

DOE/RL/10436--T2-Vol.4-Bk.11

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**INTEGRAL
MONITORED RETRIEVABLE STORAGE (MRS)
FACILITY

CONCEPTUAL DESIGN REPORT**

VOLUME IV BOOK XI — CALCULATIONS

Prepared for
**UNITED STATES DEPARTMENT OF ENERGY
Richland Operations Office**

Report No. MRS 11
Contract No. DE-AC06-84RL 10436
September 1985

**THE RALPH M. PARSONS COMPANY OF DELAWARE
Westinghouse Electric Corporation
Golder Associates**

MASTER

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THE RALPH M. PARSONS COMPANY

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Discipline MECH. UTILITIES Cost Center No. 7230 Job No. 6440
Project MRS - SUPPORT BLOCS Location _____

[illegible]



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION I

ADMINISTRATION BLDG

TITLE MRS FACILITY-ADMINISTRATION BLDG SHEET NO. 1 OF 13
 JOB NO. 6440 70-1 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/13/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Dubois</u>	<u>8-14-84</u>						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE ADMINISTRATION BUILDING & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS, CHOSEN FROM THREE TYPES OF SITES (HOT, HUMID & COLD).

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430-1, DEC. 1983
 ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS, 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY-ADMINISTRATION BUILDING SHEET NO. 2 OF 13
JOB NO. 6440-70-1 DEPARTMENT MU AUTHOR AB DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II DESIGN TEMPERATURES:

a AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

b HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - ADMINISTRATION BUILDING SHEET NO. 3 OF 13
 JOB NO. 6440- DEPARTMENT _____ AUTHOR _____ DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/23/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_R) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)

TOTAL CORRECTION: $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10



TITLE MRS FACILITY-ADMINISTRATION B SHEET NO. 4 OF 13
JOB NO. 6440- DEPARTMENT MU AUTHOR _____ DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	PLU/ESS	6/22/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49
5. "U" FLOOR = 0.93

* GLASS

1. SC = 0.55
2. CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
3. SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1, X111 -8).

TITLE MRS FACILITY-ADMINISTRATION BLDG SHEET NO. 5 OF 13
 JOB NO. 6440-70-1 DEPARTMENT MU AUTHOR AK DATE 5-22

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
1	P. WEISS	6/22/80						

* LIGHTS

$$CLF = 0.86$$

** PEOPLE

$$\begin{array}{l} SHG \\ LHG \end{array} = \begin{array}{l} 255 \\ 255 \end{array} \} \text{OFFICE}$$

$$\begin{array}{l} SHG \\ LHG \end{array} = \begin{array}{l} 345 \\ 695 \end{array} \} \text{SHOPS}$$

$$CLF = 0.84$$

*** VENTILATION AND INFILTRATION

$$\text{PEOPLE} = 5 \text{ CFM/PERSON (MIN)}$$

$$\text{TOILET} = 2 \text{ CFM/FT}^2$$

$$\text{DOORS} = 10 \text{ CFM/FT}^2$$

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	2	5/22/81	JB	PN									

ROOM OR SYSTEM NO. MRS FACILITY - ADMINISTRATION BUILDING

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	242	x	9	=	2150-310 ^{1870x}	x	0.07	x	26	or	68	=	3,400	or	8900
E WALL	92	x	9	=	830-150 ^{680x}	x	0.07	x	31	or	68	=	1,480	or	3,240
S WALL	242	x	9	=	2180-1930 ^{250x}	x	0.07	x	39	or	68	=	680	or	1,190
W WALL	82	x	9	=	740-540 ^{200x}	x	0.07	x	69	or	68	=	970	or	950
N GLASS	4x7	x	11	=	310 ^{0.55}	x	0.75	x	39	or		=	9080	or	
E GLASS	2x7	x	11	=	150 ^{0.55}	x	0.17	x	216	or		=	3,030	or	
S GLASS	25(7	x	11)	=	1930 ^{0.55}	x	0.35	x	90	or		=	33,440	or	
W GLASS	7(7	x	11)	=	540 ^{0.55}	x	0.82	x	216	or		=	9,360	or	
CEILING	242+92+242+82	x		=	660	x	0.93	x		or	68	=		or	41,610
OR ROOF		x		=		x		x		or		=		or	
FLOOR	(310+150+1930+540)	x		=	2930	x	0.43	x	16	or	68	=	20,160	or	85,680
GLASS (COND)		x		=		x		x		or		=		or	
PARTITION	20	x	92	=		x		x		or		=		or	
ROOF	20	x	72	=	19,100	x	0.05	x	30	or	68	=	28,650	or	64,940
PARTITION	140	x	82	=		x		x		or		=		or	

SUBTOTAL 110,250 206,510

INTERNAL HEAT GAINS

LIGHTS: 19,100 SQ FT x 0.86x3* WATTS/SQ FT * x 3.41 = 168,040

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08** x _____ °F x ΔT = _____

206,510

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 20 x 255x0.84 BTU/HR = 4,280

* LOAD TO CONDITIONED SPACE (ELECTRICAL INFO)

SUBTOTAL 172,320 110,250

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 282,570 206,510

LATENT HEAT GAINS

PEOPLE = 20 x 255x0.84 BTU/HR = 4280

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 4,280 = 4,280

TOTAL ROOM LOAD 286,850 206,510

SUPPLY AIR = TOTAL SENSIBLE LOAD = 282,570 = 13.030* CFM

AIR CHANGE RATE = ROOM VOLUME = 108x20 = _____ MIN

REMARKS: * USE 23000 CFM BASED @ 21.2 CFM/FT²

(see sheet #)

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-1</u>	
		SHEET <u>6</u>	OF <u>13</u>

TITLE MRS FACILITY-ADMINISTRATION BLDG. SHEET NO. 7 OF 13
 JOB NO. 6440-70-1 DEPARTMENT MU AUTHOR AB DATE 5-16-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

COOLING LOAD:

1. SUPPLY AIR:

ADMINISTRATION BLDG. AREA = 19,100 SF

$$19,100 \text{ SF} \times 1.2 \frac{\text{CFM}}{\text{SF}} = 22,920 \text{ CFM},$$

SAY 23,000 CFM

2. EXHAUST AIR:

TOILETS = 850 CFM

WENDING MACHINE AREA = 100 CFM

TOILET (RM # 174) = 100 CFM

TOTAL = 1,050 CFM

PEOPLE & INFILTRATION (ASSUME) 1,950 CFM

RETURN AIR = 23,000 - 3,000 = 20,000 CFM

MECH EQUIPMENT RM SUPPLY = 1,000 CFM

MIN OA = 23,000 - 20,000 - 1,000 = 4000 CFM

= 17% OA



TITLE MRS FACILITY-ADMINISTRATION BLDG SHEET NO. 8 OF 13
JOB NO. 6440-70-1 DEPARTMENT ML AUTHOR AB DATE 5/6-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/23/84						

COOLING LOAD (CONT'D)

MIXED AIR :

ASSUME 80°F RA FROM CEILING PLENUM

$$\begin{aligned} \therefore 95^\circ \times 0.17 &= 16.15 \\ 80^\circ \times 0.83 &= 66.4 \\ \hline &82.55^\circ \text{F DB}, 66^\circ \text{F WB}, \\ &31.7 \Delta h \end{aligned}$$

ASSUME AIR LEAVING COIL @ 56°F DB / 55°F WB,
23.9 Δh

LOAD @ 500' ELEV.

$$23,000 \times 4.33 (31.7 - 23.9) = \underline{\underline{776,800 \text{ BTUH}}}$$

HEATING LOAD :

$$\begin{aligned} \text{BLDG HEAT LOSS} &= 206,510 \text{ BTUH} \\ \text{OA} = 4000 \times (72^\circ - 4^\circ) \times 1.08 &= \underline{\underline{293,760 \text{ BTUH}}} \end{aligned}$$

$$\text{TOTAL} = \underline{\underline{500,270 \text{ BTUH}}}$$

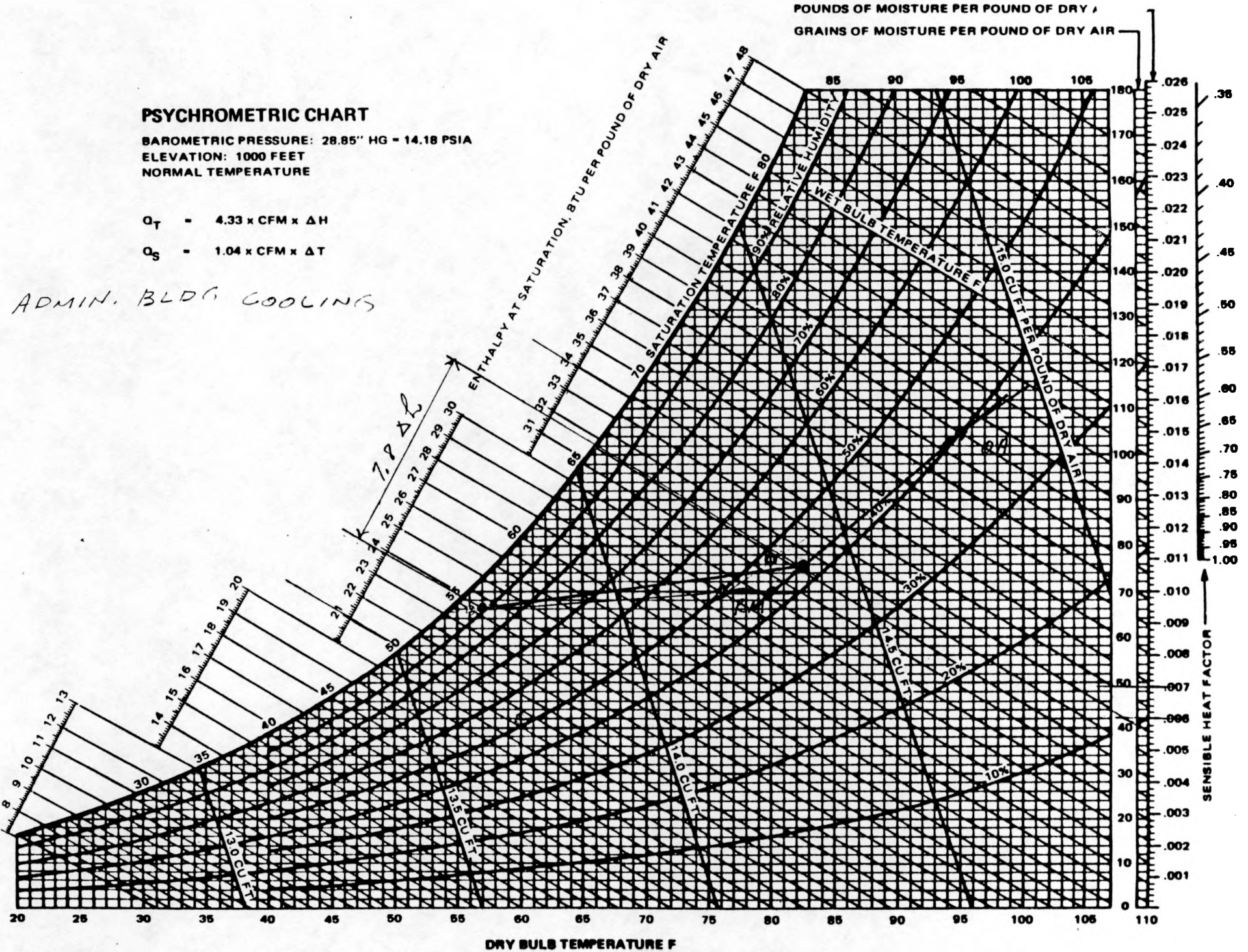
PSYCHROMETRIC CHART

BAROMETRIC PRESSURE: 28.85" HG = 14.18 PSIA
ELEVATION: 1000 FEET
NORMAL TEMPERATURE

$$Q_T = 4.33 \times \text{CFM} \times \Delta H$$

$$Q_S = 1.04 \times \text{CFM} \times \Delta T$$

ADMIN. BLDG COOLING



TITLE MRS - ADMIN. BLDG SHEET NO. 10 OF 13
 JOB NO. 6440-70-1 DEPARTMENT M. U. AUTHOR T. CRUMP DATE 4/18/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	<i>[Signature]</i>	4-6-84						

EQUIP. SELECTION

1. AIR COOLED CONDENSING UNIT: ACCU-800
USE 60 TONS FOR EQUIP. SELECTION

776,800 BTUH NET COOLING @ AH UNIT

USE CARRIER MODEL 38AG084
 81.5 KW

777,000 BTUH @ 35°F SST, 100°F AMB.

DIM. 13'-8" L x 7'-0" W x 7'-4" H

2. AIR HANDLING UNIT: AHU-800

23,000 CFM @ 3½" SP

USE CARRIER MOD. 39E 48 DUAL DUCT UNIT
 W/VARIABLE INLET VANES, DX COOLING COIL
 & HOT WATER HEATING COIL.

UNIT W/CARTRIDGE FILTER SECTION (30% PF, 85% FF)
 25 HP MOTOR
 DX COOL COIL

3. RETURN AIR FAN: RF-800
EST. 20,000 CFM @ 1½" SP

USE BUFFALO TYPE BL SISW FAN
 MOD 805 ARR #3
 40½" DIA. WHEEL
 10 HP

TITLE MRS - ADMINISTRATION BLDG.SHEET NO. 11 OF 13JOB NO. 6400-70-1 DEPARTMENT M.U.AUTHOR T. CRUMPDATE 4/18/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	<u>Bullock</u>	<u>6-6-84</u>						

HOT WATER BOILER SELECTION:

FROM PRELIM. CALC:

MAX. HEATING LOAD =

500,270 BTUH

ADD 10% PICKUP: 50,030 "

MIN. BOILER OUTPUT: 550,300 BTUHBOILER SELECTION: - B 750

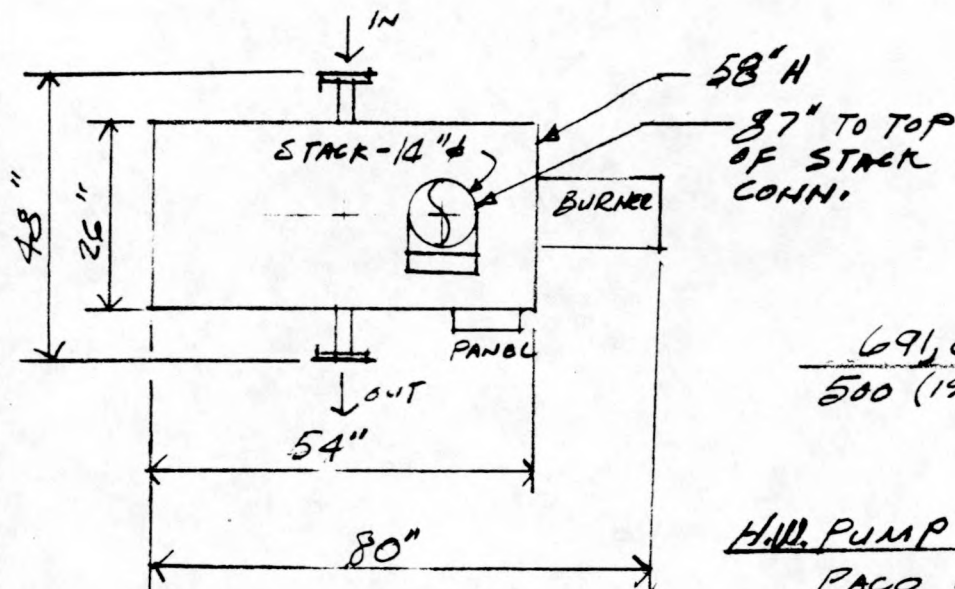
PARKER OIL FIRED

MODEL O-864

INPUT = 864 M BTUH

OUTPUT = 691 M BTUH

NO. 2 OIL



$$\frac{691,000}{500 (190-170)} = 70 \text{ GPM}$$

P-750AH.W. PUMP SELECTION: P-750B

PACO GND SUCTION
CLOSE COUPLED TYPE L
MOD. 1595-S, 1750 RPM
70 GPM @ 60 FT HD
3 HP

NO STANDBY BOILER

2 - 100% CAP. PUMPS
2 - RECIRC. FUEL OIL
PUMP (1. STANDBY)

TITLE MRS - ADMINISTRATION BUILDING SHEET NO. 12 OF 13
 JOB NO. 6440-70-1 DEPARTMENT ML AUTHOR AB DATE 6-14-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEBS	6/22/84						

BOILER RM.

$$A = 24' \times 9' = 216 \text{ SF}$$

$$V = 216 \text{ SF} \times 12' = 2,592 \text{ CUF}$$

BASIS FOR DESIGN REQUIRED 12 A.C./HOUR,

$$\therefore \text{SUPPLY AIR} = \frac{12 \times 2,592}{60} = 520, \text{ USE } \underline{\underline{550 \Phi}}$$

INTAKE LOUVER 24" x 18"

EXHAUST FAN - EF-807

USE "LOREN-COOK"

550 Φ @ 1/4" S.P 1/6 HP

HEATING LOAD:

$$OA = 550 \times (50 - 4) \times 1.08 = 27,500 \text{ BTUH}$$

USE HOT WATER UNIT HEATER, 30,000 BTUH

"WING", MODEL 13; 1/6 HP

$$\Delta T = 20^\circ \text{F}, \underline{\underline{3.6 \text{ GPM}}}$$

TITLE MRS FACILITY- ADMINISTRATION BLDG SHEET NO. 13 OF 13
 JOB NO. 6440-70-1 DEPARTMENT MU AUTHOR AB DATE 6-14-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/81						

EQUIPMENT SELECTION (CONT'D) :

EXHAUST FAN

USE LOREN-COOK,

- 1) 850 F @ 1/4" S.P. 1/6 HP MOTOR (# 165, 154, 109)
(EF-800)
- 2) 100 F @ 1/8" S.P. 1/6 HP MOTOR (# 176)
(EF-801)
- 3) 100 F @ 1/8" S.P. 1/6 HP MOTOR (# 174)
(EF-802)
- 4) 500 F @ 1/4" S.P. 1/6 HP MOTOR (BOILER RM.)
(EF-802)
- 5) UNIT HEATER (HOT WATER) (BOILER RM.)
(UH-800)



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION II

SECURITY BLDG

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 1 OF 14
JOB NO. 6440 70-2 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/13/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	8-14-84						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE SECURITY BUILDING & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430.1, DEC. 1983
ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS., 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF THE ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY- SECURITY BUILDING SHEET NO. 2 OF 14
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. Weiss DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Enrich</i>	<i>6-4-84</i>						

DESIGN CONDITIONS:

I. SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II. DESIGN TEMPERATURES:

A. AIR CONDITIONED SPACE:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	76°F DB 50% RH
WINTER : 4°F DB	72°F DB

B. HEATING AND VENTILATING:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	10°F ABOVE OUTSIDE TEMPERATURE = 105°F
WINTER : 4°F DB	65°F DB

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 3 OF 14
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. Weiss DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>P. Weiss</i>	6-4-84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_r) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP : $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)

D ROOM CORRECTION FACTOR : $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)

TOTAL CORRECTION : $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR : $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10



TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 4 OF 14
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. Weiss DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Bohner</u>	<u>6-4-84</u>						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
- 3 SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X111 - 8).

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 5 OF 14
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. Weiss DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>B. Weiss</u>	<u>6-4-84</u>						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255
 LHG = 255 } OFFICE

SHG = 345
 LHG = 695 } SHOPS

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15



TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 6 OF 14
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. WEISS DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>P. Weiss</u>	<u>6-4-84</u>						

GROUND LEVEL (NON-HARDENED AREA)

* COOLING LOAD

NON-HARDENED AREA : 4265 FT^2

ASSUME 1.2 CFM/FT^2

$$4265 \times 1.2 = 5120 \text{ CFM}$$

5% SAFETY 5374 CFM

USE 5500 CFM

OA : TOILET = 860 CFM
 MECH. EQUIP. RM. = 500 CFM

TOTAL 1360 CFM

SUPPLY AIR = 5500 CFM

EXHAUST AIR = 1360 CFM

RETURN AIR 4140 CFM

$$1360 / 5500 = 25\% \text{ OA}$$

MIXED AIR :

(ASSUME 80°F RA FROM CEILING PLENUM)

$$95^\circ \times 0.25 = 23.75$$

$$80^\circ \times 0.75 = 60.00$$

$83.75^\circ\text{F DB} / 68.2^\circ\text{F WB}$

$h = 32.4$

* THIS IS THE PRELIMINARY COOLING LOAD. IT WILL BE FINALIZED AFTER THE MRS SITE IS DETERMINED.

PSYCHROMETRIC CHART

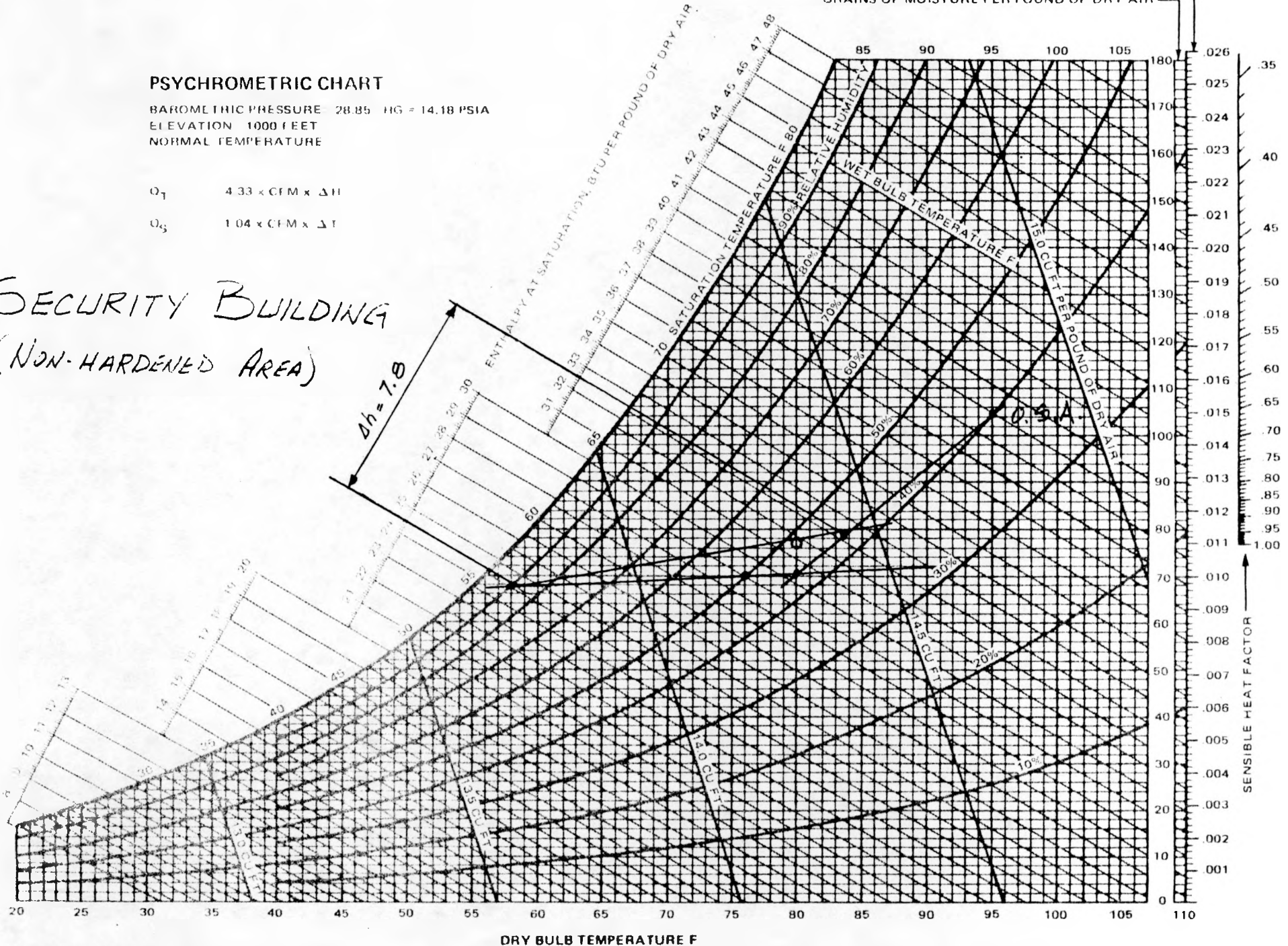
BAROMETRIC PRESSURE 28.85 HG = 14.18 PSIA
ELEVATION 1000 FEET
NORMAL TEMPERATURE

$$Q_1 = 4.33 \times \text{CFM} \times \Delta H$$

$$Q_2 = 1.04 \times \text{CFM} \times \Delta T$$

SECURITY BUILDING
(NON-HARDENED AREA)

$\Delta h = 7.8$



TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 8 OF 14
 JOB NO. 6440-70-2 DEPARTMENT MLI AUTHOR P. WEISS DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Dehens</u>	<u>6-4-84</u>						

COOLING LOAD (CONT'D)

ASSUME AIR LEAVING COIL @ $58^{\circ}\text{F DB} / 56^{\circ}\text{F WB}$
 $t = 24.6$

LOAD @ 500 FT. ELEV. :

$$5500 \left(\frac{4.5}{4.4} \times 0.982 \right) (32.4 - 24.6)$$

$$= 188,760 \text{ BTUH}$$

$$= 16 \text{ TONS}$$

HEATING LOAD

BLDG. LOAD (INCL. D.S.A.) 138,390 (FR. SHT. 8)

ADD 25% SAFETY 34,600

TOTAL 172,990 BTUH

USE 175,000 BTUH

COIL INSIDE AHU : 75,000 BTUH

REHEAT COIL TO :

SHOWERS, RESTROOM, ETC. 60,000 BTUH

MULTIPURPOSE/EXERCISE RM. 20,000 BTUH

OFFICES 20,000 BTUH

TOTAL 175,000 BTUH //

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5/25/34	PW	D									

ROOM OR SYSTEM NO. SECURITY BUILDING - NON HARDENED AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	68	x	9	=	612	x	0.07	x	26	OR	68	=	1110	OR	2910
E WALL	(108x9) - 81	x	81	=	891	x	0.07	x	31	OR	68	=	1930	OR	4240
S WALL	(68x9) - 254	x	254	=	358	x	0.07	x	39	OR	68	=	980	OR	1700
W WALL	(108x9) - 27	x	27	=	945	x	0.07	x	63	OR	68	=	4170	OR	4500
E GLASS	5 x 5.4	x	3	=	81	x	0.55 x 0.17	x	216	OR		=	1640	OR	
S GLASS	(18x9) + (3.4x9x3)	x		=	254	x	0.55 x 0.35	x	90	OR		=	4400	OR	
W GLASS	5	x	5.4	=	27	x	0.55 x 0.32	x	216	OR		=	2630	OR	
CEILING OR ROOF		x		=	4265	x	0.05	x	30	OR	68	=	6400	OR	14500
FLOOR		x		=		x		x		OR		=		OR	
O.S.A. PARTITION	1360	x	1.08	=	1470	x		x		OR	68	=		OR	99960
COND. GLASS PARTITION		x		=	362	x	0.43	x	16	OR	68	=	2490	OR	10580

SUBTOTAL 26,750 138,390

INTERNAL HEAT GAINS

LIGHTS: 4265 SQ FT x 0.86 x 3 WATTS/SQ FT * x 3.41 = 37,520

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 1360 CFM x 1.08 * x 19 °F x ΔT = 27,910

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 12 x 255 x 0.34 BTU/HR = 2570

* LOAD TO CONDITIONED SPACE

SUBTOTAL 68,000

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 93,750

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 138,390

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{93750}{1.08 \times 20}$ = 4340* CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * FOR PRELIMINARY ESTIMATES USE 5500 CFM BASED ON 1.2 CFM/FT².

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER 6440-70-2
		SHEET 9 OF 14

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 10 OF 19
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR P. WENS DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>D. WENS</u>	<u>6-4-84</u>						

HEATING LOAD (CONT'D)

BOILER RM. - ASSUME 410 CFM SUPPLY

$$\begin{array}{llll} \text{O.S.A.} & 410 \text{ CFM} \times 1.08 \times 61 & = & 27,010 \text{ BTUH} \\ \text{WALLS} & (32 \times 12) \times 0.07 \times 61 & = & 1,640 \text{ "} \\ \text{ROOF} & (20 \times 12) \times 0.05 \times 61 & = & 730 \text{ "} \end{array}$$

29,380 BTUH

15% SAFETY 4,400 BTUH

TOTAL 33,780 BTUH

USE 34,000 BTUH

EQUIPMENT SELECTION

1. AIR HANDLING UNIT (AHU-801)

"CARRIER" MODEL 39E 11, SINGLE DUCT, DRAW-THROUGH, 5500 CFM @ 3" S.P., 7 1/2 HP MOTOR, DX COOLING COIL, HOT WATER HEATING COIL, FILTER SECTION (30% PF & 85% FF).

2. AIR COOLED CONDENSING UNIT (ACCU-801)

"CARRIER" MODEL 38 AD 024, 189,000 BTUH @ 30°F SST & 95° AMBIENT, 19.2 KW, 3 COND. FANS - 1 HP EA., 1- COMP. REFR. TYPE : R-22

TITLE MRS FACILITY - SECURITY BUILDINGS SHEET NO. 14 OF 14
 JOB NO. 6440-70-2 DEPARTMENT M.V. AUTHOR P. WEN DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Pouhaiv</u>	<u>6-7-84</u>						

EQUIPMENT SELECTION (CONT'D)

3. RETURN AIR FAN (RF-801)

"BUFFALO" MODEL BL-400, STSW CENTRIF.,
 4640 CFM @ 1 1/2" S.P., 3HP MOTOR.

4. EXHAUST FANS (EF)

EF-804 : TOILET EXHAUST

"LOREN COOK" MODEL ACE-B-120 C2B,
 CENTRIFUGAL, 860 CFM @ 1/2" S.P.,
 1/6 HP MOTOR.

EF-805 : BOILER ROOM EXHAUST

"LOREN COOK" MODEL ACE-B-100 C2B,
 CENTRIFUGAL, 410 CFM @ 1/4" S.P.,
 1/6 HP MOTOR.

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 12 OF 14
 JOB NO. 6440-70-2 DEPARTMENT M.V. AUTHOR P. WEISS DATE 9/25/74

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Paulson</u>	<u>6-4-84</u>						

LOWER LEVEL (HARDENED AREA)

* COOLING LOAD

LIGHTS : $3746 \times 0.86 \times 3 = 9660 \text{ BTUH}$

STANDBY

SUBST : $300 \text{ KW} \times 0.02 \times 3410 = 20,460 \text{ BTUH}$

UPS : $11 \text{ KW} \times 3410 = 37,510 \text{ BTUH}$

CONTR. EQUIP: $4 \text{ KW} \times 3410 = 13,640 \text{ BTUH}$

TOTAL ELECTR. 81,270 BTUH

O.S.A : $1480 \text{ CFM} \times 1.08 \times 19 = 30,370 \text{ BTUH}$

TOTAL 111,640 BTUH

ADD 20% SAFETY & FUTURE LOAD 22,400 BTUH

TOTAL COOLING 134,040 BTUH

USE 135,000 BTUH

HEATING LOAD

ASSUME BLDG. LOAD OF 45,000 BTUH
 O.S.A $1480 \times 1.08 \times 68 = 108,690 \text{ BTUH}$

TOTAL 153,690 BTUH

USE 160,000 BTUH

* THIS IS THE PRELIMINARY COOLING LOAD. IT WILL BE FINALIZED AFTER THE MRS SITE IS DETERMINED.

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 13 OF 14
 JOB NO. 6440-70-2 DEPARTMENT M.U. AUTHOR P. WELLS DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Wells</i>	6-4-84						

EQUIPMENT SELECTION

1. AIR CONDITIONING UNIT (ACU-800)

"CARRIER" MODEL 50 EC-16, 6000 CFM, SINGLE PACKAGE, INDOOR AIR COOLED UNIT, 135,000 BTUH COOLING, 100°F DB COND. AIR TEMP., 67°F W/B EVAP. ENT. TEMP., 1/4" EXT. S.P., 3HP EVAP. FAN, 5 HP COND. FAN.

2. EXHAUST FANS (EF)

EF-806 : BATTERY ROOM EXHAUST

"CAR-MON" SERIES CMB-14, 1480 CFM @ 1/4" S.P., 1/6 HP MOTOR, BELT DRIVE.

EF-807 : HALON EXHAUST FAN.

"LOREN COOK" MODEL ACE-B-100C2B, CENTRIFUGAL, 200 CFM @ 1/4" S.P., 1/6 HP MOTOR.

3. BOILER (B-801)

TOTAL HEATING REQ'D:

NON-HARDENED AREA :	175,000 BTUH
HARDENED AREA :	160,000 BTUH
BOILER ROOM :	34,000 BTUH

TOTAL 369,000 BTUH

TITLE MRS FACILITY - SECURITY BUILDING SHEET NO. 14 OF 14
 JOB NO. 6440-70-2 DEPARTMENT M.V. AUTHOR F. WEISS DATE 5/6/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Below</u>	<u>6-4-84</u>						

EQUIPMENT SELECTION (CONT'D.)

3. BOILER (B-751) (CONT'D)

"PARKER" OIL FIRED BOILER MODEL O-52B,
 528 MBH INPUT, 422 MBH OUTPUT, 43 GPM,
 170°F ENT., 190°F LVG. TEMP.

4. HOT WATER PUMPS (P-751A & P-751B)

"PACO" MODEL 1550-1, 45 GPM @
 40' HEAD, 1 HP MOTOR

1- OPERATING / 1- STANDBY.

5. HOT WATER UNIT HEATER (UH-801)

"WING" SIZE 2U, 34,000 BTUH, 3.4 GPM,
 1/20 HP.



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION IIIMAIN GATE/BADGEHOUSE

TITLE MRS FACILITY - MAIN GATE / BADGEHOUSE SHEET NO. 1 OF 9
JOB NO. 6440 70-2 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/13/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	8-14-84						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE MAIN GATE / BADGEHOUSE & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430.1 , DEC. 1983
ASHRAE FUNDAMENTALS , 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES , ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY- MAIN GATE / BADGEHOUSE SHEET NO. 2 OF 9
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	A.B.	6-4-84						

DESIGN CONDITIONS:

I. SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II. DESIGN TEMPERATURES:

a. AIR CONDITIONED SPACE:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	76°F DB 50% RH
WINTER : 4°F DB	72°F DB

b. HEATING AND VENTILATING:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	10°F ABOVE OUTSIDE TEMPERATURE = 105°F
WINTER : 4°F DB	65°F DB

TITLE MRS FACILITY - MAIN GATE/BADGEHOUSE SHEET NO. 3 OF 9JOB NO. 6440-70-2 DEPARTMENT M.U. AUTHOR A.B. DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

CLTD CORR. = (CLTD + LM)K + (78 - Tr) + (To - 85)

A DAILY RANGE : 21°F

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}\text{F}$ C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}\text{F}$
(BASE)D ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 76^{\circ}\text{F} = 2^{\circ}\text{F}$
(BASE)TOTAL CORRECTION: $2^{\circ}\text{F} - 0.5^{\circ} = 1.5^{\circ}\text{F}$, USE 2°F .

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 95^{\circ} = -17^{\circ}\text{F}$
(BASE)TOTAL CORRECTION : $-17^{\circ}\text{F} - 0.5 = -17.5^{\circ}\text{F}$
USE -17°F CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY-MAIN GATE/BADGEHOUSE SHEET NO. 4 OF 9
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR A.B. DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENJ	6/20/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

1. SC = 0.55
2. CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
3. SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1,
XIII -8)

TITLE MRS FACILITY - MAIN GATE/BADGEHOUSE SHEET NO. 5 OF 9
 JOB NO. 6440-70-2 DEPARTMENT M.U. AUTHOR A.B. DATE 5/27/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
 LHG = 255 }

SHG = 345 } SHOPS
 LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION.

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF: MRS FACILITIES, - GENERAL, SHEET 12 OF 15



TITLE MRS FACILITY - MAIN GATE / BADGEHOUSE SHEET NO. 6 OF 9
JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 5/30/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. Weiss	6/20/84						

COOLING LOAD *

FLOOR AREA = 1320 SF

ASSUME 1.2 CFM/SF

$$\therefore \text{SUPPLY AIR} = (1320)(1.2) = 1580 \text{ CFM}$$

USE CLOSEST CFM RATING
OF AIR COND. UNIT = 1800 CFM

O.A. : 2 CFM / SF (FOR RESTROOM)

RESTROOM AREA = 84 SF

$$\therefore (84)(2) = 168 \text{ CFM}$$

USE 200 CFM

$$\begin{aligned} \text{LOAD} &= (1800 \text{ CFM})(1.08)(19^\circ\text{F}) = 36,940 \text{ Btu/h} \\ &= \underline{3 \text{ TONS}} \end{aligned}$$

* THIS IS THE PRELIMINARY COOLING LOAD. IT WILL BE FINALIZED AFTER THE MRS SITE IS DETERMINED.



TITLE MRS FACILITY - MAIN GATE / BADGEHOUSE SHEET NO. 7 OF 9
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/30/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WETTS	6/24/84						

HEATING LOAD

ROOF AREA = 1320. SF

FLOOR PERIMETER = 175 FT.

WALL AREA (INCLUDING WINDOWS) = $175' \times 9' = 1575$ SF

HEAT LOSS:

ROOF	:	1320	x	.05	x	68°F	=	4490	BtuH
WALLS	:	1575	x	.11*	x	68°F	=	11,780	
FLOOR†	:	175	x	.93	x	68°F	=	11,070	
O.A.	:	200 CFM	x	1.08	x	68°F	=	14,690	†

42,030 BtuH

* .11 = AVERAGE U-FACTOR FOR "WALLS" ASSUMING 10% WINDOW AREA (U-FACTOR = .43), 90% ACTUAL WALL AREA (U-FACTOR = .07)

† ASHRAE FUND. 1981, CHAPTER 25, EQUATION (6)

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5/30/84	MP	PN									

ROOM OR SYSTEM NO. MAIN GATE / BADGEHOUSE

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	55'	x	9'	=	495	x	.07	x	26	or	68	=	900	or	2360
E WALL	23½'	x	9'	=	211½	x	.07	x	31	or	68	=	460	or	1010
S WALL	44'	x	9'	=	396	x	.07	x	39	or	68	=	1080	or	1880
W WALL	23'	x	9'	=	207	x	.07	x	69	or	68	=	1000	or	990
N GLASS	(2½' x 4½') x 4			=	45	x	$\frac{.55}{.55} \times \frac{.75}{.75}$	x	39	or	-	=	720	or	
S GLASS	30 SF + 45 SF			=	75	x	$\frac{.55}{.55} \times \frac{.75}{.75}$	x	90	or	-	=	1300	or	
COND. GLASS		x		=	120	x	.43	x	16	or	68	=	830	or	3510
CEILING OR ROOF		x		=	1320	x	.05	x	30	or	68	=	1980	or	4490
FLOOR		x		=	175'	x	.93	x		or	68	=		or	11,070
D.A. PARTITION		x		=	200 CFM	x	1.08	x	19	or	68	=	4100	or	14,690
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 12,370 40,000

INTERNAL HEAT GAINS

LIGHTS: 1320 SQ FT x $\frac{.86}{.86}$ x 3 WATTS/SQ FT * x 3.41 = 11,610

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 10 x $\frac{.34}{.34}$ x 255 BTU/HR = 2140

* LOAD TO CONDITIONED SPACE

SUBTOTAL 13,750

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 26,120

LATENT HEAT GAINS

PEOPLE = 10 x 255 BTU/HR = 2550

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 28,670 40,000

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{26,120}{1.08 \times 19^\circ F}$ = 1270 * CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: *USE CFM BASED ON CFM PER SQ. FT. (SEE SHEET 5 OF 8)

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440 70-2</u>
		SHEET <u>8</u> OF <u>9</u>



TITLE MRS FACILITY - MAIN GATE / BADGEHOUSE SHEET NO. 9 OF 9
JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR M.P. DATE 5/31/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENE	6/20/84						

EQUIPMENT SELECTION

1. HEAT PUMP (ACU 801)

CARRIER, MODEL 50RQ006 SINGLE PACKAGE
HEAT PUMP

1800 CFM @ 1" SP. 42,400 Btuh COOLING
CAPACITY, 67,400 HEATING CAPACITY (WITH
13 KW ELECTRIC HEATING COIL NO. .75:1.0)

OUTDOOR (COND.) FAN : $\frac{1}{2}$ HP
INDOOR (EVAP) FAN : $\frac{3}{4}$ HP
COMPRESSOR INPUT : 6.6 KW
REFRIG. TYPE : R-22

2. EXHAUST FAN (EF 808)

LOREN COOK ROOF VENTILATOR, TYPE ACE-B
MODEL NO. 120 C2B

200 CFM @ $\frac{1}{4}$ " SP, $\frac{1}{6}$ HP MOTOR



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION IVINSPECTION GATEHOUSE



TITLE MRS FACILITY - INSPECTION GATEHOUSE SHEET NO. 1 OF 8
JOB NO. 6440 70-2 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	<i>8-14-84</i>						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE INSPECTION GATEHOUSE & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430.1 , DEC. 1983
ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.

TITLE MRS FACILITY-INSPECTION GATEHOUSE SHEET NO. 2 OF 8
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	Bulbin	6-6-84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
 LATITUDE : }
 LONGITUDE : } TBD

II DESIGN TEMPERATURES:

A AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
 75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
 50% RH

72°F DB

B HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
 75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
 TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - INSPECTION GATEHOUSE SHEET NO. 3 OF 8
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	<i>Brice</i>	6-6-84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_R) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)

TOTAL CORRECTION: $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10



TITLE MRS FACILITY-INSPECTION GATEHOUSE SHEET NO. 4 OF 8
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	Dukes	6-6-84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

1. SC = 0.55
2. CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
3. SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X111 - 8).

TITLE MRS FACILITY-INSPECTION GATEHOUSE SHEET NO. 5 OF 8

JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR MP DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	<i>Dr. H. C. H. H.</i>	6-6-84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
LHG = 255 }

SHG = 345 } SHOPS
LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
*** REF: MRS FACILITIES, - GENERAL, SHEET 12 OF 15



TITLE MRS FACILITY - INSPECTION GATEHOUSE SHEET NO. 6 OF 8
JOB NO. 644070-2 DEPARTMENT M.U. AUTHOR MD DATE 5/30/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<u>Brubaker</u>	<u>6-6-84</u>						

COOLING LOAD*

FLOOR AREA = 878 SF

ASSUME 1.1 CFM/SF

$$\therefore \text{SUPPLY AIR} = (878) 1.1 = \underline{970 \text{ CFM}}$$

USE

1000 CFM

O.A. : 2 CFM/SF FOR RESTROOM

RESTROOM AREA = 72 SF

$$\therefore (72) 2 = 144 \text{ CFM}$$

USE 200 CFM

$$\text{LOAD} = (1000 \text{ CFM}) (1.08) (19^\circ\text{F}) = \underline{20,520 \text{ BtuH}}$$

≈ 2 TONS

* THIS IS THE PRELIMINARY LOAD. IT WILL BE FINALIZED AFTER THE MRS SITE IS DETERMINED.

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION

ROOM OR SYSTEM NO. INSPECTION GATEHOUSE

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	41'	x	9'	=	369	x	.07	x	26	or	68	=	670	or	1760
E WALL	29'	x	9'	=	261	x	.07	x	31	or	68	=	570	or	1240
S WALL	41'	x	9'	=	369	x	.07	x	39	or	68	=	1010	or	1760
W WALL	29	x	9'	=	261	x	.07	x	69	or	68	=	1260	or	1240
S GLASS	13'	x	5'	=	65	x	^{SC} .55 x ^{CLF} .35	x	90	or		=	1130	or	
W GLASS	6'	x	5'	=	30	x	^{SC} .55 x ^{CLF} .82	x	216	or		=	2920	or	
COND GLASS		x		=	95	x	.43	x	16	or	68	=	650	or	2780
CEILING OR ROOF		x		=	878	x	.05	x	30	or	68	=	1320	or	2990
FLOOR		x		=	140	x	.93	x		or	68	=		or	8850
D.A. PARTITION		x		=	200 CFM	x	1.08	x	19	or	68	=	4100	or	14,690
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 13,630 35,310

INTERNAL HEAT GAINS

LIGHTS: 878 SQ FT x ^{SCF}.36 x 3 WATTS/SQ FT* x 3.41 = 7,720

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08** x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 5 x ^{CLF}.84 x 255 BTU/HR = 1070

* LOAD TO CONDITIONED SPACE

SUBTOTAL 2790

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 22,420

LATENT HEAT GAINS

PEOPLE = 5 x 255 BTU/HR = 1280

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 23,700 35,310

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{22,420}{1.08 \times 14^\circ F}$ = 1090* CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * USE 1000 CFM (SHEET 6 OF 8)

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440 70-2</u>
		SHEET <u>7</u> OF <u>8</u>



TITLE MRS FACILITY - INSPECTION GATEHOUSE SHEET NO. 8 OF 8
JOB NO. 6440 70-2 DEPARTMENT MU. AUTHOR M.P. DATE 6/12/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	<i>Dr. H. S.</i>	6-6-84						

EQUIPMENT SELECTION

1. HEAT PUMP (ACU 802)

"CARRIER" MODEL NO. 50YQ030 SINGLE PACKAGE
HEAT PUMP

1000 CFM @ $\frac{1}{2}$ " SP. 21,000 BTUH COOLING
CAPACITY, 35,000 BTUH HEATING CAPACITY
(WITH 10 KW ELECTRIC HEATING COIL)

OUTDOOR (COND.) FAN : $\frac{1}{5}$ HP
INDOOR (EVAP.) FAN : $\frac{1}{5}$ HP
COMPRESSOR INPUT : 3.8 KW
REFRIG. TYPE : R-22

2. EXHAUST FAN (EF 809)

"LOREN COOK" ROOF VENTILATOR, TYPE ACE-B
MODEL NO. 120 C2B

200 CFM @ $\frac{1}{4}$ " SP, $\frac{1}{6}$ HP MOTOR



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION V

PROTECTED AREA GATEHOUSE

TITLE MRS FACILITY- PROTECTED AREA GATEHOUSE SHEET NO. 1 OF 17
 JOB NO. 6440 70-2 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	<i>8-14-84</i>						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE PROTECTED AREA GATEHOUSE & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430-1 , DEC. 1983
 ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS, 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY-PROTECTED AREA GATEHOUSE SHEET NO. 2 OF 17
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

DESIGN CONDITIONS:

I. SITE LOCATION:

ELEVATION : 413 FT
LATITUDE : }
LONGITUDE : } TBD

II. DESIGN TEMPERATURES:

a. AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

b. HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 3 OF 17
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/5/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_R) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
 (BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
 (BASE)

TOTAL CORRECTION: $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
 (BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10



TITLE MRS FACILITY-PROTECTED AREA GATEHOUSE SHEET NO. 4 OF 17
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	D. WEISS	6/15/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

1. SC = 0.55
2. CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
3. SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1, X III -8).

TITLE MRS FACILITY-PROTECTED AREA GATEHOUSE SHEET NO. 5 OF 17
 JOB NO. 6440-70-2 DEPARTMENT ML AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255
 LHG = 255 } OFFICE

SHG = 345
 LHG = 695 } SHOPS

CLF = 0.84

*** VENTILATION AND INFILTRATION.

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15



TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 6 OF 17
JOB NO. 6440 70-2 DEPARTMENT ML AUTHOR MP DATE 6/1/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/1/84						

HARDENED AREA - LOWER LEVEL

COOLING LOAD *

FLOOR AREA = 3091 SF

ASSUME 1.4 CFM/SF

$$\therefore \text{SUPPLY AIR} = (3091)(1.4) = 4327 \text{ CFM}$$

USE 4400 CFM

TOILET EXHAUST: 2 CFM/SF

RESTROOM AREA = 44 SF

$$\therefore (44)(2) = 88 \text{ CFM}$$

USE 100 CFM

BATTERY ROOM EXHAUST:

VOLUME = 9660 CF

$$\text{USE 5 AC/Hr} \quad \therefore \text{CFM} = \frac{(9660)(5)}{60} = 805$$

USE 900 CFM

$$\text{LOAD} = (4400 \text{ CFM}) 1.08 (19^\circ \text{F}) = 90,290 \text{ BtuH}$$

* THIS IS A PRELIMINARY LOAD TO BE FINALIZED WHEN SITE IS KNOWN.

TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 7 OF 17
 JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 6/1/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

HARDENED AREA - LOWER LEVEL

HEAT REQUIRED TO RAISE TEMPERATURE OF AIR
 (FROM AIR CONDITIONING UNIT) TO ROOM DESIGN
 TEMPERATURE:

ASSUME: 70°F RETURN AIR TEMP. (THIS IS LOWER THAN
 DESIGN CONDITION OF 72°F BECAUSE OF
 UN-TEMPERED AIR SUPPLIED TO UPS ROOM)
 4°F ENTERING OUTSIDE AIR TEMP.

$$\therefore \text{RETURN AIR} = 70^{\circ}\text{F} \times \frac{3400}{4400} + 4^{\circ}\text{F} \times \frac{1000}{4400} =$$

$$= 54.1^{\circ}\text{F} + .9^{\circ}\text{F} = 55^{\circ}\text{F}$$

$$\therefore \Delta T = 72^{\circ}\text{F} - 55^{\circ}\text{F} = 17^{\circ}\text{F}$$

$$q = \text{CFM} (1.08) 17^{\circ}\text{F}$$

EHC 800

$$q = 400 (1.08) 17^{\circ}\text{F} = 7344 \text{ BtuH} = \boxed{2.2 \text{ KW}}$$

USE 3KW HEATER

EHC 802

$$q = 1100 (1.08) 17^{\circ}\text{F} = 20,196 \text{ BtuH} = \boxed{5.9 \text{ KW}}$$

USE 6 KW HEATER



TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 8 OF 17
JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 6/4/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/15/84						

HARDENED AREA - GROUND LEVEL

COOLING LOAD *

FLOOR AREA = 2036 SF

ASSUME 1.4 CFM/SF

∴ SUPPLY AIR = (2036)(1.4) = 2850 CFM

USE 3000 CFM

ELECTRIC EQUIPMENT ROOM :

EXHAUST AIR FROM EQUIP. ROOM TO SATISFY
MINIMUM VENTILATION AND TO HELP REMOVE HEAT
GENERATED BY ELECTRICAL EQUIPMENT.

USE 400 CFM

$\frac{400 \text{ CFM}}{3000 \text{ CFM}} = 13\% \quad \therefore 400 \text{ CFM O.A.} = 13\% \text{ OF SUPPLY}$

LOAD = (3000) 1.08 (19°F) = 61,560 BtuH

*

THIS IS THE PRELIMINARY LOAD TO BE FINALIZED
ONCE MRS SITE IS DETERMINED.



TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 9 OF 17
JOB NO. 6440 70-2 DEPARTMENT ML AUTHOR M.P. DATE 6/4/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

NON-HARDENED AREA

COOLING LOAD *

ASSUME 1.4 CFM / SF

FLOOR AREA = 878 SF

$$\therefore (878 \text{ SF})(1.4 \text{ CFM/SF}) = 1230 \text{ CFM}$$

ADD ELECTRICAL EQUIPMENT LOAD :

$$6 \text{ KW} \times 3410 = 20,460 \text{ Btu/h}$$

$$\therefore \text{CFM} = \frac{20,460}{1.08 \times 10} = 2000 \text{ CFM}$$

$$\therefore \text{SUPPLY AIR} = 3230 \text{ CFM}$$

USE 4000 CFM

$$\text{O.A. : } 10 \% \text{ OF SUPPLY} = \boxed{400 \text{ CFM}}$$

* THIS IS THE PRELIMINARY LOAD TO BE FINALIZED AFTER MRS. SITE IS DETERMINED.

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	6/4/94	MP	PW									

ROOM OR SYSTEM NO. PROTECTED AREA GATEHOUSE - HARDENED LOWER LEVEL

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
WALL	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
WALL	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
WALL	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
WALL	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
GLASS	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
GLASS	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
GLASS	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
CEILING OR ROOF	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
0A. CEILING	_____	x	_____	=	1000 CFM	x	1.08	x	19	OR	_____	=	20,520	OR	_____
0A. HEATING	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	7340
0A. "	_____	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	20,200
0A. PARTITION	SEE	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____
0A. PARTITION	SHEET # 6	x	_____	=	_____	x	_____	x	_____	OR	_____	=	_____	OR	_____

SUBTOTAL 20,520 27,540

INTERNAL HEAT GAINS

LIGHTS: 3091 SQ FT x 0.86 x 1.5 WATTS/SQ FT * x 3.41 = 13,600

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * x _____ °F x ΔT = _____

MISCELLANEOUS: UPS - SURVEILLANCE (4-01) (12 KW + 4 KW) * (3413) BTU/HR = 54,610

PEOPLE: 5 x 0.84 x 255 BTU/HR = 1070

* LOAD TO CONDITIONED SPACE

SUBTOTAL 69,280

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 89,800 27,540

LATENT HEAT GAINS

PEOPLE = 5 x 255 BTU/HR = 1280

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 91,080 27,540

SUPPLY AIR = TOTAL SENSIBLE LOAD = 89,800 = 4380 ⁺ CFM

AIR CHANGE RATE = 1.08 x ΔT 1.08 x 19 = _____ MIN

AIR CHANGE RATE = ROOM VOLUME = _____ MIN

REMARKS: * FROM ELECTRICAL
+ USE 4400 CFM

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440 70-2</u>
		SHEET <u>10</u> OF <u>17</u>

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	6/4/84	MP	PW									

ROOM OR SYSTEM NO. PROTECTED AREA GATEHOUSE - HARDENED AREA GROUND LEVEL

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL		x		=	<u>0</u>	x		x		OR		=	<u>0</u>	OR	<u>0</u>
<u>E</u> WALL	<u>30</u>	x	<u>9</u>	=	<u>270</u>	x	<u>.07</u>	x	<u>31</u>	OR	<u>68</u>	=	<u>590</u>	OR	<u>1290</u>
<u>S</u> WALL	<u>60</u>	x	<u>9</u>	=	<u>540</u>	x	<u>.07</u>	x	<u>39</u>	OR	<u>68</u>	=	<u>1470</u>	OR	<u>2570</u>
<u>W</u> WALL	<u>25</u>	x	<u>9</u>	=	<u>225</u>	x	<u>.07</u>	x	<u>69</u>	OR	<u>68</u>	=	<u>1090</u>	OR	<u>1070</u>
GLASS		x		=		x		x		OR		=		OR	
GLASS		x		=		x		x		OR		=		OR	
GLASS		x		=		x		x		OR		=		OR	
CEILING OR ROOF		x		=	<u>2036</u>	x	<u>.05</u>	x	<u>30</u>	OR	<u>68</u>	=	<u>3050</u>	OR	<u>6920</u>
FLOOR		x		=		x		x		OR		=		OR	
PARTITION		x		=		x		x		OR		=		OR	
PARTITION		x		=		x		x		OR		=		OR	

SUBTOTAL 6200 11,850

INTERNAL HEAT GAINS

LIGHTS: 2036 SQ FT x $\frac{CLF}{.56} \times 2$ WATTS/SQ FT * x 3.41 = 11,940

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

P.A.
INFILTRATION: 400 CFM x 1.08** x 19 °F x 68 ΔT = 5,210 29,380

ELEC EQ.
MISCELLANEOUS: 6 KW x 3413 BTU/HR = 20,480

PEOPLE: 5 x $\frac{CLF}{.84} \times 255$ BTU/HR = 1070

* LOAD TO CONDITIONED SPACE

SUBTOTAL 41,700

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 47,900

LATENT HEAT GAINS

PEOPLE = 5 x 255 BTU/HR = 1280

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 49,180 41,230

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{47,900}{(1.08) 19 F}$ = 2330 * CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * USE 3000 CFM, BASED ON CFM/SF.



CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440 70-2
SHEET 11 OF 17

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION

ROOM OR SYSTEM NO. PROTECTED AREA GATEHOUSE - NON HARDENED AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	60	x	9	=	540	x	.07	x	7	or	68	=	260	or	4620
E WALL	33	x	9	=	297	x	.07	x	12	or	68	=	250	or	1410
S WALL		x		=	0	x		x		or		=	0	or	0
W WALL	37	x	9	=	333	x	.07	x	50	or	68	=	1170	or	1590
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	878	x	0.05	x	23	or	68	=	1010	or	2990
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 2690 10,610

INTERNAL HEAT GAINS

LIGHTS: 878 SQ FT x .86 x 2 WATTS/SQ FT * x 3.41 = 5150

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

~~D.A.~~
INFILTRATION: 400 CFM x 1.08 * x 10 °F x 68 ΔT = 4320 29,380

ELEC. EQUIP
MISCELLANEOUS: 6 KW * x 3410 BTU/HR = 20,460

PEOPLE: 0 x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL 29,930

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 32,620 39,990

LATENT HEAT GAINS

PEOPLE = 0 x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 32,620 39,990

SUPPLY AIR = TOTAL SENSIBLE LOAD = 32,620 = 3020 °F CFM

AIR CHANGE RATE = 1.08 x ΔT 1.08 x 10°F = _____ MIN

AIR CHANGE RATE = ROOM VOLUME = _____ MIN

REMARKS: * FROM ELECTRICAL

† USE 4000 CFM

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440 70-2</u>
		SHEET <u>12</u> OF <u>17</u>



TITLE MRS FACILITY- PROTECTED AREA GATEHOUSE SHEET NO. 13 OF 17
JOB NO. 6440 70-2 DEPARTMENT MU. AUTHOR MP DATE 6/6/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

EQUIPMENT SELECTION

HARDENED AREA - LOWER LEVEL

1. CARRIER SINGLE PACKAGE A/C UNIT (ACU 803)
MODEL 50 EC 012 , INDOOR TYPE

4400 CFM @ 3/4" SP
120,400 BtuH
REFRIG. TYPE : R-22

EVAP FAN : 3 HP (DOUBLE OVERSIZE)
COND FAN : 5 HP (SINGLE OVERSIZE)
COND AIR ENTERING TEMP. = 105°F db
EVAP ENT TEMP. : 67°F wb

2. DUCT HEATERS (EHC 800 & 802)

CHROMALOX

400 CFM , 3 KW , 2 STAGES (EHC 800)

1100 CFM , 6 KW , 3 STAGES (EHC 802)



TITLE MRS FACILITY- PROTECTED AREA GATEHOUSE SHEET NO. 14 OF 17
JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 6/6/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/15/84						

3. EXHAUST FANS (EF 810, 811)

FUME EXHAUST (EF 810)

LOREN COOK TYPE UCB, NO. 12UC01B

900 CFM @ 1/4" SP, 1/6 HP MOTOR
EXPLOSION-PROOF MOTOR

TOILET EXHAUST (EF 811)

LOREN COOK TYPE UCD, NO 7UC10D

100 CFM @ 1/4" SP, 1/6 HP MOTOR

4. GRAVITY VENTS (GRV 804, 805)

LOREN COOK GRAVITY FANS

6600 CFM RELIEF FAN, 20.0 SF THROAT AREA (GRV 804)

7600 CFM INTAKE FAN, 20.0 SF THROAT AREA (GRV 805)

TITLE MRS FACILITY- PROTECTED AREA GATEHOUSE SHEET NO. 15 OF 17
 JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 6/6/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	6/15/84						

HARDENED AREA - GROUND LEVEL

1. SINGLE PACKAGE COOLING UNIT (ACU 804)

CARRIER MODEL 50 EC 008 , INDOOR TYPE.

3000 CFM @ 3/4" SP , 90,000 BTUH COOLING CAPACITY

EVAP. FAN : 1 1/2 HP (SINGLE OVERSIZE)

COND FAN : 3 HP "

COND. AIR ENT TEMP. : 105 °F db

EVAP. ENT TEMP : 67 °F wb

W/30 % PRE-FILTER , 85 % FINAL FILTER

2. DUCT HEATER (EHC 804)

CHROMALOX DUCT HEATER

13.6 KW , 3 STAGES

3. EXHAUST FAN (EF 813)

LOREN COOK TYPE ACE-B , # 100 C2B

400 CFM @ 1/4" SP , 1/6 HP MOTOR



TITLE MRS FACILITY - PROTECTED AREA GATEHOUSE SHEET NO. 16 OF 17
JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MP DATE 6/6/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	6/15/84						

4. GRAVITY FANS (GRV 806,807)

LOREN LOOK GRAVITY FANS

RELIEF FAN , 4500 CFM , 13.0 SF THROAT AREA
INTAKE FAN , 4900 CFM , 13.0 SF THROAT AREA

TITLE MRS FACILITY-PROTECTED AREA GATEHOUSE SHEET NO. 17 OF 17
 JOB NO. 6440 70-2 DEPARTMENT MU AUTHOR MD DATE 6/7/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WELLS	6/15/84						

NON-HARDENED AREA - GROUND LEVEL

1. AIR HANDLING UNIT (AHU 802)

CARRIER MODEL 39 B 060 , H E V ONLY
 SINGLE DUCT , NO COILS

4,000 CFM @ 1 1/2" SP , 3 HP MOTOR

30% EFFICIENCY FILTER

2. DUCT HEATER (EHC 803)

BRASCH DUCT HEATER

4,000 CFM AIR FLOW , 12 KW , 4 STEPS

3. EXHAUST FAN (EF 812)

LOREN COOK TYPE ACE-B , # 100 C2B

4000 CFM @ 1/4" SP , 3/4 HP MOTOR



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION VI

STORAGE AREA GATE STATION

TITLE MRS FACILITY - STORAGE FACILITY GATESTATION SHEET NO. 1 OF 7
 JOB NO. 6440 70-2 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	<i>8-14-84</i>						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE STORAGE FACILITY GATESTATION & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES: HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS: DOE ORDER 6430.1, DEC. 1983
 ASHRAE FUNDAMENTALS, 1981

FORMULAE: ASHRAE FUNDAMENTALS, 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY-STORAGE AREA GATE STATION SHEET NO. 2 OF 7
JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

DESIGN CONDITIONS:

I. SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II. DESIGN TEMPERATURES:

A. AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

B. HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - STOR. AREA GATE STA. SHEET NO. 3 OF 7
 JOB NO. 6440-70.2 DEPARTMENT MU. AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_r) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP : $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
 (BASE)

D ROOM CORRECTION FACTOR : $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
 (BASE)

TOTAL CORRECTION : $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR : $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
 (BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
 CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY-STOR AREA GATE STA SHEET NO. 4 OF 7
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
- 3 SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1, X111 -8).

TITLE MRS FACILITY - STOR AREA GATE STA SHEET NO. 5 OF 7
 JOB NO. 6440-70-2 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255
 LHG = 255 } OFFICE

SHG = 345
 LHG = 695 } SHOPS

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5/22/54	AB	PW									

ROOM OR SYSTEM NO. MRS FACILITY - STORAGE AREA GATE STATION

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	8	x	8	=	64	x	.07	x	26	or	68	=	120	or	300
E WALL	8	x	8	=	64	x	.07	x	31	or	68	=	140	or	300
S WALL	8	x	8	=	64	x	.07	x	39	or	68	=	170	or	300
W WALL	8	x	8	=	64	x	.07	x	69	or	68	=	310	or	300
- GLASS		x		=		x		x		or		=		or	
- GLASS		x		=		x		x		or		=		or	
- GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	64	x	.05	x	30	or	68	=	100	or	220
FLOOR		x		=		x		x		or		=		or	
D.A. PARTITION		x		=	20 CFM	x	1.08	x	19	or	68	=	410	or	1470
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 1250 2890

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: ^{2002-21 SF} 210 CFM x 1.08 ** x 19 °F x 68 ΔT = 4310 15,420

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL 1250 2890

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 5560 18,310

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 5560 = 18,310

TOTAL ROOM LOAD 5560 18,310

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440 70-2</u>
		SHEET <u>6</u> OF <u>7</u>



TITLE MRS FACILITY - STORAGE AREA GATEHOUSE SHEET NO. 7 OF 7
JOB NO. 6440 76-2 DEPARTMENT MU AUTHOR MP DATE 5/30/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WELSH	6/20/84						

EQUIPMENT SELECTION

1. HEAT PUMP

CARRIER, RIVIERA ROOM AIR CONDITIONER
MODEL NO. QDA2101

10,000 BTUH COOLING CAPACITY, 8500 BTUH HEATING
CAPACITY (HEAT PUMP ONLY), 5600 BTUH ELECTRIC
HEAT.

APPROX. 1.4 KW POWER INPUT (W/O ELECTRIC HEAT)



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION VII

SITE SERVICES BLDG

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 1 OF 27
JOB NO. 6440 70-3 DEPARTMENT MECH. UT. AUTHOR M. PERKOVICH DATE 8/13/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	8-14-84						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE SITE SERVICES BUILDING & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT , HUMID & COLD.

REFERENCES

DESIGN CONDITIONS: DOE ORDER 6430.1 , DEC. 1983
ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF THE ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.

TITLE MRS FACILITY-SITE SERVICES BUILDING SHEET NO. 2 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
 LATITUDE :
 LONGITUDE : } TBD

II DESIGN TEMPERATURES:

A AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
 75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
 50% RH

72°F DB

B HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
 75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
 TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 3 OF 27
 JOB NO. 6440-70-3 DEPARTMENT ML AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

CLTD CORR. = $(CLTD + LM)K + (78 - T_R) + (T_o - 85)$

A DAILY RANGE : 21°F

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}\text{F}$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}\text{F}$
(BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 76^{\circ}\text{F} = 2^{\circ}\text{F}$
(BASE)

TOTAL CORRECTION: $2^{\circ}\text{F} - 0.5^{\circ} = 1.5^{\circ}\text{F}$, USE 2°F .

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 95^{\circ} = -17^{\circ}\text{F}$
(BASE)

TOTAL CORRECTION : $-17^{\circ}\text{F} - 0.5 = -17.5^{\circ}\text{F}$
USE -17°F

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY-SITE SERVICES BUILDING SHEET NO. 4 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49
5. "U" FLOOR = 0.93

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
- 3 SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1, X III -8).

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 5 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
 LHG = 255 }

SHG = 345 } SHOPS
 LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5-25-84	AB	PW									

ROOM OR SYSTEM NO. OFFICE AREA

LENGTH (L) 159 x WIDTH (W) 122' = AREA (A) 19,398 x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	14	x	9	=	126	x	0.07	x	26	or	68	=	230	or	600
W WALL	122	x	9	=	1098	x	0.07	x	69	or	68	=	5,300	or	5,230
S WALL	159	x	9	=	1431	x	0.07	x	39	or	68	=	3,900	or	6,810
E WALL	122	x	9	=	1098	x	0.07	x	31	or	68	=	2,400	or	5,230
E GLASS COND	(4	x	4)	=	112	x	0.43	x	16	or	68	=	800	or	3,280
S GLASS COND	(4	x	4)	=	160	x	0.43	x	16	or	68	=	1,100	or	4,680
W GLASS COND	(4	x	4)	=	32	x	0.43	x	16	or	68	=	220	or	940
CEILING OR ROOF	159	x	122	=	19,398	x	0.05	x	30	or	68	=	29,100	or	65,950
FLOOR	(159+122+122+11)	x		=	417	x	0.93	x	-	or	68	=	-	or	26,370
E GLASS SOLAR PARTITION		x		=	112	x	8.55	x	0.17	x	216	=	2,260	or	-
S GLASS SOLAR PARTITION		x		=	160	x	0.55	x	0.35	x	90	=	2,770	or	-
W GLASS SOLAR PARTITION		x		=	32	x	0.55	x	0.82	x	216	=	3,120	or	-

SUBTOTAL 51,200 119,090

INTERNAL HEAT GAINS

LIGHTS: 19,398 SQ FT x 0.86 x 3^w WATTS/SQ FT * x 3.41 = 170,660

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * * x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 20 (ASSUMED) x 255 x .84 BTU/HR = 4300

* LOAD TO CONDITIONED SPACE * ELECTRICAL INFO

SUBTOTAL 174,960 51,200

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 126,160 119,100

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 119,100

SUPPLY AIR = TOTAL SENSIBLE LOAD = 226,160 = 10,500* CFM

AIR CHANGE RATE = 1.08 x ΔT = 1.08 x 20 = _____ MIN

SUPPLY (CFM) = _____

REMARKS: * USE 1.1 CFM/FT², ∴ TOTAL CFM = 19,398 x 1.1 = 21,300 CFM
(SEE COOLING AND HEATING LOAD CALC'S)



CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-3

SHEET OF
6 27



TITLE MRS FACILITY- SITE SERVICES BUILDING SHEET NO. 1 OF 27
JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEIN	6/22/84						

* COOLING LOAD :

OFFICE AREA :

$$159' \times 122' = 19,398 \text{ FT}^2$$

ASSUME : 1.1 CFM/FT^2 ,

∴ SUPPLY AIR :

$$19,398 \times 1.1 = 21,300 \text{ CFM}$$

EXHAUST AIR.

TOILET (RM #159)	= 200 CFM
BATTERY (RM #137)	= 200 CFM
TOILETS (RM'S #124, 125, 126)	= 1900 CFM

TOTAL = 2,300 CFM

MECHANICAL EQUIP.
RM. = 700 CFM.

OUTSIDE AIR = 3,000 CFM = 15% OA

MIXED AIR :

$$\begin{aligned} 95^\circ \times 0.15 &= 14.25^\circ \text{ F} \\ 80^\circ \times 0.85 &= 68.00^\circ \text{ F} \end{aligned}$$

$$\underline{82.25^\circ \text{ FDB}}, 66^\circ \text{ WB}, 31.7 \text{ BTU/HR}$$

* This is PRELIMINARY LOAD CALCULATIONS. It will be finalized after the MRS SITE WILL BE DETERMINED.

PSYCHROMETRIC CHART

BAROMETRIC PRESSURE 28.85" HG = 14.18 PSIA
ELEVATION 1000 FEET
NORMAL TEMPERATURE

$$Q_T = 4.33 \times CFM \times \Delta T$$

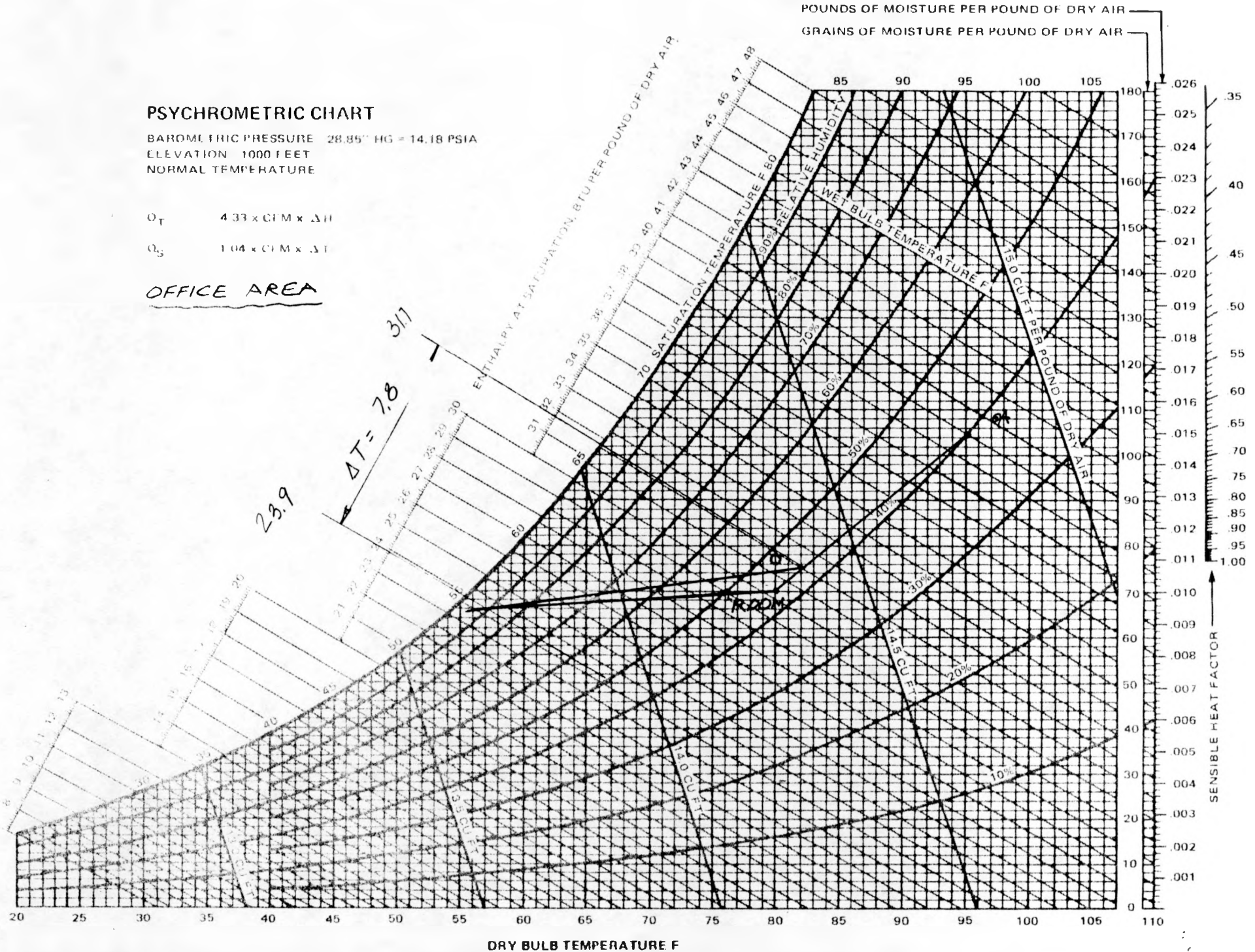
$$Q_S = 1.04 \times CFM \times \Delta T$$

OFFICE AREA

23.9

ΔT = 7.8

317



SHEET 8 of 1
Page 53

TITLE MRS FACILITY- SITE SERVICES BUILDING SHEET NO. 9 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

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COOLING LOAD (CONT'D)

OFFICE AREA :

LOAD @ 500' ELEV.:

$$21,300 \times 4.33 (31.7 - 23.9) = \underline{\underline{719,400 \text{ BTUH} = 60 \text{ T}}}$$

$$RA = 21,300 - 2,300 = 19,000 \text{ CFM}$$

$$\begin{array}{l} \text{MECH RM.} \\ \text{(SUPPLY FROM RA DUCT)} \end{array} = \underline{\underline{700 \text{ CFM}}}$$

$$\text{TOTAL } \underline{\underline{RA}} = \underline{\underline{18,300 \text{ CFM}}}$$

* COMPUTER RM

$$\text{POWER INPUT} = 15 \text{ KVA (ASSUME POWER FACTOR (PF) = 1)}$$

$$\text{EFFICIENCY} = 80\%$$

$$\therefore \underline{\underline{\text{COOLING LOAD}}} = (.20) 15 \text{ KVA} = 3 \text{ KVA} \times 3.41 \frac{\text{BTUH}}{\text{KW}} = 10.2 \text{ MBH}$$

$$\text{SIZE FOR } 10.2 \text{ MBH} \times 2^{**} = \underline{\underline{20.4 \text{ MBH}}}$$

* COOLING LOAD CALCULATIONS FOR COMPUTER RM BASED ON ELECTRICAL INFORMATION

** FACTOR OF 2 TO ACCOUNT FOR EXPANSION OF COMPUTER, PF OTHER THAN 1, AND POWER INPUT OTHER THAN 15 KVA.

TITLE MRS - SITE SERVICES BLDG SHEET NO. 10 OF 27
 JOB NO. 6440-70-3 DEPARTMENT M.U. AUTHOR T. CRUMP DATE 5/25/84

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OFFICE AREA (CONTD)

3. HEATING LOAD (RM @ 72°FDB)

$$\Delta T = 4^{\circ} \text{FDB}$$

ROOF HEAT LOSS:

$$19,398 \text{ SF} \times 0.05 \left(\overset{68^{\circ}\Delta T}{72^{\circ} - 4^{\circ}} \right) = 66,000 \text{ BTUH}$$

$$\frac{66,000}{1.08 \times \underset{22,004}{21,300}} = \underline{2.9^{\circ} \text{ LOSS}}$$

ASSUME WALL & WINDOW LOSS @ 5° LOSS

∴ RM EA = MIN 77°FDB @ EXTERIOR ZONES

INTERIOR ZONES ENT AIR = 72° + 3° = 75°FDB MAX
 W/LIGHTS "OFF"

USE AVG 80°FDB FOR LOAD ESTIMATE TO
 INCLUDE EXTERIOR ZONE HEATING

MIXED AIR:

$$\begin{array}{rcl} 4^{\circ} \times 0.15 & = & 0.60 \\ 69^{\circ} \times 0.85 & = & 58.65 \\ \hline & & 59.25^{\circ} \text{FDB} \end{array}$$

HEATING LOAD:

$$21,300 \times 1.08 \left(\overset{21^{\circ}\Delta T}{80^{\circ} - 59^{\circ}} \right) = \underline{\underline{483,000 \text{ BTUH}}}$$

TITLE MRS - SITE SERVICES BLDG

SHEET NO. 11 OF 27

JOB NO. 6440-70-3 DEPARTMENT M.U.

AUTHOR T. CRUMP

DATE 5/25/84

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SHOP AREA

1. CARPENTRY AREA $79' \times 50' = 3950 \text{ SF}$
 $48' \times 12' = 576 \text{ SF}$
TOTAL $4526 \text{ SF} \times 1.5 = 6780 \text{ CFM}$

2. OFFICE #178 $14' \times 11' = 154 \text{ SF} \times 1.6 = 250 \text{ CFM}$

3. OFF./OBSERVATION $26 \times 11 = 286 \text{ SF} \times 1.6 = 470 \text{ "}$

4. MOCK-UP $66 \times 80 = 5280 \text{ SF} \times 1.4 = 7400 \text{ "}$

5. ELEC/INSTR. $48 \times 48 = 2304 \text{ SF} \times 1.4 = 3200 \text{ "}$

6. TOOL CRIB/OFF. $28 \times 48 = 1344 \text{ SF} \times 1.2 = 1600 \text{ "}$

7. MACH. RM/OFF. $89 \times 49 = 4361 \text{ SF} \times 1.5 = 6500 \text{ "}$

8. STEAM CLEANING $16 \times 24 = 384 \text{ SF} \times 2 = 750 \text{ "}$

9. MILLWRIGHT, PIPEFITTING, SHEETMETAL WELDING $120 \times 63 = 7560 \text{ SF} \times 1.5 = 11,350 \text{ "}$

10. CORRIDOR #161 $8 \times 48 = 384 \text{ SF} \times .75 = 300 \text{ "}$

11. AISLE #174 $10 \times 248 = 2480 \text{ SF} \times .75 = 1850 \text{ "}$

12. WAREHOUSE $74 \times 48 = 3552 \text{ SF} \times 1.0 = 3550 \text{ "}$

44,000

SUPPLY AIR $= 44,000 \text{ CFM}$

OA $= 44,000 \times 15\% = 6,600 \text{ "}$

RA $= 37,400 \text{ "}$

TITLE MRS - SITE SERVICES BLDG SHEET NO. 12 OF 27
 JOB NO. 6440-70-3 DEPARTMENT M.U. AUTHOR J. CRUMP DATE 5/29/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

SHOP AREA HEATING LOAD

a) RM DESIGN TEMP. = 65°F DB

b) OA = 4°F DB

c) ROOF HEAT LOSS = ASSUME 5°F LOSS

d) WALLS/ROOF = " 8°F " " (MOCK-UP AREA)

$$\text{RM EA} = 65^{\circ} + 8^{\circ} = 73^{\circ}\text{F DB}$$

MIXED AIR:

$$\begin{aligned} 4^{\circ} \times 0.15 &= 0.60 \\ 69^{\circ} \times 0.85 &= 58.65 \\ \text{EA} &= \underline{59.25^{\circ}\text{F DB}} \end{aligned}$$

HEATING LOAD:

$$44,000 \times 1.08 (73^{\circ} - 59^{\circ}) = \underline{\underline{665,000 \text{ BTUH}}}$$

TITLE MRS - SITE SERVICES BLDGSHEET NO. 13 OF 27JOB NO. 6440-70-3 DEPARTMENT M.U.AUTHOR T. CRUMPDATE 5/29/84

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0	P. WEISS	6/22/84						

SHOP AREA COOLING LOAD (RM @ 85°F DB/60% RH)

OA = 95°/75°F WB

RA = 85°F (NO CEILING PLENUM)

MIXED AIR:

$$95^{\circ} \times 0.15 = 14.25$$

$$85^{\circ} \times 0.85 = 72.25$$

$$EA = 86.50^{\circ} \text{ FDB, } 71.0^{\circ} \text{ FWB, } 35.8 \text{ BTU/}^{\circ}\text{F}$$

$$LVG \text{ AIR} = 70 \text{ FDB/55 FWB, } 35.3 \text{ BTU/}^{\circ}\text{F}$$

ASSUME FAN MOTOR OUTSIDE OF AIRSTREAM FOR LOWER COOLING LOAD.

COOLING LOAD @ 1000 FT EL:

$$44,000 \times 4.33 \underset{4.24\%}{(35.5-31.3)} = 800,200 \text{ BTUH}$$

$$= 67 \text{ TONS}$$

PSYCHROMETRIC CHART

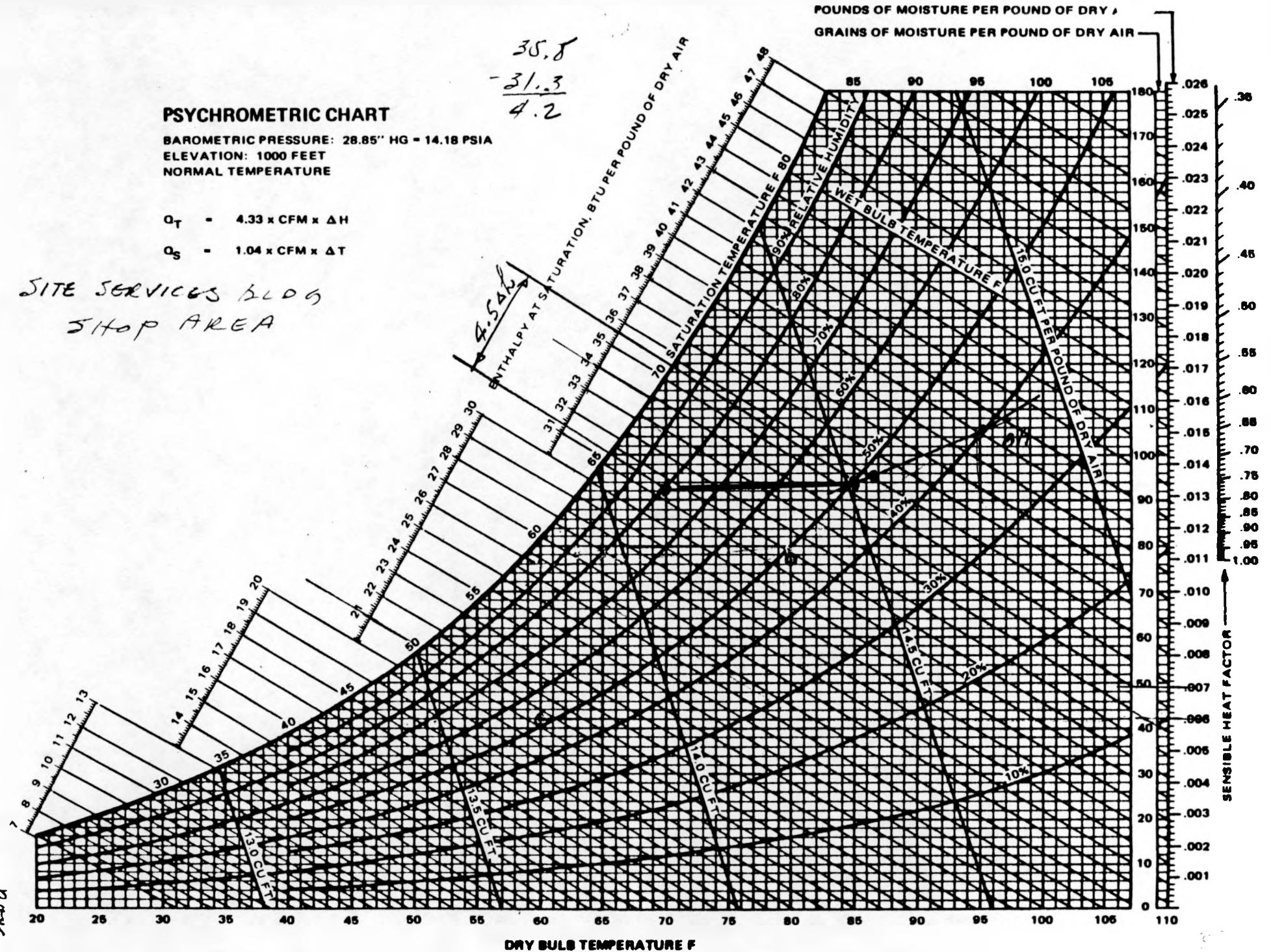
BAROMETRIC PRESSURE: 28.85" HG = 14.18 PSIA
ELEVATION: 1000 FEET
NORMAL TEMPERATURE

$$Q_T = 4.33 \times \text{CFM} \times \Delta H$$

$$Q_S = 1.04 \times \text{CFM} \times \Delta T$$

SITE SERVICES BLDG
SHOP AREA

35.8
- 31.3
4.2



TITLE MRS-SITE SERVICES BUILDING SHEET NO. 15 OF 27
 JOB NO. 6440 - DEPARTMENT MU AUTHOR AB DATE 6-2-04

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/04						

SHOP AREA.

EXHAUST SYSTEMS :

- | | |
|-----------------------------|----------|
| 1. WELDING (EF 817) | 2000 CFM |
| 2. MACHINE RM (EF 818) | 1600 CFM |
| 3. TOILET (EF 819) | 600 CFM |
| 4. STEAM CLEANING (EF 820) | 750 CFM |
| 5. DUST COLLECTOR (GRV 809) | 750 CFM |

TOTAL 5,700 CFM

SUPPLY FAN (MAX.)	44,000 CFM
EXHAUST SYSTEMS	5,700 CFM
RETURN AIR FAN	38,300 CFM.

MECHANICAL EQUIP. RM

SUPPLY (FROM RA)	900 CFM
EXHAUST	<u>900 CFM</u>

RETURN AIR 37,400 CFM

OA INTAKE : $\text{MIN}(44,000 - 37,400) = \underline{\underline{6,600 \text{ CFM}}}$

TITLE MRS-SITE SERVICES BLDG.

SHEET NO. 16 OF 27

JOB NO. 6440-70-3 DEPARTMENT MU

AUTHOR AB

DATE 6-6-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

SPRAY BOOTH & PAINT STORAGE AREA

1. PAINT STORAGE : $24' \times 25' = 600\text{SF} \times 1.5 = 900\text{\$}$
2. WORK AREAS : $40' \times 15' = 600\text{SF} \times 1.3 = 800\text{\$}$
3. SPRAY BOOTH : $15' \times 25' = 375\text{SF} \times 1.7 = 650\text{\$}$
*(1300\\$)

SUPPLY AIR :	<u>3000</u> €
OA	1,300 €
RA	1,700 €

HEATING LOAD.

RM DESIGN TEMP = 65°F DB

0A 4°F DB

MIXED AIR : $\frac{(1300 \times 4) + (1700 \times 65)}{3000} = 38.6^\circ \text{F DB}$

$$3000 \times 1.08 (65^\circ\text{F} - 38.6^\circ\text{F}) = 85,536 \text{ BTUH}$$

* BASIS FOR DESIGN REQUIRED TO PROVIDE 20 AIR CHANGES/HOUR DURING PAINTING,

- SUPPLY AIR FOR SPRAY BOOTH DURING THE PAINTING = 1300 CF.

TITLE MRS - SITE SERVICES BLDG SHEET NO. 17 OF 27
 JOB NO. 6440-70-3 DEPARTMENT M.U. AUTHOR F. UDREA DATE 5/29/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEEKS	6/22/84						

LUMBER STORAGE

1. VENTILATION (SEE SUPPORT FACILITIES GENERAL PAGE 15 FOR CLTD)

$$\text{ROOF } (40' \times 20') \times 0.05 \times 23 = 920 \text{ BTUH}$$

$$\text{WALLS N } 20' \times 9' \times 0.07 \times 7 = 90 \text{ BTUH}$$

$$\text{E } 40' \times 9' \times 0.07 \times 12 = 300 \text{ BTUH}$$

$$\text{S } 20' \times 9' \times 0.07 \times 20 = 250 \text{ BTUH}$$

$$\text{W } 40' \times 9' \times 0.07 \times 50 = 1260 \text{ BTUH}$$

$$2820 \text{ BTUH} \quad \text{USE } 3000 \text{ BTUH}$$

FOR VENTILATION ONLY $\Delta T = 10^\circ \text{F}$

O.A. CFM = 300 USE 500 CFM FOR SUMMER

2. HEATING LOAD

(50-40)

$$\text{ROOF } (40' \times 20') \times 0.05 \times 46 = 1840 \text{ BTUH}$$

$$\text{WALLS } (20' + 40') 2 \times 0.07 \times 46 = 390 \text{ BTUH}$$

O.A. (INFILTRATION)

$$100 \text{ CFM} \times 1.08 \times 46 = 4970 \text{ BTUH}$$

$$7200 \text{ BTUH}$$



TITLE MRS - SITE SERVICES BLDG SHEET NO. 18 OF 27
JOB NO. 6440-70-3 DEPARTMENT M. U AUTHOR F. UDREX DATE 5/30/80

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEICKS	6/22/81						

OIL STORAGE

1. AREA: $20' \times 20' = 400 \text{ SF} \times 1.5 = 600 \text{ CFM}$

2. HEATING LOAD:

$$\text{ROOF } (20' \times 20') \times 0.05 \times (50-4) = 920 \text{ BTUH}$$

$$\text{WALLS } (20' + 20') \times 0.07 \times 46 = 260 \text{ BTUH}$$

$$\text{O.A. } 600 \times 1.08 \times 46 = 29,810 \text{ BTUH}$$

$$\underline{\hspace{1cm}} \\ 30,990 \text{ BTUH}$$



TITLE MRS - SITE SERVICES BUILDING SHEET NO. 19 OF 27
JOB NO. 6940 DEPARTMENT MU. AUTHOR MP DATE 6/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/22/84						

SHOP AREA

ELECTRICAL EQUIP. ROOM

$$500 \text{ CFM} \times 1.08 \times (65 - 4)^\circ\text{F} = 32,940 \text{ BtuH}$$

$$\begin{aligned} \text{CEILING} &: 14' \times 32' \times .05 \times 61^\circ\text{F} = 1370 \text{ BtuH} \\ \text{WALLS} &: (14' \times 12' + 32' \times 12') \times .07 \times 61^\circ\text{F} = 2360 \downarrow \\ &3730 \text{ BtuH} \end{aligned}$$

$$\text{HEATING LOAD} = 36,670 \text{ BtuH}$$

BOILER ROOM

SAME VENTILATION RATE, CEILING AREA &
EXPOSED WALL AREA AS ELECTRICAL
EQUIPMENT ROOM.

$$\text{HEATING LOAD} = 36,670 \text{ BtuH}$$

TITLE MRS FACILITY- SITE SERVICES BUILDING SHEET NO. 20 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-87

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/87						

EQUIPMENT SELECTION:

OFFICES :

1. AIR HANDLING UNIT (AHU-803)

"CARRIER", MODEL 39E 48,
 DOUBLE DUCT, BLOW-THROUGH,
21,300 CFM @ 3 1/2" S.P., 25 HP,
 W/ DX COOLING COIL & HOT WATER
 HEATING COIL, CARTRIDGE FILTER SECTION
 (30% PF & 85% FF)

2. AIR COOLED CONDENSING UNIT (ACCU-802)

"CARRIER", MODEL 38AE 084

724,000 BTUH @ 30°F SST & 95°F AMB

COMPRESSOR - 75.2 KW, CONDENSER FANS - 6 @ 1/2 HP EA,
 REFRIG. TYPE: R-22.

3. RETURN AIR FAN (RF-802)

"BUFFALO", MODEL BL-730, SISW, CETRIF.

19,000 CFM @ 1 1/2 S.P., 10 HP.

TITLE MRS FACILITY- SITE SERVICES BLDG. SHEET NO. 21 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-28-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERN	6/22/81						

EQUIPMENT SELECTION (CONT'D)

4. EXHAUST FANS:

EF - 814 - TOILET RM # 159,

USE LOREN COOK, MODEL ACE-B 120 C2B
 200 F, $\frac{1}{4}$ " S.P.; $\frac{1}{6}$ HP. (ROOF TYPE)

EF - 815 - BATTERY ROOM # 137,

LOREN COOK, MODEL ACE-B 120 C2B
 200 F; $\frac{1}{4}$ " S.P.; $\frac{1}{6}$ HP (FUME EXHAUST)

EF - 816 - TOILET (OFFICES)

LOREN COOK, MODEL ACE-B 135 C4B
 1900 CFM, @ $\frac{1}{4}$ " S.P.; $\frac{1}{3}$ HP (ROOF TYPE)

GRV-808 - RELIEF FAN (MECHANICAL EQUIP. RM)

700 CFM, 2.3 FT²-THROAT AREA

5. AIR CONDITIONING UNIT (COMPUTER RM) - ACU-806

USE "LIEBERT UNIT", MODEL AU 27A,

23 MBH COOLING @ 72°F DB, 60°F WB.
 TOTAL UNIT POWER INPUT: 10 KW
 COOLING UNIT INDOORS, W/ ELECTRIC
 REHEAT COIL AND HUMIDIFIER.

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 22 OF 27
 JOB NO. 6440-76-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/2/84						

EQUIPMENT SELECTION (CONT'D).

SHOP AREA

1. AIR HANDLING UNIT - AHU-804

SINGLE DUCT DRAW-THROUGH

USE "CARRIER", MODEL 39E 90,

44,000 CFM, 3 1/2" S.P. 60 HP MOTOR,
 WITH DX COOLING COIL, HOT WATER
 HEATING COIL, CARTRIDGE FILTER SECTION
 (30% PF & 85% FF)

2. AIR COOLED CONDENSING UNIT (ACCU-803)

"CARRIER" MODEL 38AE 084

858,000 BTUH @ 40°F SST & 100°F AMB

COMPRESSOR - 86.0 KW

CONDENSER FANS - 6-1HP (EA), REFRIG TYPE, R22.

3. RETURN AIR FAN - RF-803

"BUFFALO" TYPE BL-1085, SISW, CENTRIF.

38,300 CFM @ 1 1/2" S.P. 20 HP MOTOR

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 23 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	6/22/84						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

4. EXHAUST FANS:

EF-817 - WELDING,

USE "CAR-MON" PRODUCTS,
2000 CFM @ $\frac{1}{2}$ " S.P., 1 HP (FLUME EXHAUST)

EF-818 - MACHINE ROOM,

USE "LOREN COOK", ACE-B #120C4B
1600 CFM @ $\frac{1}{4}$ " S.P., $\frac{1}{3}$ HP (ROOF TYPE)

EF-819 - TOILETS

USE "LOREN COOK", ACE-B 120C2B
600 CFM @ $\frac{1}{4}$ " S.P., $\frac{1}{6}$ HP MOTOR

EF-820 - STEAM CLEANING

USE "LOREN COOK", ACRU-B 100R2B
750 CFM @ $\frac{1}{4}$ " S.P., $\frac{1}{6}$ HP MOTOR

GRV-809 - RELIEF FAN - PLASTIC GLASS & CERAMICS

↓
750 CFM @ 3.3 FT² THROAT AREA

DCU-800 - DUST COLLECTOR

"TORIT", SERIES 19 FM, 750 CFM @ 9" S.P.,
 W/ 5" DIA INLET, 2 HP MOTOR

TITLE MRS. FACILITY-SITE SERVICES BUILDING SHEET NO. 24 OF 27
 JOB NO. 6440-70-3 DEPARTMENT NH AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	6/22/84						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

GRV-810 - MECHANICAL EQUIPMENT RM.

900 CFM @ 3.3 FT² THROAT AREA.

PAINT SHOP

1. AIR HANDLING UNIT - (AHU-805)

"CARRIER", MODEL 39B060 (H&V ONLY)
 SINGLE DUCT, DRAW-THROUGH

3000 CFM @ 1 1/2" S.P. 3 HP
 W/ ELECTRIC HEATING COIL - 25 KW &
 FILTER SECTION (30%)

2. EXHAUST FAN - EE-821 (PAINT FUME EXHAUST FAN)

USE "LOREN COOK" ACE-B-135C2B
 1500 CFM @ 1/2" S.P. , 1/3 HP MOTOR.

TITLE MRS FACILITY - SITE SERVICES BUILDING SHEET NO. 25 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR APD DATE 5-29-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEBS	6/22/84						

EQUIPMENT SELECTION (CONT'D)

LUMBER STORAGE

1. EXHAUST FAN (EF-822) -

USE "LOREN COOK", TYPE ACE B 120C2B
 500 CFM @ 1/4" SP & 1/6 HP MOTOR.

2. UNIT HEATER (UH-802)

USE "BRASCH" ELECT. UNIT HEATER, MODEL # 5-2771,
 10,000 BTUH, 3 KW, (2 STEPS OPTION)

OIL STORAGE

1. EXHAUST FAN (EF-823)

USE "LOREN COOK", TYPE ACE-B 120C2B
 600 CFM @ 1/4" SP, 1/6 HP MOTOR.

2. UNIT HEATER (UH-803)

USE "BRASCH" ELECTRIC UNIT HEATER,
 MODEL # 10-2771, 10 KW, 34000 BTUH
 (2 STEPS OPTION)

TITLE MRS FACILITY-SITE SERVICES BUILDING SHEET NO. 26 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEAVER	6/22/84						

EQUIPMENT SELECTION (CONT'D)

ELECTRICAL ROOM

1 EXHAUST FAN (EF-824)

USE "LOREN COOK", TYPE ACE-B 120C2B
 500 CFM @ 1/4" S.P. & 1/6 HP MOTOR.

2 UNIT HEATER (UH-804)

USE "WING" HCR 15, HOT WATER UNIT
 HEATER, 40,000 BTUH, 4 GPM, 1/4" S.P.
 1/6 HP FAN MOTOR

BOILER ROOM

1 EXHAUST FAN (EF-825)

USE "LOREN COOK", TYPE ACE-B 120C2B
 500 CFM @ 1/4" S.P. & 1/6 HP MOTOR

2 UNIT HEATER (UH-805)

USE "WING" HCR 15, HOT WATER UNIT HEATER,
 40,000 BTUH, 4 GPM, 1/4" S.P.,
 1/6 HP FAN MOTOR

TITLE MRS FACILITY- SITE SERVICES BUILDING SHEET NO. 27 OF 27
 JOB NO. 6440-70-3 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/22/84						

EQUIPMENT SELECTION (CONT'D)

BOILER - (B-752)

TOTAL HEATING LOAD: SHOP AREA: 665,000 BTUH
 OFFICE AREA: 483,000 BTUH

1,148,000 BTUH

$$1,148,000 + 5\% = \underline{1,205,400 \text{ MBTUH}}$$

USE "PARKER" HOT WATER BOILER
 MODEL O-1536, OIL FIRED, $\Delta T = 20^\circ F$

INPUT = 1,536 MBTUH,
 OUTPUT = 1,229 MBTUH.

HOT WATER PUMP (P-752A & P-752B)

$$\frac{1,229,000 \text{ MBTUH}}{500^\circ F (190^\circ - 170^\circ)} = 122.9 \text{ GPM};$$

USE "PACO" HOT WATER PUMP, END SUCTION
 CLOSE COUPLE TYPE L, MOD. 2095-1,
 1750 RPM,
 150 GPM @ 80' HEAD, 5 HP MOTOR.

1 - RECIRCULATING } 100% CAPACITY
 1 - STANDBY } PUMPS.



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION VIIIVEHICLE MAINTENANCE BLDG

TITLE MRS FACILITY - VEHICLE MAINTENANCE BLDG. SHEET NO. 1 OF 18
JOB NO. 6440 70-4 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Richard</i>	8-14-84						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE VEHICLE MAINTENANCE BUILDING & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430-1 , DEC. 1983
ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 2 OF 18
JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-20-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
5	P. WEST	6/20/84						

DESIGN CONDITIONS:

I. SITE LOCATION:

ELEVATION : 413 FT
LATITUDE : }
LONGITUDE : } TBD

II. DESIGN TEMPERATURES:

a. AIR CONDITIONED SPACE:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	76°F DB 50% RH
WINTER : 4°F DB	72°F DB

b. HEATING AND VENTILATING:

<u>OUTDOOR</u>	<u>INDOOR</u>
SUMMER : 95°F DB 75°F WB	10°F ABOVE OUTSIDE TEMPERATURE = 105°F
WINTER : 4°F DB	65°F DB

TITLE MRS FACILITY - VEHICLE MAINTENANCE BLDG SHEET NO. 3 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND

CLTD CORR. = (CLTD + LM)K + (78 - TR) + (To - 85)

A DAILY RANGE : 21°F

B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}\text{F}$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}\text{F}$
(BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 76^{\circ}\text{F} = 2^{\circ}\text{F}$
(BASE)

TOTAL CORRECTION: $2^{\circ}\text{F} - 0.5^{\circ} = 1.5^{\circ}\text{F}$, USE 2°F .

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}\text{F} - 95^{\circ} = -17^{\circ}\text{F}$
(BASE)

TOTAL CORRECTION : $-17^{\circ}\text{F} - 0.5 = -17.5^{\circ}\text{F}$
USE -17°F

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 4 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
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* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49
5. "U" FLOOR = 0.93

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
- 3 SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X111-8).

TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 5 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	D. WEISS	6/20/84						

* LIGHTS

$$CLF = 0.86$$

** PEOPLE

$$\begin{array}{l} SHG \\ LHG \end{array} = \begin{array}{l} 255 \\ 255 \end{array} \} \text{OFFICE}$$

$$\begin{array}{l} SHG \\ LHG \end{array} = \begin{array}{l} 345 \\ 695 \end{array} \} \text{SHOPS}$$

$$CLF = 0.84$$

*** VENTILATION AND INFILTRATION

$$\text{PEOPLE} = 5 \text{ CFM/PERSON (MIN)}$$

$$\text{TOILET} = 2 \text{ CFM/FT}^2$$

$$\text{DOORS} = 10 \text{ CFM/FT}^2$$

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 6 OF 18
 JOB NO. 6440-70-9 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/2/84						

* COOLING LOAD :

OFFICE AREA :

LUNCH RM. = 620 SF
 SHOP MGR. = 110 SF
 SERVICE ADVISER = 70 SF
800 SF

USE 1.2 CFM/SF

$\therefore 800 \times 1.2 = 960 \text{ CFM, USE } \underline{1000 \text{ CFM}}$

ASSUME 15% OA = $1000 \times 0.15 = 150 \text{ CFM}$
 RA = 850 CFM

MIXED AIR (ASSUME 80°F RA FROM CEILING PLENUM)

$95^\circ \times 0.15 = 14.25^\circ$
 $80^\circ \times 0.85 = 68.00^\circ$
82.25°F DB,
 66°F WB
 $h = 31.7$

LOAD @ 500' EL.

$1000 \times 4.33 (31.7 - 23.9) = 33,800 \text{ BTU/HR} = 3 \text{ T.}$
 SEE PSYCH CHART

* THIS IS PRELIMINARY COOLING LOAD.
 IT WILL BE FINALIZED AFTER THE MRS
 SITE IS DETERMINED

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5-3-87	AB	PN									

ROOM OR SYSTEM NO. OFFICE AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>W</u> WALL	<u>28</u>	x	<u>9</u>	=	<u>252</u>	x	<u>0.07</u>	x	<u>69</u>	or	<u>68°</u>	=	<u>1,220</u>	or	<u>1,200</u>
<u>N</u> WALL	<u>4</u>	x	<u>9</u>	=	<u>36</u>	x	<u>0.07</u>	x	<u>26</u>	or	<u>68°</u>	=	<u>70</u>	or	<u>200</u>
<u>S</u> WALL	<u>4</u>	x	<u>9</u>	=	<u>36</u>	x	<u>0.07</u>	x	<u>39</u>	or	<u>68°</u>	=	<u>100</u>	or	<u>200</u>
_____ WALL	_____	x	_____	=	_____	x	_____	x	_____	or	_____	=	_____	or	_____
_____ GLASS (COND) (<u>6</u> x <u>4</u>) <u>3</u>	_____	x	_____	=	<u>72</u>	x	<u>0.43</u>	x	<u>16</u>	or	<u>68</u>	=	<u>500</u>	or	<u>2,100</u>
_____ GLASS (SOLAR) (<u>6</u> x <u>4</u>) <u>3</u>	_____	x	_____	=	<u>72</u>	x	<u>0.55</u>	x	<u>0.82</u>	or	<u>26</u>	=	<u>7,020</u>	or	_____
_____ GLASS	_____	x	_____	=	_____	x	_____	x	_____	or	_____	=	_____	or	_____
_____ CEILING OR ROOF	<u>28</u>	x	<u>22</u>	=	<u>620</u>	x	<u>0.05</u>	x	<u>30</u>	or	<u>68</u>	=	<u>920</u>	or	<u>2,100</u>
_____ FLOOR	<u>PERIMETER</u>	x	_____	=	<u>36</u>	x	<u>0.93</u>	x	_____	or	<u>68</u>	=	_____	or	<u>2,300</u>
_____ PARTITION	_____	x	_____	=	_____	x	_____	x	_____	or	_____	=	_____	or	_____
_____ PARTITION	_____	x	_____	=	_____	x	_____	x	_____	or	_____	=	_____	or	_____

SUBTOTAL 9,830 8,100

INTERNAL HEAT GAINS

LIGHTS: 820 SQ FT x 0.86 WATTS/SQ FT * x 3.41 = 2,220

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 6 x 255 x 0.84 BTU/HR = 1,300

* LOAD TO CONDITIONED SPACE ELECTRIFICATION SUBTOTAL 8,520 9,830

** FACTOR FOR STANDARD CONDITIONS TOTAL SENSIBLE LOAD 18,350 8,100

LATENT HEAT GAINS

PEOPLE = 6 x 255 x 0.84 BTU/HR = 1300

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 1300 = 1300

TOTAL ROOM LOAD 19,480 8,100

SUPPLY AIR = TOTAL SENSIBLE LOAD = 18,350 = 850 * CFM

AIR CHANGE RATE = $\frac{1.08 \times \Delta T}{\text{ROOM VOLUME}}$ = $\frac{1.08 \times 20}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: USE 1000 CFM TO PROVIDE 1.2 CFM/SF

R/P

CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER

SHEET 7 OF 18

PSYCHROMETRIC CHART

BAROMETRIC PRESSURE: 28.85" HG = 14.18 PSIA
ELEVATION: 1000 FEET
NORMAL TEMPERATURE

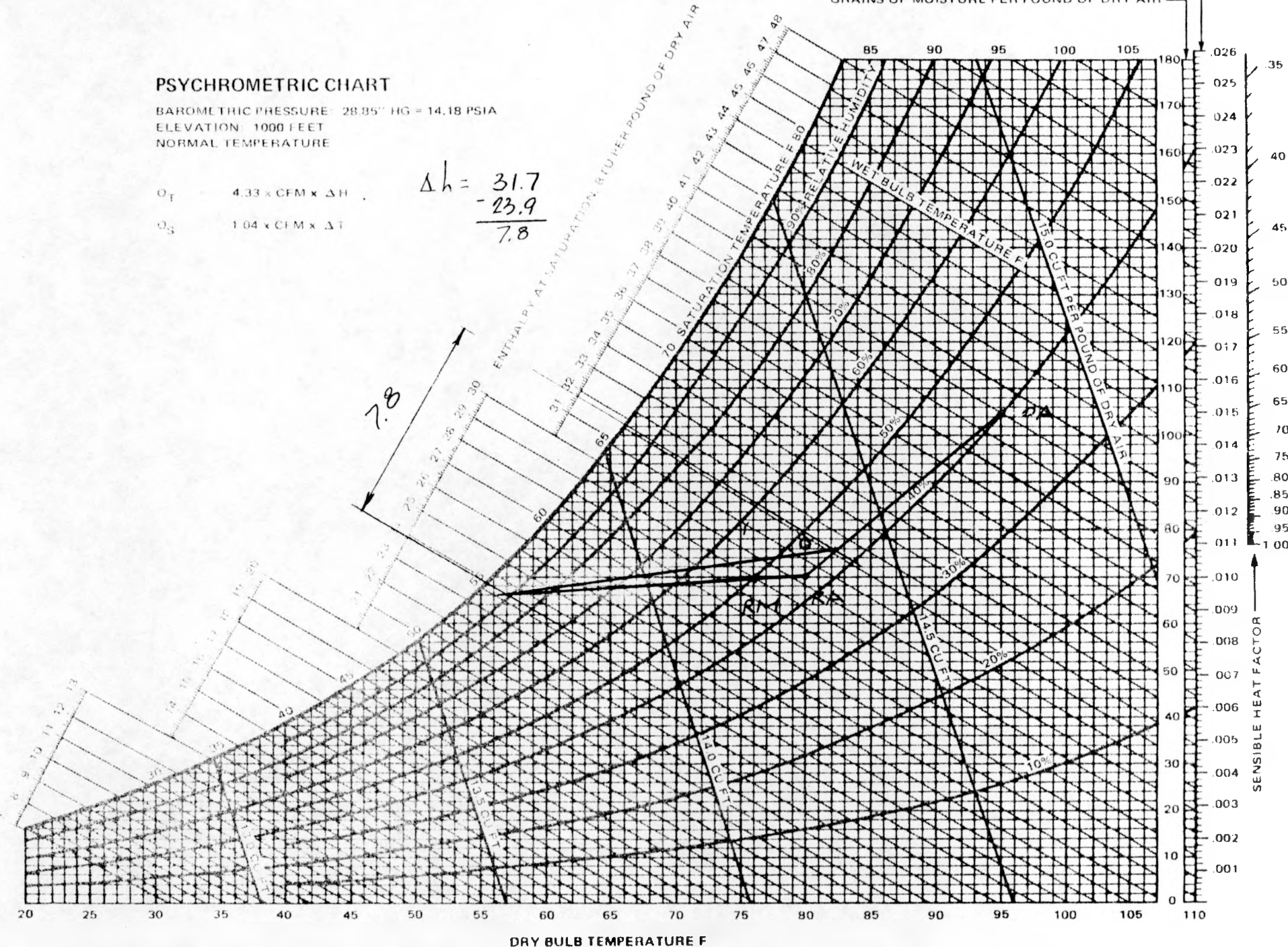
$$Q_T = 4.33 \times \text{CFM} \times \Delta H$$

$$Q_S = 1.04 \times \text{CFM} \times \Delta T$$

$$\Delta h = \frac{31.7 - 23.9}{7.8}$$

7.8

POUNDS OF MOISTURE PER POUND OF DRY AIR
GRAINS OF MOISTURE PER POUND OF DRY AIR



TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 9 OF 10
 JOB NO. 6440-D-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

HEATING LOAD.

BLD'G LOAD (SEE SHT 6 OF 17)
 OA $150 \times 1.08 \times (72^\circ - 4^\circ)$

$$= 8,100 \text{ BTUH}$$

$$= 11,020 \text{ BTUH}$$

$$\underline{19,120 \text{ BTUH}}$$

SAY 20,000 BTUH

COOLING LOAD :

SHOP AREA :

SF

101	VEST.	60
106	LOCKERS	220
107	MEN	200
108	VEST.	60
105, 113	CORR	350
110	WOMEN	200
111	VEST	60
112	STORAGE	550
114	PARTS	60
116	MACHINE SHOP (INCL. TIRE SHOP, MAINTEN, ALIGNMENT, ETC)	15,420
117	MECH EQUIP RM	900
118	BOILER RM	450
119	GLASS & UPHOLSTERY	170
128	BATTERY	120
129	STOR.	60
130	PAINTING & BODY SHOP	540
131	WASH & STEAM CLEANING	540
109	Jan & MISC	540

TOTAL

$$20,500 \text{ SF} \times 1.4 \text{ E/FT}^2 =$$

$$= 28,700 \text{ CFM.}$$

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	1	5-30-84	AD	PW									

ROOM OR SYSTEM NO. SHOP AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>115</u>	x	<u>25</u>	=	<u>2,880</u>	x	<u>0.07</u>	x	<u>7</u>	or	<u>61</u>	=	<u>1,410</u>	or	<u>12,300</u>
<u>E</u> WALL	<u>88</u>	x	<u>25</u>	=	<u>2,150</u>	x	<u>0.07</u>	x	<u>12</u>	or	<u>61</u>	=	<u>2,650</u>	or	<u>13,450</u>
<u>W</u> WALL	<u>155</u>	x	<u>25</u>	=	<u>3,880</u>	x	<u>0.07</u>	x	<u>50</u>	or	<u>61</u>	=	<u>13,580</u>	or	<u>16,570</u>
WALL		x		=		x		x		or		=		or	
<u>N</u> DOOR	<u>12</u>	x	<u>15</u>	=	<u>360</u>	x	<u>0.49</u>	x	<u>7</u>	or	<u>61</u>	=	<u>1,240</u>	or	<u>10,760</u>
<u>E</u> DOOR	<u>15</u>	x	<u>15</u>	=	<u>230</u>	x	<u>0.49</u>	x	<u>12</u>	or	<u>61</u>	=	<u>1,350</u>	or	<u>6,880</u>
<u>W</u> DOOR	<u>15</u>	x	<u>15</u>	=	<u>230</u>	x	<u>0.49</u>	x	<u>50</u>	or	<u>61</u>	=	<u>5,640</u>	or	<u>4,880</u>
<u>S</u> CEILING	<u>115</u>	x	<u>155</u>	=	<u>1,470</u>	x	<u>0.49</u>	x	<u>20</u>	or	<u>61</u>	=	<u>14,410</u>	or	<u>43,940</u>
OR ROOF		x		=		x		x		or		=		or	
FLOOR	<u>(115+115+85+127)</u>	x		=	<u>462</u>	x	<u>0.93</u>	x		or	<u>61</u>	=		or	<u>26,210</u>
ROOF		x		=		x		x		or		=		or	
PARTITION		x		=	<u>17,300</u>	x	<u>0.05</u>	x	<u>23</u>	or	<u>61</u>	=	<u>19,900</u>	or	<u>52,800</u>
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 60,180 189,790

INTERNAL HEAT GAINS

LIGHTS: 17,300 SQ FT x 0.86 WATTS/SQ FT * x 3.41 = 44,630

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 ** x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 20 x 345 x 0.84 BTU/HR = 5,800

* LOAD TO CONDITIONED SPACE (ELECTR INFORM)

SUBTOTAL 50,430 50,430

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 110,610 189,790

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = TOTAL SENSIBLE LOAD 110,610 = 20,480 * CFM
1.08 x ΔT 1.08 x 5°

AIR CHANGE RATE = ROOM VOLUME = MIN
SUPPLY (CFM)

REMARKS: * USE 24,600 CFM BASED ON 1.2 CFM/FT²

RMP
CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-4
SHEET 10 OF 18

TITLE MRS FACILITY - VEHICLE MAINTENANCE BLDG SHEET NO. 11 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/29/84						

COOLING LOAD (CONT'D)

SHOP AREA :

EXHAUST SYSTEM:

- 1 BOILER RM (SUPPLY FROM = 500 CFM
RETURN DUCT)
- 2 TAILPIPE EXHAUST: = 2,400 CFM.
- 3 MECH EQUIPMENT RM.: = 1,000 CFM
(SUPPLY FROM RETURN DUCT).
- 4 PAINT SHOP & STORAGE = 1,200 CFM
- 5 BATTERY RM = 170 CFM
- 6 TOILETS, LOCKERS = 1,620 CFM

TOTAL 6,890 CFM

<u>SUPPLY AIR</u>	<u>24,600 CFM</u>
EXHAUST AIR	6,890 CFM
RETURN AIR	17,710 CFM
TRANSFER AIR FROM SERVICE ADVISER (RM #103)	150 CFM

TOTAL RA	<u>17,860 CFM</u>
TOTAL OA: 24,600 - 17,860 =	<u>6,740 CFM</u>

TITLE MRS - VEHICLE MAINTENANCE BUILDING SHEET NO. 12 OF 18
 JOB NO. 6440 DEPARTMENT _____ AUTHOR M.P. DATE 6/1/89

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	AB	6-4-84						

TAILPIPE EXHAUST SYSTEM

GIVEN CONDITIONS:

- 1) 4 STALLS FOR LIGHT DUTY VEHICLES
- 2) 4 STALLS FOR HEAVY DUTY VEHICLES

ASSUMPTIONS:

- 1) EACH STALL NEEDS EXHAUSTING
- 2) LIGHT DUTY VEHICLES HAVE 100-300 HP GAS ENGINES
- 3) HEAVY DUTY VEHICLES HAVE DIESEL ENGINES UP TO 500 HP

FROM
MANUALS

∴ EXHAUST RATE FOR LIGHT VEHICLES = 200 CFM PER OUTLET
 " " " HEAVY " = 400 CFM PER OUTLET

∴ TOTAL EXHAUST RATE = 2400 CFM

1. USE OVERHEAD EXPOSED SYSTEM FOR SIMPLICITY (THE OTHER ALTERNATIVE IS A BELOW GROUND SYSTEM) AND COST-EFFECTIVENESS; SINGLE BRANCH.

2. EXHAUST FAN

(EF 830) 17-M211 SERIES CM3, MODEL NO. 20. 1/2 HP MOTOR
 2400 CFM @ 1 1/4" SP (SP ASSUMED)

3. ACCESSORIES

- CAP-PIVOT COUPL ADAPTERS FOR TAIL EXHAUST SYSTEM
- DAMPERS TO SHUT OFF AIR FLOW IN ANY TUBE NOT IN USE.
- TUBES FOR OVERHEAD EXPOSED SYSTEM



TITLE MRS FACILITY- VEHICLE MAINTENANCE BLDG SHEET NO. 13 OF 18
JOB NO. 6440-70-9 DEPARTMENT MLI AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/20/84						

HEATING LOAD

$$\text{BLDG. LOAD (SHEET 9)} = 189,790 \text{ BTU/HR}$$

$$\text{OA: } 6740 \times 1.08 \times 61 = 444,030 \text{ BTU/HR}$$

$$\begin{aligned} & 633,820 \text{ BTU/HR} \\ & \underline{633,82 \text{ MBH}} \end{aligned}$$

DOOR HEATERS:

ASSUME 2 DOOR HEATERS FOR SERVICE AREA &
1 DOOR HEATER FOR WASH & STEAM CLEANING

HEATING REQUIRED:

$$\begin{aligned} & * 445 \text{ MBH} \times 3 \\ & = 1,335 \text{ MBH} \end{aligned}$$

$$\begin{aligned} \text{TOTAL HEATING REQUIRED:} & = 1,968,820 \text{ BTU/HR} \\ & = \underline{\underline{1,969 \text{ MBH}}} \end{aligned}$$

* "WING" - HOT WATER HEATERS.

TITLE MRS FACILITY - VEHICLE MAINTENANCE Bldg SHEET NO. 14 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

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0	P. WENS	6/20/84						

PAINTING AND BODY SHOP - MAKE UP AIR HANDLING UNIT

$$\text{AREA} = 36' \times 15' = 540 \text{ SF}$$

$$V = 540 \text{ SF} \times 20.5' = 11,070 \text{ FT}^3$$

BASIS FOR DESIGN REQUIRED TO PROVIDE THE SUPPLY AIR @ AN AIR FLOW RATE OF 20 AC PER HOUR DURING THE PAINTING.

∴ TOTAL SUPPLY AIR REQUIRED :

$$\frac{20 \times 11,070}{60} = 3,690 \text{ CFM} = 3,700 \text{ CFM}$$

SUPPLY AIR PROVIDED BY SHOP AREA AIR HANDLING UNIT = 1,080 CFM

$$\therefore 3,700 - 1,080 = \underline{\underline{2,620 \text{ CFM}}}$$

HEATING LOAD :

$$2,620 \times 1.08 \times (65 - 4) = 172,600 \text{ BTU/HR}$$

$$\frac{172,600}{3413} = \underline{\underline{51 \text{ KW}}}$$

TITLE MRS FACILITY- VEHICLE MAINTENANCE BLDG SHEET NO. 15 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

EQUIPMENT SELECTION :

OFFICES :

1. AIR HANDLING UNIT (AHU-809)

"CARRIER", MODEL 39B040, SINGLE DUCT,
 DRAIN-THROUGH,

1000 CFM @ 1" SP. , 1 HP MOTOR
 WITH DX COOLING COIL & HOT WATER
 HEATING COIL - CAPACITY : 20,000 BTUH,
 FLOW RATE : 2.0 GPM, AND CARTRIDGE FILTER
 SECTION (30% PF).

2. AIR COOLED CONDENSING UNIT (ACCU-806)

"CARRIER", MODEL 38ED036

33,800 BTU/HR @ 45° SST,
 1 COMPRESSOR - 3.32 KW
 1 COND FAN - 1 HP
 REFRIG TYPE - R-22.

TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 16 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 5-30-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

1) AIR HANDLING UNIT (AHU-807)

USE: "CARRIER" MODEL 39EH 48,
 SINGLE DUCT, DRAW-THROUGH,

24,600 CFM @ 3 1/2" S.P., 30 HP MOTOR

WITH HOT WATER HEATING COIL
 CAPACITY: 372,000 BTUH, 37.5 GPM
 AND CARTRIDGE FILTER SECTION (30% PF & 85% PF)

2) RETURN FAN (RF-804)

USE: "BUFFALO" - BL 730 SISW,

19,360 CFM @ 1 1/2" SP, 10 HP MOTOR

3) MAKE-UP AIR HANDLING UNIT (AHU 808) (PAINTING SHOP)

USE: "CARRIER", MODEL 39B060 (H&V),

2,620 CFM @ 1 1/2" S.P., 2 HP MOTOR

WITH EL. HEATING COIL 51 KW,
 30% EFF. FILTER.

TITLE MRS FACILITY-VEHICLE MAINTENANCE BLDG SHEET NO. 17 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MLU AUTHOR AB DATE 5-30-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/81						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

4) EXHAUST FANS:

EF-830 - FUME EXHAUST, CENTRIF. FAN
 (SEE SHEET 11 OF 17) 2400 CFM @ 1 3/4" S.P.
 1 1/2 HP MOTOR

EF-831 - FUME EXHAUST, CENTRIF. FAN,
 2,620 CFM @ 1 1/2" S.P., 1 1/2 HP MOTOR

EF-832 - FUME EXHAUST, CENTRIF. FAN,
 1200 CFM @ 1/4" S.P. 1/4 HP MOTOR

EF-833 - FUME EXHAUST CENTRIF. FAN,
 170 CFM @ 1/4" S.P., 1/6 HP MOTOR

EF-834 - ROOF EXHAUST (TOILET AREAS)
 1,620 CFM @ 1/4" S.P., 1/4 HP MOTOR

GRV-811 - GRAVITY FAN, 1000 CFM,
 (MECH EQUIP RM) THROAT AREA = 3.3 FT²

GRV-812 - GRAVITY FAN, 500 CFM,
 (BOILER RM) THROAT AREA = 3.3 FT²

5) UNIT HEATERS: (HOT WATER DOOR UNIT HEATERS)

UH-816, UH-817, UH-818 (TOTAL - 3)

USE "WING", SIZE 36, \$10,000 E, 1 1/2 HP MOTOR
 (EA) 445 MBH, 46 GPM

TITLE MRS FACILITY- VEHICLE MAINTENANCE SHEET NO. 18 OF 18
 JOB NO. 6440-70-4 DEPARTMENT MU AUTHOR AB DATE 530 84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/20/84						

EQUIPMENT SELECTION (CONT'D)

6) BOILER (B 754)

USE "PARKER".

HOT WATER BOILER,
 OIL FIRED,
 MODEL O-2640
 $\Delta T^{\circ} \text{WATER} = 190 - 170 = 20^{\circ} \text{F}$
 INPUT: 2,640 BTU/HR
OUTPUT: 2,112 BTU/HR
 210 GPM - FLOW RATE

7) PUMP: - HOT WATER: (P 754A & P 754B)

$$\frac{2,112,000}{500 \times 20^{\circ}} = 210 \text{ GPM.}$$

USE "PACO":

END SUCTION, CLOSE
 COUPLED, TYPE L,
 MODEL 2095-1, 1750 RPM,
 210 GPM @ 60' TOTAL HEAD,
 5 HP MOTOR

1- RECIRCULATING } TOTAL
 1- STANDBY } 2



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION IXFIRE STATION

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 1 OF 20JOB NO. 6440 70-6 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOVICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>B. K. H.</i>	8-14-84						

OBJECTIVES

CALCULATE, HEATING & COOLING LOADS FOR FIRE STATION & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430.1 , DEC. 1983
ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.

TITLE MRS FACILITY- FIRE STATIONSHEET NO. 2 OF 20JOB NO. 6440-70-6 DEPARTMENT MUAUTHOR ABDATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

DESIGN CONDITIONS:I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II DESIGN TEMPERATURES:A AIR CONDITIONED SPACE:OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

B HEATING AND VENTILATING:OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 3 OF 20JOB NO. 6440-70.6DEPARTMENT MUAUTHOR ABDATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

CLTD CORR. = $(CLTD + LM)K + (78 - T_R) + (T_o - 85)$

A DAILY RANGE : $21^{\circ}F$ B OUTDOOR DAILY AVG TEMP : $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$ C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)D ROOM CORRECTION FACTOR : $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)TOTAL CORRECTION : $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR : $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$ CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)* MAX CLTD : 4 PM.

	AIR COND	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY - FIRE STATION SHEET NO. 4 OF 20
 JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

1. SC = 0.55
2. CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
3. SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X III - 8).

TITLE MRS FACILITY - FIRE STATION SHEET NO. 5 OF 20
 JOB NO. 6440-706 DEPARTMENT MU AUTHOR AB DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/14/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
 LHG = 255 }

SHG = 345 } SHOPS
 LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 & ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19

*** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

PSYCHROMETRIC CHART

BAROMETRIC PRESSURE: 28.85" HG = 14.18 PSIA
ELEVATION: 1000 FEET
NORMAL TEMPERATURE

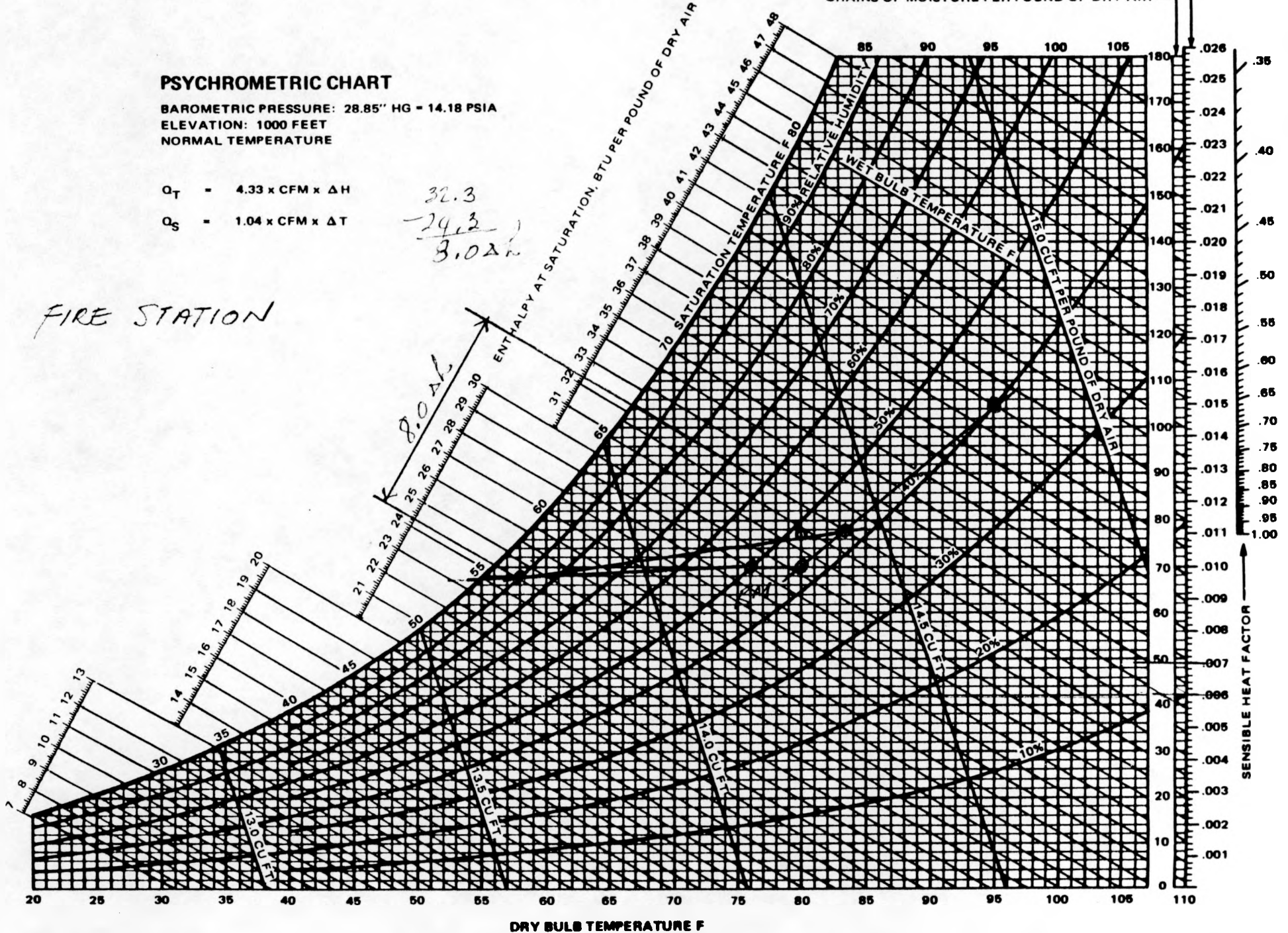
$$Q_T = 4.33 \times \text{CFM} \times \Delta H$$

$$Q_S = 1.04 \times \text{CFM} \times \Delta T$$

32.3
-24.3
8.0 Δh

FIRE STATION

POUNDS OF MOISTURE PER POUND OF DRY AIR
GRAINS OF MOISTURE PER POUND OF DRY AIR



TITLE MRS FACILITY - FIRE STATION

SHEET NO. 7 OF 20

JOB NO. 6440-70-6 DEPARTMENT ML

AUTHOR AB

DATE 5-22-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

* COOLING LOAD :

(INCLUDING FUTURE EXPANSION)

OFFICE AREA = 6,200 SF

ASSUME : 1.0 CFM/SF

∴ 6,200 x 1.0 = 6,200 CFM,
5% safety = 6,510 CFM
USE 6,600 CFM.

OA : TOILETS (MEN'S, WOMEN'S, VEST.) = 1,000 CFM
JANITOR (ADMIN.) = 50 CFM
MECH EQUIP. RM = 450 CFM

1,500 CFM

SUPPLY AIR	=	6,600 CFM
EXHAUST AIR	=	1,500 CFM
RETURN AIR		<u>5,100 CFM</u>

1500 / 6600 = 23% OA

MIXED AIR :

(ASSUME 80°F RA FROM CEILING PLENUM)

95° x 0.23 = 21.85

80° x 0.77 = 61.60

83.45°F DB / 67°F WB, 32.3-h

* THIS IS THE PRELIMINARY COOLING LOAD. IT WILL BE FINALIZED AFTER THE MRS SITE IS DETERMINED

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 8 OF 20JOB NO. 6440-7-6 DEPARTMENT MUAUTHOR ABDATE 5-22-87

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	4/20/87						

COOLING LOAD (CONT'D).

ASSUME : AIR LEAVING COIL @ 58°F DB,
56°F WB;
LOAD @ 500 FT ELEV. 24.3 Δh

$$6600 \times \left(\frac{4.5 \times 0.982}{4.4} \right) \times \left(\frac{32.3 - 24.3}{8} \right) = \underline{232,320 \text{ BTUH}} \\ = \underline{\underline{19 \text{ TONS.}}}$$

MAIN APPARATUS ROOM & AMBULANCE /
FIRE CHIEF PARKING

WINTER:

1 AIR LEAKAGE THROUGH THE DOORS

DOOR DIMENSIONS : 24' x 8' (1)
12' x 14' (5)

CRACK WIDTH = 1/8"
CRACK LENGTH = 324'
ΔP = 0.1" H₂O GAGE

* AIR LEAKAGE RATE = 300 CFM
(21' CRACK LENGTH, 1/8" CRACK WIDTH, 0.3" ΔP)

∴ AIR LEAKAGE THROUGH THE DOOR :

$$Q = C(\Delta P)^{0.55} = \frac{300 \times 324'}{21'} \times \left(\frac{0.1}{0.3} \right)^{0.55} = 2,530 \text{ CFM, USE } \underline{\underline{2,600 \text{ CFM}}}$$

* ASHRAE GUIDE, FUNDAMENTALS, 22.1, FIG 9)

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	5/22/81	AB	FW									

ROOM OR SYSTEM NO. FIRE STATION (INCLUDING FUTURE EXPANSION)

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	L	x	COOL (CLTD)	DR	HEAT ΔT	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	82'-8"	x	9'	=	740	x	0.07	x	26	or	68	=	1,350	or	3,520
E WALL	38'-4"	x	9'	=	350	x	0.07	x	31	or	68	=	760	or	1,670
S WALL	78'-8"	x	9'	=	710	x	0.07	x	39	or	68	=	1,980	or	3,380
W WALL	145'-4"	x	9'	=	1310	x	0.07	x	69	or	68	=	6,330	or	6,240
S GLASS	3(5 x 5) + (9 x 4) 2			=	147	x	0.55 x 0.35 x 90	x				=	2,550	or	
W GLASS	3(5 x 5) x 2(9 x 4)			=	105	x	0.55 x 0.82 x 216	x				=	10,300	or	
COND GLASS		x		=	252	x	0.43	x	16	or	68	=	4,000	or	7,400
CEILING OR ROOF		x		=	6200	x	0.05	x	30	or	68	=	12,240	or	21,100
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

FUTURE EXPANSION _____ SUBTOTAL 39,510 42,410

INTERNAL HEAT GAINS

LIGHTS: 6,200 SQ FT x 0.86 x 3* WATTS/SQ FT * x 3.41 = 55,000

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08** x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 20 x 255 x 0.84 BTU/HR = 4,300

* LOAD TO CONDITIONED SPACE (ELECTRICAL INFOR) SUBTOTAL 59,300 39,510

** FACTOR FOR STANDARD CONDITIONS TOTAL SENSIBLE LOAD 98,810 92,410

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 120,000

SUPPLY AIR = TOTAL SENSIBLE LOAD 98,810 = 4,600* CFM

AIR CHANGE RATE = ROOM VOLUME 1.08 x 20 = _____ MIN

SUPPLY (CFM)

REMARKS: * FOR PRELIMINARY ESTIMATES USE 6,600 CFM, BASED ON 1.0 CFM/FT²

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-6</u>
		SHEET OF <u>9</u> <u>20</u>

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
		0	5-25-84	AB									

ROOM OR SYSTEM NO. MAIN APPARATUS RM & AMBULANCE / FIRE CHIEF PARKING.

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	COOL BTU/HR	OR	HEAT BTU/HR	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
E WALL	108	x	9	=	972	x	0.07	x	12	820	or	4,150
WALL		x		=		x		or			or	
DOOR WALL		x		=	1032	x	0.49	x	12	6,070	or	31,000
WALL		x		=		x		or			or	
GLASS		x		=		x		or			or	
GLASS		x		=		x		or			or	
GLASS		x		=		x		or			or	
CEILING OR ROOF		x		=	4400	x	0.05	x	23	5,060	or	13,420
FLOOR		x		=		x		or			or	
PARTITION		x		=		x		or			or	
PARTITION		x		=		x		or			or	

SUBTOTAL 11,950 48,570

INTERNAL HEAT GAINS

LIGHTS: 4400 SQ FT x 0.86 x 15 WATTS/SQ FT * x 3.41 = 19,400

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * * x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE (BY ELECTRICAL)

SUBTOTAL 19,400 19,400

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 31,350 48,570

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{31,350}{108 \times 10^\circ}$ = 3,000* CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * USE 4600 CFM, CONSIDERING 1,054/FT².
ΔT AT THIS CASE = 7°F



CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-6
SHEET 10 OF 20

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 11 OF 20JOB NO. 6440-76-6DEPARTMENT MUAUTHOR ABDATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P.W. Weiss	6/20/84						

MAIN APPARATUS ROOM & AMBULANCE
FIRE CHIEF PARKING (CONT'D)

SUMMER

AREA (SF) = 4400 SF

ASSUME : 1.05 $\frac{Btu}{ft^2 \cdot h}$ / SF OR BASED ON COOLING
LOAD:

$\therefore 4400 \times 1.05 = 4620 \text{ CFM, USE}$

4600 CFM

HEATING LOAD:

OFFICE AREA

OA: $1500 \times 1.08 \times 68 = 110,160 \text{ BTUH}$

BLDG HEAT LOSS = 120,000 BTUH

230,160 BTUH

MAIN APPARATUS ROOM

OA: $2600 \times 1.08 \times (65-4) = 171,288 \text{ BTUH}$

BLDG. HEAT LOSS 48,510 BTUH

219,858 BTUH

SAY 220,000 BTUH



TITLE MRS FACILITY - FIRE STATION SHEET NO. 12 OF 20
JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5/25/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

BOILER RM.
SUPPLY AIR: ASSUME - 500 CFM
HEATING LOAD:

$$\begin{array}{rcl} \text{DA: } 500 \text{ ft} \times 1.08 \times 61^{\circ} & = & 33,000 \\ \text{WALL: } (12 \times 12) \times 0.07 \times 61^{\circ} & = & 615 \\ \text{ROOF: } 11' \times 12' \times 0.05 \times 61^{\circ} & = & 400 \end{array}$$

34,015 BTUH

SAY 40,000 BTUH.

MECHANICAL EQUIPMENT RM

SUPPLY AIR: 6 AC/HR

$$\frac{6 \times (350 \times 12)}{60} = 420 \text{ CFM,}$$

USE 450 CFM

USE SUPPLY AIR FROM THE RETURN DUCTWORK.

TITLE MRS FACILITY - FIRE STATION SHEET NO. 13 OF 20
 JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5-25-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. Weiss	6/20/81						

EQUIPMENT SELECTION:

OFFICES.

1. AIR HANDLING UNIT (AHU-811)

"CARRIER", MODEL 39E 13, SINGLE
 DUCT, DRAW-THROUGH,

6,600 CFM @ 3" SP (H₂O), 7 1/2 HP,

W/ DX COOLING COIL & HOT WATER
 HEATING COIL,

CARTRIDGE FILTER SECTION (30% PF & 85% FF)

2. AIR COOLED CONDENSING UNIT (ACCU-805)

"CARRIER", MODEL 38 AD024,

243,000 BTUH @ 45°F SST & 100° AMBIENT

23.3 KW, 3 COND FANS - 1 HP EA, 1 COMPR.
 REFRIG TYPE: R-22

3. RETURN AIR FAN (RF 805)

"BUFFALO", MODEL BL-400, SISW, CENTRIF.

5500 CFM @ 1 1/2" S.P., 3 HP MOTOR

TITLE MRS FACILITY - FIRE STATION

SHEET NO. 14 OF 20

JOB NO. 6440-70-6 DEPARTMENT MLI

AUTHOR AB

DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

EQUIPMENT SELECTION: (CONT'D)

4. TERMINAL REHEAT UNITS (HC).

HC - 803 - HOT WATER UNIT HEATER

"WING", MODEL # 15 (FUTURE).

2000 CFM ; 36,400 BTUH, MOTOR: 1/6 HP
 @ ENT. AIR TEMP. = 69.2°F
 LVG AIR TEMP. = 86.0°F

ENT WATER TEMP = 190°F
 LVG AIR TEMP. = 170°F
 GPM = 3.7

HC - 804 - HOT WATER UNIT HEATER

"WING", MODEL # 1.5 U

410 CFM ; 7500 BTU/HR. MOTOR: 1/20 HP
 @ ENT AIR TEMP = 69.2°F
 LVG AIR TEMP. = 86.0°F

ENT WATER TEMP = 190°F
 LVG AIR TEMP. = 170°F
 GPM = 0.8

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 15 OF 20JOB NO. 6440-70-6DEPARTMENT MLUAUTHOR ABDATE 5-25-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/81						

EQUIPMENT SELECTION: (CONT'D)HC-805 - HOT WATER UNIT HEATER"KING", MODEL $2\frac{1}{2}U$

1,410 CFM, 25,600 BTU/HR, MOTOR: $\frac{1}{20}$ HP
@ ENT. AIR TEMP. = $69.2^{\circ}F$
LVG AIR TEMP. = $86.0^{\circ}F$

ENT WATER TEMP. = $190^{\circ}F$
LVG AIR TEMP. = $170^{\circ}F$
GPM = 2.6

HC-806 - HOT WATER UNIT HEATER

"WING", MODEL 15

2,200 CFM, 40,000 BTU/HR, MOTOR: $\frac{1}{6}$ HP
@ ENT. AIR TEMP. = $69.2^{\circ}F$
LVG AIR TEMP. = $86.0^{\circ}F$

ENT WATER TEMP. = $190^{\circ}F$
LVG AIR TEMP. = $170^{\circ}F$
GPM = 4

TITLE MRS FACILITY-FIRE STATION SHEET NO. 16 OF 20
 JOB NO. 6440-706 DEPARTMENT MLI AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. Weiss	6/20/84						

EQUIPMENT SELECTION : (CONT'D)

HC-807 - HOT WATER UNIT HEATER

"WING", MODEL #

580 CFM, 10,500 BTU/HR, MOTOR: 1/20 HP

@ ENT. AIR TEMP = 69.2°F

LVG. AIR TEMP. = 86°F

ENT. WATER TEMP. = 190°F

LVG. AIR TEMP. = 170°F

GPM = 1.

EXHAUST FAN :

ROOF EXHAUST (TOILETS,

RM'S # 109, 110, 111, 112, 113, 120)

- EF-840

Q = 1050 CFM

LOREN Cook, MODEL ACE-B-120 C2B

CENTRIFUGAL FAN, 1/6 HP, MOTOR @ 1/4" S.P.



TITLE MRS FACILITY- FIRE STATION SHEET NO. 17 OF 20
JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	6/20/84						

EQUIPMENT SELECTION: (CONT'D)

MECHANICAL EQUIPMENT RM

GRAVITY EXHAUST FAN:

GRV - 814 , RELIEF ,
450 CFM , 0.9" S.P. (TBD)

TITLE MRS FACILITY - FIRE STATIONSHEET NO. 18 OF 20JOB NO. 6440-706 DEPARTMENT MUAUTHOR ABDATE 5-25-89

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/91						

EQUIPMENT SELECTION (CONT'D):MAIN APPARATUS ROOM &
AMBULANCE / FIRE CHIEF PARKING.1. AIR HANDLING UNIT (AHU 812)

CARRIER MODEL 398060, H & V ONLY
 SINGLE DUCT, 4600 CFM @ 1 1/2" S.P.
 3 HP MOTOR, NO COILS

2. EXHAUST FANS:

EF-836, EF-837 - ROOF EXHAUST,
 CENTRIFUGAL TYPE
 Q = 1000 CFM (EA) OPERATING IN
 SUMMER ONLY.

LOREN COOK, MODEL ACE-B 120C2B,
 @ 1/4" S.P. 1/6 HP MOTOR

EF-838 - ROOF EXHAUST, CENTR. TYPE

Q = 2600 CFM (OPERATING CONTINUOUSLY)

LOREN COOK, MODEL ACE-B 150C5B,
 @ 1/4" S.P. 3/4 HP MOTOR

TITLE MRS FACILITY - FIRE STATION SHEET NO. 19 OF 20
 JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5-25-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

EQUIPMENT SELECTION (CONT'D)

MAIN APPARATUS ROOM & AMBULANCE /
FIRE CHIEF PARKING

UNIT HEATER - HOT WATER - UH-819,
UH-820,
UH-821

850 CFM (EA), 74,000 BTU/H (EA)

"KING", MODEL 26,

850 E, 80,000 BTU/HR, MOTOR 3/4 HP

ΔT WATER = 20° , GPM = 8 GPM (EA)

BOILER RM

EXHAUST FAN EF-839

ROOF EXHAUST, CENTRIF. $Q = 500$ CFM

LOREN COOK, MODEL ACE-B 120C2B,

@ 1/4" SP 1/6 HP MOTOR

UNIT HEATER UH-822 - HOT WATER,

40,000 BTU/H, 4 GPM

$\Delta T_{\text{WATER}} = 20^{\circ}$

TITLE MRS FACILITY - FIRE STATION SHEET NO. 20 OF 20
 JOB NO. 6440-70-6 DEPARTMENT MU AUTHOR AB DATE 5-25-77

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/20/84						

EQUIPMENT SELECTION (CONT'D)

BOILER RM :

TOTAL HEATING LOAD : $230,160 \text{ BTUH}$
 $+ 221,000 \text{ BTUH}$
 $451,160 \text{ BTUH.}$

$451,160 + 10\% = 496,280 \text{ BTUH.}$

USE "PARKER" OIL FIRED BOILER B-755

INPUT - 672 MBTU 54 GPM
 OUTPUT - 538 MBTU

WATER : ENT: 170°F
 LVG: 190°F

HOT WATER PUMPS : P 755.A ; P 755.B

"PACO" , MODEL 1550-1

54 GPM @ 40' HEAD, 1 HP.

1- RECIRC ; 1- STANDBY



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION XWAREHOUSE

TITLE MRS FACILITY - WAREHOUSE SHEET NO. 1 OF 10
JOB NO. 6440 70-3 DEPARTMENT MECH. UTIL. AUTHOR M. PERKOYICH DATE 8/14/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
	<i>Perkovich</i>	8-14-84						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE WAREHOUSE & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES : HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430.1 , DEC. 1983
ASHRAE FUNDAMENTALS , 1981

FORMULAE : ASHRAE FUNDAMENTALS , 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.

TITLE MRS FACILITY- WAREHOUSESHEET NO. 2 OF 10JOB NO. 6440-70-3DEPARTMENT MLIAUTHOR ABDATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

DESIGN CONDITIONS:I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II DESIGN TEMPERATURES:A AIR CONDITIONED SPACE:OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

B HEATING AND VENTILATING:OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

50°F DB

TITLE MRS FACILITY - WAREHOUSESHEET NO. 3 OF 10JOB NO. 6440-70-3DEPARTMENT MLIAUTHOR ABDATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_r) + (T_o - 85)$$

A DAILY RANGE : $21^{\circ}F$ B OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$ C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)D ROOM CORRECTION FACTOR: $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)TOTAL CORRECTION: $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$ CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
CALC'S, SHEET 15 OF 15)* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY- WAREHOUSESHEET NO. 4 OF 10JOB NO. 6440-70-3 DEPARTMENT MUAUTHOR ABDATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P WENS	6/20/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
- 3 SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X111 - 8).

TITLE MRS FACILITY - WAREHOUSE SHEET NO. 5 OF 10
 JOB NO. 6440-71-3 DEPARTMENT MU AUTHOR AB DATE 5/22/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	6/20/84						

* LIGHTS

CLF = 0.86

** PEOPLE

SHG = 255
 LHG = 255 } OFFICE

SHG = 345
 LHG = 695 } SHOPS

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
 *** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	7	5-22-74	AB	DW									

ROOM OR SYSTEM NO. MRS FACILITY - WAREHOUSE STORAGE AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>275</u>	x	<u>21.5</u>	=	<u>5912</u>	x	<u>.07</u>	x	<u>7</u>	or	<u>46</u>	=	<u>2900</u>	or	<u>19,040</u>
<u>E</u> WALL	<u>150</u>	x	<u>21.5</u>	=	<u>3225</u>	x	<u>.07</u>	x	<u>12</u>	or	<u>46</u>	=	<u>2710</u>	or	<u>10,380</u>
<u>S</u> WALL	<u>275</u>	x	<u>21.5</u>	=	<u>5912</u>	x	<u>.07</u>	x	<u>20</u>	or	<u>46</u>	=	<u>8280</u>	or	<u>19,040</u>
<u>W</u> WALL	<u>150</u>	x	<u>21.5</u>	=	<u>3225</u>	x	<u>.07</u>	x	<u>50</u>	or	<u>46</u>	=	<u>11,290</u>	or	<u>10,380</u>
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>37,000</u>	x	<u>.05</u>	x	<u>23</u>	or	<u>46</u>	=	<u>42,550</u>	or	<u>85,100</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 67,730 143,940

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 500 CFM x 1.08** x 10 °F x 46 ΔT = 5400 24,840

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL 5400

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 73,130 168,780

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 73,130 168,780

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T} = \frac{73,130}{1.08 \times 10^{\circ}\text{F} = 10^{\circ}\text{F}}$ = 6,723 * CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * USE 24,000 CFM TO MAINTAIN 20.5 CFM/FT²



CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440 70-3
SHEET 6 OF 10

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	1	5-22-81	AW										

ROOM OR SYSTEM NO. MRS FACILITY - WAREHOUSE OFFICE AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>E</u> WALL	<u>49'</u>	x	<u>9'</u>	=	<u>441</u>	x	<u>.07</u>	x	<u>12</u>	or	<u>68</u>	=	<u>370</u>	or	<u>2100</u>
<u>S</u> WALL	<u>29'</u>	x	<u>9'</u>	=	<u>261</u>	x	<u>.07</u>	x	<u>20</u>	or	<u>68</u>	=	<u>370</u>	or	<u>1240</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=		x		x		or		=		or	
FLOOR		x		=		x		x		or		=		or	
<u>PA</u> PARTITION		x		=	<u>400 CFM</u>	x	<u>1.08</u>	x	<u>10</u>	or	<u>68</u>	=	<u>4320</u>	or	<u>29,380</u>
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 5060 32,720

INTERNAL HEAT GAINS

LIGHTS: 994 SQ FT x $\frac{CLF}{160} \times 3$ WATTS/SQ FT * x 3.41 = 8750

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * x _____ °F x ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 5 x $\frac{CLF}{84} \times 255$ BTU/HR = 1070

* LOAD TO CONDITIONED SPACE

SUBTOTAL 7820

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 14,880

LATENT HEAT GAINS

PEOPLE = 5 x 255 BTU/HR = 1280

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 16,160 32,720

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{14880}{1.08 \times 9}$ = 725 * CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * USE 600 GPM GALLON 1.3 CFM / FT² = 1400 CFM

R/P
CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
1440 70-2
SHEET 7 OF 10

TITLE MRS. FACILITY - WAREHOUSESHEET NO. 8 OF 10JOB NO. 6440-70-3DEPARTMENT MUAUTHOR AB

DATE

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

COOLING LOAD (CONT'D).OFFICE AREA :

$$\text{RECEIVING} : 19.5' \times 27.5' = 536 \text{ SF} \times 1.3 \text{ E/ft}^2 = 700 \text{ E}$$

$$\text{WAITING} : 12' \times 19.5' = 234 \text{ SF} \times 1.3 \text{ E/ft}^2 = 300 \text{ E}$$

$$\text{TOILET} : 9.5' \times 19.5' = 185 \text{ SF} \times 2 \text{ E/ft}^2 = 400 \text{ E}$$

TOTAL SUPPLY

1,400 CFM

TOILET EXHAUST

400 CFM

R A

1000 CFM

LOAD @ 500' ELEV.

$$1,400 \times 1.08 \times 0.964 \times 20^\circ \text{F} = 29,151 \text{ BTUH, SAY}$$
$$\underline{\underline{30,000 \text{ BTUH}}}$$

HEATING LOAD :

$$= 32,720 \text{ BTUH}$$

(SEE SHEET 6 OF 9)

TITLE MRS FACILITY - WAREHOUSE SHEET NO. 9 OF 10
 JOB NO. 6440 70-3 DEPARTMENT MU AUTHOR AB DATE 6/11/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	6/20/84						

EQUIPMENT SELECTION

1. AIR HANDLING UNIT (AHU 806)

CARRIER 39 8040 W/ DX COOLING COIL.
 SINGLE DUCT DRAW-THROUGH.

1400 CFM @ 1 1/2" S.P. 1 HP FAN MOTOR.
 30,000 BtuH COOLING CAPACITY.

30 % EFFICIENCY PRE-FILTER

2. AIR COOLED CONDENSING UNIT (ACCU 804)

CARRIER MODEL 38 ED 030

30,000 BtuH CAPACITY, 2.75 KW POWER INPUT,
 40°F SUCTION TEMPERATURE, 1 CONDENSER FAN
 @ 1 HP. 1 COMPRESSOR.
 REFRIG. TYPE: R-22

3. TOILET EXHAUST FAN (EF 829)

LOREN COOK

400 CFM @ 1/4" S.P. , 1/6 HP MOTOR

TITLE MRS FACILITY- WAREHOUSESHEET NO. 10 OF 10JOB NO. 644070-3 DEPARTMENT MUAUTHOR ARDATE 6/11/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P.WE/SE	6/20/84						

4. DUCT HEATER (EHC 805)

BRASCH DUCT HEATER

1400 CFM AIR FLOW , 10 KW , 2 STAGES5. LOUVERS6 DAMPER OPERATED INTAKE LOUVERS W/ FILTER
(30 %). 36" x 42" (EA.)6. POWER ROOF EXHAUST FANS (EF 826-828)

LOREN COOK MODEL 36 UR 8B , 3 FANS

8,000 CFM @ 1/2" SP , 1 1/2 HP MOTOR (EACH FAN)7. UNIT HEATERS (UH 806-815)

CHROMALOX , MODEL MUH-05-4 , (10)

17,000 BTUH HEATING CAPACITY , 5 KW POWER INPUT (EA.)



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION XISTANDBY GENERATOR BLOG

TITLE MRS FACILITY - STANDBY GENERATOR BLDG SHEET NO. 1 OF 12
JOB NO. 3440-31 DEPARTMENT MECH. UTIL. AUTHOR T. CRUMP DATE 7/1/85

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
1	P. WEISS	7/19/85						

STANDBY GENERATOR BLDG

OBJECTIVES

REVISE HEATING & VENTILATING LOAD CALCULATIONS FOR THE STANDBY GENERATOR BLDG, REVISE H & V EQUIPMENT SELECTIONS AND ADD H & V EQUIPMENT AS REQUIRED DUE TO INCREASED BLDG SIZE.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS REMAIN UNCHANGED.

REFERENCES

DESIGN CONDITIONS: DOE ORDER 6430.1, DEC, 1983,
ASHRAE FUNDAMENTALS, 1981

FORMULAE: ASHRAE FUNDAMENTALS, 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.

TITLE MRS - STANDBY GENERATOR SHEET NO. 2 OF 12
 JOB NO. 6440 DEPARTMENT MU AUTHOR AB DATE 8-8-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	7/19/85						

DESIGN CONDITIONS:

I SITE LOCATION.

~~ELEVATION 413 FT~~
~~LATITUDE~~ } DELETED
~~LONGITUDE~~ } TBD

II DESIGN TEMPERATURES:

HEATING AND VENTILATING:

OUTDOOR

INDOOR

SUMMER : 94° F DB
 77° F WB

10° F ABOVE OUTSIDE
 TEMPERATURE = 105° F DB

WINTER : 14° F DB

50° F DB

III. CLTD CORRECTION

MAX. CLTD (VENTILATION) :

N WALL	7
E WALL	12
S WALL	20
W WALL	50
ROOF	23

TITLE MRS - STANDBY GENERATORSHEET NO. 3 OF 12JOB NO. 6440DEPARTMENT MUAUTHOR M. PERKOVICH DATE 7/19/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	7/19/85						

ESTIMATED H & V. LOAD (SEE PROGRESS PRINT OF 7/18/82)

1. ASSUMPTIONS

A. GENERATOR ROOMS AND SWITCHGEAR ROOM TO BE HEATED.

B. 50°F INSIDE DESIGN TEMP ∴ ΔT = 36°F

C. 1500 CFM OUTSIDE AIR LOAD - (10 CFM/SF OF DOOR) X 4 X (21 SF DOORS). REMAINDER OF THE 1500 CFM ASSUMED TO COME THROUGH FILTER BANKS. ∴ THIS ASSUMPTION APPLIES ONLY TO GENERATOR ROOM

D. CONDUCTIVITY OF CONCRETE BUILDING MATERIAL
 $= 9.0 \frac{\text{Btu} \cdot \text{in}}{\text{ft}^2 \cdot \text{hr} \cdot ^\circ\text{F}} *$

E. 24" THICK WALLS, 18" THICK CEILING

$$U_{\text{WALLS}} = \frac{9.0}{24} = .375 \frac{\text{Btu}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} \quad \boxed{\text{USE } .38}$$

$$U_{\text{CEILING}} = \frac{9.0}{18} = .50 \frac{\text{Btu}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} \quad \boxed{}$$

* ASHRAE FUNDAMENTALS, 1981. TABLE 3A, CHAPTER 23, SEE MASONRY MATERIALS, 140 $\frac{\text{lb}}{\text{ft}^3}$ CONCRETE



TITLE MRS - STANDBY GENERATOR SHEET NO. 4 OF 12
JOB NO. 6446 DEPARTMENT M. U AUTHOR M. PERKOVICH DATE 7/30/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	7/19/85						

F. SOUTH WALL OF SWITCHGEAR ROOM EXPOSED
TO 140°F AIR TEMPERATURE.

G. FLOOR OF SWITCHGEAR ROOM HAS SAME U-VALUE
AS WALLS.

H. 15,000 KW GOES INTO SWITCHGEAR ROOM,
1% OF WHICH IS DISSIPATED AS HEAT. †

† ESTIMATION FROM ELECTRICAL DEPT.

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	7/11/89	AB	PW									

ROOM OR SYSTEM NO. GENERATOR ROOMS (W/ INSULATION)

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	VENT (ETD) OR 1 ROOM ONLY	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	155	x	23	=	3565	x	.07	x		36	=		or	8985
E WALL	41	x	23	=	943	x	.07	x		36	=		or	2375
S WALL	155	x	23	=	3565	x	.07	x		36	=		or	8985
W WALL	41	x	23	=	943	x	.07	x	50	36	=	3300	or	2375
GLASS		x		=		x		x			=		or	
GLASS		x		=		x		x			=		or	
GLASS		x		=		x		x			=		or	
CEILING OR ROOF	155	x	41	=	6355	x	.05	x	23 x 1/4	36	=	1830	or	11440
FLOOR		x		=		x		x			=		or	
PARTITION		x		=		x		x			=		or	
PARTITION		x		=		x		x			=		or	

SUBTOTAL 5130 34160INTERNAL HEAT GAINS CLFLIGHTS: 1260 SQ FT x .86 x 2 WATTS/SQ FT * x 3.41 = 7390

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 1875 CFM x 1.08 ** x _____ °F x 36 ΔT = 72900MISCELLANEOUS: (@ 375 CFM x 5 INTAKE LOUVERS) BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL 7390

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 12,520 107060

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = = TOTAL ROOM LOAD SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{12,520}{1.08 \times 10 F}$ = 1160 (PER ROOM) CFMAIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = USE 25% SAFETY FACTOR = 1400 CFM MINREMARKS: HEATING LOAD CALCULATED FOR ALL 5 ROOMS. COOLING LOAD IS FOR THE MOST EXPOSED ROOM ONLY.**R/P**CALCULATION SHEET
THE RALPH M. PARSONS COMPANYHEATING AND COOLING
LOADJOB NUMBER
6440

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	7/11/85	HB	PW									

ROOM OR SYSTEM NO. GENERATOR ROOMS (W/O INSULATION)

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	ROOM VENT (ETD) ONLY	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>155</u>	x	<u>23</u>	=	<u>3565</u>	x	<u>.38</u>	x		or	<u>36</u>	=		or	<u>48770</u>
<u>E</u> WALL	<u>41</u>	x	<u>23</u>	=	<u>943</u>	x	<u>.38</u>	x		or	<u>36</u>	=		or	<u>12900</u>
<u>S</u> WALL	<u>155</u>	x	<u>23</u>	=	<u>3565</u>	x	<u>.38</u>	x		or	<u>36</u>	=		or	<u>48770</u>
<u>W</u> WALL	<u>41</u>	x	<u>23</u>	=	<u>943</u>	x	<u>.38</u>	x	<u>50</u>	or	<u>36</u>	=	<u>17,920</u>	or	<u>12900</u>
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF	<u>155</u>	x	<u>41</u>	=	<u>6355</u>	x	<u>.50</u>	x	<u>23 x 1/4</u>	or	<u>36</u>	=	<u>18,270</u>	or	<u>114390</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 36,190 237730

INTERNAL HEAT GAINS

LIGHTS: 1260 SQ FT x .36 x 2 WATTS/SQ FT * x 3.41 = 7390

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 1375 CFM x 1.08** x _____ °F x 36 ΔT = _____

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

72900

* LOAD TO CONDITIONED SPACE

SUBTOTAL 7390

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 43,580 310630

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{43,580}{1.08 \times 10^\circ F}$ = 4040 (PER ROOM) CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: HEATING LOAD IS TOTAL LOAD FOR ALL 4 ROOMS.
COOLING LOAD IS FOR THE MOST EXPOSED ROOM ONLY.

RMP
 CALCULATION SHEET
 THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
 LOAD

JOB NUMBER
6446

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	7/11/85	EB	PW									

ROOM OR SYSTEM NO. ELECTRICAL SWITCHGEAR ROOM (W/INSULATION)
 LENGTH (L) 153 x WIDTH (W) 14 = AREA (A) 2142 x HEIGHT (H) 15 = VOLUME (V) 32,130

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
X1 WALL	191	x	15	=	2865	x	.07	x	7	or	36	=	1400	or	7220
E WALL	14	x	15	=	210	x	.07	x	12	or	36	=	180	or	530
S WALL	191	x	15	=	2865	x	.07	x	(140-105)	or	36	=	7020	or	7220
W WALL	14	x	15	=	210	x	.07	x	50	or	36	=	740	or	530
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF	191	x	14	=	2674	x	.05	x	23	or	36	=	3080	or	4810
FLOOR	191	x	14	=	2674	x	.07	x	—	or	36	=		or	6740
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 12420 27,050

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 420 CFM x 1.08 * x _____ °F x 36 ΔT = 16,330

ELEC. GEAR MISCELLANEOUS: 1500 KW X 3400 BTU/H X 0.01 BTU/HR = 510,000

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 522,420 43380

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{522,420}{(1.08)(100F)}$ = 48,370 CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = $\frac{32,130}{48,370}$ = USE 49,300 CFM MIN

REMARKS: * USE 5% SAFETY FACTOR, ∴ SUPPLY AIR = 34,000 CFM

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6447</u>

TITLE MRS - STANDBY GENERATORSHEET NO. 8 OF 12JOB NO. 6440DEPARTMENT MUAUTHOR M. PERKOVICHDATE 7/19/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. Weiss	7/19/85						

INSULATE TO GET U-FACTORS OF .07 FOR WALLS
 & .05 FOR CEILING. ASSUME INSULATION HAS
 CONDUCTIVITY, $k = 0.25 \frac{\text{Btu} \cdot \text{in}}{\text{hr} \cdot \text{ft}^2 \cdot \text{F}}$

1. WALLS

$$U = .07 = \frac{1}{\frac{\Delta x_1}{k_1} + \frac{\Delta x_2}{k_2}} = \frac{1}{\frac{24''}{9.0} + \frac{\Delta x_2}{.25}}$$

$$\therefore \Delta x = .25 \left(\frac{1}{.07} - \frac{24}{9} \right) = 2.9''$$

USE 3.0''

2. CEILING

$$U = .05 = \frac{1}{\frac{18}{9.0} + \frac{\Delta x}{.25}}$$

$$\therefore \Delta x = .25 \left(\frac{1}{.05} - \frac{18}{9.0} \right) = 4.5''$$

USE 4 1/2''

3. FLOOR = WALLS ; INSULATION =

3.0''

TITLE MRS. STANDBY GENERATORSHEET NO. 9 OF 12JOB NO. 6440-DEPARTMENT MUAUTHOR ABDATE 8-17-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	7/19/85						

GENERATOR RMSUPPLY AIR REQUIRED:

BASED ON MANUFACTURER'S INFORMATION *

HEAT REJECTION TO COOLANT = 48,282 BTU/MIN

HEAT REJECTION TO ATMOSPHERE

FROM ENGINE = 10,640 BTU/MIN

HEAT REJECTION TO ATMOSPHERE

FROM GENERATOR = 3,983 BTU/MIN

TOTAL = 62,905 BTU/MIN

 $62,905 \text{ BTU/M} \times 60 = 3,774,300 \text{ BTU/H}$

$$\frac{3,774,300}{1.08 \times 40^\circ\text{F}} = 87,400 \text{ CFM}$$

(ΔT ASSUMED)

ASSUME ADDITIONAL 20% SAFETY FACTOR IN ORDER
TO KEEP THE ROOM @ DESIGN CONDITIONS:

$$\text{TOTAL AIR SUPPLY} = 87,400 + 20\% = 105,000 \text{ CFM}$$

(MAX)

* "CATERPILLAR", 3516 GENERATOR SET (SEE ATTACH)

TITLE MRS-STANDBY GENERATORSHEET NO. 10 OF 12JOB NO. 6440-DEPARTMENT MLIAUTHOR ABDATE 8-10-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. Weiss	7/18/84						

GENERATOR RM.

BASED ON ROOM COOLING LOAD (SEE SHEET 7)

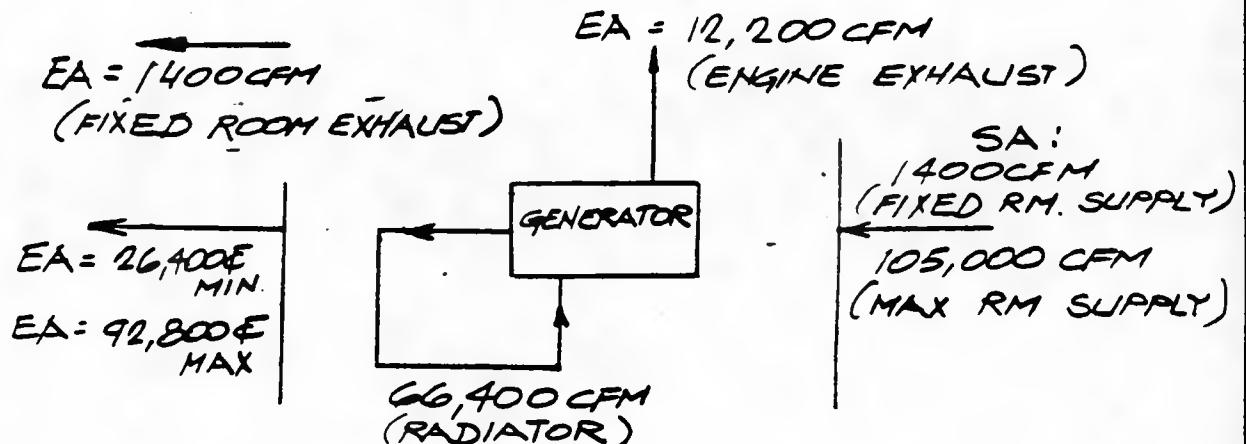
FIXED AIR SUPPLY TO THE ROOM = 1,400 CFMFIXED AIR EXHAUST = 1,400 CFMIN CASE OF STANDBY GENERATOR OPERATING:MAX AIR SUPPLY = 105,000 CFM

* ENGINE EXHAUST = 12,200 CFM

* RADIATOR EXHAUST = 66,400 CFM

MAX. AIR EXHAUST (SUMMER) = 92,800 CFM

** MIN. AIR EXHAUST (WINTER) = 26,400 CFM

* MANUFACTURER'S INFORMATION - "CATERPILLAR"
(SEE ATTACHED)** BASED ON ASSUMPTION: 20% OF SUPPLY AIR
TO BE EXHAUST IN ORDER TO KEEP THE ROOM @
DESIGN CONDITIONS.

TITLE MRS - STANDBY GENERATOR

SHEET NO. 211 OF 12

JOB NO. 6440

DEPARTMENT ML

AUTHOR AB

DATE 8-2-81

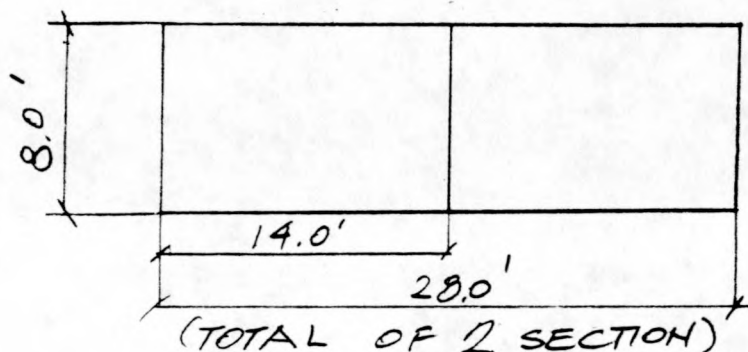
REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	7/19/85						

EQUIPMENT SELECTION (GENERATOR RM.)

1) INTAKE LOUVERS 28' x 8'

2) AIR FILTERS:

USE CAMBRIDGE "AUTO-ROLL" FILTERS



TYPICAL BANK

105,000 CFM @ 570 FPM
OR USE (48) 24x24x2 FILTERS (GYP FOR 48
1-FOR FUTURE)

3) ELECTRIC UNIT HEATER

21,410 BTU/HR (STRUCTURE) (FR. SHT. 5:107060/5)
54,430 BTU/HR (1400 x 1.08 x 36) - OA

75,840 BTU/HR.

$$\frac{75,840}{3,413} = 22.2 \text{ kW, SAY } \underline{\underline{30 \text{ kW.}}}$$

TITLE MRS-STANDBY GENERATORSHEET NO. 12 OF 12JOB NO. 6440DEPARTMENT MUAUTHOR ABDATE 8-20-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEBS	7/19/85						

EQUIPMENT SELECTION (GENERATOR RM) CONT'D.

4) EXHAUST FAN

USE PROPELLER TYPE FAN (ILG-PF24A
OR EQUAL)

1400 CFM, 1/4" S.P. 1/4-HP MOTOR - (4)

ELECTRICAL SWITCHGEAR ROOM

1) AIR HANDLING UNIT (H & V ONLY)

USE (2) "CARRIER" UNITS, MODEL 39E 30

24,650 CFM @ 2" S.P. 25 HP MOTOR
W/ EL. HEATING COIL:

HEATING REQUIREMENTS:

STRUCTURE = 43,300 BTU/HR (FR. SH. 7)
OA 4900 X 1.08 X 46 = 190,510 BTU/HR

233,890 BTU/HR
SAY 300,000 BTU/HR

$\frac{300,000}{3413} = 87.9$, SAY 90 KW (45 KW EA)



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION XIICONCRETE CASK BLDG



TITLE MRS FACILITY- CONCRETE CASK BLDG. SHEET NO. 1 OF 11
JOB NO. 6440-70-08 DEPARTMENT MU AUTHOR AB DATE 9-7-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
<u>C</u>	<u>P. WEISS</u>	<u>9/27/84</u>						

OBJECTIVES

CALCULATE HEATING & COOLING LOADS FOR THE CONCRETE CASK BUILDING & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES: HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS: DOE ORDER 6430-1,
DEC 1983

ASHRAE FUNDAMENTALS,
1981

FORMULAE: ASHRAE FUNDAMENTALS, 1981.

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY- CONCRETE CASK BLDG SHEET NO. 2 OF 11
JOB NO. 6440-70-08 DEPARTMENT MU AUTHOR AB DATE 9-5-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	9/27/84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II DESIGN TEMPERATURES:

a AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

b HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

65°F DB

TITLE MRS FACILITY - CONCRETE CASE BLDG. SHEET NO. 3 OF 11
 JOB NO. 6440-70-08 DEPARTMENT MU AUTHOR AB DATE 9-5-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WILKS	9/27/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_r) + (T_o - 85)$$

* A DAILY RANGE : $21^{\circ}F$

B. OUTDOOR DAILY AVG TEMP: $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
 (BASE)

D ROOM CORRECTION FACTOR: $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
 (BASE)

TOTAL CORRECTION: $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR: $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
 (BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
 CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY-CONCRETE CASK BLDG SHEET NO. 3 OF 11
 JOB NO. 6440-7008 DEPARTMENT MU AUTHOR AB DATE 9-5-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
2	P. WEISS	9/21/84						

* "U" FACTORS PROPOSED

- 1 "U" WALL = 0.07
- 2 "U" ROOF = 0.05
- 3 "U" GLASS = 0.43
- 4 "U" ROLL UP DOOR = 0.49

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
- 3 SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1, XIII -8).

TITLE MRS FACILITY - CONCRETE CASE BLDG SHEET NO. Y OF 11
 JOB NO. 6440-70-08 DEPARTMENT MU AUTHOR AB DATE 9-5-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

* LIGHTS

* CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
 LHG = 255 }

SHG = 345 } SHOPS
 LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
 ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19

*** REF: MRS FACILITIES, - GENERAL, SHEET 12 OF 15



TITLE MRS FACILITY - CONCRETE CASK BLDG. SHEET NO. 5 OF 11
JOB NO. 6440-70-08 DEPARTMENT MECH UTILITIES AUTHOR M PERKOVICH DATE 9/5/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

OFFICE AREA

OFFICES - 500 SF

SUPPLY AIR (BASED ON 2.0 CFM/SF) =

$$(2.0)(500) = 1000 \text{ CFM}$$

BOILER ROOM

VENTILATION RATE: USE 500 CFM (5AC/HR).
(TYPICAL FOR OTHER BOILER ROOMS IN THOSE
SUPPORT BUILDINGS WITH BOILERS)

SHOP AREA

FLOOR SPACE = 43,200 SF, USE 1.5 CFM/SF

$$\therefore \text{SUPPLY AIR} = (43,200)(1.5) = \boxed{64,800 \text{ CFM}}$$

$$\text{O.A. (ASSUMING 20\% OF S.A.)} = (.20)(64,800) = 13,000 \text{ CFM}$$

TITLE MRS FACILITY - CONCRETE CASK BLDG. SHEET NO. 6 OF 11
 JOB NO. 6440-70-08 DEPARTMENT MECH. UTILITIES AUTHOR M PERKOVICH DATE 9/5/84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

CHANGE ROOM

$$\text{VENTILATION RATE} = 2 \text{ CFM/SF}$$

$$\text{FLOOR AREA} = 640 \text{ SF}$$

$$\therefore \text{O.A.} = (2)(640) = 1280 \text{ CFM, SAY } \underline{1300 \text{ CFM}}$$

HEATING LOAD FOR BOILER ROOM, CHANGE ROOM

BOILER ROOM

$$\begin{aligned} \text{WALLS} &: 46' \times 12' \times 0.07 \times (50-4)^{\circ}\text{F} = 1780 \text{ BtuH} \\ \text{CEILING} &: 26' \times 20' \times 0.05 \times (50-4)^{\circ}\text{F} = 1200 \\ \text{O.A.} &: 500 \times 1.68 \times (50-4)^{\circ}\text{F} = 24,840 \end{aligned}$$

$$\underline{27,820 \text{ BtuH}}$$

CHANGE ROOM

$$\begin{aligned} \text{WALL} &: 20' \times 10' \times 0.07 \times (72-4)^{\circ}\text{F} = 950 \text{ BtuH} \\ \text{CEILING} &: 20' \times 32' \times 0.05 \times (72-4)^{\circ}\text{F} = 2180 \\ \text{O.A.} &: 1280 \times 1.08 \times (72-4)^{\circ}\text{F} = 94,000 \end{aligned}$$

$$\underline{97,130 \text{ BtuH}}$$

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	9/5/84	AB	PN									

ROOM OR SYSTEM NO. CONCRETE CASK BLDG. OFFICE AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
WALL		x		=		x		x		OR		=		OR	
WALL		x		=		x		x		OR		=		OR	
WALL		x		=		x		x		OR		=		OR	
W WALL	16	x	10	=	160	x	0.07	x	69	OR	68	=	770	OR	760
GLASS		x		=		x		x		OR		=		OR	
GLASS		x		=		x		x		OR		=		OR	
GLASS		x		=		x		x		OR		=		OR	
CEILING OR ROOF		x		=	500	x	0.05	x	30	OR	68	=	750	OR	1700
FLOOR		x		=		x		x		OR		=		OR	
PARTITION		x		=		x		x		OR		=		OR	
PARTITION		x		=		x		x		OR		=		OR	

SUBTOTAL 1520 2460

INTERNAL HEAT GAINS

LIGHTS: 500 SQ FT x 0.86 x 3 WATTS/SQ FT * x 3.41 = 4400

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

~~O.A.~~ INFILTRATION: 160 CFM x 1.08 * x 19 °F x 68 ΔT = 3280 11,750

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: 2 x 0.84 x 255 BTU/HR = 430

* LOAD TO CONDITIONED SPACE

SUBTOTAL 8110 8110

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 9630 14,210

LATENT HEAT GAINS

PEOPLE = 2 x 255 BTU/HR = 510

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 510 = 510

TOTAL ROOM LOAD 10,140 14,210

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = $\frac{9630}{(1.08)(20^\circ F)}$ = 450 CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: * O.A. = 20% OF SUPPLY AIR BASED ON 1.5 CFM/SF
 † USE CFM BASED ON 1.5 CFM/SF = 1000 CFM

R/P
 CALCULATION SHEET
 THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
 LOAD

JOB NUMBER
6440-70-08
 SHEET 7 OF 11

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	7/5/84	AB	PW									

ROOM OR SYSTEM NO. CONCRETE CASK BLDG - SHOP AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) _____ x HEIGHT (H) _____ = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
N WALL	432	x	20	=	8640	x	0.07	x		or	61	=		or	36,900
E WALL	100	x	20	=	2000	x	0.07	x		or	61	=		or	8540
S WALL	142	x	20	=	2840	x	0.07	x		or	61	=		or	12,130
W WALL	432	x	20	=	8640	x	0.07	x		or	61	=		or	36,900
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=		x		x		or		=		or	
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 94,470

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 13,000 CFM x 1.08 * x _____ °F x 61 ΔT = 856,440

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 950,910

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD 950,910

SUPPLY AIR = TOTAL SENSIBLE LOAD = _____ = _____ CFM

AIR CHANGE RATE = $\frac{1.08 \times \Delta T}{\text{ROOM VOLUME}}$ = _____ = _____ MIN

REMARKS: _____

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-08</u>
		SHEET <u>8</u> OF <u>11</u>

TITLE MRS FACILITY - CONCRETE CASE BLDG. SHEET NO. 9 OF 11
 JOB NO. 6442-70-08 DEPARTMENT MU AUTHOR AB DATE 9-7-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WENS	9/27/84						

EQUIPMENT SELECTION :

OFFICES :

1. AIR HANDLING UNIT (AHU-816)

USE "CARRIER", MODEL 39B040, SINGLE DUCT, DRAW-THROUGH UNIT.

1000 CFM @ 1" S.P., 1HP MOTOR

WITH DX COOLING COIL & HOT WATER HEATING COIL - CAPACITY 15,000 BTUH, FLOW RATE: 1.5 GPM, CARTRIDGE FILTER SECTION (30% PF)

2 AIR COOLED CONDENSING UNIT (ACCU-807)

USE "CARRIER", MODEL 3BED018,

CAP. 12,600 BTU/HR @ 30°F SST, 95°F-AMB.

1 COMP. - 1.47 KW, COND. FAN - PROPELLER TYPE, DIRECT DRIVE.
 REFRIG. TYPE - R22.

TITLE MRS FACILITY-CONCRETE CASK BLDG SHEET NO. 10 OF 11
 JOB NO. 6440-70-08 DEPARTMENT ML AUTHOR AB DATE 9-10-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WELSH	9/27/81						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

	SUPPLY AIR:	HEATING:
CHANGE RM :	1300 CFM	97,130 BTUH
SHOP AREA :	<u>64,800 CFM</u>	<u>950,910 BTUH</u>
TOTAL :	<u>66,100 CFM</u>	<u>1,048,040 BTUH</u>

1) AIR HANDLING UNIT (AHU-814#815)

USE (2) UNITS : "CARRIER", MODEL 39EH57
 SINGLE DUCT, HORIZONTAL
 DRAW THROUGH UNIT,
33,050 CFM @ 3 1/2" S.P.
40 HP. MOTOR
 WITH HOT WATER HEATING
 COIL, CAPACITY:

524,020 BTUH : 52.5 GPM

AND CARTRIDGE FILTER
 SECTION (30% PF)

2) RETURN FAN (RF-806#807)

TOTAL RETURN AIR: 66,100
- 13,000
- 1,300
51,800

USE (2) "BUFFALO" - BL 980 SISW
25,900 CFM @ 2 1/2" S.P. 25 HP
 MOTOR.

TITLE MRS FACILITY-CONCRETE CASK BLDG SHEET NO. 11 OF 11
 JOB NO. 6440-70-08 DEPARTMENT MU AUTHOR AB DATE 9-10-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

EQUIPMENT SELECTION (CONT'D)

SHOP AREA

3) EXHAUST FANS:

EF - 847

ROOF EXHAUST (CHANGE RM)

1300 CFM @ 1/4" S.P.,
 1/4 HP MOTOR

GRV - 813
 (BOILER RM)

GRAVITY FAN, 500 CFM,
 THROAT AREA = 1.5 FT²

GRV - 815

GRAVITY FAN - 13,000 CFM
 THROAT AREA = 26 FT²

4) UNIT HEATER: (HOT WATER UNIT HEATER)

UH - 825
 (BOILER RM)

40,000 BTUH, 4 GPM



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION XIIIWATER TREATMENT FACILITY

TITLE MRS FACILITY - WATER TREATMENT FACILITY SHEET NO. 1 OF 12
 JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	9/27/84						

OBJECTIVES :

CALCULATE HEATING & COOLING LOADS FOR THE WATER TREATMENT FACILITY & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES: HOT, HUMID & COLD.

REFERENCES

DESIGN CONDITIONS : DOE ORDER 6430-1, DEC. 1983
 ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS, '83

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC. OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS



TITLE MRS FACILITY-WATER TREATMENT FACILITY SHEET NO. 2 OF 12
JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	9/27/84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : TBD

II DESIGN TEMPERATURES:

a AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

b HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

50
65°F DB

TITLE MRS FACILITY - WATER TREATMENT FACILITY SHEET NO. 12 OF 12
 JOB NO. 6440-70-07 DEPARTMENT MV AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WELLS	9/27/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.

$$CLTD CORR. = (CLTD + LM)K + (78 - T_R) + (T_o - 85)$$

* A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP : $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
(BASE)

D ROOM CORRECTION FACTOR : $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
(BASE)

TOTAL CORRECTION : $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR : $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
(BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND.	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10



TITLE MRS FACILITY-WATER TREATMENT FACILITY SHEET NO. 4 OF 12
JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	9/27/84						

* "U" FACTORS PROPOSED

- 1 "U" WALL = 0.07
- 2 "U" ROOF = 0.05
- 3 "U" GLASS = 0.43
- 4 "U" ROLL UP DOOR = 0.49

* GLASS

- 1 SC = 0.55
- 2 CLF N = 0.75
CLF E = 0.17
CLF S = 0.35
CLF W = 0.82
- 3 SHG N = 39
SHG E = 216
SHG S = 90
SHG W = 216

* MRS FACILITIES-GENERAL (BASED ON DOE 6430.1,
XIII -8).



TITLE MRS FACILITY-WATER TREATMENT FACILITY SHEET NO. 5 OF 12
JOB NO. 6440-10-01 DEPARTMENT MU AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	9/27/84						

* LIGHTS

* CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
LHG = 255 }

SHG = 345 } SHOPS
LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19
*** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

TITLE WATER TREATMENT FACILITY SHEET NO. 6 OF 12
 JOB NO. 6440-7007 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

EQUIPMENT RM (AREA = 1,458 SF)

SUPPLY AIR (BASED ON 1.5 CFM/SF) =

$$(1.5)(1458) = 2,187 \text{ CFM} \quad \text{USE } \underline{2000 \text{ CFM.}}$$

FIRE WATER PUMP ROOM (AREA = 374 SF)

SUPPLY AIR (BASED ON 1.5 CFM/SF) =

$$(1.5)(374) = 561, \quad \text{USE } \underline{500 \text{ CFM.}}$$

ELECTRICAL EQUIPMENT RM (AREA = 77 SF)

SUPPLY AIR (BASED ON 1.5 CFM/SF) =

$$(1.3)(77) = 115 \text{ CFM, USE } \underline{100 \text{ CFM.}}$$

CHEMICAL STORAGE (AREA = 121 SF)

SUPPLY AIR: (BASED ON 1.5 CFM/SF) =

$$(1.5)(121) = 182 \text{ CFM, USE } \underline{200 \text{ CFM}}$$

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	9-10-83	LB	PN									

ROOM OR SYSTEM NO. WATER TREATMENT FACILITY - EQUIP. RM

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 1,458 x HEIGHT (H) 13' = VOLUME (V) 18,954

		L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>W</u>	WALL	<u>46.8</u>	x	<u>13</u>	=	<u>608</u>	x	<u>0.07</u>	x		OR	<u>46</u>	=		OR	<u>1,960</u>
<u>N</u>	WALL	<u>25</u>	x	<u>13</u>	=	<u>325</u>	x	<u>0.07</u>	x		OR	<u>46</u>	=		OR	<u>1,050</u>
<u>E</u>	WALL	<u>5</u>	x	<u>13</u>	=	<u>65</u>	x	<u>0.07</u>	x		OR	<u>46</u>	=		OR	<u>210</u>
<u>S</u>	WALL	<u>16</u>	x	<u>13</u>	=	<u>208</u>	x	<u>0.07</u>	x		OR	<u>46</u>	=		OR	<u>670</u>
<u>DOOR</u>	GLASS	<u>15</u>	x	<u>11</u>	=	<u>165</u>	x	<u>2.49</u>	x		OR	<u>46</u>	=		OR	<u>3,720</u>
	GLASS		x		=		x		x		OR		=		OR	
	GLASS		x		=		x		x		OR		=		OR	
	CEILING OR ROOF		x		=	<u>1458</u>	x	<u>0.05</u>	x		OR	<u>46</u>	=		OR	<u>3,350</u>
	FLOOR		x		=		x		x		OR		=		OR	
	PARTITION		x		=		x		x		OR		=		OR	
	PARTITION		x		=		x		x		OR		=		OR	

SUBTOTAL 10,960

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * * x _____ °F x ΔT = _____

MISCELLANEOUS: OA = 2000 x 1.08 x 46 BTU/HR = 99,360

PEOPLE: _____ x _____ BTU/HR = _____

99,360

* LOAD TO CONDITIONED SPACE

SUBTOTAL .

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 110,320

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-07</u>
		SHEET <u>7</u> OF <u>12</u>

REVISES	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISES	NO.	DATE	BY	CK	APP	DESCRIPTION
		1	9-12-87	AB	FW								

ROOM OR SYSTEM NO. WATER TREATMENT FACILITY- FIREWATER PUMP RM
 LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 374 x HEIGHT (H) 13 = VOLUME (V) 4,862

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>18</u>	x	<u>13</u>	=	<u>234</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>750</u>
<u>E</u> WALL	<u>21</u>	x	<u>13</u>	=	<u>273</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>880</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>374</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>860</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 2,490

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08** x _____ °F x ΔT = _____

MISCELLANEOUS: 24 = 500 x 1.08 x 46 BTU/HR = 24,840

PEOPLE: _____ x _____ BTU/HR = _____

24,840

* LOAD TO CONDITIONED SPACE

SUBTOTAL 27,330

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 27,330

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 27,330 = 27,330

TOTAL ROOM LOAD 27,330

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM
 AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-07</u>	
		SHEET <u>3</u>	OF <u>12</u>

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	1	9-12-89	AR	PJ									

ROOM OR SYSTEM NO. WATER TREATMENT FACILITY-ELECTR EQUIP ROOM

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 77 x HEIGHT (H) 13 = VOLUME (V) 1000

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>E</u> WALL	<u>7</u>	x	<u>13</u>	=	<u>91</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>290</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>77</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>180</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL

470

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * * x _____ °F x ΔT = _____

MISCELLANEOUS: OA = 100 CFM x 1.08 x 46 BTU/HR = 4970

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD

5,440

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = _____ = _____

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

R/P

CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-07
SHEET 12 OF 12

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
		0	7-12-81	RE	AV								

ROOM OR SYSTEM NO. WATER TREATMENT FACILITY - CHEMICAL STORAGE

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 121 x HEIGHT (H) 13 = VOLUME (V) 1573

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>E</u> WALL	<u>11</u>	x	<u>13</u>	=	<u>143</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>460</u>
<u>S</u> WALL	<u>11</u>	x	<u>13</u>	=	<u>143</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>460</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>121</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>280</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL

1200

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 ** x _____ °F x ΔT = _____

9,940

MISCELLANEOUS: CA = 200 x 1.08 x 46 BTU/HR = 9,940

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD

11,140

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

RMP

CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-07

SHEET 10 OF 12

TITLE WATER TREATMENT FACILITYSHEET NO. 11 OF 12JOB NO. 6440-70-07 DEPARTMENT MUAUTHOR ABDATE 9-12-81

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/81						

EQUIPMENT SELECTION.EQUIPMENT RM.

1) USE INTAKE LOUVERS (2) 36" x 18" ("RUSKIN")

$$\text{FREE AREA} = 1.7 \text{ FT}^2 (\text{EA})$$

$$\frac{2000}{1.7 \times 2} = 600 \text{ FPM VELOCITY.}$$

2) EXHAUST FAN (EF-848 & EF-849)

USE (2) ROOF EXHAUST, 1000 CFM @ 1/4" S.P.
1/6 HP MOTOR

3) UNIT HEATER (UH-826 & UH-827)

HEATING REQUIREMENTS: (SEE SHEET #7)

$$\frac{110,320 \text{ BTUH}}{3413} = 32.3 \text{ KW,}$$

USE (2) UNIT HEATERS

"CHROMALOX" - 20 KW (EA) - 56,000 BTUH

TITLE WATER TREATMENT FACILITYSHEET NO. 12 OF 12JOB NO. 6440-7007DEPARTMENT MUAUTHOR ABDATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	7/27/84						

EQUIPMENT SELECTION (CONT'D)FIRE WATER PUMP RM.

- 1) INTAKE LOUVER (1) - (24" x 18") - "RUSKIN"
- 2) EXHAUST FAN (EF-850)
 - (1) 500 CFM @ 1/4" S.P. 1/6 HP MOTOR
- 3) UNIT HEATER (1) - 10 KW. (UH-828)

$$\frac{27330}{3413} = 8 \text{ KW}, \text{ USE } 10 \text{ KW}$$

ELECTR EQUIP. RM

- 1) INTAKE LOUVER (1) - 18" x 18"
- 2) EXHAUST FAN : (EF-851) 100 CFM @ 1/4" S.P. 1/6 HP
- 3) UNIT HEATER (1) (UH-829) - 2 KW (5440 : 3413 = 1.6 KW)

CHEMICAL STORAGE

- 1) INTAKE LOUVER (1) 18" x 18"
- 2) EXHAUST FAN (1) EF-852 200 CFM @ 1/4" S.P. 1/6 HP
- 3) UNIT HEATER (1) (UH-830) - 4 KW (11,140 : 3413 = 3.3 KW)



TITLE _____ SHEET NO. _____ OF _____

JOB NO. _____ DEPARTMENT _____ AUTHOR _____ DATE _____

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE

SECTION XIVSEWAGE TREATMENT FACILITY

TITLE MRS FACILITY-SEWAGE TREATMENT FACILITY SHEET NO. 1 OF 14
 JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-11-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

OBJECTIVES :

CALCULATE HEATING & COOLING LOADS FOR THE WATER TREATMENT FACILITY & SELECT HVAC EQUIPMENT BASED ON THE RESULTS OF THE CALCULATIONS.

ASSUMPTIONS :

OUTSIDE DESIGN CONDITIONS ARE A COMPOSITE OF "WORST CASE" CONDITIONS CHOSEN FROM THREE TYPES OF SITES: HOT, HUMID & COLD.

REFERENCES :

DESIGN CONDITIONS: DOE ORDER 6430-1, DEC. 1983
 ASHRAE FUNDAMENTALS, 1981

FORMULAE : ASHRAE FUNDAMENTALS, 1981

ANY OTHER REFERENCES OR SPECIFIC CHAPTERS, PAGES, TABLES, ETC., OF ABOVE REFERENCES ARE NOTED IN THE BODY OF THE CALCULATIONS.



TITLE MRS FACILITY-SEWAGE TREATMENT FACILITY SHEET NO. 2 OF 14
JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

DESIGN CONDITIONS:

I SITE LOCATION:

ELEVATION : 413 FT
LATITUDE :
LONGITUDE : } TBD

II DESIGN TEMPERATURES:

a AIR CONDITIONED SPACE:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

76°F DB
50% RH

72°F DB

b HEATING AND VENTILATING:

OUTDOOR

SUMMER : 95°F DB
75°F WB

WINTER : 4°F DB

INDOOR

10°F ABOVE OUTSIDE
TEMPERATURE = 105°F

50°F
~~65°F~~ DB

TITLE MRS FACILITY - SEWAGE TREATMENT FACILITY SHEET NO. 3 OF 14
 JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9/27/84						

III * EQUIVALENT TEMP DIFFERENCE (TETD) - AIR COND.
 $CLTD CORR. = (CLTD + LM)K + (78 - T_R) + (T_o - 85)$

A DAILY RANGE : $21^{\circ}F$

B OUTDOOR DAILY AVG TEMP : $95^{\circ} - \frac{21^{\circ}}{2} = 84.5^{\circ}F$

C CORRECTION FACTOR : $84.5^{\circ} - 85^{\circ} = -0.5^{\circ}F$
 (BASE)

D ROOM CORRECTION FACTOR : $78^{\circ}F - 76^{\circ}F = 2^{\circ}F$
 (BASE)

TOTAL CORRECTION : $2^{\circ}F - 0.5^{\circ} = 1.5^{\circ}F$, USE $2^{\circ}F$.

IV HEATING & VENTILATION

ROOM CORRECTION FACTOR : $78^{\circ}F - 95^{\circ} = -17^{\circ}F$
 (BASE)

TOTAL CORRECTION : $-17^{\circ}F - 0.5 = -17.5^{\circ}F$
USE $-17^{\circ}F$

CORRECTED CLTD : (SEE MRS FACILITY - GENERAL
 CALC'S, SHEET 15 OF 15)

* MAX CLTD : 4 PM.

	AIR COND	VENT.
N WALL	26	7
E WALL	31	12
S WALL	39	20
W WALL	69	50
ROOF	30	23
GLASS	16	

* ASHRAE GRP 158, CHAPTER 3, TABLE 3.10

TITLE MRS FACILITY - SEWAGE TREATMENT FACILITY SHEET NO. 4 OF 14
 JOB NO. 6440-7007 DEPARTMENT MU AUTHOR AP DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WESS	9/27/84						

* "U" FACTORS PROPOSED

1. "U" WALL = 0.07
2. "U" ROOF = 0.05
3. "U" GLASS = 0.43
4. "U" ROLL UP DOOR = 0.49

* GLASS

1. SC = 0.55
2. CLF N = 0.75
 CLF E = 0.17
 CLF S = 0.35
 CLF W = 0.82
3. SHG N = 39
 SHG E = 216
 SHG S = 90
 SHG W = 216

* MRS FACILITIES - GENERAL (BASED ON DOE 6430.1, X-111 - 8).



TITLE MRS FACILITY-SEWAGE TREATMENT FACILITY SHEET NO. 5 OF 14
JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	9/27/84						

* LIGHTS

* CLF = 0.86

** PEOPLE

SHG = 255 } OFFICE
LHG = 255 }

SHG = 345 } SHOPS
LHG = 695 }

CLF = 0.84

*** VENTILATION AND INFILTRATION

PEOPLE = 5 CFM / PERSON (MIN)

TOILET = 2 CFM / FT²

DOORS = 10 CFM / FT²

* REF.: MRS FACILITIES - GENERAL, SHEET 11 OF 15 &
ASHRAE GUIDE, CHAPTER 26, TABLE 17B

** REF.: ASHRAE GUIDE, CHAPTER 26, TABLE 18 & 19

*** REF.: MRS FACILITIES, - GENERAL, SHEET 12 OF 15

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	9-12-74	AB	PW									

ROOM OR SYSTEM NO. SEWAGE TREATMENT - EQUIPMENT RM

LENGTH (L) 62 x WIDTH (W) 27 = AREA (A) 1,674 x HEIGHT (H) 13 = VOLUME (V) 21,762

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>S</u> WALL	<u>62</u>	x	<u>13</u>	=	<u>806</u>	x	<u>0.07</u>	x	<u>7</u>	or	<u>46</u>	=		or	<u>2,130</u>
<u>W</u> WALL	<u>27</u>	x	<u>13</u>	=	<u>351</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>1,130</u>
<u>E</u> WALL	<u>27</u>	x	<u>13</u>	=	<u>351</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>1,130</u>
WALL		x		=		x		x		or		=		or	
<u>DOOR</u>	<u>13</u>	x	<u>11</u>	=	<u>143</u>	x	<u>0.49</u>	x		or	<u>46</u>	=		or	<u>3,220</u>
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
<u>CEILING</u>	<u>62</u>	x	<u>27</u>	=	<u>1,674</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>3,850</u>
OR ROOF		x		=		x		x		or		=		or	
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL

11,460

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * x _____ °F x ΔT = _____

MISCELLANEOUS: * OA 2000 x 1.08 x 46 BTU/HR = 99,360

PEOPLE: _____ x _____ BTU/HR = _____

99,360

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD

110,820

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = _____ = _____

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

RMP

CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-07

SHEET OF

2 14

REVISES	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISES	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	9-12-84	AB	FJ									

ROOM OR SYSTEM NO. SEWAGE TREATMENT-BLOWER RM

LENGTH (L) 14 x WIDTH (W) 17 = AREA (A) 238 x HEIGHT (H) 13 = VOLUME (V) _____

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>17</u>	x	<u>13</u>	=	<u>221</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>710</u>
<u>W</u> WALL	<u>14</u>	x	<u>13</u>	=	<u>182</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>590</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>238</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>550</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL

1850

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: _____ CFM x 1.08 * * x _____ °F x ΔT = _____

99,360

MISCELLANEOUS: DA = 2000 x 1.08 x 46 BTU/HR = 90,360

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD

101,210

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = _____ = _____

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

 CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-70-07</u>
		SHEET <u>1</u> OF <u>14</u>

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
		1	9-12-84	AB	PW								

ROOM OR SYSTEM NO. SEWAGE TREATMENT FACILITY-CHEMICAL STORAGE

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 264 x HEIGHT (H) 13 = VOLUME (V) 3,432

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>24</u>	x	<u>13</u>	=	<u>312</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>1,000</u>
_____ WALL		x		=		x		x		or		=		or	
_____ WALL		x		=		x		x		or		=		or	
_____ WALL		x		=		x		x		or		=		or	
_____ GLASS		x		=		x		x		or		=		or	
_____ GLASS		x		=		x		x		or		=		or	
_____ GLASS		x		=		x		x		or		=		or	
_____ CEILING OR ROOF		x		=	<u>264</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>610</u>
_____ FLOOR		x		=		x		x		or		=		or	
_____ PARTITION		x		=		x		x		or		=		or	
_____ PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 1610

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

^{OA}
INFILTRATION: 400 CFM x 1.08 * * x 46 °F * ΔT = 19,880 19,880

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE SUBTOTAL

** FACTOR FOR STANDARD CONDITIONS TOTAL SENSIBLE LOAD 21,490

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = 21,490
 3413 = 6.5kw

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = $\frac{\text{TOTAL SENSIBLE LOAD}}{1.08 \times \Delta T}$ = _____ CFM

AIR CHANGE RATE = $\frac{\text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ MIN

REMARKS: _____

CALCULATION SHEET THE RALPH M. PARSONS COMPANY	HEATING AND COOLING LOAD	JOB NUMBER <u>6440-10-07</u> SHEET <u>3</u> OF <u>14</u>
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REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
		0	9.2.84	AB	RW								

ROOM OR SYSTEM NO. SEWAGE TREATMENT FACILITY - EL. EQUIP. ROOM

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 98 x HEIGHT (H) 13 = VOLUME (V) 1274

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>7</u>	x	<u>13</u>	=	<u>91</u>	x	<u>0.07</u>	x		or	<u>46</u>	=		or	<u>290</u>
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
WALL		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
GLASS		x		=		x		x		or		=		or	
CEILING OR ROOF		x		=	<u>98</u>	x	<u>0.05</u>	x		or	<u>46</u>	=		or	<u>230</u>
FLOOR		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	
PARTITION		x		=		x		x		or		=		or	

SUBTOTAL 520

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: ^{OA} 150 CFM x 1.08 * * x 46 °F * ~~ΔT~~ = 7,450 7,450

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL .

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 7,970

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____ 7970 = 2.4KW

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = =

TOTAL ROOM LOAD

SUPPLY AIR = TOTAL SENSIBLE LOAD = _____ = _____ CFM

1.08 x ΔT

AIR CHANGE RATE = ROOM VOLUME = _____ = _____ MIN

SUPPLY (CFM)

REMARKS: _____

CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-07

SHEET 9 OF 14

REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO.	DATE	BY	CK	APP	DESCRIPTION
	0	9.12.84	AB	PW									

ROOM OR SYSTEM NO. SEWAGE TREATMENT FACILITY - LAB & OFFICE AREA

LENGTH (L) _____ x WIDTH (W) _____ = AREA (A) 196 x HEIGHT (H) 13 = VOLUME (V) 2548

	L	x	W	=	AREA	x	"U"	x	COOL (ETD)	OR	HEAT (ΔT)	=	COOLING (BTU/HR)	OR	HEATING (BTU/HR)
<u>N</u> WALL	<u>14</u>	x	<u>13</u>	=	<u>182</u>	x	<u>0.07</u>	x		OR	<u>68</u>	=		OR	<u>870</u>
<u>E</u> WALL	<u>14</u>	x	<u>13</u>	=	<u>182</u>	x	<u>0.07</u>	x		OR	<u>68</u>	=		OR	<u>870</u>
_____ WALL		x		=		x		x		OR		=		OR	
_____ WALL		x		=		x		x		OR		=		OR	
_____ GLASS		x		=		x		x		OR		=		OR	
_____ GLASS		x		=		x		x		OR		=		OR	
_____ GLASS		x		=		x		x		OR		=		OR	
_____ CEILING OR ROOF	<u>14</u>	x	<u>14</u>	=	<u>196</u>	x	<u>0.05</u>	x		OR	<u>68</u>	=		OR	<u>670</u>
_____ FLOOR		x		=		x		x		OR		=		OR	
_____ PARTITION		x		=		x		x		OR		=		OR	
_____ PARTITION		x		=		x		x		OR		=		OR	

SUBTOTAL 2,410

INTERNAL HEAT GAINS

LIGHTS: _____ SQ FT x _____ WATTS/SQ FT * x 3.41 = _____

MOTORS: _____ HP x _____ FACTOR x 2545 = _____

INFILTRATION: 300 CFM x 1.08 * * x 68 °F * ΔT = 22,030 22,030

MISCELLANEOUS: _____ BTU/HR = _____

PEOPLE: _____ x _____ BTU/HR = _____

* LOAD TO CONDITIONED SPACE

SUBTOTAL 24,440

** FACTOR FOR STANDARD CONDITIONS

TOTAL SENSIBLE LOAD 24,440

LATENT HEAT GAINS

PEOPLE = _____ x _____ BTU/HR = _____

MISC = _____ BTU/HR = _____

ROOM LATENT HEAT = 24,440 = 7,200

TOTAL ROOM LOAD 24,440 7,200

SUPPLY AIR = TOTAL SENSIBLE LOAD = _____ = _____ CFM

AIR CHANGE RATE = $\frac{1.08 \times \Delta T \times \text{ROOM VOLUME}}{\text{SUPPLY (CFM)}}$ = _____ = _____ MIN

REMARKS: _____

R/P
CALCULATION SHEET
THE RALPH M. PARSONS COMPANY

HEATING AND COOLING
LOAD

JOB NUMBER
6440-70-07
SHEET 0 OF 14

TITLE SEWAGE TREATMENT FACILITY SHEET NO. 11 OF 14
 JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WEISS	9.27.84						

EQUIPMENT RM. (AREA = 1,674 SF)

SUPPLY AIR (BASED ON 1.5 CFM/SF)

$$(1.5)(1,674) = 2,511 \text{ CFM} \quad \text{USE } \underline{2,500 \text{ CFM}}$$

BLOWER RM (AREA = 238 SF)

SUPPLY AIR :

HEAT FROM THE BLOWER

$$75 \text{ HP} = 21,000 \text{ BTUH}$$

$$\frac{21,000}{1.08 \times 10} = 1944, \quad \text{USE } \underline{2000 \text{ CFM}}$$

CHEMICAL STORAGE (AREA = 264 SF)

SUPPLY AIR (BASED ON 1.5 CFM/FT²)

$$(1.5)(264) = 396, \quad \text{USE } \underline{400 \text{ CFM}}$$

ELECTRICAL EQUIPMENT RM. (AREA = 98 SF)

SUPPLY AIR (BASED ON 1.5 CFM/FT²)

$$(1.5)(98) = \underline{147 \text{ CFM}}, \quad \text{USE } \underline{\underline{150 \text{ CFM}}}$$

TITLE SEWAGE TREATMENT FACILITYSHEET NO. 12 OF 14JOB NO. 6440-70-07 DEPARTMENT MUAUTHOR ABDATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WELLS	9.27.84						

LAB. & OFFICE (AREA = 196 SF).

SUPPLY AIR (BASED ON 1.5 CFM/SF)

$(1.5)(196) = 294 \text{ CFM}$, USE 300 CFM

EQUIPMENT SELECTION

EQUIPMENT ROOM :

1) USE INTAKE LOUVERS (2) 36" x 18"

$$\frac{2500}{1.7 \times 2} = 735 \text{ FPM VELOCITY}$$

2) EXHAUST FAN EF-853 & EF-854

USE (2) ROOF EXHAUST, 1250 CFM

@ 1/4" S.P. & 1/4 HP MOTOR

3) UNIT HEATER (UH-831 & UH-832)

(FOR HEATING REQUIREMENTS SEE SHEET #6)

$$\frac{110,820}{3413} \approx 32.5 \text{ KW}$$

USE (2) UNIT HEATERS

"CHROMALOX" - 20 KW (EA)

TITLE SEWAGE TREATMENT FACILITY SHEET NO. 13 OF 14
 JOB NO. 6440-70-07 DEPARTMENT MU AUTHOR AB DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	D. WEISS	9.27.84						

EQUIPMENT SELECTION (CONT'D)

BLOWER RM.

- 1) INTAKE LOUVERS (2) 36" x 18"

$$\frac{2000}{1.7 \times 2} \approx 600 \text{ FPM FACE VELOCITY}$$

- 2) EXHAUST FAN (EF-855)

(1) 2000 CFM @ 1/4" S.P. 1/2 HP

- 3) UNIT HEATER (UH-833) (SEE SHEET #7)

$$\frac{110,820}{3413} = 32.5 \text{ kW},$$

USE (1) - 35 kW "CHROMALOX"

CHEMICAL STORAGE

- 1) INTAKE LOUVER - USE (2) DOOR LOUVERS 24" x 12"
 (0.5 FT² - FREE AREA)

- 2) EXHAUST FAN (EF-856)

(1) 400 CFM @ 1/4" S.P. & 1/4 HP MOTOR

- 3) UNIT HEATER (1) - 10 KW - 22,000 BTUH (SEE SHEET #8)
 (UH-834)

TITLE SEWAGE TREATMENT FACILITY

SHEET NO. 14 OF 14

JOB NO. 6440-70-07 DEPARTMENT MU

AUTHOR AB

DATE 9-12-84

REV	CHECKER	DATE	REV	CHECKER	DATE	REV	CHECKER	DATE
0	P. WERS	9-27-84						

EQUIPMENT SELECTION (CONT'D)

ELECTRICAL EQUIPMENT ROOM

- 1) INTAKE LOUVER (1) 18" x 18"
EF-857
- 2) EXHAUST FAN: 150 CFM @ 1/4" S.P. & 1/6 HP
- 3) UNIT HEATER (1) USE 5 KW (SEE SHEET #9)
UH-835 (8000 BTUH)

LAB & OFFICE AREA

- 1) INTAKE LOUVER (1): 18" x 18"
EF-858
- 2) EXHAUST FAN (1): 300 CFM @ 1/4" S.P. 1/4 HP
- 3) UNIT HEATER (1): 10 KW (SEE SHEET #10)
(UH-836)