	16.8	952
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	104.0	87.2	16.8	952
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	87.5	87.2	0.3	17
EAST	Door C22	7.2	6.00	43.0	0.448	87.5	87.2	0.3	6
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	63.9	87.2	-23.3	-6,271
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	110.0	87.2	22.8	3,482
WEST	Door C20	7.3	3.50	25.6	0.448	110.0	87.2	22.8	261
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	89.1	87.2	1.9	110
WEST	Door C21	7.2	3.00	21.5	0.448	89.1	87.2	1.9	18
FLOOR	692.0' - C2, 18" CI	[illegible]	[illegible]	989.0	0.305	85.0	87.2	-2.2	-664
FLOOR	692.0' - C3, 18" CI	[illegible]	[illegible]	775.9	0.305	88.2	87.2	1.0	237
FLOOR	692.0' - C4, 18" CI	[illegible]	[illegible]	842.5	0.305	87.2	87.2	0.0	0
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	189.8	0.305	85.7	87.2	-1.5	-87
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	544.0	0.305	85.4	87.2	-1.8	-299
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	3341.2	0.305	95.0	87.2	7.8	7,949
					TOTAL TRANSMISSION LOAD =				18,900

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	229,272
TOTAL ROOM SENSIBLE LOAD:					248,672

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	52.8	) + (	248,672	/(1.08 x	6,691	) =	87.2 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				400

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 400 / (4840 x 6,691) = 0.0084

STEADY STATE ROOM CONDITIONS:	87.2 °F dry bulb 31 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 87.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	81.8	87.5	-5.7	-322
EAST	Door C24	7.2	6.0	43.0	0.448	81.8	87.5	-5.7	-110
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	87.2	87.5	-0.3	-17
WEST	Door C22	7.2	6.0	43.0	0.448	87.2	87.5	-0.3	-6
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	110.0	87.5	22.5	3,909
SOUTH	Door C26	7.2	3.4	24.4	0.448	110.0	87.5	22.5	246
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	63.9	87.5	-23.6	-8,466
NORTH	Door C23	7.2	6.0	43.0	0.448	63.9	87.5	-23.6	-455
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	312.0	0.305	85.4	87.5	-2.1	-200
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	312.0	0.305	95.0	87.5	7.5	714
					TOTAL TRANSMISSION LOAD =				-4,707

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	5,638.0	X	3.413	X	100%	=	19,242
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								18,175

STEADY STATE ROOM CONDITIONS:	87.5 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity: 40-60
Steady State Temperature: 63.9 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	87.5	63.9	23.6	8,466
SOUTH	Door C23	7.2	6.0	43.0	0.448	87.5	63.9	23.6	455
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	63.9	40.1	1,292
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	104.0	63.9	40.1	5,905
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	81.8	63.9	17.9	5,812
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	87.2	63.9	23.3	7,565
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	765.9	0.376	85.7	63.9	21.8	6,278
FLOOR	692.0' - C6, 18" CI	[illegible]	[illegible]	526.1	0.376	85.6	63.9	21.7	4,293
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	1292.0	0.305	95.0	63.9	31.1	12,256
							TOTAL TRANSMISSION LOAD =		52,321

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	46,236
TOTAL ROOM SENSIBLE LOAD:					**99,057**

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.8)	100	5367	52.8	34130	58.7

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5367	8000	
Temperature, °F	58.7	56.17	(See below)

Total flow = 13,367 cfm
Supply air temperature: 57.2 °F

Note: Calculated temperature from the AIRCOOL program (see pg.7.9.33): 53.54 °F
Temperature rise due to motor (see Section 7.7): 2.63 °F
Supplemental AHU supply temperature : 53.54) + (2.63) = 56.17 °F

ROOM TEMPERATURE (Tr) = (Ts 57.2) + (Q 99,057 / (1.08 x CFM 13,367) = 64.0 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
Flow Rate (cfm)	5,367	8,000	
Humidity ratio	0.0084	0.0082	← See pg. 7.9.33

Total flow = 13,367 cfm
Wr' = 0.0083 # moist / # dry air
Wr = 0.0083 + 400 / (4840 x 13,367) = **0.0083**

STEADY STATE ROOM CONDITIONS: **63.9 °F dry bulb**
65 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7583 cfm (Supply from AHU)
AHU Supply Air Temp: 52.8 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 81.8 °F Design Rm Temperature: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	110.0	81.8	28.2	9,748
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	83.0	81.8	1.2	211
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	104.0	81.8	22.2	770
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	104.0	81.8	22.2	477
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	104.0	81.8	22.2	403
NORTH	713.0' - Ion, fltr rm, 36" CI	42.0	16.00	672.0	0.236	104.0	81.8	22.2	3,521
NORTH	713'-AB Gen Area, 36" CI	48.0	16.00	768.0	0.236	104.0	81.8	22.2	4,024
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	63.9	81.8	-17.9	-6,021
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	87.5	81.8	5.7	322
WEST	Door C24	7.2	6.0	43.0	0.448	87.5	81.8	5.7	110
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	110.0	81.8	28.2	4,477
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	83.0	81.8	1.2	70
EAST	Door C25	7.2	3.0	21.5	0.448	83.0	81.8	1.2	12
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.376	85.6	81.8	3.8	326
FLOOR	692.0' - C11, 18" CI	74.0	8.0	592.0	0.376	85.4	81.8	3.6	801
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.376	86.5	81.8	4.7	665
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.376	82.2	81.8	0.4	90
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	73.4	81.8	-8.4	-938
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.305	89.9	81.8	8.1	3,538
CEILING	729.0 - C1, 18" CI	[illegible]		3595.7	0.305	95.0	81.8	13.2	14,476
					TOTAL TRANSMISSION LOAD =				37,081

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	201,162
TOTAL ROOM SENSIBLE LOAD:					238,493

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	52.8	) + (	238,493	/(1.08 x	7,583	) =	81.9 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				200

ROOM HUMIDITY RATIO (Wr) =	0.0084	+	200 / (4840 x	7,583	) =	0.0084

STEADY STATE ROOM CONDITIONS:	81.8 °F dry bulb 36 % RH

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 89.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	89.1	20.9	769
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	89.1	20.9	1,731
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	87.2	89.1	-1.9	-333
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	87.2	89.1	-1.9	-110
EAST	Door C21	7.2	3.0	21.5	0.448	87.2	89.1	-1.9	-18
FLOOR (See Note)									
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		2,039

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING (See page 45)	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								3,022

STEADY STATE ROOM CONDITIONS:	89.1 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.1
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 83.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	110.0	83.0	27.0	994
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	110.0	83.0	27.0	2,237
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	81.8	83.0	-1.2	-211
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	81.8	83.0	-1.2	-81
WEST	Door C25	7.2	3.0	21.5	0.448	81.8	83.0	-1.2	-12
FLOOR (See Note)									
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	2,928

Note: No transmission through the filor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250			=	0
LIGHTING (See page 46)	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**3,911**

STEADY STATE ROOM CONDITIONS:	83.0 °F dry bulb

NORMAL OPERATION (SUMMER CASE 2)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2304	75.9	0.0084	19.4	174,874
COMMUNICATION ROOM (692.0' - C9)	3303	89.9	0.0084	27.9	296,940
MECHANICAL EQUIP. ROOM WEST (C1)	4572	82.9	0.0084	38.4	378,977
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	6691	87.2	0.0084	56.3	583,455
COMPUTER ROOM (708.0' - C3)	5367	63.9	0.0083	44.5	342,951
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7583	81.8	0.0084	63.7	620,249
OUTSIDE AIR	2420	95.0	0.0133	32.2	229,900
TOTAL	Vreturn = 32,239			282.3	2,627,346

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn:	Treturn = 81.5 °F
Return Air Humidity Ratio from EBR spaces:	Wreturn = 0.0088 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:44 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:44 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:44 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_2a
DATE: 10-14-09
PROCEDURE: EBR Normal

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	38.17
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	16119.50
Inlet Temperature (degrees F):	42.00	81.50
Outlet Temperature (degrees F):	48.17	46.85
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1911.05	10.11
Clean Pressure Drop (psi):	39.44	Not Calculated
Fouled Pressure Drop (psi):	47.17	Not Calculated
Velocity (ft/s and ft/min):	10.94	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 737426/ 589290/ 148137 Btu/hr
Average Overall Heat Transfer Coefficient: 7.40 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 46.85 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:57 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:57 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 1:21:57 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_2b
DATE: 10-14-09
PROCEDURE: EBR NORMAL

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	38.17
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	16119.50
Inlet Temperature (degrees F):	42.00	81.50
Outlet Temperature (degrees F):	46.79	46.48
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2387.41	10.11
Clean Pressure Drop (psi):	63.98	Not Calculated
Fouled Pressure Drop (psi):	76.50	Not Calculated
Velocity (ft/s and ft/min):	14.34	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 750625/ 595173/ 155452 Btu/hr
Average Overall Heat Transfer Coefficient: 7.52 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 46.48 deg F

This page is added by Rev.016

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:26 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:26 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:26 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_2
DATE: 10-14-09
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	65.47
Outlet Relative Humidity (%):	Not Required	94.99
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	42.00	63.90
Outlet Temperature (degrees F):	50.21	53.54
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	691.51	12.09
Clean Pressure Drop (psi):	2.13	Not Calculated
Fouled Pressure Drop (psi):	2.54	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 90725/ 90725/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 8.92 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 52.18 deg F

LOCA CONDITION (SUMMER CASE 1)

LOCA CONDITION (SUMMER - CASE 1) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MINIMUM CHILLED WATER FLOW RATES OF 216 GPM TO EACH EBR AHU
- MAXIMUM CHILLED WATER SUPPLY TEMPERATURE OF 48°F
- LOCA CONDITION INTERNAL (ELECTRICAL) LOAD IN PAGE 4 IN APPENDIX 11
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- STEAM INJECTION SYSTEM IN SERVICE (SEE SECTION 7.5)

This case conservatively minimizes the cooling capability of the EBR AHUs by modeling the minimum chilled water flow rate concurrent with maximum chilled water temperature. This case also conservatively maximizes the predicted room temperatures by assuming no concurrent LOOP. The EXCEL spreadsheet (see pg.74 to 96) and AIRCOOL models (see pg. 97 to 99) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equtes to approximately 88°F (see pg. 96) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

T_z = 51.6 °F (estimated air side outlet temperature for each EBR AHU based on the AIRCOOL model; see pg.99)

Δt = 6.1 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.5)

$T_s = T_z + \Delta t$ = 57.7 °F

Since the computer room supplemental AHUs are not safety-related and this case is predicting maximum LOCA room temperatures, these were not credited. For this scenario, the computer room is only cooled by air supplied by EBR AHUs as reflected in the spreadsheet.

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 85.8 °F Design Rm Temp °F: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	85.8	-17.8	-748
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	85.8	-17.8	-837
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	85.8	-17.8	-409
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	119.0	85.8	33.2	1,888
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	85.8	18.2	308
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	86.3	85.8	0.5	50
EAST	Door C2	8.0	7.2	57.6	0.448	86.3	85.8	0.5	13
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.3	85.8	-13.5	-416
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	85.8	-17.8	-914
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	85.8	34.2	20,591
					TOTAL TRANSMISSION LOAD =				19,526

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	9,027
TOTAL ROOM SENSIBLE LOAD:					28,554

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	3588	984
Temperature, °F	86.3	57.7

Total flow = 4,572 cfm
Supply air temperature: 80.1 °F

	Ts		Q	CFM		
ROOM TEMPERATURE (Tr) =	(80.1	) + (	28,554	/(1.08 x 4,572)	=	85.9 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	3588	984
Humidity ratio	0.0069	0.0069

Total flow = 4,572 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 85.8 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 86.3 °F Design Rm Temp °F: 83

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	85.8	86.3	-0.5	-50
WEST	Door C2	7.2	8.0	57.6	0.448	85.8	86.3	-0.5	-13
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	89.7	86.3	3.4	747
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	86.4	86.3	0.1	5
SOUTH	Door C3	7.2	8.0	57.6	0.448	86.4	86.3	0.1	3
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.3	86.3	-14.0	-1,575
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	86.3	17.7	517
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	86.3	17.7	946
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	86.3	-18.3	-471
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	93.7	86.3	7.4	2,232
					TOTAL TRANSMISSION LOAD =				2,342

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,468
TOTAL ROOM SENSIBLE LOAD:					6,809

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	3367	221
Temperature, °F	86.4	57.7

Total flow = 3,588 cfm
Supply air temperature: 84.6 °F

ROOM TEMPERATURE (Tr) = (Ts 84.6) + (Q 6,809 /(1.08 x CFM 3,588) = 86.4 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	3367	221
Humidity ratio	0.0069	0.0069

Total flow = 3,588 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 86.3 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 86.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 89.7 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	87.5	89.7	-2.2	-483
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	86.3	89.7	-3.4	-747
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	86.4	89.7	-3.3	-467
SOUTH	Door C4	7.2	3.7	26.6	0.448	86.4	89.7	-3.3	-39
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	89.7	14.3	330
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	89.7	14.3	695
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	89.7	-21.7	-438
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	93.7	89.7	4.0	947
					TOTAL TRANSMISSION LOAD =				-204

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					3,619

ROOM TEMPERATURE (Tr) = (Ts 86.4) + (Q 3,619 / (1.08 x CFM 990) = 89.8 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM CONDITIONS:	89.7 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,394 cfm (Supply from AHU)
AHU Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 87.5 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	86.4	87.5	-1.1	-161
SOUTH	Door C5	7.2	6.3	45.2	0.448	86.4	87.5	-1.1	-22
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	87.5	16.5	1,283
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	86.6	87.5	-0.9	-198
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	89.7	87.5	2.2	483
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	87.5	-19.5	-427
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	93.7	87.5	6.2	1,593
					TOTAL TRANSMISSION LOAD =				2,552

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0	X 250	=	0
	ELECTRICAL LOAD			=	74,642
TOTAL ROOM SENSIBLE LOAD:					**77,194**

ROOM TEMPERATURE (Tr) = (Ts 57.7) + (Q 77,194 / (1.08 x CFM 2,394)) = 87.6 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2394) = **0.0069**

STEADY STATE ROOM CONDITIONS: 87.5 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2,520 cfm (Supply from AHU)
AHU Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 86.6 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	86.4	86.6	-0.2	-34
SOUTH	Door C6	7.2	6.3	45.2	0.448	86.4	86.6	-0.2	-4
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	86.6	17.4	1,107
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	86.6	17.4	428
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	88.0	86.6	1.4	308
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	87.5	86.6	0.9	198
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	86.6	-18.6	-462
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	73.7	86.6	-12.9	-3,013
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	93.7	86.6	7.1	411
						TOTAL TRANSMISSION LOAD =			-1,062

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	79,977
TOTAL ROOM SENSIBLE LOAD:					78,915

ROOM TEMPERATURE (Tr) = (Ts 57.7) + (Q 78,915 / (1.08 x CFM 2,520) = 86.7 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2520) = 0.0069

STEADY STATE ROOM CONDITIONS: 86.6 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 86.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 88.0 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.6	311.3	0.455	86.4	88.0	-1.6	-227
SOUTH	Door C7	7.2	3.7	26.5	0.448	86.4	88.0	-1.6	-19
NORTH	692.0' - AB/A31, 42" CI	20.3	14.6	294.4	0.212	104.0	88.0	16.0	998
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	88.0	16.0	148
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	88.4	88.0	0.4	88
WEST	692.0' - C5, 8" RMW	33.3	14.6	482.9	0.455	86.6	88.0	-1.4	-308
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	88.0	-20.0	-403
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.305	88.4	88.0	0.4	28
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	73.7	88.0	-14.3	-2,295
					TOTAL TRANSMISSION LOAD =				-1,990

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					1,833

ROOM TEMPERATURE (Tr) = (Ts 86.4) + (Q 1,833 / (1.08 x CFM 990) = 88.1 °F

LATENT LOAD:

					Q latent
PEOPLE	0 X		200		0
TOTAL ROOM LATENT LOAD:					0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM CONDITIONS: 88.0 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 86.4 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 88.4 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	86.4	88.4	-2.0	-125
SOUTH	Door C8	7.2	3.7	26.5	0.448	86.4	88.4	-2.0	-24
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	88.4	15.6	542
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	82.9	88.4	-5.5	-1,208
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	88.0	88.4	-0.4	-88
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	88.4	-20.4	-200
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.305	88.4	88.4	0.0	0
						TOTAL TRANSMISSION LOAD =			-1,103

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,041
TOTAL ROOM SENSIBLE LOAD:					938

ROOM TEMPERATURE (Tr) = (Ts 86.4) + (Q 938 / CFM (1.08 x 440) = 88.4 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = 0.0069

STEADY STATE ROOM CONDITIONS:	88.4 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 873 cfm (Supply from AHU)
AHU Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 82.9 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.6	234.5	0.455	86.4	82.9	3.5	373
SOUTH	Door C9	7.2	3.7	26.6	0.448	86.4	82.9	3.5	42
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	82.9	21.1	1,168
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	85.7	82.9	2.8	382
EAST (ABOVE C12	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.1	82.9	-8.8	-733
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	88.4	82.9	5.5	1,208
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	82.9	-14.9	-232
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	88.4	82.9	5.5	1,005
					TOTAL TRANSMISSION LOAD =				3,213

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	0 X	250	=	0
	ELECTRICAL LOAD			=	20,683
TOTAL ROOM SENSIBLE LOAD:					23,895

ROOM TEMPERATURE (Tr) = (Ts 57.7) + (Q 23,895 / (1.08 x CFM 873) = 83.0 °F

LATENT LOAD:				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 873) = 0.0069

STEADY STATE ROOM CONDITIONS: 82.9 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 90.5 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	85.7	90.5	-4.8	-655
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	74.1	90.5	-16.4	-1,367
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	77.6	90.5	-12.9	-1,296
EAST	Door C11	7.2	8.0	57.4	0.448	77.6	90.5	-12.9	-331
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	86.4	90.5	-4.1	-569
SOUTH	Door C10	7.2	8.0	57.4	0.448	86.4	90.5	-4.1	-105
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	71.9	90.5	-18.6	-2,209
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	111.0	90.6	20.5	1,260
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	111.0	90.5	20.5	1,449
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	90.5	-22.5	-838
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	88.4	90.6	-2.1	-917
							TOTAL TRANSMISSION LOAD =		-5,577

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	103,424
TOTAL ROOM SENSIBLE LOAD:					98,348
SUPPLIMENTAL AIR HANDLING UNIT:					0
NET ROOM SENSIBLE LOAD:					98,348

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	626	2678
Temperature, °F	85.7	57.7

Total flow = 3,303 cfm
Supply air temperature: 63.0 °F

ROOM TEMPERATURE (Tr) = (Ts 63.0) + (Q 98,348 / (1.08 x CFM 3,303) = 90.6 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				400

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	626	2678
Humidity ratio	0.0070	0.0069

Total flow = 3,303 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 3,303) = 0.0069

STEADY STATE ROOM CONDITIONS: 90.5 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,304 cfm (Supply from AHU)
AHU Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 77.6 °F Design Rm Temp °F: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqf	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	77.6	-9.6	-403
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	77.6	-9.6	-451
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	77.6	-9.6	-211
NORTH	692.0' - AB/A27, 42" Cl	21.0	14.5	304.5	0.212	119.0	77.6	41.4	2,673
NORTH	692.0' - AB/A29, 42" Cl	4.0	14.5	58.0	0.212	111.0	77.6	33.4	411
WEST*	692.0' - C9, 36" Cl	33.0	14.5	420.9	0.236	90.6	77.6	12.9	1,281
WEST	Door C11	8.0	7.2	57.6	0.448	90.6	77.6	12.9	333
WEST	692.0' - Stair C2, 36" Cl	9.0	14.5	130.5	0.236	71.9	77.6	-5.7	-176
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	77.6	-9.6	-493
CEILING	708.0 - TB/T1, 18" Cl	42.0	47.0	1974.0	0.305	120.0	77.6	42.4	25,528
					TOTAL TRANSMISSION LOAD =				28,491

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LAOD				=	21,304
TOTAL ROOM SENSIBLE LOAD:					49,795

ROOM TEMPERATURE (Tr) = (Ts 57.7) + (Q 49,795 / (1.08 x CFM 2,304) = 77.7 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2304) = 0.0069

STEADY STATE ROOM CONDITIONS: 77.6 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 86.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	86.4	-18.4	-3,330
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	86.3	86.4	-0.1	-5
NORTH	Door C3	7.2	8.0	57.4	0.448	86.3	86.4	-0.1	-3
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	89.7	86.4	3.3	467
NORTH	Door C4	7.2	3.7	26.5	0.448	89.7	86.4	3.3	39
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	87.5	86.4	1.1	161
NORTH	Door C5	7.2	6.3	45.2	0.448	87.5	86.4	1.1	22
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	86.6	86.4	0.2	34
NORTH	Door C6	7.2	6.3	45.2	0.448	86.6	86.4	0.2	4
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	88.0	86.4	1.6	227
NORTH	Door C7	7.2	3.7	26.5	0.448	88.0	86.4	1.6	19
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	88.4	86.4	2.0	125
NORTH	Door C8	7.2	3.7	26.5	0.448	88.4	86.4	2.0	24
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	82.9	86.4	-3.5	-373
NORTH	Door C9	7.2	3.7	26.5	0.448	82.9	86.4	-3.5	-42
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	85.7	86.4	-0.7	-25
NORTH	Door C13	7.2	3.0	21.5	0.448	85.7	86.4	-0.7	-7
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	74.1	86.4	-12.3	-338
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	90.5	86.4	4.1	545
NORTH	Door C10	7.2	8.0	57.4	0.448	90.5	86.4	4.1	106
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	71.9	86.4	-14.5	-623
EAST	Door C12	7.2	3.0	21.5	0.448	71.9	86.4	-14.5	-140
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.3	86.4	-14.1	-606
WEST	Door C1	7.2	3.0	21.5	0.448	72.3	86.4	-14.1	-136
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	86.4	-18.4	-693
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	93.7	86.4	7.3	1,211
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.305	89.3	86.4	2.9	276
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.305	88.4	86.4	2.0	361
					TOTAL TRANSMISSION LOAD =				-2,700

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:					208

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2394	2520	873
Temperature, °F	87.5	86.6	82.9

Total flow = 5,787 cfm
Supply air temperature: 86.4 °F

		Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(	86.4	) + (	208	/(1.08 x	5,787)	=	86.4 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2394	2520	873
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 5,787 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 86.4 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 626 cfm (Supply from AHU)
AHU Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 85.7 °F Design Rm Temperature: 79

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	90.6	85.7	4.8	655
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	82.9	85.7	-2.8	-382
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.6	0.455	86.4	85.7	0.7	25
SOUTH	Door C13	7.2	3.0	21.6	0.448	86.4	85.7	0.7	7
NORTH	692.0' - AB/A31, 42" Cl	8.0	9.0	72.0	0.212	104.0	85.7	18.3	279
NORTH	692.0' - AB/A30, 42" Cl	3.0	9.0	27.0	0.212	111.0	85.7	25.3	145
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	85.7	-17.7	-169
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	74.1	85.7	-11.6	-1,402
					TOTAL TRANSMISSION LOAD =				-842

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:				
PEOPLE	1 X	250	=	250
ELECTRICAL LOAD			=	19,570
TOTAL ROOM SENSIBLE LOAD:				**18,978**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.7	) + (	18,978	/(1.08 x	626	) =	85.8 °F

				Q latent
LATENT LOAD:				
PEOPLE	1 X	200		200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 626) = **0.0070**

STEADY STATE ROOM CONDITIONS: 85.7 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 74.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	90.5	74.1	16.4	1,367
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	82.9	74.1	8.8	733
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	86.4	74.1	12.3	339
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	74.1	29.9	279
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	111.0	74.1	36.9	129
FLOOR	692.0' C12	11.0	33.3	366.3	0.330	85.7	74.1	11.6	1,402
CEILING	708.0' -C4, 16" CI	11.0	33.3	366.3	0.305	88.4	74.1	14.3	1,598
					TOTAL TRANSMISSION LOAD =				5,846

STEADY STATE ROOM CONDITIONS: 74.1 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 72.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	85.8	72.3	13.5	370
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.3	-4.3	-1,122
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	86.3	72.3	14.0	1,575
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	86.4	72.3	14.1	606
EAST	Door C1	7.2	3.0	21.5	0.448	86.4	72.3	14.1	136
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.3	-4.3	-16
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		1,548

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**2,531**

STEADY STATE ROOM CONDITIONS:	72.3 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 71.9 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	86.4	71.9	14.5	623
WEST	Door C12	7.2	3.0	21.5	0.448	86.4	71.9	14.5	140
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	71.9	-3.9	-1,018
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	90.5	71.9	18.6	2,209
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	77.6	71.9	5.7	156
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	71.9	-3.9	-15
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		2,096

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**3,078**

STEADY STATE ROOM CONDITIONS: 71.9 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 6,691 cfm
Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 93.7 °F Design Rm Temp: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	120.0	93.7	26.3	8,254
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	91.3	93.7	-2.4	-421
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	104.0	93.7	10.3	316
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	104.0	93.7	10.3	225
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	104.0	93.7	10.3	183
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	118.0	93.7	24.3	5,157
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	112.0	93.7	18.3	1,037
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	113.0	93.7	19.3	1,093
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	89.3	93.7	-4.4	-249
EAST	Door C22	7.2	6.00	43.0	0.448	89.3	93.7	-4.4	-85
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	73.7	93.7	-20.0	-5,383
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	120.0	93.7	26.3	4,017
WEST	Door C20	7.3	3.50	25.6	0.448	120.0	93.7	26.3	301
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	91.3	93.7	-2.4	-139
WEST	Door C21	7.2	3.00	21.5	0.448	91.3	93.7	-2.4	-23
FLOOR	692.0' - C2, 18" CI	[redacted]	[redacted]	989.0	0.305	86.3	93.7	-7.4	-2,232
FLOOR	692.0' - C3, 18" CI	[redacted]	[redacted]	775.9	0.305	89.7	93.7	-4.0	-947
FLOOR	692.0' - C4, 18" CI	[redacted]	[redacted]	842.5	0.305	87.5	93.7	-6.2	-1,593
FLOOR	692.0' - C5, 18" CI	[redacted]	[redacted]	189.8	0.305	86.6	93.7	-7.1	-411
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	544.0	0.305	86.4	93.7	-7.3	-1,211
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	3341.2	0.305	116.0	93.7	22.3	22,725
					TOTAL TRANSMISSION LOAD =				30,615

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
	PEOPLE	2 X	250	=	500
	ELECTRICAL LOAD			=	229,272
TOTAL ROOM SENSIBLE LOAD:					260,387

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.7	) + (	260,387	/(1.08 x	6,691)	=	93.7 °F

LATENT LOAD:

				Q latent
PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				400

Room humidity ratio Wr = 0.0069 + 400 / (4840 x 6,691) = 0.0069

STEADY STATE ROOM CONDITIONS: 93.7 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 89.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	88.4	89.3	-0.9	-51
EAST	Door C24	7.2	6.0	43.0	0.448	88.4	89.3	-0.9	-17
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	93.7	89.3	4.4	249
WEST	Door C22	7.2	6.0	43.0	0.448	93.7	89.3	4.4	85
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	120.0	89.3	30.7	5,333
SOUTH	Door C26	7.2	3.4	24.4	0.448	120.0	89.3	30.7	335
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	73.7	89.3	-15.6	-5,596
NORTH	Door C23	7.2	6.0	43.0	0.448	73.7	89.3	-15.6	-301
FLOOR	692.0' - C11, 18" CI			312.0	0.305	86.4	89.3	-2.9	-276
CEILING	729.0 - C1, 18" CI			312.0	0.305	116.0	89.3	26.7	2,541
					TOTAL TRANSMISSION LOAD =				2,302

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	Does not operate during this LOCA case(Computer Rm Supplement.Cooling)					=	0
	PEOPLE	0	X	250			=	0
	LIGHTING	5,638.0	X	3.413	X	100%	=	19,242
	EQUIPMENT	217.0	X	3.413	X	100%	=	741
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**22,285**

STEADY STATE ROOM CONDITIONS: 89.3 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 73.7 °F Design Rm Temp °F: 82

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	89.3	73.7	15.6	5,596
SOUTH	Door C23	7.2	6.0	43.0	0.448	89.3	73.7	15.6	301
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	73.7	30.3	976
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	118.0	73.7	44.3	6,524
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	88.4	73.7	14.7	4,773
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	93.7	73.7	20.0	6,494
FLOOR	692.0' - C5, 18" CI	[illegible]	[illegible]	765.9	0.305	86.6	73.7	12.9	3,013
FLOOR	692.0' - C6, 18" CI	[illegible]	[illegible]	526.1	0.305	88.0	73.7	14.3	2,295
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	1292.0	0.305	116.0	73.7	42.3	16,669
					TOTAL TRANSMISSION LOAD =				46,641

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	46,236
TOTAL ROOM SENSIBLE LOAD:					93,376

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	5367	0
Temperature, °F	57.7	0.0

Total flow = 5,367 cfm
Supply air temperature: 57.7 °F

ROOM TEMPERATURE (Tr) = Ts + Q / (1.08 x CFM) = 57.7 + 93,376 / (1.08 x 5,367) = 73.8 °F

LATENT LOAD:

				Q latent
PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				400

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	5,367.0	0.0
Humidity ratio	0.0069	0.0000

Total flow = 5,367 cfm
Wr' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 5,367) = 0.0069

STEADY STATE ROOM CONDITIONS: 73.7 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,583 cfm (Supply from AHU)
Supply Air Temp: 57.7 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 88.4 °F Design Rm Temperature: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	75.1	19.5	1464.5	0.236	120.0	88.4	31.6	10,921
SOUTH	708.0' - Stair C2, 8" Cl	18.0	19.5	351.0	0.500	85.2	88.4	-3.2	-562
NORTH	692.0' - AB/A31, 36" Cl	42.0	3.50	147.0	0.236	104.0	88.4	15.6	541
NORTH	692.0' - AB/A30, 36"Cl	26.0	3.50	91.0	0.236	111.0	88.4	22.6	485
NORTH	692.0' - AB/A29, 36" Cl	22.0	3.50	77.0	0.236	111.0	88.4	22.6	411
NORTH	713.0' - Ion, fltr rm, 36" Cl	42.0	16.00	672.0	0.236	118.0	88.4	29.6	4,694
NORTH	713'-AB Gen Area, 36" Cl	48.0	16.00	768.0	0.236	118.0	88.4	29.6	5,366
WEST	708.0' - C3, 8" Cl	34.5	19.5	672.8	0.500	73.7	88.4	-14.7	-4,945
WEST*	708.0' - C2, 8" Cl	8.0	19.5	113.0	0.500	89.3	88.4	0.9	51
WEST	Door C24	7.2	6.0	43.0	0.448	89.3	88.4	0.9	17
EAST	708.0' - TB/T1, 36" Cl	34.5	19.5	672.8	0.236	120.0	88.4	31.6	5,017
EAST*	Stair C2, 8" Cl	8.0	19.5	134.5	0.431	85.2	88.4	-3.2	-185
EAST	Door C25	7.2	3.0	21.6	0.448	85.2	88.4	-3.2	-31
FLOOR	692.0' - C6, 18" Cl	33.3	6.9	229.8	0.305	88.0	88.4	-0.4	-28
FLOOR	692.0' - C11, 18" Cl	74.0	8.0	592.0	0.305	86.4	88.4	-2.0	-361
FLOOR	692.0' - C7, 18" Cl	11.3	33.3	376.3	0.305	88.4	88.4	0.0	0
FLOOR	692.0' - C8, 18" Cl	18.0	33.3	599.4	0.305	82.9	88.4	-5.5	-1,005
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	74.1	88.4	-14.3	-1,598
FLOOR	692.0' - C9, 18" Cl	43.0	33.3	1431.9	0.305	90.5	88.4	2.1	917
CEILING	729.0 - C1, 18" Cl	[redacted]	[redacted]	3595.7	0.305	116.0	88.4	27.6	30,268
					TOTAL TRANSMISSION LOAD =				49,974

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:						
PEOPLE	1	X	250	=		250
ELECTRICAL LOAD				=		201,162
TOTAL ROOM SENSIBLE LOAD:						251,386

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	57.7 +	251,386 / (1.08 x	7,583) =	88.4 °F	

				Q latent
LATENT LOAD:				
PEOPLE	1 X	200		200
TOTAL ROOM LATENT LOAD:				200

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 7,583) = 0.0069

STEADY STATE ROOM CONDITIONS: 88.4 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 91.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	91.3	28.7	1,057
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	91.3	28.7	2,377
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	93.7	91.3	2.4	421
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	93.7	91.3	2.4	139
EAST	Door C21	7.2	3.0	21.5	0.448	93.7	91.3	2.4	23
FLOOR (See Note)	[redacted]								
CEILING (See	[redacted]								
					TOTAL TRANSMISSION LOAD =				4,017

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								5,000

STEADY STATE ROOM CONDITIONS:	91.3 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 85.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	85.2	34.8	1,281
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	85.2	34.8	2,883
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	88.4	85.2	3.2	562
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	88.4	85.2	3.2	215
WEST	Door C25	7.2	3.0	21.6	0.448	88.4	85.2	3.2	31
FLOOR (See Note)									
CEILING (See									
					TOTAL TRANSMISSION LOAD =				4,972

Note: No transmission through the flior & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**5,954**

STEADY STATE ROOM CONDITIONS: 85.2 °F dry bulb

LOCA CONDITION (SUMMER CASE 1)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,304	77.6	0.0069	15.9	178,790
COMMUNICATION ROOM (692.0' - C9)	3,303	90.5	0.0069	22.9	298,922
MECHANICAL EQUIP. ROOM WEST (C1)	4,572	85.8	0.0069	31.5	392,235
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	6,691	93.7	0.0069	46.3	626,947
COMPUTER ROOM (708.0' - C3)	5,367	73.7	0.0069	37.1	395,548
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7,583	88.4	0.0069	52.4	670,293
OUTSIDE AIR	3,000	95.0	0.0133	39.9	285,000
EXFILTRATION (for balancing purpose only)	-580				
TOTAL	Vreturn = 32,239			246.0	2,847,734

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 88.3 °F
Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0076 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:19 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:19 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:19 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_3
DATE: 10-14-09
PROCEDURE: EBR LOCA

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	26.78
Outlet Relative Humidity (%):	Not Required	93.93
Flow Rate (gpm and acfm):	216.00	16119.50
Inlet Temperature (degrees F):	48.00	88.30
Outlet Temperature (degrees F):	53.72	51.60
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1829.71	10.09
Clean Pressure Drop (psi):	32.84	Not Calculated
Fouled Pressure Drop (psi):	39.27	Not Calculated
Velocity (ft/s and ft/min):	9.93	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 618580/ 618580/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 6.70 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 49.96 deg F

This page is added by Rev.016

LOCA CONDITION (SUMMER CASE 2)

LOCA CONDITION (SUMMER - CASE 2) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- LOCA CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN PAGE 5 IN APPENDIX 11
- 95°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS RUNNING
- STEAM INJECTION SYSTEM IN SERVICE (SEE SECTION 7.5)

This case conservatively maximizes the cooling capability of the EBR AHUs by modeling the maximum chilled water flow rate concurrent with minimum chilled water temperature. This case was performed to conservatively predict the maximum load on the chillers during accident conditions since this value is reported in the system description (Ref. 5.1) Table 9.6.

The EXCEL spreadsheet (see pg.101 to 123) and AIRCOOL models (see pg.124 to 132) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were approximately equal. This equtes to approximately 83°F (see pg.123) which is significantly greater than the controller setpoint of 68°F. This simply means that the bypass damper will be fully closed and the entire air flow (with the exception of any leakage) will pass through the cooling coil of each EBR AHU. At this condition, the calculated mixed supply air temperature from the EBR AHU (Ts) is:

$T_{Z(B-A)}$ = 45.75 °F (estimated air side outlet temperature for EBR AHU B-A based on the AIRCOOL model; see pg.126)

$T_{Z(A-A)}$ = 46.18 °F (estimated air side outlet temperature for EBR AHU A-A based on the AIRCOOL model; see pg. 129)

Tz = 45.97 °F (calculated average air side outlet temperature for each EBR AHU)

Δt = 6.10 °F (total air temperature rise thru AHU including steam injection temperature rise; see Section 7.5)

Ts = Tz + Δt = 52.1 °F

Since the computer room supplemental AHUs are also credited in this LOCA cooling mode, an AIRCOOL model of one of these units is included in this section (see pg.130 to 132). This model was also iterated until the assumed entering air conditions used in the AIRCOOL model were approximately equal to the room temperature / humidity conditions computed in the speadsheet.

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 81.6 °F Design Rm Temp °F: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	68.0	81.6	-13.6	-571
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	81.6	-13.6	-639
NORTH	692.0' - Ground	23.0	NA	NA	1.000	68.0	81.6	-13.6	-313
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	119.0	81.6	37.4	2,127
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	104.0	81.6	22.4	379
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	81.4	81.6	-0.2	-20
EAST	Door C2	8.0	7.2	57.6	0.448	81.4	81.6	-0.2	-5
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	72.2	81.6	-9.4	-290
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	81.6	-13.6	-698
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	81.6	38.4	23,119
					TOTAL TRANSMISSION LOAD =				23,089

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:				
PEOPLE	0 X	250	=	0
ELECTRICAL LOAD			=	9,027
TOTAL ROOM SENSIBLE LOAD:				**32,117**

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	3588	984
Temperature, °F	81.4	52.1

Total flow = 4,572 cfm
Supply air temperature: 75.1 °F

ROOM TEMPERATURE (Tr) = (Ts 75.1) + (Q 32,117 / CFM (1.08 x 4,572)) = 81.6 °F

LATENT LOAD: Q latent

PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	3588	984
Humidity ratio	0.0069	0.0069

Total flow = 4,572 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 81.6 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 81.4 °F Design Rm Temp °F: 83

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	81.6	81.4	0.2	20
WEST	Door C2	7.2	8.0	57.6	0.448	81.6	81.4	0.2	5
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	84.8	81.4	3.4	747
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	81.3	81.4	-0.1	-5
SOUTH	Door C3	7.2	8.0	57.6	0.448	81.3	81.4	-0.1	-3
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	72.2	81.4	-9.2	-1,035
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	104.0	81.4	22.6	661
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	104.0	81.4	22.6	1,208
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	68.0	81.4	-13.4	-345
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.305	89.0	81.4	7.6	2,293
					TOTAL TRANSMISSION LOAD =				3,546

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:					
PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	4,468
TOTAL ROOM SENSIBLE LOAD:					**8,014**

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	3367	221
Temperature, °F	81.3	52.1

Total flow = 3,588 cfm
Supply air temperature: 79.5 °F

ROOM TEMPERATURE (Tr) = (Ts 79.5) + (Q 8,014 / CFM (1.08 x 3,588) = 81.6 °F

LATENT LOAD: Q latent

PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	3367	221
Humidity ratio	0.0069	0.0069

Total flow = 3,588 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 81.4 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 81.3 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 84.8 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	82.1	84.8	-2.7	-593
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	81.4	84.8	-3.4	-747
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	81.3	84.8	-3.5	-496
SOUTH	Door C4	7.2	3.7	26.6	0.448	81.3	84.8	-3.5	-42
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	104.0	84.8	19.2	443
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	104.0	84.8	19.2	933
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	84.8	-16.8	-339
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	89.0	84.8	4.2	994
					TOTAL TRANSMISSION LOAD =				153

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
PEOPLE 0 X 250 = 0
ELECTRICAL LOAD = 3,823
TOTAL ROOM SENSIBLE LOAD: 3,975

ROOM TEMPERATURE (Tr) = (Ts 81.3) + (Q 3,975 / (1.08 x CFM 990) = 85.0 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS: 84.8 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,394 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 82.1 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	81.3	82.1	-0.8	-117
SOUTH	Door C5	7.2	6.3	45.2	0.448	81.3	82.1	-0.8	-16
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	104.0	82.1	21.9	1,703
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	80.9	82.1	-1.2	-264
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	84.8	82.1	2.7	593
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	68.0	82.1	-14.1	-309
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	89.0	82.1	6.9	1,773
					TOTAL TRANSMISSION LOAD =				3,364

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	74,642
TOTAL ROOM SENSIBLE LOAD:					**78,006**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 78,006 / (1.08 x CFM 2,394) = 82.2 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2394) = **0.0069**

STEADY STATE ROOM CONDITIONS: 82.1 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 2,520 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 80.9 °F Design Rm Temp °F: 85

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	81.3	80.9	0.4	68
SOUTH	Door C6	7.2	6.3	45.2	0.448	81.3	80.9	0.4	8
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	104.0	80.9	23.1	1,470
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	104.0	80.9	23.1	568
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	82.6	80.9	1.7	373
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	82.1	80.9	1.2	264
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	68.0	80.9	-12.9	-321
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	62.6	80.9	-18.3	-4,275
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	89.0	80.9	8.1	469
					TOTAL TRANSMISSION LOAD =				-1,376

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	79,977
TOTAL ROOM SENSIBLE LOAD:					**78,601**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 78,601 / (1.08 x CFM 2,520) = 80.9 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2520) = **0.0069**

STEADY STATE ROOM CONDITIONS: 80.9 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 81.3 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 82.6 °F Design Rm Temp °F: 88

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	81.3	82.6	-1.3	-184
SOUTH	Door C7	7.2	3.7	26.5	0.448	81.3	82.6	-1.3	-15
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	104.0	82.6	21.4	1,335
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	104.0	82.6	21.4	197
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	83.4	82.6	0.8	176
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	80.9	82.6	-1.7	-373
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	68.0	82.6	-14.6	-295
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.305	83.7	82.6	1.1	77
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	62.6	82.6	-20.0	-3,209
					TOTAL TRANSMISSION LOAD =				-2,291

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	3,823
TOTAL ROOM SENSIBLE LOAD:					1,531

ROOM TEMPERATURE (Tr) = (Ts 81.3) + (Q 1,531 / (1.08 x CFM 990) = 82.7 °F

LATENT LOAD:

				Q latent
PEOPLE	0 X	200		0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = **0.0069**

STEADY STATE ROOM CONDITIONS:	**82.6 °F dry bulb**

LOCA CONDITION (SUMMER CASE 2)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 81.3 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 83.4 °F Design Rm Temp °F: 90

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.5	137.3	0.455	81.3	83.4	-2.1	-131
SOUTH	Door C8	7.2	3.7	26.5	0.448	81.3	83.4	-2.1	-25
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	104.0	83.4	20.6	716
EAST	692.0' - C8, 8" RMW	33.3	14.5	482.9	0.455	78.0	83.4	-5.4	-1,186
WEST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	82.6	83.4	-0.8	-176
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	68.0	83.4	-15.4	-151
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.305	83.7	83.4	0.3	34
					TOTAL TRANSMISSION LOAD =				-919

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250	=	0
ELECTRICAL LOAD				=	2,041
TOTAL ROOM SENSIBLE LOAD:					**1,122**

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	81.3	) + (	1,122	/(1.08 x	440	) =	83.7 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = **0.0069**

STEADY STATE ROOM CONDITIONS:	**83.4 °F dry bulb**

LOCA CONDITION (SUMMER CASE 2)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 873 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 78.0 °F Design Rm Temp °F: 74

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	81.3	78.0	3.3	352
SOUTH	Door C9	7.2	3.7	26.5	0.448	81.3	78.0	3.3	39
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	104.0	78.0	26.0	1,439
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	80.9	78.0	2.9	395
EAST (ABOVE C12	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.4	78.0	-4.6	-383
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	83.4	78.0	5.4	1,186
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	68.0	78.0	-10.0	-156
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	83.7	78.0	5.7	1,042
					TOTAL TRANSMISSION LOAD =				3,915

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X 250	=	0
ELECTRICAL LOAD			=	20,683
TOTAL ROOM SENSIBLE LOAD:				**24,597**

	Ts	Q	CFM	
ROOM TEMPERATURE (Tr) =	(52.1)	+ (24,597	/(1.08 x 873) =	78.2 °F

LATENT LOAD:

		Q latent
PEOPLE	0 X 200	0
TOTAL ROOM LATENT LOAD:		**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 873) = **0.0069**

STEADY STATE ROOM CONDITIONS: 78.0 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 85.6 °F Design Rm Temp °F: 88

# WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	80.9	85.6	-4.7	-641
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	73.4	85.6	-12.2	-1,017
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	73.5	85.6	-12.1	-1,215
EAST	Door C11	7.2	8.0	57.4	0.448	73.5	85.6	-12.1	-311
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	81.3	85.6	-4.3	-597
SOUTH	Door C10	7.2	8.0	57.4	0.448	81.3	85.6	-4.3	-110
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	72.0	85.6	-13.6	-1,615
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	111.0	85.6	25.4	1,562
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	111.0	85.6	25.4	1,796
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	68.0	85.6	-17.6	-655
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	83.7	85.6	-1.9	-830
					TOTAL TRANSMISSION LOAD =				-3,634

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	103,424
TOTAL ROOM SENSIBLE LOAD:					**100,290**

SUPPLIMENTAL AIR HANDLING UNIT: **0**

NET ROOM SENSIBLE LOAD: **100,290**

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	626	2678
Temperature, °F	80.9	52.1

Total flow = 3,303 cfm
Supply air temperature: 57.5 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	57.5	) + (	100,290	/(1.08 x	3,303	) =	85.6 °F

LATENT LOAD: Q latent

PEOPLE	2 X	200		400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	626	2678
Humidity ratio	0.0070	0.0069

Total flow = 3,303 cfm
Wr ' = 0.0069 # moist / # dry air
Wr = 0.0069 + 400 / (4840 x 3,303) = 0.0069

STEADY STATE ROOM CONDITIONS: 85.6 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,304 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 73.5 °F Design Rm Temp °F: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sq	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	68.0	73.5	-5.5	-231
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	68.0	73.5	-5.5	-259
NORTH	692.0' - Ground	22.0	NA	NA	1.000	68.0	73.5	-5.5	-121
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	119.0	73.5	45.5	2,937
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	111.0	73.5	37.5	461
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	85.6	73.5	12.1	1,202
WEST	Door C11	8.0	7.2	57.6	0.448	85.6	73.5	12.1	312
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	72.0	73.5	-1.5	-46
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	68.0	73.5	-5.5	-282
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.305	120.0	73.5	46.5	27,996
					TOTAL TRANSMISSION LOAD =				31,970

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL						
PEOPLE	0	X	250		=	0
ELECTRICAL LAOD					=	21,304
TOTAL ROOM SENSIBLE LOAD:						**53,274**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 53,274 / (1.08 x CFM 2,304) = 73.5 °F

LATENT LOAD:

					Q latent
PEOPLE	0 X		200		0
TOTAL ROOM LATENT LOAD:					**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2304) = **0.0069**

STEADY STATE ROOM CONDITIONS: 73.5 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 81.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	68.0	81.3	-13.3	-2,407
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	81.4	81.3	0.1	5
NORTH	Door C3	7.2	8.0	57.4	0.448	81.4	81.3	0.1	3
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	84.8	81.3	3.5	496
NORTH	Door C4	7.2	3.7	26.5	0.448	84.8	81.3	3.5	42
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	82.1	81.3	0.8	117
NORTH	Door C5	7.2	6.3	45.2	0.448	82.1	81.3	0.8	16
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	80.9	81.3	-0.4	-68
NORTH	Door C6	7.2	6.3	45.2	0.448	80.9	81.3	-0.4	-8
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	82.6	81.3	1.3	184
NORTH	Door C7	7.2	3.7	26.5	0.448	82.6	81.3	1.3	15
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	83.4	81.3	2.1	131
NORTH	Door C8	7.2	3.7	26.5	0.448	83.4	81.3	2.1	25
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	78.0	81.3	-3.3	-352
NORTH	Door C9	7.2	3.7	26.5	0.448	78.0	81.3	-3.3	-39
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	80.9	81.3	-0.4	-14
NORTH	Door C13	7.2	3.0	21.5	0.448	80.9	81.3	-0.4	-4
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	73.4	81.3	-7.9	-217
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	85.6	81.3	4.3	571
NORTH	Door C10	7.2	8.0	57.4	0.448	85.6	81.3	4.3	110
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	72.0	81.3	-9.3	-400
EAST	Door C12	7.2	3.0	21.5	0.448	72.0	81.3	-9.3	-90
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	72.2	81.3	-9.1	-391
WEST	Door C1	7.2	3.0	21.5	0.448	72.2	81.3	-9.1	-88
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	68.0	81.3	-13.3	-501
CEILING	708.0' - C1, 18" Cl	68.0	8.0	544.0	0.305	89.0	81.3	7.7	1,278
CEILING	708.0' - C2, 18" Cl	39.0	8.0	312.0	0.305	87.5	81.3	6.2	590
CEILING	708.0 - C4, 18" Cl	74.0	8.0	592.0	0.305	83.7	81.3	2.4	433
					TOTAL TRANSMISSION LOAD =				-562

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:						
	PEOPLE	0	X	250	=	0
	ELECTRICAL LOAD				=	2,908
TOTAL ROOM SENSIBLE LOAD:						2,346

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2394	2520	873
Temperature, °F	82.1	80.9	78.0

Total flow = 5,787 cfm
Supply air temperature: 81.0 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	81.0	) + (	2,346	/(1.08 x	5,787	) =	81.3 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2394	2520	873
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 5,787 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 81.3 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 626 cfm (Supply from AHU)
AHU Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 80.9 °F Design Rm Temperature: 79

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	85.6	80.9	4.7	641
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	78.0	80.9	-2.9	-395
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	81.3	80.9	0.4	14
SOUTH	Door C13	7.2	3.0	21.5	0.448	81.3	80.9	0.4	4
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	104.0	80.9	23.1	353
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	111.0	80.9	30.1	172
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	68.0	80.9	-12.9	-123
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	73.4	80.9	-7.5	-907
					TOTAL TRANSMISSION LOAD =				-241

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	19,570
TOTAL ROOM SENSIBLE LOAD:					**19,579**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 19,579 / (1.08 x CFM 626) = 81.0 °F

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 200 / (4840 x 626) = **0.0070**

STEADY STATE ROOM CONDITIONS: 80.9 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 73.4 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	85.6	73.4	12.2	1,017
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	78.0	73.4	4.6	383
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	81.3	73.4	7.9	217
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	104.0	73.4	30.6	285
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	111.0	73.4	37.6	132
FLOOR	692.0' C12	11.0	33.3	366.3	0.330	80.9	73.4	7.5	907
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	83.7	73.4	10.3	1,151
					TOTAL TRANSMISSION LOAD =				4,092

STEADY STATE ROOM CONDITIONS: 73.4 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 72.2 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	81.6	72.2	9.4	257
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.2	-4.2	-1,096
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	81.4	72.2	9.2	1,035
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	81.3	72.2	9.1	391
EAST	Door C1	7.2	3.0	21.5	0.448	81.3	72.2	9.1	88
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.2	-4.2	-16
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	659

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**1,642**

STEADY STATE ROOM CONDITIONS: 72.2 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 72.0 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	81.3	72.0	9.3	400
WEST	Door C12	7.2	3.0	21.5	0.448	81.3	72.0	9.3	90
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	68.0	72.0	-4.0	-1,044
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	85.6	72.0	13.6	1,615
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	73.5	72.0	1.5	41
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	68.0	72.0	-4.0	-15
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,087

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**2,070**

STEADY STATE ROOM CONDITIONS: 72.0 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 6,691 cfm
Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 89.0 °F Design Rm Temp: 89

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	68.2	19.50	1329.9	0.236	120.0	89.0	31.0	9,730
SOUTH	708.0' - Stair C1, 8" CI	18.0	19.50	351.0	0.500	89.1	89.0	0.1	18
NORTH	676.0' - AB/A2, 36" CI	37.2	3.50	130.2	0.236	104.0	89.0	15.0	461
NORTH	692.0' - AB/A3, 36" CI	26.5	3.50	92.8	0.236	104.0	89.0	15.0	328
NORTH	692.0' - AB/A5, 36" CI	21.5	3.50	75.3	0.236	104.0	89.0	15.0	266
NORTH	713.0' - Gen.area, 36" CI	56.2	16.00	899.2	0.236	118.0	89.0	29.0	6,154
NORTH	713'- A25, 36" CI	15.0	16.00	240.0	0.236	112.0	89.0	23.0	1,303
NORTH	713'- A26, 36" CI	15.0	16.00	240.0	0.236	113.0	89.0	24.0	1,359
EAST*	708.0' - C2, 8" CI	8.0	19.50	113.0	0.500	87.5	89.0	-1.5	-85
EAST	Door C22	7.2	6.00	43.0	0.448	87.5	89.0	-1.5	-29
EAST	708.0' - C3, 8" CI	34.5	19.50	538.3	0.500	62.6	89.0	-26.4	-7,105
WEST*	708.0' - TB/T1, 36" CI	34.5	19.50	647.2	0.236	120.0	89.0	31.0	4,735
WEST	Door C20	7.3	3.50	25.6	0.448	120.0	89.0	31.0	355
WEST*	Stair C1, 8" CI	8.0	19.50	134.5	0.431	89.1	89.0	0.1	6
WEST	Door C21	7.2	3.00	21.5	0.448	89.1	89.0	0.1	1
FLOOR	692.0' - C2, 18" CI	[redacted]	[redacted]	989.0	0.305	81.4	89.0	-7.6	-2,293
FLOOR	692.0' - C3, 18" CI	[redacted]	[redacted]	775.9	0.305	84.8	89.0	-4.2	-994
FLOOR	692.0' - C4, 18" CI	[redacted]	[redacted]	842.5	0.305	82.1	89.0	-6.9	-1,773
FLOOR	692.0' - C5, 18" CI	[redacted]	[redacted]	189.8	0.305	80.9	89.0	-8.1	-469
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	544.0	0.305	81.3	89.0	-7.7	-1,278
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	3341.2	0.305	116.0	89.0	27.0	27,515
					TOTAL TRANSMISSION LOAD =				38,206

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	229,272
TOTAL ROOM SENSIBLE LOAD:					**267,977**

ROOM TEMPERATURE (Tr) = (Ts 52.1) + (Q 267,977 / (1.08 x CFM 6,691) = 89.1 °F

LATENT LOAD:

PEOPLE	2	X	200	Q latent 400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr): 0.0069 + 400 / (4840 x 6,691) = **0.0069**

STEADY STATE ROOM CONDITIONS: 89.0 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 87.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	83.7	87.5	-3.8	-215
EAST	Door C24	7.2	6.0	43.0	0.448	83.7	87.5	-3.8	-73
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	89.0	87.5	1.5	85
WEST	Door C22	7.2	6.0	43.0	0.448	89.0	87.5	1.5	29
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	120.0	87.5	32.5	5,646
SOUTH	Door C26	7.2	3.4	24.4	0.448	120.0	87.5	32.5	355
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	62.6	87.5	-24.9	-8,933
NORTH	Door C23	7.2	6.0	43.0	0.448	62.6	87.5	-24.9	-480
FLOOR	692.0' - C11, 18" CI	[illegible]	[illegible]	312.0	0.305	81.3	87.5	-6.2	-590
CEILING	729.0 - C1, 18" CI	[illegible]	[illegible]	312.0	0.305	116.0	87.5	28.5	2,712
					TOTAL TRANSMISSION LOAD =				-1,464

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	7.5 HP	1,066.5	X	3.413	MOTOR IN, MACH OUT			3,640
	PEOPLE	0	X	250			=	0
	LIGHTING	5,638.0	X	3.413	X	100%	=	19,242
	EQUIPMENT	217.0	X	3.413	X	100%	=	741
	CABLE TRAYS	0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**22,159**

STEADY STATE ROOM CONDITIONS:	87.5 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 62.6 °F Design Rm Temp °F: 82

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	87.5	62.6	24.9	8,933
SOUTH	Door C23	7.2	6.0	43.0	0.448	87.5	62.6	24.9	480
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	104.0	62.6	41.4	1,334
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	118.0	62.6	55.4	8,158
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	83.7	62.6	21.1	6,851
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	89.0	62.6	26.4	8,571
FLOOR	692.0' - C5, 18" CI			765.9	0.305	80.9	62.6	18.3	4,275
FLOOR	692.0' - C6, 18" CI			526.1	0.305	82.6	62.6	20.0	3,209
CEILING	729.0 - C1, 18" CI			1292.0	0.305	116.0	62.6	53.4	21,043
					TOTAL TRANSMISSION LOAD =				62,854

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	2	X	250	=	500
ELECTRICAL LOAD				=	46,236
TOTAL ROOM SENSIBLE LOAD:					**109,590**

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)	
cfm	5367	8000	(See below)
Temperature, °F	52.1	57.1	

Total flow = 13,367 cfm
Supply air temperature: 55.0 °F

Note: Calculated temperature from the AIRCOOL program (see pg.7.11.33): 54.42 °F
Temperature rise due to motor (see Section 7.7): 2.63 °F
Supplemental AHU supply temperature : (54.42) + (2.63) = 57.05 °F

ROOM TEMPERATURE (Tr) = Ts 55.0 + Q 109,590 / (1.08 x CFM 13,367) = 62.6 °F

LATENT LOAD: Q latent

PEOPLE	2	X	200	400
TOTAL ROOM LATENT LOAD:				**400**

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)	
cfm	5,367	8,000	
Humidity ratio	0.0069	0.0060	← See pg. 7.11.33

Total flow = 13,367 cfm
Wr' = 0.0064 # moist / # dry air
Wr = 0.0064 + 400 / (4840 x 13,367) = **0.0064**

STEADY STATE ROOM CONDITIONS: 62.6 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 7,583 cfm (Supply from AHU)
AHU A1654Supply Air Temp: 52.1 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 83.7 °F Design Rm Temperature: 87

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	120.0	83.7	36.3	12,546
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	83.0	83.7	-0.7	-123
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	104.0	83.7	20.3	704
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	111.0	83.7	27.3	586
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	111.0	83.7	27.3	496
NORTH	713.0' - Ion, fltr rm, 36" CI	42.0	16.50	693.0	0.236	118.0	83.7	34.3	5,610
NORTH	713'-AB Gen Area, 36" CI	48.0	16.50	792.0	0.236	118.0	83.7	34.3	6,411
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	62.6	83.7	-21.1	-7,098
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	87.5	83.7	3.8	215
WEST	Door C24	7.2	6.0	43.0	0.448	87.5	83.7	3.8	73
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	120.0	83.7	36.3	5,763
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	83.0	83.7	-0.7	-41
EAST	Door C25	7.2	3.0	21.5	0.448	83.0	83.7	-0.7	-7
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.305	82.6	83.7	-1.1	-77
FLOOR	692.0' - C11, 18" CI	74.0	8.0	592.0	0.305	81.3	83.7	-2.4	-433
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.305	83.4	83.7	-0.3	-34
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.305	78.0	83.7	-5.7	-1,042
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	73.4	83.7	-10.3	-1,151
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.305	85.6	83.7	1.9	830
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	3595.7	0.305	116.0	83.7	32.3	35,423
							TOTAL TRANSMISSION LOAD =		58,651

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	1	X	250	=	250
ELECTRICAL LOAD				=	201,162
TOTAL ROOM SENSIBLE LOAD:					**260,064**

	Ts		Q		CFM			
ROOM TEMPERATURE (Tr) =	51.2	+	260,064	/ (1.08 x	7,583	) =	83.8 °F	

LATENT LOAD:

				Q latent
PEOPLE	1	X	200	200
TOTAL ROOM LATENT LOAD:				**200**

ROOM HUMIDITY RATIO (Wr) =	0.0069	+	200	/ (4840 x	7,583	) =	**0.0069**

STEADY STATE ROOM CONDITIONS: 83.7 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 89.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	89.1	30.9	1,138
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	89.1	30.9	2,560
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	89.0	89.1	-0.1	-18
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	89.0	89.1	-0.1	-6
EAST	Door C21	7.2	3.0	21.5	0.448	89.0	89.1	-0.1	-1
FLOOR (See Note)									
CEILING (See									
					TOTAL TRANSMISSION LOAD =				3,673

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:								
	PEOPLE	0	X	250			=	0
	LIGHTING	288.0	X	3.413	X	100%	=	983
	EQUIPMENT	0.0	X	3.413	X	100%	=	0
	CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:								**4,656**

STEADY STATE ROOM CONDITIONS: 89.1 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.2
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 83.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	120.0	83.0	37.0	1,362
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	120.0	83.0	37.0	3,065
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	83.7	83.0	0.7	123
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	83.7	83.0	0.7	47
WEST	Door C25	7.2	3.0	21.5	0.448	83.7	83.0	0.7	7
FLOOR (See Note)									
CEILING (See									
								TOTAL TRANSMISSION LOAD =	4,604

Note: No transmission through the filor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

PEOPLE	0	X	250			=	0
LIGHTING	288.0	X	3.413	X	100%	=	983
EQUIPMENT	0.0	X	3.413	X	100%	=	0
CABLE TRAYS	0.0	X	3.413	X	100%	=	0
TOTAL ROOM SENSIBLE LOAD:							**5,587**

STEADY STATE ROOM CONDITIONS: 83.0 °F dry bulb

LOCA CONDITION (SUMMER CASE 2)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,304	73.5	0.0069	15.9	169,344
COMMUNICATION ROOM (692.0' - C9)	3,303	85.6	0.0069	22.9	282,737
MECHANICAL EQUIP. ROOM WEST (C1)	4,572	81.6	0.0069	31.5	373,034
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	6,691	89.0	0.0069	46.3	595,499
COMPUTER ROOM (708.0' - C3)	5,367	62.6	0.0064	34.2	335,974
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	7,583	83.7	0.0069	52.4	634,655
OUTSIDE AIR	3,000	95.0	0.0133	39.9	285,000
EXFILTRATION (for balancing purpose only)	-580				
TOTAL	Vreturn = 32,239			243.0	2,676,244

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 83.0 °F
Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0075 # MOIST / # DRY AIR

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:42 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:42 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:50:42 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_4a
DATE: 10-14-09
PROCEDURE: EBR LOCA

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	31.37
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	16119.50
Inlet Temperature (degrees F):	42.00	83.00
Outlet Temperature (degrees F):	46.53	45.75
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2384.78	10.10
Clean Pressure Drop (psi):	63.99	Not Calculated
Fouled Pressure Drop (psi):	76.52	Not Calculated
Velocity (ft/s and ft/min):	14.34	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 709757/ 632199/ 77558 Btu/hr
Average Overall Heat Transfer Coefficient: 7.30 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 45.75 deg F

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:03 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:03 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:03 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_4b
DATE: 10-14-09
PROCEDURE: EBR LOCA

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	31.37
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	16119.50
Inlet Temperature (degrees F):	42.00	83.00
Outlet Temperature (degrees F):	47.82	46.18
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1908.53	10.11
Clean Pressure Drop (psi):	39.46	Not Calculated
Fouled Pressure Drop (psi):	47.19	Not Calculated
Velocity (ft/s and ft/min):	10.94	460.56

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 694480/ 625212/ 69268 Btu/hr
Average Overall Heat Transfer Coefficient: 7.08 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 46.18 deg F

This page is added by Rev.016

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:51 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	3	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	1	
Coil Type (serpentine):	Half	
Length of Finned Tubes Exposed to Air Flow (in.):	60.000	
Number of Tubes per Row:	20	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Copper	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0100	
Number of Fins per Inch:	8.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:51 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: COMPRO~1.AIR
Unit Name: COMPROOM
Unit Description: Computer Room Cooling

This report was created on: Wednesday, October 14, 2009 at 12:52:51 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_4
DATE: 10-14-09
PROCEDURE: CompRmSupplment

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	52.82
Outlet Relative Humidity (%):	Not Required	71.62
Flow Rate (gpm and acfm):	22.00	8000.00
Inlet Temperature (degrees F):	42.00	62.60
Outlet Temperature (degrees F):	48.72	54.14
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	684.28	12.11
Clean Pressure Drop (psi):	2.13	Not Calculated
Fouled Pressure Drop (psi):	2.54	Not Calculated
Velocity (ft/s and ft/min):	3.24	640.00

Air Flow Zones: 1
Air Flow Percentage: 100.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 74241/ 74241/ 0 Btu/hr
Average Overall Heat Transfer Coefficient: 7.05 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 815.92 sq ft
Dew Point Temperature: 45.22 deg F

This page is added by Rev.016

NORMAL OPERATION (WINTER)

NORMAL OPERATION (WINTER) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- ACTUAL CHILLED WATER FLOW RATES AS SHOWN ON DWG. 1-47W865-7 (REF. 5.41)
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- NORMAL OPERATION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN PAGE 6 IN APPENDIX 11
- 60°F PRESSURIZING AIR
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- LATENT LOADS DUE TO PERSONNEL CONSERVATIVELY NOT CONSIDERED

This case conservatively evaluates the cooling capability of the EBR AHUs by modeling the minimum chilled water temperature. Since the normal summertime Case 2 (discussed in Section 5.2, Appendix 11) already considered concurrently both minimum chilled water temperature and maximum chilled water flow in an effort to maximize the chiller load, this combination was not run in the spreadsheet below. Increasing the chilled water flows to 10% would only slightly reduce the room temperatures beyond what has been computed below.

The EXCEL spreadsheet (pg.134 to 156) and AIRCOOL models (pg.157) were iterated until the mixed air temperature (both dry bulb and wet bulb) to the AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL models were both equal to 68°F. In order to achieve this condition, the following non-safety related heaters (see Section 7.6) were credited as running @ 100% capacity: 0-HTR-31-83, 1-HTR-31-87 & 2-HTR-21-89. It is recognized that control of these heaters is via local thermostats, but it is reasonable to credit their operation on order to maintain comfortable temperatures (i.e., greater that 64°F). (Note)

Note: The AIRCOOL model was not re-run for this case and the final mixing temperature was obtained by extrapolation with using current data.

Iterations between the speadsheet and AIRCOOL indicated that full flow through the coils would not exist during this winter time condition because the mixed return air temperature would be greater than the controller setpoint of 68°F. Therefore, the bypass damper would modulate open to a throttled position. An additional spreadsheet was developed on the previous Rev. 13 which accounts for various bypass flow rates in computing a mixed off-coil temperature. This same speadsheet was utilized in Rev. 14 with the following modifications:

1) The controller setpoint was changed from 75°F to 68°F
2) The total flow rate through each AHU was changed to 20,020.5 cfm to agree with the flow rates as shown on the simplified flow diagram Appendix 3

Otherwise, the equations remained unchanged. The results indicate approximately 36,000 cfm of the total flow will continue to flow through the coils (see pg.157).

Calculated EBR AHU supply temperature Ts:

Tz = 47.6 °F (resulting mixed air AIRCOIL temperature upstream the fans; see this section, pg. 157)
q = 98435 Btuh (see Section 7.2)
Q = 20,020.5 cfm (See Appendix 3; one fan only)
Δt = 0.45 °F (steam injection temperature rise; see Section 7.2 & 7.4)

$Ts = Tz + \Delta t + q / (1.08 \times Q) =$ 52.6 °F

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 67.8 °F Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	50.0	67.8	-17.8	-748
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	67.8	-17.8	-837
NORTH	692.0' - Ground	23.0	NA	NA	1.000	50.0	67.8	-17.8	-409
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	60.0	67.8	-7.8	-444
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	60.0	67.8	-7.8	-132
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	74.1	67.8	6.3	626
EAST	Door C2	8.0	7.2	57.6	0.448	74.1	67.8	6.3	163
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	58.7	67.8	-9.1	-280
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	67.8	-17.8	-914
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	50.0	67.8	-17.8	-13,212
					TOTAL TRANSMISSION LOAD =				-16,186

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 4,918

TOTAL INTERNAL: 4,918

Total Sensible Load = (Trans + Other Sensible) = -16,186 + 4918 = -11,268

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	4922.5	1298
Temperature, °F	74.1	52.6

Total flow = 6,221 cfm
Supply air temperature: 69.6 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	69.6	) + (	-11,268	/(1.08 x	6,221	) =	67.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	4922.5	1298
Humidity ratio	0.0084	0.0084

Total flow = 6,221 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 67.8 °F dry bulb
58 % RH

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 20-60
Steady State Temperature: 74.1 °F Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.5	425.3	0.236	67.8	74.1	-6.3	-632
WEST	Door C2	7.2	8.0	57.6	0.448	67.8	74.1	-6.3	-163
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	75.7	74.1	1.6	352
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.456	75.7	74.1	1.6	82
SOUTH	Door C3	7.2	8.0	57.6	0.448	75.7	74.1	1.6	41
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	58.7	74.1	-15.4	-1,732
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	60.0	74.1	-14.1	-412
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	60.0	74.1	-14.1	-754
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	50.0	74.1	-24.1	-620
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.378	73.2	74.1	-0.9	-336
					TOTAL TRANSMISSION LOAD =				-4,173

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	1,826
TOTAL INTERNAL:	**1,826**

Total Sensible Load = (Trans + Other Sensible) = -4,173 + 1826 = -2,347

DUCT HTR (KW)	% Htr Opr	FLOW RATE	SUP. TEMP	HTR BTUR	SUPPLY TEMP
20 (See Sect. 7.6)	100	14,196	52.6	68260	57.1

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	4653	269.5
Temperature, °F	75.7	57.1

Total flow = 4,923 cfm
Supply air temperature: 74.7 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	74.7	) + (	-2,347	/(1.08 x	4,923	) =	74.2 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	4653	269.5
Humidity ratio	0.0084	0.0084

Total flow = 4,923 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 74.1 °F dry bulb, 47 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 75.7 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 75.7 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	78.3	75.7	2.6	571
WEST	692.0' - C2, 8" RMW	33.3	14.5	482.9	0.455	74.1	75.7	-1.6	-352
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	75.7	75.7	0.0	0
SOUTH	Door C4	7.2	3.7	26.6	0.448	75.7	75.7	0.0	0
NORTH	676.0' - AB/A2, 42" CI	7.5	14.5	108.8	0.212	60.0	75.7	-15.7	-362
NORTH	692.0' - AB/A3, 42" CI	15.8	14.5	229.1	0.212	60.0	75.7	-15.7	-763
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	75.7	-25.7	-518
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.376	73.2	75.7	-2.5	-729
							TOTAL TRANSMISSION LOAD =		-2,153

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	2,061
TOTAL INTERNAL:	**2,061**

Total Sensible Load = (Trans + Other Sensible) = -2,153 + 2061 = -91

ROOM TEMPERATURE (Tr) = (Ts 75.7) + (Q -91) / (1.08 x CFM 990) = 75.6 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = 0.0084

STEADY STATE ROOM CONDITIONS:	**75.7 °F dry bulb**
	44 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,926 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 78.3 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	75.7	78.3	-2.6	-381
SOUTH	Door C5	7.2	6.3	45.2	0.448	75.7	78.3	-2.6	-53
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	60.0	78.3	-18.3	-1,423
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	77.9	78.3	-0.4	-88
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	75.7	78.3	-2.6	-571
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	50.0	78.3	-28.3	-620
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.376	73.2	78.3	-5.1	-1,616
					TOTAL TRANSMISSION LOAD =				-4,751

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	72,001
TOTAL INTERNAL:	72,001

Total Sensible Load = (Trans + Other Sensible) = -4,751 + 72001 = **67,250**

ROOM TEMPERATURE (Tr) = Ts 57.1 | Q 67,250 / (1.08 x CFM 2926) = 78.4 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2926) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**78.3 °F dry bulb**
	41 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 3,080 cfm
Supply Air Temp: 57.1 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 77.9 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	75.7	77.9	-2.2	-371
SOUTH	Door C6	7.2	6.3	45.2	0.448	75.7	77.9	-2.2	-45
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	60.0	77.9	-17.9	-1,139
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	60.0	77.9	-17.9	-440
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	74.4	77.9	-3.5	-769
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	78.3	77.9	0.4	88
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	50.0	77.9	-27.9	-693
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	59.6	77.9	-18.3	-4,275
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.376	73.2	77.9	-4.7	-336
							TOTAL TRANSMISSION LOAD =		-7,980

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 77,335

TOTAL INTERNAL: 77,335

Total Sensible Load = (Trans + Other Sensible) = -7,980 + 77335 = 69,355

	Ts	Q		CFM		
ROOM TEMPERATURE (Tr) =	57.1	69,355	/ (1.08 x	3080	) =	77.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 3080) = 0.0084

STEADY STATE ROOM CONDITIONS:	77.9 °F dry bulb
	41 % RH

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 75.7 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 74.4 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.5	311.3	0.455	75.7	74.4	1.3	184
SOUTH	Door C7	7.2	3.7	26.6	0.448	75.7	74.4	1.3	16
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	60.0	74.4	-14.4	-899
NORTH	676.0' - AB/A3, 42" CI	3.0	14.5	43.5	0.212	60.0	74.4	-14.4	-133
EAST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.2	74.4	-0.2	-44
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	77.9	74.4	3.5	769
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	74.4	-24.4	-492
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	69.2	74.4	-5.2	-449
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	59.6	74.4	-14.8	-2,375
					TOTAL TRANSMISSION LOAD =				-3,423

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	2,061
TOTAL INTERNAL:	**2,061**

Total Sensible Load = (Trans + Other Sensible) = -3,423 + 2061 = **-1,362**

ROOM TEMPERATURE (Tr) = (Ts 75.7) + (Q -1,362 / (1.08 x CFM 990) = 74.4 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 990) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**74.4 °F dry bulb** **46 % RH**

NORMAL OPERATION (WINTER)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 75.7 °F
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 18-60
Steady State Temperature: 74.2 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.6	137.3	0.455	75.7	74.2	1.5	94
SOUTH	Door C8	7.2	3.7	26.6	0.448	75.7	74.2	1.5	18
NORTH	692.0' - AB/A31, 42" CI	11.3	14.6	163.9	0.212	60.0	74.2	-14.2	-493
EAST	692.0' - C8, 8" RMW	33.3	14.6	482.9	0.455	71.7	74.2	-2.6	-549
WEST	692.0' - C6, 8" RMW	33.3	14.6	482.9	0.455	74.4	74.2	0.2	44
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	50.0	74.2	-24.2	-237
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	69.2	74.2	-5.0	-707
					TOTAL TRANSMISSION LOAD =				-1,831

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	1,160
TOTAL INTERNAL:	**1,160**

Total Sensible Load = (Trans + Other Sensible) = -1,831 + 1160 = **-671**

ROOM TEMPERATURE (Tr) = (Ts 75.7) + (Q -671 / (1.08 x CFM 440) = 74.3 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 440) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**74.2 °F dry bulb**
	47 % RH

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NORMAL OPERATION (WINTER)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 1,067 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 26-60
Steady State Temperature: 71.7 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.456	75.7	71.7	4.0	427
SOUTH	Door C9	7.2	3.7	26.6	0.448	75.7	71.7	4.0	48
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	60.0	71.7	-11.7	-647
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	75.0	71.7	3.3	450
EAST (ABOVE C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	70.3	71.7	-1.4	-117
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	74.2	71.7	2.5	549
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	50.0	71.7	-21.7	-338
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.376	69.2	71.7	-2.5	-563
					TOTAL TRANSMISSION LOAD =				-192

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	17,147
TOTAL INTERNAL:	17,147

Total Sensible Load = (Trans + Other Sensible) = -192 + 17147 = 16,955

ROOM TEMPERATURE (Tr) = Ts 57.1 + Q 16,955 / (1.08 x CFM 1,067) = 71.8 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 1,067) = 0.0084

STEADY STATE ROOM CONDITIONS:	71.7 °F dry bulb 51 % RH

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: 18-60
Steady State Temperature: 78.6 °F Design Rm Temp °F: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	75.0	78.6	-3.6	-491
WEST (ATTIC C12)	692.0' - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	70.3	78.6	-8.3	-692
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	60.2	78.6	-18.4	-1,848
EAST	Door C11	7.2	8.0	57.4	0.448	60.2	78.6	-18.4	-473
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	75.7	78.6	-2.9	-403
SOUTH	Door C10	7.2	8.0	57.4	0.448	75.7	78.6	-2.9	-75
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	58.8	78.6	-19.8	-2,351
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	60.0	78.6	-18.6	-1,144
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	60.0	78.6	-18.6	-1,315
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	50.0	78.6	-28.6	-1,085
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.376	69.2	78.6	-9.4	-5,061
							TOTAL TRANSMISSION LOAD =		-14,916

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 94,032

TOTAL ROOM SENSIBLE LOAD: 94,032

SUPPLEMENTAL AIR HANDLING UNIT: 0

TOTAL INTERNAL: 94,032

Total Sensible Load = (Trans + Other Sensible) = -14,916 + 94032 = 79,116

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU	
cfm	764.5	3273	
Temperature, °F	75.0	57.1	(See supply temperature for room 692.0'-C2)

Total flow = 4,038 cfm
Supply air temperature: 60.5 °F

ROOM TEMPERATURE (Tr) = (Ts 60.5) + (Q 79,116 / (1.08 x CFM 4,038) = 78.6 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	764.5	3273
Humidity ratio	0.0084	0.0084

Total flow = 4,038 cfm
Wr ' = 0.0084 # moist / # dry air
Wr = 0.0084 + 0 / (4840 x 4,038) = 0.0084

STEADY STATE ROOM CONDITIONS: 78.6 °F dry bulb
40 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,816 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 20-60
Steady State Temperature: 60.2 °F Design Rm Temp °F: 73

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	50.0	60.2	-10.2	-428
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	60.2	-10.2	-479
NORTH	692.0' - Ground	22.0	NA	NA	1.000	50.0	60.2	-10.2	-224
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	60.0	60.2	-0.2	-13
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	60.0	60.2	-0.2	-2
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	78.6	60.2	18.4	1,828
WEST	Door C11	8.0	7.2	57.6	0.448	78.6	60.2	18.4	476
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	58.8	60.2	-1.4	-43
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	60.2	-10.2	-524
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	50.0	60.2	-10.2	-7,571
							TOTAL TRANSMISSION LOAD =		-8,982

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	16,608
TOTAL INTERNAL:	**16,608**

Total Sensible Load = (Trans + Other Sensible) = -6,982 + 16608 = **9,625**

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	57.1	9,625 / (1.08 x	2816	) =	60.3 °F

LATENT LOAD:

			Q latent
PEOPLE	0 X	200	0
TOTAL ROOM LATENT LOAD:			**0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 2816) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**60.2 °F dry bulb**
	76 % RH

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity %: NA
Steady State Temperature: 75.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	50.0	75.7	-25.7	-4,652
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	74.1	75.7	-1.6	-82
NORTH	Door C3	7.2	8.0	57.4	0.448	74.1	75.7	-1.6	-41
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	75.7	75.7	0.0	0
NORTH	Door C4	7.2	3.7	26.5	0.448	75.7	75.7	0.0	0
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	78.3	75.7	2.6	381
NORTH	Door C5	7.2	6.3	45.2	0.448	78.3	75.7	2.6	53
NORTH*	692.0' - C5, 8" RMW	28.7	14.5	371.0	0.455	77.9	75.7	2.2	371
NORTH	Door C6	7.2	6.3	45.2	0.448	77.9	75.7	2.2	45
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	74.4	75.7	-1.3	-184
NORTH	Door C7	7.2	3.7	26.5	0.448	74.4	75.7	-1.3	-15
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	74.2	75.7	-1.5	-94
NORTH	Door C8	7.2	3.7	26.5	0.448	74.2	75.7	-1.5	-18
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	71.7	75.7	-4.0	-427
NORTH	Door C9	7.2	3.7	26.5	0.448	71.7	75.7	-4.0	-48
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	75.0	75.7	-0.7	-25
NORTH	Door C13	7.2	3.0	21.5	0.448	75.0	75.7	-0.7	-7
NORTH	Attic (Above C12)	11.0	5.5	60.5	0.455	70.3	75.7	-5.4	-149
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	78.6	75.7	2.9	385
NORTH	Door C10	7.2	8.0	57.4	0.448	78.6	75.7	2.9	75
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	58.8	75.7	-16.9	-727
EAST	Door C12	7.2	3.0	21.5	0.448	58.8	75.7	-16.9	-163
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	58.7	75.7	-17.0	-731
WEST	Door C1	7.2	3.0	21.5	0.448	58.7	75.7	-17.0	-164
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	50.0	75.7	-25.7	-968
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.376	73.2	75.7	-2.5	-511
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.376	65.7	75.7	-10.0	-1,173
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	69.2	75.7	-6.5	-1,447
					TOTAL TRANSMISSION LOAD =				-10,314

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

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NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	485
TOTAL INTERNAL:	485

Total Sensible Load = (Trans + Other Sensible) = -10,314 + 485 = -9,829

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2926	3080	1067
Temperature, °F	78.3	77.9	71.7

Total flow = 7,073 cfm
Supply air temperature: 77.1 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	77.1	) + (	-9,829	/(1.08 x	7,073	) =	75.8 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2926	3080	1067
Humidity ratio	0.0084	0.0084	0.0084

Total flow = 7,073 cfm
Wr = 0.0084 # moist / # dry air

STEADY STATE ROOM CONDITIONS: 75.7 °F dry bulb

NORMAL OPERATION (WINTER)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 765 cfm (Supply from AHU)
Supply Air Temp: 57.1 °F (See supply temperature for room 692.0'-C2)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 26-60
Steady State Temperature: 75.0 °F Design Rm Temperature: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	78.6	75.0	3.6	491
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	71.7	75.0	-3.3	-450
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	75.7	75.0	0.7	25
SOUTH	Door C13	7.2	3.0	21.5	0.448	75.7	75.0	0.7	7
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	60.0	75.0	-15.0	-229
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	60.0	75.0	-15.0	-86
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	50.0	75.0	-25.0	-238
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	70.3	75.0	-4.7	-568
					TOTAL TRANSMISSION LOAD =				-1,049

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	15,792
TOTAL INTERNAL:	**15,792**

Total Sensible Load = (Trans + Other Sensible) = -1,049 + 15792 = **14,743**

ROOM TEMPERATURE (Tr) = Ts 57.1 | Q 14,743 / (1.08 x CFM 765) = 74.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 765) = **0.0084**

STEADY STATE ROOM CONDITIONS:	**75.0 °F dry bulb**
	45 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 70.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.456	78.6	70.3	8.3	692
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.456	71.7	70.3	1.4	117
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.456	75.7	70.3	5.4	149
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	60.0	70.3	-10.3	-96
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	60.0	70.3	-10.3	-36
FLOOR	692.0' - C12	11.0	33.3	366.3	0.330	75.0	70.3	4.7	568
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.376	69.2	70.3	-1.1	-152
					TOTAL TRANSMISSION LOAD =				1,242

STEADY STATE ROOM CONDITIONS:	70.3 °F dry bulb

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 58.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	67.8	58.7	9.1	249
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	58.7	-8.7	-2,271
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	74.1	58.7	15.4	1,732
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	75.7	58.7	17.0	731
EAST	Door C1	7.2	3.0	21.5	0.448	75.7	58.7	17.0	164
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	58.7	-8.7	-33
CEILING (See Note)	[redacted]								
					TOTAL TRANSMISSION LOAD =				573

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 573

STEADY STATE ROOM CONDITIONS:	58.7 °F dry bulb

NORMAL OPERATION (WINTER)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity: NA
Steady State Temperature: 58.8 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	75.7	58.8	16.9	727
WEST	Door C12	7.2	3.0	21.5	0.448	75.7	58.8	16.9	163
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	58.8	-8.8	-2,297
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	78.6	58.8	19.8	2,351
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	60.2	58.8	1.4	38
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	58.8	-8.8	-33
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				949

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: **949**

STEADY STATE ROOM CONDITIONS: 58.8 °F dry bulb

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 8,602 cfm (Supply from AHU)
Supply Air Temp: 56.3 °F (See below)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity %: 27-60
Steady State Temperature: 73.2 °F Design Rm Temp: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	50.0	73.2	-23.2	-7,281
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	64.0	73.2	-9.2	-1,615
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	60.0	73.2	-13.2	-406
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	60.0	73.2	-13.2	-289
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	60.0	73.2	-13.2	-234
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	60.0	73.2	-13.2	-2,801
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	60.0	73.2	-13.2	-748
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	60.0	73.2	-13.2	-748
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	65.7	73.2	-7.5	-424
EAST	Door C22	7.2	6.00	43.0	0.448	65.7	73.2	-7.5	-145
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	59.6	73.2	-13.6	-3,660
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	50.0	73.2	-23.2	-3,544
WEST	Door C20	7.3	3.50	25.6	0.448	50.0	73.2	-23.2	-266
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	64.0	73.2	-9.2	-533
WEST	Door C21	7.2	3.00	21.5	0.448	64.0	73.2	-9.2	-89
FLOOR	692.0' - C2, 18" Cl	[illegible]	[illegible]	989.0	0.376	74.1	73.2	0.9	335
FLOOR	692.0' - C3, 18" Cl	[illegible]	[illegible]	775.9	0.376	75.7	73.2	2.5	729
FLOOR	692.0' - C4, 18" Cl	[illegible]	[illegible]	842.5	0.376	78.3	73.2	5.1	1,616
FLOOR	692.0' - C5, 18" Cl	[illegible]	[illegible]	189.8	0.376	77.9	73.2	4.7	335
FLOOR	692.0' - C11, 18" Cl	[illegible]	[illegible]	544.0	0.376	75.7	73.2	2.5	511
CEILING	729.0 - C1, 18" Cl	[illegible]	[illegible]	3341.2	0.376	60.0	73.2	-13.2	-16,583
					TOTAL TRANSMISSION LOAD =				-35,838

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
EQUIPMENT 194,050

TOTAL INTERNAL 194,050

Total Sensible Load = (Trans + Other Sensible) = -35,838 + 194050 = 158,212

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.7)	100	8,602	52.6	34130	56.3

(See Notes for this Section)

ROOM TEMPERATURE (Tr) = (Ts 56.3) + (Q 158,212 /(1.08 x CFM 8,602) = 73.3 °F

LATENT LOAD:

				Q latent
PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr):

Wr = 0.0084 + 0 /(4840 x 8,602) = **0.0084**

STEADY STATE ROOM CONDITIONS:	73.2 °F dry bulb 48 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. - 708.0' - C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: CORRIDOR

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 65.7 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	69.2	65.7	3.5	198
EAST	Door C24	7.2	6.0	43.0	0.448	69.2	65.7	3.5	67
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	73.2	65.7	7.5	424
WEST	Door C22	7.2	6.0	43.0	0.448	73.2	65.7	7.5	145
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	50.0	65.7	-15.7	-2,727
SOUTH	Door C26	7.2	3.4	24.4	0.448	50.0	65.7	-15.7	-171
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	59.6	65.7	-6.1	-2,188
NORTH	Door C23	7.2	6.0	43.0	0.448	59.6	65.7	-6.1	-118
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	312.0	0.376	75.7	65.7	10.0	1,173
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	312.0	0.376	60.0	65.7	-5.7	-669
					TOTAL TRANSMISSION LOAD =				-3,867

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	1,085
TOTAL ROOM SENSIBLE LOAD:	-2,782

STEADY STATE ROOM CONDITIONS:	65.7 °F dry bulb

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below Design Rm Humidity: 40-60
Steady State Temperature: 59.6 °F Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	65.7	59.6	6.1	2,188
SOUTH	Door C23	7.2	6.0	43.0	0.448	65.7	59.6	6.1	118
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	60.0	59.6	0.4	13
NORTH	713.0' - Ion, fltr rm, 36" CI	39.0	16.0	624.0	0.236	60.0	59.6	0.4	59
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	69.2	59.6	9.6	3,117
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	73.2	59.6	13.6	4,416
FLOOR	692.0' - C5, 18" CI	[redacted]	[redacted]	765.9	0.305	77.9	59.6	18.3	4,275
FLOOR	692.0' - C6, 18" CI	[redacted]	[redacted]	526.1	0.305	74.4	59.6	14.8	2,375
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	1292.0	0.376	60.0	59.6	0.4	194
					TOTAL TRANSMISSION LOAD =				16,754

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 34,202

TOTAL ROOM SENSIBLE LOAD: 34,202

Total Sensible Load = (Trans + Other Sensible) = 16,754 + 34202 = **50,956**

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.8)	0	6,677	52.6	0	52.6

(See Notes for this Section)

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	6677	0
Temperature, °F	52.6	0.0

Total flow = 6,677 cfm
Supply air temperature: 52.6 °F

ROOM TEMPERATURE (Tr) = (Ts 52.6) + (Q 50,956) / (1.08 x CFM 6,677) = 59.7 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	6677	0.0
Humidity ratio	0.0084	0.0000

Total flow = 6,677 cfm
Wr' = 0.0084 # moist / # dry air
Wr = 0.0084 + 0 / (4840 x 6,677) = **0.0084**

STEADY STATE ROOM CONDITIONS: **59.6 °F dry bulb**
77 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 9,268 cfm (Supply from AHU)
Supply Air Temp: 56.1 °F (See below)
Supply Air Humidity Ratio: 0.0084 lbW/lb dry air Design Rm Humidity: 27-60
Steady State Temperature: 69.2 °F Design Rm Temperature: 75

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	50.0	69.2	-19.2	-6,636
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	59.8	69.2	-9.4	-1,650
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	60.0	69.2	-9.2	-319
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	60.0	69.2	-9.2	-198
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	60.0	69.2	-9.2	-167
NORTH	713.0' - Ion, fltr rm, 36" CI	42.0	16.00	672.0	0.236	60.0	69.2	-9.2	-1,458
NORTH	713'-AB Gen Area, 36" CI	48.0	16.00	768.0	0.236	60.0	69.2	-9.2	-1,667
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	59.6	69.2	-9.6	-3,229
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	65.7	69.2	-3.5	-198
WEST	Door C24	7.2	6.0	43.0	0.448	65.7	69.2	-3.5	-67
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	50.0	69.2	-19.2	-3,048
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	59.8	69.2	-9.4	-545
EAST	Door C25	7.2	3.0	21.5	0.448	59.8	69.2	-9.4	-91
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.376	74.4	69.2	5.2	449
FLOOR	692.0' - C11, 18" CI	74.0	8.0	592.0	0.376	75.7	69.2	6.5	1,447
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.376	74.2	69.2	5.0	707
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.376	71.7	69.2	2.5	563
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.376	70.3	69.2	1.1	152
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.376	78.6	69.2	9.4	5,061
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	3595.7	0.376	60.0	69.2	-9.2	-12,438
					TOTAL TRANSMISSION LOAD =				-23,333

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 155,257
TOTAL ROOM SENSIBLE LOAD: 155,257

Total Sensible Load = (Trans + Other Sensible) = -23,333 + 155257 = 131,925

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.9)	100	9,268	52.6 (See Notes for this Section)	34130	56.1

ROOM TEMPERATURE (Tr) = Ts 56.1 | Q 131,925 / (1.08 x CFM 9,268) = 69.2 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0084 + 0 / (4840 x 9,268) = 0.0084

STEADY STATE ROOM CONDITIONS: 69.2 °F dry bulb, 55 % RH

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 64.0 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	50.0	64.0	-14.0	-515
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	50.0	64.0	-14.0	-1,160
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	73.2	64.0	9.2	1,615
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	73.2	64.0	9.2	533
EAST	Door C21	7.2	3.0	21.5	0.448	73.2	64.0	9.2	89
FLOOR (See Note)									
CEILING (See Note)									
								TOTAL TRANSMISSION LOAD =	561

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

TOTAL ROOM SENSIBLE LOAD: 561

STEADY STATE ROOM CONDITIONS: 64.0 °F dry bulb

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.3
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air Design Rm Humidity %: NA
Steady State Temperature: 59.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	50.0	59.8	-9.8	-361
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	50.0	59.8	-9.8	-812
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	69.2	59.8	9.4	1,650
WEST*	708.0' - C4, 8" CI	8.0	19.5	134.5	0.500	69.2	59.8	9.4	632
WEST	Door C25	7.2	3.0	21.5	0.448	69.2	59.8	9.4	91
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,200

Note: No transmission through the flior & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

TOTAL ROOM SENSIBLE LOAD: 1,200

STEADY STATE ROOM CONDITIONS:	59.8 °F dry bulb

This page replaced by Revision 016.

NORMAL OPERATION (WINTER)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,816	60.2	0.0084	23.7	169,523
COMMUNICATION ROOM (692.0' - C9)	4,038	78.6	0.0084	33.9	317,348
MECHANICAL EQUIP. ROOM WEST (C1)	6,221	67.8	0.0084	52.3	421,750
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	8,602	73.2	0.0084	72.3	629,666
COMPUTER ROOM (708.0' - C3)	6,677	59.6	0.0084	56.1	397,949
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	9,268	69.2	0.0084	77.8	641,311
OUTSIDE AIR	2,420	60.0	0.0003	0.7	145,200
TOTAL	Vreturn = 40,041			316.7	2,722,747

Return Air Temperature from MCR spaces: SUM (cfm X °F) / Vreturn: Treturn = 68.0 °F
Return Air Humidity Ratio from MCR spaces: Wreturn = 0.0079 # MOIST / # DRY AIR

NORMAL OPERATION (WINTER)

The table below summarizes results from AIRCOOL runs performed on pages 7.12.26 to 7.12.55 which established AHU leaving coil air temperatures at various air flow rates.

Fbp = flow bypass, cfm
Fc = flow through coil, cfm
F_T = total flow through AHU, cfm

Tbp = bypass air temperature, °F
Tc = leaving coil air temperature, °F
Tmix = final air mixture temperature, °F

$$F_T = Fbp + Fc = 20{,}020.5 \text{ cfm}$$
$$\text{Thus } Fbp = 20{,}020.5 - Fc$$

$$Tmix = (Fbp \times Tbp + Tc \times Fc) / (Fbp + Fc)$$

Substituting Fbp = (20,020.5 - Fc) into the equation →

$$Tmix = [(20{,}020.5 - Fc) \times Tbp] + Tc \times Fc) / [(20{,}020.5 - Fc) + Fc]$$
$$Tmix = Tbp + Fc\,(Tc - Tbp) / 20{,}020.5$$

AHU bypass damper controller setpoint is set @ 68°F , thus Tbp = 68°F.

$$Tmix = 68 + Fc\,(Tc - 68) / 20{,}020.5$$

AIRCOOL RUNS SUMMARY

AHU 1 (216 GPM) (See pg. 7.12.26 to 7.12.40)				AHU 2 (284 GPM) (See pg. 7.12.41 to 7.12.55)				FINAL
FLOW RATE THROUGH COIL (CFM)	Tc (DEG F)	Tmix (DEG F)	BYPASS FLOW RATE (CFM)	FLOW RATE THROUGH COIL (CFM)	Tc (DEG F)	Tmix (DEG F)	BYPASS FLOW RATE (CFM)	Tmix (DEG F)
10000	43.53	55.8	10020.5	10000	43.28	55.7	10020.5	55.7
10500	43.74	55.3	9520.5	10500	43.40	55.1	9520.5	55.2
11000	43.86	54.7	9020.5	11000	43.50	54.5	9020.5	54.6
11500	43.98	54.2	8520.5	11500	43.71	54.0	8520.5	54.1
12000	44.10	53.7	8020.5	12000	43.92	53.6	8020.5	53.6
12500	44.23	53.2	7520.5	12500	44.03	53.0	7520.5	53.1
13000	44.34	52.6	7020.5	13000	44.14	52.5	7020.5	52.6
13500	44.47	52.1	6520.5	13500	44.26	52.0	6520.5	52.1
14000	44.58	51.6	6020.5	14000	44.37	51.5	6020.5	51.5
14500	44.71	51.1	5520.5	14500	44.47	51.0	5520.5	51.0
15000	44.82	50.6	5020.5	15000	44.58	50.5	5020.5	50.5
15500	45.04	50.2	4520.5	15500	44.69	50.0	4520.5	50.1
16000	45.25	49.8	4020.5	16000	44.80	49.5	4020.5	49.6
				16500	Extrapolation			49.1
				17000				48.6
				17500				48.1
				18000				47.6
				18500				47.1
				19000				46.6

LOOP CONDITION (WINTER)

LOOP CONDITION (WINTER) CONSIDERS THE FOLLOWING PARAMETERS:

- GENERAL METHODOLOGY AS SHOWN IN SECTION 6.9
- AIR FLOW RATES AS SHOWN IN PAGE 9 IN APPENDIX 11
- SPECIFIC HUMIDITY OF THE SUPPLY AIR AS SHOWN IN SECTION 7.3
- RELATIVE HUMIDITY IS N/A (REF. 5.5-5.7); EVALUATED FOR INFORMATION ONLY
- MAXIMUM CHILLED WATER FLOW RATE OF 216 GPM + 10% = 238 GPM TO EBR AHU A-A
- MAXIMUM CHILLED WATER FLOW RATE OF 284 GPM + 10% = 312 GPM TO EBR AHU B-A
- MINIMUM CHILLED WATER SUPPLY TEMPERATURE OF 42°F
- LOOP CONDITION INTERNAL (ELECTRICAL) LOAD AS SHOWN IN IN PAGE 7 IN APPENDIX 11
- 13°F PRESSURIZING AIR (144 KW HEATER NOT ENERGIZED)
- COMPUTER ROOM SUPPLEMENTAL AHU IS NOT RUNNING
- LATENT LOADS DUE TO PERSONNEL CONSERVATIVELY NOT CONSIDERED

This spreadsheet (see pg. 159 to 181) and AIRCOOL model (see pg.182 to 187) were iterated until the mixed return air temperature (both dry and wet bulb) to the EBR AHU coils (calculated in the spreadsheet) and the assumed entering air temperature (dry and wet bulb) input to the AIRCOOL program were approximately equal. This equates to approximately 50°F which is significantly lower than the controller setpoint of 68°F. Unlike the normal winter operating condition evaluated in Section 5.5 in Appendix 11, the bypass damper will be fully open during this operating condition. Since the face dampers were removed, a significant portion of the return air flow will continue through the EBR AHU coils. A trial and error solution based on the relative pressure drop associated with the flow through the coil and around the coil through the bypass damper was performed and documented in Appendix 7. Results indicate that approximately 30% of the total flow will continue go through the coil, and the remaining 70% will flow through the bypass damper. In this flow contition, calculated EBR AHU supply temperature Ts:

LAT = 42.4 °F (average temperature based on AIRCOOL results for 64.5°F EAT; see pg.184 & 187)

Tr = 64.5 °F (based on the weighted average; see pg.184)

Total return flow to one AHU Q = 20020.5 cfm (see Appendix 3)

Considered that 30% cools off by AHU.

Tz = ([0.3Q x LAT) + (0.7Q x Treturn)]/Q

Tz = 57.9 °F (weighted average temperature downstream of coil/damper)

q = 98435 Btuh (see Section 7.2)

Ts =Tz + q / (1.08 x Q) = 62.4 °F

Since the computer room & communications room supplemental AHUs are not safety-related, they will not be energized during this LOOP scenario. Also see Assumption 4.1.10.

Duct heaters are not operating; see Methodology, Section 6.9, item # 8.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM WEST

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 61.1 °F Design Rm Temp °F: 62

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - Ground	42.0	NA	NA	1.000	50.0	61.1	-11.1	-466
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	61.1	-11.1	-522
NORTH	692.0' -Ground	23.0	NA	NA	1.000	50.0	61.1	-11.1	-255
NORTH	692.0' - AB/A1, 42" CI	18.5	14.5	268.3	0.212	60.0	61.1	-1.1	-63
NORTH	692.0' - AB/A5, 42" CI	5.5	14.5	79.8	0.212	60.0	61.1	-1.1	-19
EAST*	692.0' - C2, 36" CI	33.0	14.5	420.9	0.236	63.2	61.1	2.1	209
EAST	Door C2	8.0	7.2	57.6	0.448	63.2	61.1	2.1	54
EAST	692.0' - Stair C1, 36" CI	9.0	14.5	130.5	0.236	53.1	61.1	-8.0	-246
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	61.1	-11.1	-570
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	40.0	61.1	-21.1	-15,661
					TOTAL TRANSMISSION LOAD =				-17,539

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 4,918

TOTAL INTERNAL: 4,918

Total Sensible Load = (Trans + Other Sensible) = -17,539 + 4,918 = -12,620

SUPPLY AIR :
Supply air is a mix of air from room C2 & AHU.

Room	C2	AHU
cfm	4922.5	1298
Temperature, °F	63.2	62.4

Total flow = 6,221 cfm
Supply air temperature: 63.0 °F

ROOM TEMPERATURE (Tr) = (Ts 63.0) + (Q -12,620 /(1.08 x CFM 6,221) = 61.2 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C2	AHU
cfm	4922.5	1298
Humidity ratio	0.0069	0.0069

Total flow = 6,221 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 61.1 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM (Battery Room Exhaust Fan)

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 63.2 °F Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C1, 36" CI	33.3	14.6	425.3	0.236	61.1	63.2	-2.1	-211
WEST	Door C2	7.2	8.0	57.6	0.448	61.1	63.2	-2.1	-54
EAST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	64.2	63.2	1.0	220
SOUTH*	692.0 - C11, 8" RMW	11.7	14.5	112.1	0.455	62.8	63.2	-0.4	-20
SOUTH	Door C3	7.2	8.0	57.6	0.448	62.8	63.2	-0.4	-10
SOUTH	692.0' - Stair C1, 12" CI	18.0	14.5	261.0	0.431	53.1	63.2	-10.1	-1,136
NORTH	692.0' - AB/A3, 48" CI	10.5	14.5	152.3	0.192	60.0	63.2	-3.2	-94
NORTH	692.0' - AB/A5, 48" CI	19.2	14.5	278.4	0.192	60.0	63.2	-3.2	-171
FLOOR	692.0' - Ground	29.7	33.3	989.0	0.026	50.0	63.2	-13.2	-339
CEILING	708.0' - C1, 18" CI	29.7	33.3	989.0	0.306	76.1	63.2	12.9	3,891
					TOTAL TRANSMISSION LOAD =				2,075

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 2,075 + 0 = 2,075

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
20 (See Sect. 7.6)	0	14,196	62.4	0	62.4

SUPPLY AIR :
Supply air is a mix of air from room C11 & AHU.

Room	C11	AHU
cfm	4653	269.5
Temperature, °F	62.8	62.4

Total flow = 4,923 cfm
Supply air temperature: 62.8 °F

ROOM TEMPERATURE (Tr) = (Ts 62.8) + (Q 2,075) / (1.08 x CFM 4,923) = 63.2 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C11	AHU
cfm	4653	269.5
Humidity ratio	0.0069	0.0069

Total flow = 4,923 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 63.2 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY ROOM 1

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 62.8 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 64.2 °F Design Rm Temp °F: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C4, 8" RMW	33.3	14.6	482.9	0.455	63.2	64.2	-1.0	-220
WEST	692.0' - C2, 8" RMW	33.3	14.6	482.9	0.455	63.2	64.2	-1.0	-220
SOUTH*	692.0 - C11, 8" RMW	23.3	14.5	311.2	0.455	62.8	64.2	-1.4	-198
SOUTH	Door C4	7.2	3.7	26.6	0.448	62.8	64.2	-1.4	-17
NORTH	676.0' - AB/A2, 42" CI	7.6	14.6	108.8	0.212	60.0	64.2	-4.2	-97
NORTH	692.0' - AB/A3, 42" CI	15.8	14.6	229.1	0.212	60.0	64.2	-4.2	-204
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	64.2	-14.2	-286
CEILING	708.0' - C1, 18" CI	23.3	33.3	775.9	0.305	76.1	64.2	11.9	2,816
					TOTAL TRANSMISSION LOAD =				1,574

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 1,574 + 0 = 1,574

ROOM TEMPERATURE (Tr) = (Ts 62.8) + (Q 1,574 / (1.08 x CFM 990) = 64.3 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM TEMPERATURE: 64.2 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY BOARD ROOM 1

Design air flow: 2,926 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 63.2 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW*	25.3	14.5	321.7	0.455	62.8	63.2	-0.4	-59
SOUTH	Door C5	7.2	6.3	45.2	0.448	62.8	63.2	-0.4	-8
NORTH	676.0' - AB/A2, 42" CI	25.3	14.5	366.9	0.212	60.0	63.2	-3.2	-249
EAST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	62.6	63.2	-0.7	-154
WEST	692.0' - C3, 8" RMW	33.3	14.5	482.9	0.455	64.2	63.2	1.0	220
FLOOR	692.0' - Ground	25.3	33.3	842.5	0.026	50.0	63.2	-13.2	-289
CEILING	708.0' - C1, 18" CI	25.3	33.3	842.5	0.305	76.1	63.2	12.9	3,315
					TOTAL TRANSMISSION LOAD =				2,776

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 2,776 + 0 = 2,776

ROOM TEMPERATURE (Tr) = Ts 62.4 + Q 2,776 / (1.08 x CFM 2926) = 63.3 °F

LATENT LOAD: **Q latent**
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2926) = 0.0069

STEADY STATE ROOM TEMPERATURE: 63.2 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C5 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY BOARD ROOM 2

Design air flow: 3,080 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 62.5 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	28.7	14.5	371.0	0.455	62.8	62.5	0.3	51
SOUTH	Door C6	7.2	6.3	45.2	0.448	62.8	62.5	0.3	6
NORTH	676.0' - A2, 42" CI	20.7	14.5	300.2	0.212	60.0	62.5	-2.5	-159
NORTH	676.0' - A3, 42" CI	8.0	14.5	116.0	0.212	60.0	62.5	-2.5	-61
EAST	692.0' - C6, 8" RMW	33.3	14.5	482.9	0.455	63.1	62.5	0.6	132
WEST	692.0' - C4, 8" RMW	33.3	14.5	482.9	0.455	63.2	62.5	0.7	154
FLOOR	692.0' - Ground	28.7	33.3	955.7	0.026	50.0	62.5	-12.5	-311
CEILING	708.0' - C3, 18" CI	23.0	33.3	765.9	0.305	63.0	62.5	0.5	117
CEILING	708.0' - C1, 18" CI	5.7	33.3	189.8	0.305	76.1	62.5	13.6	787
					TOTAL TRANSMISSION LOAD =				715

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0
TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 715 + 0 = 715

ROOM TEMPERATURE (Tr) = Ts 62.4 + Q 715 / (1.08 x CFM 3080) = 62.6 °F

LATENT LOAD: Q latent
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 3080) = 0.0069

STEADY STATE ROOM TEMPERATURE: 62.5 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C6 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 250V BATTERY ROOM 2

Design air flow: 990 cfm (Transfer from room C11)
Supply Air Temp: 62.8 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 63.1 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	23.3	14.6	311.3	0.455	62.8	63.1	-0.3	-42
SOUTH	Door C7	7.2	3.7	26.5	0.448	62.8	63.1	-0.3	-4
NORTH	692.0' - AB/A31, 42" CI	20.3	14.5	294.4	0.212	60.0	63.1	-3.1	-193
NORTH	676.0' - AB/A3, 42" CI	3.0	14.6	43.6	0.212	60.0	63.1	-3.1	-29
EAST	692.0' - C7, 8" RMW	33.3	14.6	482.9	0.455	63.9	63.1	0.8	176
WEST	692.0' - C5, 8" RMW	33.3	14.5	482.9	0.455	62.5	63.1	-0.6	-132
FLOOR	692.0' - Ground	23.3	33.3	775.9	0.026	50.0	63.1	-13.1	-264
CEILING	708.0' - C4, 18" CI	6.9	33.3	229.8	0.376	72.3	63.1	9.2	795
CEILING	708.0' - C3, 18" CI	15.8	33.3	526.1	0.305	63.0	63.1	-0.1	-16
					TOTAL TRANSMISSION LOAD =				290

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 290 + 0 = 290

ROOM TEMPERATURE (Tr) = (Ts 62.8) + (Q 290 / (1.08 x CFM 990) = 63.1 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 990) = 0.0069

STEADY STATE ROOM TEMPERATURE: 63.1 °F dry bulb

LOOP CONDITION (WINTER)

ROOM NO. 692.0-C7 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 24V & 48V BATTERY ROOM

Design air flow: 440 cfm (Transfer from room C11)
Supply Air Temp: 62.8 °F
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 63.9 °F Design Rm Temp °F: 64

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	11.3	14.6	137.3	0.456	62.8	63.9	-1.1	-69
SOUTH	Door C8	7.2	3.7	26.5	0.448	62.8	63.9	-1.1	-13
NORTH	692.0' - AB/A31, 42" CI	11.3	14.5	163.9	0.212	60.0	63.9	-3.9	-135
EAST	692.0' - C8, 8" RMW	33.3	14.6	482.9	0.455	63.1	63.9	-0.8	-176
WEST	692.0' - C6, 8" RMW	33.3	14.6	482.9	0.455	63.1	63.9	-0.8	-176
FLOOR	692.0' - Ground	11.3	33.3	376.3	0.026	50.0	63.9	-13.9	-136
CEILING	708.0' - C4, 18" CI	11.3	33.3	376.3	0.376	72.3	63.9	8.4	1,188
					TOTAL TRANSMISSION LOAD =				484

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0
TOTAL INTERNAL:	**0**

Total Sensible Load = (Trans + Other Sensible) = 484 + 0 = 484

ROOM TEMPERATURE (Tr) = (Ts 62.8) + (Q 484) / (1.08 x CFM 440) = 63.8 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 440) = **0.0069**

STEADY STATE ROOM TEMPERATURE: 63.9 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)

ROOM NO. 692.0-C8 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: 24V & 48V BATTERY BOARD AND CHARGER ROOM

Design air flow: 1,067 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 63.1 °F Design Rm Temp °F: 64

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	692.0' - C11, 8" RMW	18.0	14.5	234.5	0.455	62.8	63.1	-0.3	-32
SOUTH	Door C9	7.2	3.7	26.6	0.448	62.8	63.1	-0.3	-4
NORTH	692.0' - AB/A31, 42" CI	18.0	14.5	261.0	0.212	60.0	63.1	-3.1	-172
EAST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	61.9	63.1	-1.2	-164
EAST (ABOVE C12)	692.0' - ATTIC, 8' RMW	33.3	5.6	183.2	0.455	57.3	63.1	-5.8	-483
WEST	692.0' - C7, 8" RMW	33.3	14.5	482.9	0.455	63.9	63.1	0.8	176
FLOOR	692.0' - Ground	18.0	33.3	599.4	0.026	50.0	63.1	-13.1	-204
CEILING	708.0' - C4, 18" CI	18.0	33.3	599.4	0.305	72.3	63.1	9.2	1,682
					TOTAL TRANSMISSION LOAD =				799

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 799 + 0 = 799

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	62.4 +	799 / (1.08 x	1,067)	=	63.1 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 1,067) = 0.0069

STEADY STATE ROOM TEMPERATURE: 63.1 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C9 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: COMMUNICATION ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 62.6 °F Design Rm Temp °F: 67

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C12, 8" RMW	33.3	9.0	299.7	0.455	61.9	62.6	-0.7	-95
WEST (ATTIC C12)	692.0" - ATTIC, 8" RMW	33.3	5.5	183.2	0.455	57.3	62.6	-5.3	-442
EAST*	692.0' - C10, 36" CI	33.3	14.5	425.5	0.236	61.8	62.6	-0.8	-80
EAST	Door C11	7.2	8.0	57.4	0.448	61.8	62.6	-0.8	-21
SOUTH*	692.0' - C11, 8" RMW	25.0	14.5	305.1	0.455	62.8	62.6	0.2	28
SOUTH	Door C10	7.2	8.0	57.4	0.448	62.8	62.6	0.2	5
SOUTH	692.0' - Stair C2, 8"RMW	18.0	14.5	261.0	0.455	53.5	62.6	-9.1	-1,081
NORTH	692.0' - AB/A29, 42" CI	20.0	14.5	290.0	0.212	60.0	62.6	-2.6	-160
NORTH	692.0' - AB/A30, 42" CI	23.0	14.5	333.5	0.212	60.0	62.6	-2.6	-184
FLOOR	692.0' - Ground	43.0	33.3	1431.9	0.026	50.0	62.6	-12.6	-469
CEILING	708.0' - C4, 18" CI	43.0	33.3	1431.9	0.305	72.3	62.6	9.7	4,236
					TOTAL TRANSMISSION LOAD =				1,738

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL ROOM SENSIBLE LOAD: 0

SUPPLEMENTAL AIR HANDLING UNIT: 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = 1,738 + 0 = 1,738

SUPPLY AIR :
Supply air is a mix of air from room C12 & AHU.

Room	C12	AHU
cfm	764.5	3273
Temperature, °F	61.9	62.4

Total flow = 4,038 cfm
Supply air temperature: 62.3 °F

	Ts		Q		CFM		
ROOM TEMPERATURE (Tr) = (	62.3	) + (	1,738	/(1.08 x	4,038	) =	62.7 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	C12	AHU
cfm	764.5	3273
Humidity ratio	0.0069	0.0069

Total flow = 4,038 cfm
Wr ' = 0.0069 # moist / # dry air

Wr =	0.0069	+	0	/ (4840 x	4,038	) =	0.0069

STEADY STATE ROOM TEMPERATURE: 62.6 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C10 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: MECHANICAL EQUIPMENT ROOM EAST

Design air flow: 2,816 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 61.8 °F Design Rm Temp °F: 60

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - Ground	42.0	NA	NA	1.000	50.0	61.8	-11.8	-496
SOUTH	692.0' - Ground	47.0	NA	NA	1.000	50.0	61.8	-11.8	-555
NORTH	692.0' - Ground	22.0	NA	NA	1.000	50.0	61.8	-11.8	-260
NORTH	692.0' - AB/A27, 42" CI	21.0	14.5	304.5	0.212	60.0	61.8	-1.8	-116
NORTH	692.0' - AB/A29, 42" CI	4.0	14.5	58.0	0.212	60.0	61.8	-1.8	-22
WEST*	692.0' - C9, 36" CI	33.0	14.5	420.9	0.236	62.6	61.8	0.8	79
WEST	Door C11	8.0	7.2	57.6	0.448	62.6	61.8	0.8	21
WEST	692.0' - Stair C2, 36" CI	9.0	14.5	130.5	0.236	53.5	61.8	-8.3	-256
FLOOR	692.0' - Ground	42.0	47.0	1974.0	0.026	50.0	61.8	-11.8	-606
CEILING	708.0 - TB/T1, 18" CI	42.0	47.0	1974.0	0.376	40.0	61.8	-21.8	-16,180
					TOTAL TRANSMISSION LOAD =				-18,390

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	16,608
TOTAL INTERNAL:	**16,608**

Total Sensible Load = (Trans + Other Sens.) = -18,390 + 16,608 = -1,782

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	62.4 +	-1,782 / (1.08 x	2816)	=	61.8 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD:	**0**

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 2816) = **0.0069**

STEADY STATE ROOM TEMPERATURE: 61.8 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C11 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: CORRIDOR

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 62.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	692.0' - Ground	181.0	NA	NA	1.000	50.0	62.8	-12.8	-2,317
NORTH*	692.0' - C2, 8" RMW	11.7	14.5	112.3	0.455	63.2	62.8	0.4	20
NORTH	Door C3	7.2	8.0	57.4	0.448	63.2	62.8	0.4	10
NORTH*	692.0' - C3, 8" RMW	23.3	14.5	311.3	0.455	64.2	62.8	1.4	198
NORTH	Door C4	7.2	3.7	26.5	0.448	64.2	62.8	1.4	17
NORTH*	692.0' - C4, 8" RMW	25.3	14.5	321.7	0.455	63.2	62.8	0.4	59
NORTH	Door C5	7.2	6.3	45.2	0.448	63.2	62.8	0.4	8
NORTH*	692.0' - C5, 8" RMW	28.7	14.6	371.0	0.455	62.5	62.8	-0.3	-51
NORTH	Door C6	7.2	6.3	45.2	0.448	62.5	62.8	-0.3	-6
NORTH*	692.0' - C6, 8" RMW	23.3	14.5	311.3	0.455	63.1	62.8	0.3	42
NORTH	Door C7	7.2	3.7	26.5	0.448	63.1	62.8	0.3	4
NORTH*	692.0' - C7, 8" RMW	11.3	14.5	137.3	0.455	63.9	62.8	1.1	69
NORTH	Door C8	7.2	3.7	26.5	0.448	63.9	62.8	1.1	13
NORTH*	692.0' - C8, 8" RMW	18.0	14.5	234.5	0.455	63.1	62.8	0.3	32
NORTH	Door C9	7.2	3.7	26.5	0.448	63.1	62.8	0.3	4
NORTH*	692.0' - C12, 8" RMW	11.0	9.0	77.5	0.455	61.9	62.8	-0.9	-32
NORTH	Door C13	7.2	3.0	21.5	0.448	61.9	62.8	-0.9	-8
NORTH	Attic (Above C12)	11.0	5.6	60.5	0.455	57.3	62.8	-5.5	-151
NORTH*	692.0' - C9, 8" RMW	24.1	14.5	292.1	0.455	62.6	62.8	-0.2	-27
NORTH	Door C10	7.2	8.0	57.4	0.448	62.6	62.8	-0.2	-6
EAST*	Stair C2, 8" RMW	8.0	14.5	94.5	0.455	53.5	62.8	-9.3	-400
EAST	Door C12	7.2	3.0	21.5	0.448	53.5	62.8	-9.3	-90
WEST*	Stair C1, 8" RMW	8.0	14.5	94.5	0.455	53.1	62.8	-9.7	-417
WEST	Door C1	7.2	3.0	21.5	0.448	53.1	62.8	-9.7	-93
FLOOR	692.0' - Ground	181.0	8.0	1448.0	0.026	50.0	62.8	-12.8	-482
CEILING	708.0' - C1, 18" CI	68.0	8.0	544.0	0.305	76.1	62.8	13.3	2,207
CEILING	708.0' - C2, 18" CI	39.0	8.0	312.0	0.376	56.9	62.8	-5.9	-692
CEILING	708.0 - C4, 18" CI	74.0	8.0	592.0	0.376	72.3	62.8	9.5	2,116
					TOTAL TRANSMISSION LOAD =				26

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C11
ROOM NAME: CORRIDOR (cont'd)

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0
TOTAL INTERNAL:	**0**

Total Sensible Load = (Trans + Other Sensible) = 26 + 0 = 26

SUPPLY AIR :
Supply air is a mix of air from rooms C4, C5 & C8 & outside air.

Room	C4	C5	C8
cfm	2926	3080	1067
Temperature, °F	63.2	62.5	63.1

Total flow = 7,073 cfm
Supply air temperature: 62.9 °F

		Ts		Q		CFM		
ROOM TEMPERATURE (Tr) =	(	62.9	) + (	26	/(1.08 x	7,073	) =	62.9 °F

LATENT LOAD: **Q latent**

TOTAL ROOM LATENT LOAD: **0**

ROOM HUMIDITY RATIO (Wr):

Room	C4	C5	C8
cfm	2926	3080	1067
Humidity ratio	0.0069	0.0069	0.0069

Total flow = 7,073 cfm
Wr = 0.0069 # moist / # dry air

STEADY STATE ROOM TEMPERATURE: 62.8 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. 692.0-C12 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: SECONDARY ALARM STATION ROOM

Design air flow: 765 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 61.9 °F Design Rm Temperature: 65

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	9.0	299.7	0.455	62.6	61.9	0.7	95
WEST	692.0' - C8, 8" RMW	33.3	9.0	299.7	0.455	63.1	61.9	1.2	164
SOUTH*	692.0' - C11, 8" RMW	11.0	9.0	77.5	0.455	62.8	61.9	0.9	32
SOUTH	Door C13	7.2	3.0	21.5	0.448	62.8	61.9	0.9	9
NORTH	692.0' - AB/A31, 42" CI	8.0	9.0	72.0	0.212	60.0	61.9	-1.9	-29
NORTH	692.0' - AB/A30, 42" CI	3.0	9.0	27.0	0.212	60.0	61.9	-1.9	-11
FLOOR	692.0' - Ground	11.0	33.3	366.3	0.026	50.0	61.9	-11.9	-113
CEILING	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	57.3	61.9	-4.6	-556
					TOTAL TRANSMISSION LOAD =				-410

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 0

TOTAL INTERNAL: 0

Total Sensible Load = (Trans + Other Sensible) = -410 + 0 = -410

	Ts	Q	CFM		
ROOM TEMPERATURE (Tr) =	62.4 +	-410 / (1.08 x	765)	=	61.9 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 765) = 0.0069

STEADY STATE ROOM TEMPERATURE: 61.9 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. - N/A
ROOM NAME: ATTIC (above C12) Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 57.3 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	692.0' - C9, 8" RMW	33.3	5.5	183.2	0.455	62.6	57.3	5.3	442
WEST	692.0' - C8, 8" RMW	33.3	5.5	183.2	0.455	63.1	57.3	5.8	483
SOUTH	692.0' - C11, 8" RMW	11.0	5.5	60.5	0.455	62.8	57.3	5.5	151
NORTH	692.0' - AB/A31, 42" CI	8.0	5.5	44.0	0.212	60.0	57.3	2.7	25
NORTH	692.0' - AB/A30, 42" CI	3.0	5.5	16.5	0.212	60.0	57.3	2.7	9
FLOOR	ATTIC (Susp. ceiling)	11.0	33.3	366.3	0.330	61.9	57.3	4.6	556
CEILING	708.0' -C4, 18" CI	11.0	33.3	366.3	0.305	72.3	57.3	15.0	1,676
					TOTAL TRANSMISSION LOAD =				3,343

STEADY STATE ROOM TEMPERATURE:	57.3 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)
ROOM NO. - 692.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 53.1 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	692.0' - C1, 36" CI	8.0	14.5	116.0	0.236	61.1	53.1	8.0	219
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	53.1	-3.1	-809
NORTH	692.0' - C2, 12" CI	18.0	14.5	261.0	0.431	63.2	53.1	10.1	1,136
EAST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	62.8	53.1	9.7	417
EAST	Door C1	7.2	3.0	21.5	0.448	62.8	53.1	9.7	93
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	53.1	-3.1	-12
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				1,045

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	=	0

TOTAL ROOM SENSIBLE LOAD: 1,045

STEADY STATE ROOM TEMPERATURE:	53.1 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. 692.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 53.5 °F Design Rm Temperature: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST*	692.0' - C11, 8" RMW	8.0	14.5	94.5	0.455	62.8	53.5	9.3	400
WEST	Door C12	7.2	3.0	21.5	0.448	62.8	53.5	9.3	90
SOUTH	692.0' - Ground	18.0	14.5	261.0	1.000	50.0	53.5	-3.5	-914
NORTH	692.0' - C9, 8" RMW	18.0	14.5	261.0	0.455	62.6	53.5	9.1	1,081
EAST	692.0' - C10, 36" CI	8.0	14.5	116.0	0.236	61.8	53.5	8.3	227
FLOOR	692.0' - Ground	18.0	8.0	144.0	0.026	50.0	53.5	-3.5	-13
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		871

Note: No transmission through the ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 871

STEADY STATE ROOM TEMPERATURE:	53.5 °F dry bulb

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LOOP CONDITION (WINTER)
ROOM NO. 708.0-C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: UNIT 1 AUXILIARY INSTRUMENT ROOM

Design air flow: 8,602 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 76.1 °F Design Rm Temp: 63

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" Cl	68.2	19.50	1329.9	0.236	40.0	76.1	-36.1	-11,330
SOUTH	708.0' - Stair C1, 8" Cl	18.0	19.50	351.0	0.500	54.5	76.1	-21.6	-3,791
NORTH	676.0' - AB/A2, 36" Cl	37.2	3.50	130.2	0.236	60.0	76.1	-16.1	-495
NORTH	692.0' - AB/A3, 36" Cl	26.5	3.50	92.8	0.236	60.0	76.1	-16.1	-352
NORTH	692.0' - AB/A5, 36" Cl	21.5	3.50	75.3	0.236	60.0	76.1	-16.1	-286
NORTH	713.0' - Gen.area, 36" Cl	56.2	16.00	899.2	0.236	60.0	76.1	-16.1	-3,417
NORTH	713'- A25, 36" Cl	15.0	16.00	240.0	0.236	60.0	76.1	-16.1	-912
NORTH	713'- A26, 36" Cl	15.0	16.00	240.0	0.236	60.0	76.1	-16.1	-912
EAST*	708.0' - C2, 8" Cl	8.0	19.50	113.0	0.500	56.9	76.1	-19.2	-1,085
EAST	Door C22	7.2	6.00	43.0	0.448	56.9	76.1	-19.2	-370
EAST	708.0' - C3, 8" Cl	34.5	19.50	538.3	0.500	63.0	76.1	-13.1	-3,526
WEST*	708.0' - TB/T1, 36" Cl	34.5	19.50	647.2	0.236	40.0	76.1	-36.1	-5,514
WEST	Door C20	7.3	3.50	25.6	0.448	40.0	76.1	-36.1	-413
WEST*	Stair C1, 8" Cl	8.0	19.50	134.5	0.431	54.5	76.1	-21.6	-1,252
WEST	Door C21	7.2	3.00	21.5	0.448	54.5	76.1	-21.6	-208
FLOOR	692.0' - C2, 18" Cl			989.0	0.305	63.2	76.1	-12.9	-3,891
FLOOR	692.0' - C3, 18" Cl			775.9	0.305	64.2	76.1	-11.9	-2,816
FLOOR	692.0' - C4, 18" Cl			842.5	0.305	63.2	76.1	-12.9	-3,315
FLOOR	692.0' - C5, 18" Cl			189.8	0.305	62.5	76.1	-13.6	-787
FLOOR	692.0' - C11, 18" Cl			544.0	0.305	62.8	76.1	-13.3	-2,207
CEILING	729.0 - C1, 18" Cl			3341.2	0.376	60.0	76.1	-16.1	-20,226
					TOTAL TRANSMISSION LOAD =				-67,104

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 194,050

TOTAL INTERNAL 194,050

Total Sensible Load = (Trans + Other Sensible) = -67,104 + 194,050 = 126,945

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.7)	0	8,602	62.4 (See Notes for this Section)	0	62.4

ROOM TEMPERATURE (Tr) = (Ts 62.4) + (Q 126,945 / (1.08 x CFM 8,602) = 76.1 °F

LATENT LOAD: Q latent

TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):
Wr = 0.0069 + 0 / (4840 x 8,602) = 0.0069

STEADY STATE ROOM TEMPERATURE: 76.1 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. - 708.0' - C2
ROOM NAME: CORRIDOR

Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 56.9 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST*	708.0' - C4, 8" CI	8.0	19.5	113.0	0.500	72.3	56.9	15.4	870
EAST	Door C24	7.2	6.0	43.0	0.448	72.3	56.9	15.4	297
WEST*	708.0' - C1, 8" CI	8.0	19.5	113.0	0.500	76.1	56.9	19.2	1,085
WEST	Door C22	7.2	6.0	43.0	0.448	76.1	56.9	19.2	370
SOUTH*	708.0' - TB/T1, 36" CI	39.0	19.5	736.1	0.236	40.0	56.9	-16.9	-2,936
SOUTH	Door C26	7.2	3.4	24.4	0.448	40.0	56.9	-16.9	-185
NORTH*	708.0' - C3, 8" CI	39.0	19.5	717.5	0.500	63.0	56.9	6.1	2,188
NORTH	Door C23	7.2	6.0	43.0	0.448	63.0	56.9	6.1	118
FLOOR	692.0' - C11, 18" CI	[redacted]	[redacted]	312.0	0.376	62.8	56.9	5.9	692
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	312.0	0.305	60.0	56.9	3.1	295
					TOTAL TRANSMISSION LOAD =				2,794

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:	
EQUIPMENT	0
TOTAL ROOM SENSIBLE LOAD:	2,794

STEADY STATE ROOM CONDITIONS:	56.9 °F dry bulb

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LOOP CONDITION (WINTER)
ROOM NO. 708.0-C3 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: COMPUTER ROOM

Design air flow: Mixed flow - see below
Supply Air Temp: Mixed flow - see below
Supply Air Humidity Ratio: Mixed flow - see below
Steady State Temperature: 63.0 °F Design Rm Temp °F: 63

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH*	708.0' - C2, 8" CI	39.0	19.5	717.5	0.500	56.9	63.0	-6.1	-2,188
SOUTH	Door C23	7.2	6.0	43.0	0.448	56.9	63.0	-6.1	-118
NORTH	676.0' - AB/A3, 36" CI	39.0	3.5	136.5	0.236	60.0	63.0	-3.0	-97
NORTH	713.0' - Ion, fltr rm, 36"	39.0	16.0	624.0	0.236	60.0	63.0	-3.0	-442
EAST	708.0' - C4, 8" CI	33.3	19.5	649.4	0.500	72.3	63.0	9.3	3,019
WEST	708.0' - C1, 8" CI	33.3	19.5	649.4	0.500	76.1	63.0	13.1	4,253
FLOOR	692.0' - C5, 18" CI	[redacted]	[redacted]	765.9	0.305	62.5	63.0	-0.5	-117
FLOOR	692.0' - C6, 18" CI	[redacted]	[redacted]	526.1	0.305	63.1	63.0	0.1	16
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	1292.0	0.376	60.0	63.0	-3.0	-1,457
					TOTAL TRANSMISSION LOAD =				2,870

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:
EQUIPMENT 34,202
TOTAL ROOM SENSIBLE LOAD: 34,202

Total Sensible Load = (Trans + Other Sensible) = 2,870 + 34,202 = 37,072

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.8)	0	6,677	62.4 (See Notes for this Section)	0	62.4

SUPPLY AIR :
Supply air is a mix of air from two different air handling units.

Room	AHU(MER)	AHU (CR)
cfm	6677	0
Temperature, °F	62.4	0.0

Total flow = 6,677 cfm
Supply air temperature: 62.4 °F

ROOM TEMPERATURE (Tr) = (Ts 62.4) + (Q 37,072 /(1.08 x CFM 6,677) = 67.6 °F

LATENT LOAD: Q latent
PEOPLE 0 X 200 0
TOTAL ROOM LATENT LOAD: 0

ROOM HUMIDITY RATIO (Wr):

Room	AHU(MER)	AHU (CR)
cfm	6677	0.0
Humidity ratio	0.0069	0.0000

Total flow = 6,677 cfm
Wr' = 0.0069 # moist / # dry air
Wr = 0.0069 + 0 / (4840 x 6,677) = 0.0069

STEADY STATE ROOM TEMPERATURE: 63.0 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. 708.0-C4 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: UNIT 2 AUXILIARY INSTRUMENT ROOM

Design air flow: 9,268 cfm (Supply from AHU)
Supply Air Temp: 62.4 °F (Supply from AHU)
Supply Air Humidity Ratio: 0.0069 lbW/lb dry air
Steady State Temperature: 72.3 °F Design Rm Temperature: 62

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
SOUTH	708.0' - TB/T1, 36" CI	75.1	19.5	1464.5	0.236	40.0	72.3	-32.3	-11,163
SOUTH	708.0' - Stair C2, 8" CI	18.0	19.5	351.0	0.500	51.8	72.3	-20.5	-3,598
NORTH	692.0' - AB/A31, 36" CI	42.0	3.50	147.0	0.236	60.0	72.3	-12.3	-427
NORTH	692.0' - AB/A30, 36"CI	26.0	3.50	91.0	0.236	60.0	72.3	-12.3	-264
NORTH	692.0' - AB/A29, 36" CI	22.0	3.50	77.0	0.236	60.0	72.3	-12.3	-224
NORTH	713.0' - Ion, fltr rm, 36"	42.0	15.00	630.0	0.236	60.0	72.3	-12.3	-1,829
NORTH	713'-AB Gen Area, 36" CI	48.0	14.50	696.0	0.236	60.0	72.3	-12.3	-2,020
WEST	708.0' - C3, 8" CI	34.5	19.5	672.8	0.500	63.0	72.3	-9.3	-3,128
WEST*	708.0' - C2, 8" CI	8.0	19.5	113.0	0.500	56.9	72.3	-15.4	-870
WEST	Door C24	7.2	6.0	43.0	0.448	56.9	72.3	-15.4	-297
EAST	708.0' - TB/T1, 36" CI	34.5	19.5	672.8	0.236	40.0	72.3	-32.3	-5,128
EAST*	Stair C2, 8" CI	8.0	19.5	134.5	0.431	51.8	72.3	-20.5	-1,188
EAST	Door C25	7.2	3.0	21.5	0.448	51.8	72.3	-20.5	-198
FLOOR	692.0' - C6, 18" CI	33.3	6.9	229.8	0.376	63.1	72.3	-9.2	-795
FLOOR	692.0' - C11, 18" CI	75.9	8.0	607.2	0.376	62.8	72.3	-9.5	-2,169
FLOOR	692.0' - C7, 18" CI	11.3	33.3	376.3	0.376	63.9	72.3	-8.4	-1,188
FLOOR	692.0' - C8, 18" CI	18.0	33.3	599.4	0.305	63.1	72.3	-9.2	-1,682
FLOOR	692.0'-Attic(above C12)	11.0	33.3	366.3	0.305	57.3	72.3	-15.0	-1,676
FLOOR	692.0' - C9, 18" CI	43.0	33.3	1431.9	0.305	62.6	72.3	-9.7	-4,236
CEILING	729.0 - C1, 18" CI	[redacted]	[redacted]	3610.9	0.305	60.0	72.3	-12.3	-13,546
					TOTAL TRANSMISSION LOAD =				-55,626

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:
EQUIPMENT 155,257

TOTAL ROOM SENSIBLE LOAD: 155,257

Total Sensible Load = (Trans + Other Sensible) = -55,626 + 155,257 = 99,631

DUCT HTR (KW)	% Htr Opr	FLOW RATE	AHU SUPPLY TEMP	HTR BTUR	SUPPLY TEMP
10 (See Sect. 7.9)	0	9,268	62.4 (See Notes for this Section)	0	62.4

ROOM TEMPERATURE (Tr) = (Ts 62.4 + Q 99,631) / (1.08 x CFM 9,268) = 72.4 °F

LATENT LOAD:

				Q latent
PEOPLE	0	X	200	0
TOTAL ROOM LATENT LOAD:				0

ROOM HUMIDITY RATIO (Wr) = 0.0069 + 0 / (4840 x 9,268) = 0.0069

STEADY STATE ROOM TEMPERATURE: 72.3 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. - 708.0' - STAIR C1 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: WEST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 54.5 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
WEST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	40.0	54.5	-14.5	-534
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	40.0	54.5	-14.5	-1,201
NORTH	708.0' - C1, 8" CI	18.0	19.5	351.0	0.500	76.1	54.5	21.6	3,791
EAST*	708.0' - C1, 8" CI	8.0	19.5	134.5	0.431	76.1	54.5	21.6	1,252
EAST	Door C21	7.2	3.0	21.5	0.448	76.1	54.5	21.6	208
FLOOR (See Note)									
CEILING (See Note)									
					TOTAL TRANSMISSION LOAD =				3,516

Note: No transmission through the floor & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:

INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 3,516

STEADY STATE ROOM TEMPERATURE:	54.5 °F dry bulb

LOOP CONDITION (WINTER)
ROOM NO. 708.0' - STAIR C2 Ref: 5.5 - 5.11, 5.14 - 5.16, 5.18, 5.20, 5.47 - 5.54, 5.56, 5.57, 6.4
ROOM NAME: EAST STAIRWELL

Design air flow: NA cfm
Supply Air Temp: NA °F
Supply Air Humidity Ratio: NA lbW/lb dry air
Steady State Temperature: 51.8 °F Design Rm Temp °F: NA

WALL	TYPE OF ENCLOSURE	LENGTH/ HGT. (Ft)	WIDTH (Ft)	AREA (Sq Ft)	U Btu/h.sqft.F	Ts (°F)	Tr (°F)	DELTA T (°F)	SENSIBLE HEAT (BTU/h)
EAST	708.0' - TB/T1, 36" CI	8.0	19.5	156.0	0.236	40.0	51.8	-11.8	-434
SOUTH	708.0' - TB/T1, 36" CI	18.0	19.5	351.0	0.236	40.0	51.8	-11.8	-977
NORTH	708.0' - C4, 8" CI	18.0	19.5	351.0	0.500	72.3	51.8	20.5	3,598
WEST*	708.0' - C4, 8" CI	8.0	19.6	134.5	0.500	72.3	51.8	20.5	1,379
WEST	Door C25	7.2	3.0	21.5	0.448	72.3	51.8	20.5	198
FLOOR (See Note)									
CEILING (See Note)									
							TOTAL TRANSMISSION LOAD =		3,762

Note: No transmission through the flior & ceiling is considered; open space (stairs) between elevations 692.0 and 755.0

(*) The area of the door, listed directly below this wall area, has been subtracted from the total wall area.

LOAD SUMMARY:
INTERNAL:

EQUIPMENT	0.0	X	3.413	X	100%	= 0

TOTAL ROOM SENSIBLE LOAD: 3,762

STEADY STATE ROOM TEMPERATURE: 51.8 °F dry bulb

This page replaced by Revision 016.

LOOP CONDITION (WINTER)

CALCULATION OF AVERAGE RETURN AIR TEMPERATURE AND SPECIFIC HUMIDITY ENTERING THE AIR HANDLING UNIT:

SOURCE OF RETURN AIR FLOW	RETURN FLOW (cfm)	TEMP. (°F)	HUMIDITY # MOIST / # DRY	cfm X HUM.	cfm X °F
MECHANICAL EQUIP. ROOM EAST (C10)	2,816	61.8	0.0069	19.4	174,029
COMMUNICATION ROOM (692.0' - C9)	4,038	62.6	0.0069	27.9	252,748
MECHANICAL EQUIP. ROOM WEST (C1)	6,221	61.1	0.0069	42.9	380,073
UNIT 1 AUX. INSTRUMENT ROOM (708.0'-C1)	8,602	76.1	0.0069	59.4	654,612
COMPUTER ROOM (708.0' - C3)	6,677	63.0	0.0069	46.1	420,651
UNIT 2 AUX. INSTRUMENT ROOM (708.0'-C4)	9,268	72.3	0.0069	63.9	670,040
OUTSIDE AIR	2,420	13.0	0.0003	0.7	31,460
TOTAL	Vreturn = 40,041	[illegible]		260.3	2,583,612

Return Air Temperature from EBR spaces: SUM (cfm X °F) / Vreturn: Treturn = 64.5 °F
Return Air Humidity Ratio from EBR spaces: Wreturn = 0.0065 # MOIST / # DRY AIR

This page replaced by Revision 016.

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:34 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:34 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:34 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_5a
DATE: 10-14-19
PROCEDURE: EBR LOOP Winter

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.43
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	312.00	6006.00
Inlet Temperature (degrees F):	42.00	64.50
Outlet Temperature (degrees F):	43.07	42.32
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	2364.37	5.65
Clean Pressure Drop (psi):	64.20	Not Calculated
Fouled Pressure Drop (psi):	76.78	Not Calculated
Velocity (ft/s and ft/min):	14.34	171.60

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 168355/ 145238/ 23117 Btu/hr
Average Overall Heat Transfer Coefficient: 4.96 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 42.32 deg F

This page is added by Rev.016

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:44 PM

***** EQUIPMENT CONFIGURATION *****

	VALUE	QA REF
Number of Coil Groups per Unit:	1	
Number of Tube Rows Crossed by Airflow in Group 1:	8	
Number of Tubes Plugged in Group 1:	0	
Number of HX Coil Sections in Parallel per Group:	2	
Coil Type (serpentine):	Single	
Length of Finned Tubes Exposed to Air Flow (in.):	105.000	
Number of Tubes per Row:	16	
Tube Outside Diameter (in.):	0.6250	
Tube Wall Thickness (in.):	0.0490	
Tube Material:	Copper	
Tube Spacing Transverse to Air Flow (in.):	1.5000	
Tube Spacing In-Line with Air Flow (in.):	1.5000	
Fin Material:	Aluminum	
Fin Style:	Flat Plate	
Fin Thickness (in.):	0.0080	
Number of Fins per Inch:	9.0	

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:44 PM

***** QA REFERENCES *****

QA REF	REFERENCE SOURCE DESCRIPTION

PROGRAM AIRCOOL - REVISION 6.1

Finned Tube Air Cooler Rating Program

This computer code is QA Validated under Holtec International's QA system.

File Name: EBR_DUAL.AIR
Unit Name: EBR
Unit Description: EBR Coils

This report was created on: Wednesday, October 14, 2009 at 12:51:44 PM

***** PERFORMANCE PREDICTION MODE RESULTS *****

CASE ID: U2_5b
DATE: 10-14-09
PROCEDURE: EBR LOOP WINTER

CONVERGENCE TOLERANCE: 0.5 %

PARAMETER	WATER SIDE	AIR SIDE
Pressure (psia):	Not Required	14.70
Inlet Relative Humidity (%):	Not Required	50.43
Outlet Relative Humidity (%):	Not Required	100.00
Flow Rate (gpm and acfm):	238.00	6006.00
Inlet Temperature (degrees F):	42.00	64.50
Outlet Temperature (degrees F):	43.40	42.39
Fouling Factor (1/Btu/hr/sqft/F):	0.0010	0.0000
Heat Transfer Coeff (Btu/hr/sqft/F):	1887.18	5.65
Clean Pressure Drop (psi):	39.62	Not Calculated
Fouled Pressure Drop (psi):	47.39	Not Calculated
Velocity (ft/s and ft/min):	10.94	171.60

Air Flow Zones: 1 2
Air Flow Percentage: 50.00 50.00
Tubeside Fouling Layer Thermal Conductivity: 10.00 Btu/sqft/F/in/hr

Heat Duty (Total/Sensible/Latent): 167458/ 144812/ 22646 Btu/hr
Average Overall Heat Transfer Coefficient: 4.77 Btu/hr/sqft/F
Gross Heat Transfer Surface Area: 3412.31 sq ft
Dew Point Temperature: 42.39 deg F

This page is added by Rev.016

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.1 NORMAL PLANT OPERATION - SUMMER

Case 1 (Maximum Room Temperatures and Minimum AHU Cooling Capability)

Table 6.1-1 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.1. Design values reflect the current normal maximum EDD temperatures.

TABLE 6.1-1 (Temperature & Relative Humidity - Normal Summer - Case 1)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	23,781		86	84	20-60	34
MECHANICAL EQUIPMENT ROOM (C2)	6,384		86	85	20-60	33
250V BATTERY ROOM 1 (C3)	3,317		90	88	18-60	30
250V BATTERY BOARD ROOM 1 (C4)	76,484		90	86	26-60	31
250V BATTERY BOARD ROOM 2 (C5)	76,855		90	85	26-60	33
250V BATTERY ROOM 2 (C6)	892		90	88	18-60	32
24V & 48V BATTERY ROOM (C7)	775		90	87	18-60	31
24V & 48V BATTERY BOARD ROOM (C8)	23,573		90	82	26-60	36
COMMUNICATION ROOM (C 9)	98,731	400	90	89	18-60	29
MECHANICAL EQUIPMENT ROOM EAST (C10)	45,150		86	75	20-60	45
CORRIDOR (C 11)	26,093			85		
SECONDARY ALARM STATION (C12)	18,970	200	90	85	26-60	33
ATTIC (above C12)	5,061			74		
WEST STAIRWELL (STAIR C1)	2,226			72		
EAST STAIRWELL (STAIR C2)	2,779			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	240,032	400	90	90	27-60	28
CORRIDOR (C 2)	18,188			89		
COMPUTER ROOM (C3)	94,540	400	74	67	40-60	58
UNIT # 2 AUX INSTRUMENT ROOM (C4)	228,618	200	90	85	27-60	33
WEST STAIRWELL (STAIR C1)	2,904			91		
EAST STAIRWELL (STAIR C2)	3,824			85		
SUMMARY:	997,178	1,600				

As shown in Table 6.1-1, calculated temperatures and relative humidities in each room are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 8.1-1A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (summer) cooling scenario.

TABLE 6.1-1A (Cooling Loads & AHU Heat Duty - Normal Summer - Case 1)

Cooling Load Name	Final Cooling Load	Computer Room AHU **	AHU A-A (216 gpm) AIRCOOL *	AHU B-A (216 gpm) AIRCOOL *	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	997,178	69,442	540,599	540,599	1,150,640
Latent	1,600	-	48,122	48,122	96,244
Total	998,778	69,442	588,721	588,721	1,246,884

* For Heat Duty see pg.36
** For Heat Duty see pg.29

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.1 NORMAL PLANT OPERATION - SUMMER

Case 2 (Minimum Room Temperatures and Maximum AHU Cooling Capability)

Table 6.1-2 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.2. Design values reflect the current normal maximum EDD temperatures.

TABLE 6.1-2 (Temperature & Relative Humidity - Normal Summer - Case 2)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	24,400		86	83	20-60	44
MECHANICAL EQUIPMENT ROOM (C2)	5,294		86	85	20-60	33
250V BATTERY ROOM 1 (C3)	2,957		90	88	18-60	30
250V BATTERY BOARD ROOM 1 (C4)	75,119		90	87	26-60	31
250V BATTERY BOARD ROOM 2 (C5)	75,211		90	86	26-60	32
250V BATTERY ROOM 2 (C6)	353		90	86	18-60	32
24V & 48V BATTERY ROOM (C7)	579		90	87	18-60	31
24V & 48V BATTERY BOARD ROOM (C8)	22,659		90	82	26-60	36
COMMUNICATION ROOM (C 9)	94,869	400	90	90	18-60	28
MECHANICAL EQUIPMENT ROOM EAST (C10)	44,343		86	76	20-60	44
CORRIDOR (C 11)	-1,709			85		
SECONDARY ALARM STATION (C12)	18,584	200	90	86	26-60	32
ATTIC (above C12)	5,268			73		
WEST STAIRWELL (STAIR C1)	2,299			72		
EAST STAIRWELL (STAIR C2)	2,862			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	248,672	400	90	87	27-60	31
CORRIDOR (C 2)	18,175			88		
COMPUTER ROOM (C3)	99,057	400	74	64	40-60	65
UNIT # 2 AUX INSTRUMENT ROOM (C4)	238,493	200	90	82	27-60	36
WEST STAIRWELL (STAIR C1)	3,022			89		
EAST STAIRWELL (STAIR C2)	3,911			83		
SUMMARY:	984,418	1,600				

As shown in Table 6.1-2, calculated temperatures and relative humidities in each room are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7).

As shown in Table 6.1-2A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (summer) cooling scenario.

TABLE 6.1-2A (Cooling Loads & AHU Heat Duty - Normal Summer - Case 2)

Cooling Load Name	Final Cooling Load	Computer Room AHU ***	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	984,418	90,725	589,290	595,173	1,275,188
Latent	1,600	-	148,137	155,452	303,589
Total	986,018	90,725	737,427	750,625	1,578,777

* For Heat Duty see pg. 66
** For Heat Duty see pg. 69
*** For Heat Duty see pg.72

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.2 LOCA CONDITION - SUMMER - NO CONCURRENT LOOP

Case 1 (Maximum Room Temperatures and Minimum AHU Cooling Capability)

Table 6.2-1 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.3. Design values reflect the current maximum LOCA EDD temperatures.

TABLE 6.2-1 (Temperature & Relative Humidity - LOCA Summer - Case 1)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	28,554		89	86	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	6,809		83	86	NA	NA
250V BATTERY ROOM 1 (C3)	3,619		88	90	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	77,194		85	88	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	78,915		85	87	NA	NA
250V BATTERY ROOM 2 (C6)	1,833		88	88	NA	NA
24V & 48V BATTERY ROOM (C7)	938		90	88	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	23,895		74	83	NA	NA
COMMUNICATION ROOM (C 9)	98,348	400	88	91	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	49,795		87	78	NA	NA
CORRIDOR (C 11)	208			86		
SECONDARY ALARM STATION (C12)	18,978	200	79	86	NA	NA
ATTIC (above C12)	5,846			74		
WEST STAIRWELL (STAIR C1)	2,531			72		
EAST STAIRWELL (STAIR C2)	3,078			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	260,387	400	89	94	NA	NA
CORRIDOR (C 2)	22,285			89		
COMPUTER ROOM (C3) [2]	93,376	400	82	74	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	251,386	200	87	88	NA	NA
WEST STAIRWELL (STAIR C1)	5,000			91		
EAST STAIRWELL (STAIR C2)	5,954			85		
SUMMARY:	1,038,930	1,600				

As shown in Table 6.2-1, calculated temperatures in each room with the exception of the room 692.0' - C2, C3, C4, C5, C8, C9, C12 and 708' - C1, C4 are less or equal than values currently shown on the applicable EDDs (Ref. 5.5 through 5.7). EDD data for room 692.0' - C2, C3, C4, C5, C8, C9, C12 and 708' - C1, C4 need be revised.

As shown in Table 6.2-1A, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOCA (summer) cooling scenario.

TABLE6.2-1A (Cooling Loads & AHU Heat Duty - LOCA Summer - Case 1)

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (216 gpm) AIRCOOL *	AHU B-A (216 gpm) AIRCOOL *	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	1,038,930	N/A	618,580	618,580	1,237,160
Latent	1,600	N/A	-	-	-
Total	1,040,530	N/A	618,580	618,580	1,237,160

* For Heat Duty see pg.99

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.2 LOCA CONDITION - SUMMER - NO CONCURRENT LOOP

Case 2 (Minimum Room Temperatures and Maximum AHU Cooling Capability)

Table 6.2-2 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.4. Design values reflect the current maximum LOCA EDD temperatures.

TABLE 6.2-2 (Temperature & Relative Humidity - LOCA Summer - Case 2)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	32,117		89	82	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	8,014		83	81	NA	NA
250V BATTERY ROOM 1 (C3)	3,975		88	86	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	78,006		86	82	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	78,601		86	81	NA	NA
250V BATTERY ROOM 2 (C6)	1,531		88	83	NA	NA
24V & 48V BATTERY ROOM (C7)	1,122		90	83	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	24,597		74	78	NA	NA
COMMUNICATION ROOM (C 9)	100,290	400	88	86	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	53,274		87	74	NA	NA
CORRIDOR (C 11)	2,346			81		
SECONDARY ALARM STATION (C12)	19,579	200	79	81	NA	NA
ATTIC (above C12)	4,092			73		
WEST STAIRWELL (STAIR C1)	1,642			72		
EAST STAIRWELL (STAIR C2)	2,070			72		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	267,977	400	89	89	NA	NA
CORRIDOR (C 2)	22,159			88		
COMPUTER ROOM (C3)	109,590	400	82	63	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	260,064	200	87	84	NA	NA
WEST STAIRWELL (STAIR C1)	4,656			89		
EAST STAIRWELL (STAIR C2)	5,587			83		
SUMMARY:	1,081,289	1,600				

As shown in Table 6.2-2, calculated temperatures in each room with the exception of the room 692.0' - C8, C12 are less than the values currently shown on the applicable EDDs (Ref. 5.5 through 5.7). EDD data for room 692.0' - C8, C12 need be revised.

As shown in Table 6.2-2A, at a controller setpoint of 68 °F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOCA (summer) cooling scenario.

TABLE 6.2-2A (Cooling Loads & AHU Heat Duty - LOCA Summer - Case 2)

Cooling Load Name	Final Cooling Load	Computer Room AHU***	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	1,081,289	74,241	625,212	632,199	1,331,652
Latent	1,600	-	69,268	77,558	146,826
Total	1,082,889	74,241	694,480	709,757	1,478,478

* For Heat Duty see pg. 126
** For Heat Duty see pg. 129
*** For Heat Duty see pg.132

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.3 NORMAL PLANT OPERATION - WINTER

Table 6.3 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.5. Design values reflect the current normal minimum EDD temperatures.

TABLE 6.3 (Temperature & Relative Humidity - Normal Winter)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	-11,268		73	68	20-60	58
MECHANICAL EQUIPMENT ROOM (C2)	-2,347		73	74	20-60	47
250V BATTERY ROOM 1 (C3)	-91		75	76	18-60	44
250V BATTERY BOARD ROOM 1 (C4)	67,250		75	78	26-60	41
250V BATTERY BOARD ROOM 2 (C5)	69,355		75	78	26-60	41
250V BATTERY ROOM 2 (C6)	-1,362		75	74	18-60	48
24V & 48V BATTERY ROOM (C7)	-671		75	74	18-60	47
24V & 48V BATTERY BOARD ROOM (C8)	16,955		75	72	26-60	51
COMMUNICATION ROOM (C 9)	79,116	0	75	79	18-60	40
MECHANICAL EQUIPMENT ROOM EAST (C10)	9,625		73	60	20-60	76
CORRIDOR (C 11)	-9,829			76		
SECONDARY ALARM STATION (C12)	14,743		75	75	26-60	45
ATTIC (above C12)	1,242			70		
WEST STAIRWELL (STAIR C1)	573			59		
EAST STAIRWELL (STAIR C2)	949			59		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	158,212	0	75	73	27-60	48
CORRIDOR (C 2)	-2,782			66		
COMPUTER ROOM (C3)	50,956	0	65	60	40-60	77
UNIT # 2 AUX INSTRUMENT ROOM (C4)	131,925	0	75	69	27-60	55
WEST STAIRWELL (STAIR C1)	561			64		
EAST STAIRWELL (STAIR C2)	1,200			60		
SUMMARY:	574,311	0				

As shown in Table 63, calculated temperatures in each room with the exception of rooms 692.0-C2, C3, C4,C5, C9 & 708.0-C2 are less than currently shown on the applicable EDDs (Ref. 5.5 through 5.7). EDD data for these room temperature need be revised. Relative humidity levels are within the limits as shown on EDDs (Ref. 5.5 through 5.7) with the exception of room 692.0 C10 & 708.0-C3. The humidity level EDD for these room need to be revised .

As shown in Table 6.3.1, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this NORMAL (winter) cooling scenario.

TABLE 6.3.1 (Cooling Loads & AHU Heat Duty - Normal Winter)

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (216 gpm) AIRCOOL*	AHU B-A (284 gpm) AIRCOOL**	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	574,311	-	394,254	401,521	795,775
Latent	0	-	68,717	77,150	145,867
Total	574,311	-	462,971	478,671	941,642

* For Heat Duty see pg. 7.12.40. The calculated capacity for 16000 cfm through the coild was used for evaluation.
** For Heat Duty see pg. 7.12.55. The calculated capacity for 16000 cfm through the coild was used for evaluation.

6.0 SUMMARY OF RESULTS AND CONCLUSIONS

6.4 LOOP CONDITION - WINTER (minimum room temperatures at maximum AHU capability)

Table 6.4 below lists cooling loads, temperatures and relative humidities of the rooms served by EBR AHUs. These steady state data were extracted from Section 5.6. Design values reflect the current minimum LOCA EDD temperatures.

TABLE 6.4 (Temperature & Relative Humidity - LOOP Winter)

ROOM	COOLING LOAD (BTU/HR)		TEMPERATURE °F		RELATIVE HUMIDITY (%)	
	SENSIBLE	LATENT	DESIGN	ST. STATE	DESIGN	ST.STA.
ROOMS @ ELEVATION 692.0'						
MECHANICAL EQUIPMENT ROOM WEST (C1)	-12,620		62	61	NA	NA
MECHANICAL EQUIPMENT ROOM (C2)	2,075		65	63	NA	NA
250V BATTERY ROOM 1 (C3)	1,574		65	64	NA	NA
250V BATTERY BOARD ROOM 1 (C4)	2,776		67	63	NA	NA
250V BATTERY BOARD ROOM 2 (C5)	715		67	63	NA	NA
250V BATTERY ROOM 2 (C6)	290		67	63	NA	NA
24V & 48V BATTERY ROOM (C7)	484		64	64	NA	NA
24V & 48V BATTERY BOARD ROOM (C8)	799		64	63	NA	NA
COMMUNICATION ROOM (C 9)	1,738	0	67	63	NA	NA
MECHANICAL EQUIPMENT ROOM EAST (C10)	-1,782		60	62	NA	NA
CORRIDOR (C 11)	26			63		
SECONDARY ALARM STATION (C12)	-410		65	62	NA	NA
ATTIC (above C12)	3,343			57		
WEST STAIRWELL (STAIR C1)	1,045			63		
EAST STAIRWELL (STAIR C2)	871			54		
ROOMS @ ELEVATION 708.0'						
UNIT # 1 AUX INSTRUMENT ROOM (C1)	126,945	0	63	78	NA	NA
CORRIDOR (C 2)	2,794			57		
COMPUTER ROOM (C3)	37,072	0	63	63	NA	NA
UNIT # 2 AUX INSTRUMENT ROOM (C4)	99,631	0	62	72	NA	NA
WEST STAIRWELL (STAIR C1)	3,516			55		
EAST STAIRWELL (STAIR C2)	3,762			52		
SUMMARY:	274,645	0				

As shown in Table 6.4, calculated temperatures in each room with exception of rooms 692.0'-C7, C10 & 708.0'-C1, C3, C4 are less than currently shown on the applicable EDDs (Ref. 5.5 through 5.7). These temperatures need be revised (decreased).

As shown in Table 6.4.1, at a controller setpoint of 68°F, the following cooling loads and cooling capacities were computed. Final cooling loads are less than cooling capacities, thus adequate cooling capacity exists during this LOOP (winter) cooling scenario.

TABLE 6.4.1 (Cooling Loads & AHU Heat Duty - LOOP Winter)

Cooling Load Name	Final Cooling Load	Computer Room AHU	AHU A-A (238 gpm) AIRCOOL *	AHU B-A (312 gpm) AIRCOOL **	TOTAL three (3) AHUs
	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)	(Btu/h)
Sensible	274,645	-	144,812	145,238	290,050
Latent	0	-	22,646	23,117	45,763
Total	274,645	-	167,458	168,355	335,813

* For Heat Duty see pg. 15.30
** For Heat Duty see pg. 15.27

6.5 Evaluation of DCN 51656 Potential Impact on Dual Unit Operation

Calculation EPMMCP071689 Rev.016 assesses the proposed changes to be performed by DCN 51656. Stage 3 was included in this DCN to rebalance the air flow of the Control Building Electrical Board Room Areas HVAC system such that air flow to the Secondary Alarm Station was reduced from 695 cfm to 200 cfm. Systems Engineering was unable to get the air flows adjusted to within the G-37 requirements specified in stage 3. As a result, PIC 52252 was initiated to disposition the measured air flows.

The calculation concluded that this reduction in air flow did not result in excessive temperatures because the calculation at that time used electrical heat loads from MDQ00003120010065 (field measured heat loads for single unit operation) rather than the theoretical heat loads from the Electrical Engineering Branch electrical heat loads calculations.

An analysis was performed to determine potential impact on the design room temperature for dual unit operation if stage 3 of DCN 51656 was implemented. In this preliminary analysis, the airflow rate used in this spread sheet is the same as Revision 15 with implementation of Stage 3 of DCN 51656. Based on the result of this analysis, the room temperature in Secondary Alarm Station (EL.692-C12) with issued electrical heat loads for dual unit operation is 106 °F for Normal Operation (Summer Case 1) and 107 °F for LOCA Operation (Summer Case 1) operating case, which are much higher than the design limits for normal (90°F) and LOCA (79 °F) conditions. The spread sheet for this preliminary analysis has been uploaded to FILEKEEPER (EPMMCP071689R16_Preliminary.xls, # 313161).

Considering that the room temperature in Secondary Alarm Station (EL.692-C12) will be over 104 °F for normal and LOCA cases with rebalanced flow rate data, it is recommended that the Stage 3 of DCN 51656 should be cancelled for dual unit operation. This is added as an UVA in Section 2.2.1.

This page is added by Rev.016

Calculation sheet

Document:	EPMMCP071689	Rev.: 021	Plant: WBN / Units 1,2	Page: 1
Subject:	Appendix 12 – Evaluation of Relative Humidity in Unit 2 Auxiliary Instrument Room during LOCA Condition			

1. Purpose

This Appendix is to determine the maximum relative humidity in Unit 2 Aux Instrument Room during the LOCA conditions. According to environmental drawing 2-47E235-17 and -19 Revision 0 (Reference 2.1 & 2.2), the maximum temperature during a LOCA is 91 °F for elevation 692.0 and 94 °F for elevation 708.0 with a specific humidity of 140 grains of moisture per pound of dry air (0.02 pound of moisture per pound dry air). The Electrical Board Room (EBR) Air Handling Units (AHUs) provides 36,400 cfm air (30,665 cfm return air plus 5,735 cfm outside air) to the various rooms on Elevation 692.0 and 708.0. The Unit 2 Auxiliary Instrument Room is located on elevation 708.0 and receives 8425 cfm of the 36,400 cfm from the EBR AHUs.

2. References

2.1 TVA Drawing 2-47E235-19, Revision 0 (For Information only)
2.2 TVA Drawing 2-47E235-17, Revision 0
2.3 TVA Drawing 47A373-1, Revision 2 (Information only)
2.4 TVA Drawing 1-47W866-4. Flow Diagram – Heating Ventilating and Air Conditioning Air Flow, R40
2.5 ASHRAE Fundamental 2009, IP edition

3. Design Input Data

3.1 LOCA Condition Auxiliary Equipment Room (Reference 2.2)

Elevation 708.0 - Temperature, °F	88
Specific Humidity, pound of moisture per pound dry air	0.02

3.2 For the normal operation, the intake flow rate from outside to Electrical Board Room air conditioning unit is 5,735 cfm and the total return air flow is 30,665 cfm (Reference 2.4).

3.3 The air temperature, humidity ratio, and relative humidity for Unit 2 Auxiliary Instrument Room with normal maximum temperature are 84.7°F, 0.0084 lb water vapor/lb dry air (58.8 grains) and 33%; respectively. (Reference Appendix 11, Page 30 of 194).

3.4 For LOCA condition, the Unit 2 Auxiliary Instrument Room humidity ratio is 0.0069 lb water vapor/lb dry air (48.3 grains) and the steady state room temperature (dry bulb) is 88.4 °F (Appendix 11, Page 93 of 194).

Humidity in Main Control Room and Auxiliary Instrument Room is desired to be higher than 20% as lower than 20% humidity may affect function of touch screens and will affect operability of Unit 2 QPAMS.

For the Electrical Board Room AHUs, the total return airflow from is 30,665 cfm and the intake flow rate from outside is 5,735 cfm, which is about 16 % of total return flow rate.

Considering that the amount of intake flow rate from outside is relatively small, the impact of the variation of outside conditions from normal maximum condition (95 °F with specific humidity of 0.0133 lb moisture/ lb air – Section 6.9.17) to LOCA maximum condition (88 °F with specific humidity of 0.02 lb moisture/ lb air) on cooling coil performance is not significant.

Referring to Psychometric Chart for Air-Steam Mixtures (Reference 2.5), relative humidity for LOCA steady state room conditions temperature 88.4 °F and humidity ratio 0.0069 lb water vapor / lb of dry air (48.3 grains) is about 24% for the Unit 2 Auxiliary Instrument Room. The humidity ratio and the steady state room temperature were retrieved from Page 93 of the Appendix 11 of this calculation. Note that this humidity ratio is for condition when the heaters are assumed to be not operating. If the heaters are assumed in operation, the humidity ratio is 0.0084 lb water vapor / lb of dry air (58.8 grains) the relative humidity in the room is about 29% at 88.4 °F.

4.0 Conclusion

Based on the above analysis, the temperature and relative humidity in Unit 2 Auxiliary Instrument Room still remains as 88.4°F and 24% RH during LOCA condition and humidifiers not in operation.

This page was added by Revision 021