COMBINED ARMS STAFF TRAINER
MCON P-872
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

BASIS OF DESIGN & OUTLINE SPECIFICATION
PHASE 1 : 35% SUBMITTAL
16 NOVEMBER 1987

T&A

TIPPETT AND ASSOCIATES
ARCHITECTS

NEWCOMB AND BOYD
MECHANICAL, ELECTRICAL, & PLUMBING
ENGINEERS

ARMOUR, CAPE AND POND
STRUCTURAL AND CIVIL
ENGINEERS

COMBINED ARMS STAFF TRAINER (CAST) FACILITY

MARINE CORPS BASE - CAMP LEJEUNE, NORTH CAROLINA

PHASE I SUBMITTAL: 35% DESIGN

A/E: Tippett and Associates/Architects
Armour Cape and Pond: Structural and Civil
Newcomb and Boyd: Mechanical, Electrical, and Fire Protection

BASIS OF DESIGN
INDEX

Need to identify Telephone Service ie; Telephone room location, type of service, etc.

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PART ONE: INTRODUCTION

A. PROJECT IDENTIFICATION:

1. This Submittal represents 35% design phase for:

   Combined Arms Staff Trainer (CAST) Facility
   MCON P-872
   Marine Corps Base
   Camp Lejeune, North Carolina

2. Using Agency: Marine Corps

3. Contracting Agency: Atlantic Division
   Naval Facilities Engineering Command
   Norfolk, Virginia

4. A/E Contract Data: Tippett and Associates/Architects, Inc.
   Contract Number: N62470-86-C-9247

5. Programmed Scope: 14,000 square feet

6. Construction Cost Limit: $1,451,000.00

B. PROJECT DESCRIPTION:

Project involves construction of a facility to house a Combined Arms Staff Trainer (CAST). The building is a one story, load-bearing concrete block structure on spread footing, concrete floor, steel joist, metal roof deck with EPDM roofing. Project also involves construction of additional parking spaces for 50 cars.

C. GENERAL CRITERIA:

Fundamental criteria used by A/E team for guidance:

1. APPENDIX B, 29 June 1987, Combined Arms Staff Trainer.

2. A/E GUIDE, LANTDIV NORVA 4-4330/89C, (REV 10/84), Guide for A/E Firms Performing Services for the Atlantic Division.

3. DOD CONSTRUCTION CRITERIA MANUAL, DOD 4270.1-M, 15 December 1983.

4. DESIGN MANUALS:

   a. DM-1.01 - Basic Architectural Requirements and Design Considerations, April 1986.

   b. DM-2.1 - Structural Engineering, General Requirements, May 1980.

c. DM-3 - Mechanical Engineering, through Change 5.

d. DM-4.1 - Electrical Engineering, December 1979.

e. DM-5.01 - Surveying, Civil Engineering, April 1986.

f. DM-6 - Drawings and Specifications, February 1978.

g. DM-6.2 - Guide Specification Manual, May 1985.

h. DM-7.01 - Soil Mechanics, Change 1, September 1986.

i. DM-8 - Fire Protection Engineering, April 1981.

5. North Carolina Environmental Permit Directory, 1985.

6. Environmental Permit Information for Projects Planned at Marine Corps Base, Camp Lejeune.

7. Guide for Developing Soil Erosion and Sediment Control Plans, North Carolina Department of Natural Resources and Community Development, Division of Land Resources, Land Quality Section.

8. Engineering and Design Criteria for Navy Facilities, NAVFAC P-34, August 1987.

9. MANUAL, Technical Guidelines and Criteria for Electrical Design, June 1987.

10. REPORT, Detailed Military Characteristics for CAST, Device 16N8 for Camp Lejeune.

11. CAST, Base Electronic System Engineering Plan, Final BESEP, 22 July 1987.

12. EFR Phase I, Facility Requirements Identification for 16N8/2 Combined Arms Staff Trainer (CAST), EFR #N-00401 (86), 10 August 1987.

13. Trainer Installation Requirements Report, for the Invertron Training Set, Fire Observation (30 student TSFO), DAAA09-81-C-2441/1, 27 November 1981.

14. Chapter 3, Disassembly and Installation Instructions, TSFO, Pages 3-1 through 3-14, NAVTRADEV P-6158.

15. Trainer Facilities Report, Device 16N8 Combined Arms Staff Trainer (CAST), Contract #N61339-86-C-0123 (CDRL A004), Report 1, August 1987.

16. DOCUMENT, Color Design,

17. NAVFEC Letter, 6 January 1987, regarding Cost.

18. NAVFEC Letter, 3 February 1987, regarding Fee Proposal.

19. Letter, 13 August 1987, Elton C. O'Byrne to Steve Clepper, regarding TSFO information.

20. Memorandum, C.R. Rose, regarding Specification Language, 7 November 1979.

21. A/E Conference, 18 February 1987, Pre-Negotiation Conferences.

22. A/E Conference, 28 August 1987, Pre-Design Conferences.

23. A/E Conference, 23 October 1987, Concept Meetings.

24. Uniform Building Code, 1985 Edition.

25. NFPA-101, Life Safety Code, 1985 Edition.

PART TWO: DESIGN PROVISIONS AND ANALYSIS

A. ARCHITECTURAL:

1. Type of Construction: Type IIN (Unprotected non-combustible) per Uniform Building Code. This category allows 12,000 sq. ft. area in a non-sprinklered building with a threefold increase for sprinklers.

2. Thermal Insulation: Per DOD 4270.1-m, dated December 15, 1983, Chapter 8, Page 8-8:

   a. U-value of gross wall assemblies is .18.
   b. U-value of all elements of the opaque wall area is .10.
   c. U-value of roof assemblies is .04.

3. Description of Materials:

   a. Exterior walls will be of load-bearing cavity wall construction, 14" total thickness, with inner wythe of 8" CMU and outer wythe of 4" brick. Bituminous dampproofing will be applied to the outer face of the inner wythe with rigid insulation in the cavity.

   b. Interior partition will be constructed of non-load-bearing 5/8" gypsum board on 3-5/8" metal stud wall.

   c. Roof structure, will consist of steel framing, metal deck, insulation and roofing membrane. The structure will be sloped to provide a minimum 1/4" per foot slope.

   d. Exterior colors will match existing brick and precast concrete. Interior colors will be of a light value to increase reflective light in the space.

4. Handicap Access: Handicapped accessibility is not required in this project.

5. Computation in Gross Floor Area: In accord with DOD 4270.IM: Total gross area equals 14,002 sq. ft. (Computed using outside building dimensions.)

6. Life Safety: NFPA 101 1985 Edition was reviewed for this project with the following requirements for New Business Occupancy Classification (Sprinklered building):

   Occupant Load: 1 Person/100 sq. ft.
   Minimum Number of Exits: Two
   Maximum Travel Distance to Exit: 300 ft.

   All requirements of NFPA 101 have been met by the design.

B. CIVIL

Combined Arms Staff Trainer Facility

1. Water System - Site is served by an 10" water main approximately 100 feet to the south of the building. Service to the building will be by a single 2-1/2" line from the 10" line to the south side of the building. Line was sized to match domestic line from the building. Due to the short run and size of main tapped, this should be adequate. Final design will be in accordance with DM 5.7 and DM 8.

2. Sewers and Sewage Disposal System - The site is served by a 8" line to the south of the building; connection will be made to the manhole closest to the building, approximately 115′ to the south-east. There is one source of sewage from the building. This is a 6" domestic sanitary line on the south side of the building. Four inch lines are designed to be installed at no less than 1.0% slopes, 6" at no less than 0.6% slopes and 8" at no less than 0.4% slopes, to maintain a minimum velocity at capacity of 2.5′ per second.

3. Driveways, parking areas, and walks - An existing parking area and driveway to the northeast of the building will be extended to provide additional parking spaces. The existing asphalt pavement is basically in sound structural condition with the major distress being surface cracking. This existing pavement will be overlayed with a single surface treatment to prevent reflective crackign then an asphaltic leveling course and 1" wearing course. The new parking areas will be designed for group 1 light vehicles only, traffic count of 40 per day, and an assumed CBR of 10. The design index is 1, design thickness is 7.25", round up to 8". Use minimum thicknesses of 2" asphalt and 6" graded aggregate base. Sidewalks will be 4" thick with no base. The edges against pavement will be turned down to form an integral curb. Flexible pavement design is based on DM 5.4. Soil testing should include one test to determine modulus of subgrade reaction and one test to determine the CBR value.

4. Airfield Pavement - None.

5. Dust and Erosion Control - Dust and erosion control will be in accordance with the standard specifications. Locations for erosion control devices will be shown on the drawings.

6. Fencing - None.

7. Electronic Systems - Not applicable.

8. Cathodic Protection - Not applicable.

9. Environmental Pollution Control - Environmental Pollution Controls for this project are described under Sections: "Sewers and Sewage Disposal Systems" and "Dust and Erosion Control."

10. Site Development - Currently, the site is primarily cleared and is bounded on the north by an existing parking lot and driveway, on the east by River Road and a circle drive, to the south is Building H-14 and to the west is Cutler Street. The site requires minimal clearing and earthwork and is suitable for the proposed development.

CIVIL OUTLINE SPECIFICATIONS

COMBINED ARMS STAFF TRAINER FACILITY

DIVISION 2 - SITEWORK

NFGS - 02050	Demolition and Removal Items to be demolished include asphalt pavement, trees, storm drainage, piping, etc.
NFGS - 02102	Clearing and Grubbing This includes top soil stripping and stockpiling and vegetation removal.
NFGS - 02221	Earthwork for Structures and Pavements This covers all cut and fill for building and pavement construction
NFGS - 02225	Excavation, Backfilling and Compacting for Utilities This covers installation of piping systems for water and sanitary sewers
NFGS - 02233	Graded Crushed Aggregate Base Course for Flexible Pavement 6" base for new pavements
nfgs - 02234	Bituminous Base Course For leveling course over existing parking lot prior to appication of Bituminous Hot Mix pavement.
NFGS - 02250	Soil Treatment for Subterranean Termite Control
NFGS - 02420	Storm Drainage System Materials: Reinforced Concrete Pipe Concrete Drainage Structures Cast Iron Grate and Frames Cast Iron Cover and Frames
NFGS - 02555	Bituminous Surface Treatment Single surface treatment for existing pavement receiving an asphaltic overlay
NFGS - 02557	Bituminous Prime Coat
NFGS - 02558	Bituminous Tack Coat
NFGS - 02573	Bituminous Hot Mix Pavement 2" wearing surface for asphaltic pavement
NFGS - 02577	Pavement Markings (Airfields and Roads) For parking lot stripping, handicap symbols and driveways

P1071013

TS - 02713	Exterior Water distribution System Materials: PVC pipe
TS - 02722	Exterior Sanitary Sewer System Materials: PVC pipe

P1071013

STRUCTURAL BASIS OF DESIGN
C.A.S.T. FACILITY

A. Foundation conditions at this site consist of loose to firm clayey sand to depths up to 60 feet. Conventional shallow spread footings for columns and strip footings for walls founded 24" below finish grade or floor slab will be used. The footings will be founded in virgin soil following proofrolling and compaction of any required fill. The maximum allowable bearing pressure will be 2500 psf.

B. The type of construction selected for this project is exterior loadbearing c.m.u. walls and steel columns supporting a structural steel framed roof. A single interior braced stud shear wall supplements lateral load resistance.

Roof framing consists of steel roof joists, or steel beams spanning to loadbearing c.m.u. walls, joist girders or steel columns. The roof deck is a 1-1/2" wide rib deck which will act as a flexible diaphragm to transfer lateral loads to shear walls. Joist spans vary from 21 feet to 50 feet, joist girders span from 22 feet to 32 feet and beams span 50 feet.

Principal materials used are:

Masonry	f'_m = 1350 psi, Type S mortar
Steel Joists	f_y = 50000 psi
Steel Beams	f_y = 60000 psi
Steel Joist Girders	f_y = 50000 psi
Steel Tubes	f_y = 46000 psi
Concrete	f'_c = 3000 psi
Reinf. Steel	f_y = 60000 psi

C. There are no special features included in this structure. Definitive drawings were not used for this project.

D. Structural floor system will be a concrete slab on grade.

E. See (b) above.

F. See (b) above.

G. Live loads for the structure are as follows:

Mechanical Rooms	125 psf NAVFAC DM 2.2, 1981
Classrooms, Lobbies Corridors	100 psf NAVFAC DM 2.2, 1981
Offices	50 psf NAVFAC DM 2.2, 1981
Roof	20 psf NAVFAC DM 2.2, 1981
Wind	34 psf NAVFAC DM 2.2, 1981
Snow	10 psf ANSI A58.1
Seismic (Zone 1)	K = 1.33, I = 1.0 NAVFAC P-355, 1981

P1071013

H. There are no special considerations that affect the design.

I. No crane design required.

J. 1. Not required per Appendix A
2. See structural calculations attached.
3. Structural geometry does not require special consideration.
4. No consideration of heavy equipment supports is required.

P1071013

STRUCTURAL OUTLINE SPECIFICATION
COMBINED ARMS STAFF TRAINING FACILITY - CAMP LEJEUNE

Division 3 - Concrete

NFGS-03300

Cast-in-place Concrete
Covers foundations and slabs on grade.
Conforms to American Concrete Institute.

Materials: 3000 psi concrete.

Division 4 - Masonry

NFGS - 04230

Reinforced Masonry
Covers masonry reinforcement, mortar and grout to be used.

Materials: ASTM-A615, 60 ksi Reinf.
Type S Mortar
5000 psi grout

Division 5 - Metals

NFGS - 05120

Structural Steel
Covers steel beams, columns and connections. Conforms to American Institute of Steel Construction.

Materials: A-36 FY=36 ksi steel beams & misc. shapes

A-500 Grade B FY=46 ksi

A-325 Bolts for all connections

A-307 Anchor bolts

NFGS - 05210

Steel Joists and Joist Girders
Covers steels joists and accessories.
Conforms to Steel Joist Institute.

NFGS - 05311

Steel Roof Deck
Covers roof deck and accessories.
Conforms to Steel deck Institute.

P1071013

D. ELECTRICAL

1. Design Criteria

a. NFPA 70-1987

b. LANTNAVFACENGCOM Technical Guidelines and Criteria for Electrical Design

c. IES

2. Power

a. Power provided to the CAST Facility will be derived from the underground power system located in a manhole in the vicinity of the site.

b. An underground primary feeder will be run to a 300 KVA pad-mounted transformer located 10' away from the building. Power will be transformed from 15 KV to 208/120 volt, 3 phase, 4 wire, solid neutral, wye.

c. Both primary and secondary services will be buried underground.

d. Because the majority of the power requirements is 208/120 volts, 3 phase and 1 phase, the building will be serviced at 208/120 volts, 3 phase, 4 wire.

e. Main switchboard will be rated for 208/120 volts, 3 phase, 4 wire service. The building main disconnecting device will be rated for 800 amps. The distribution devices in the main switchboard will be molded case circuit breakers. An ammeter and voltmeter complete with selector switches will be provided at the main switchboard.

f. Motors 1/2 horsepower and larger will operate at 208 volt, 3 phase. Fluorescent lighting will operate at 120 volt, 1 phase. Duplex receptacles, incandescent lighting, and motors less than 1/2 horsepower will be provided electric service at 120 volt, 1 phase. Other equipment will be provided power at the most economical voltage based on its electrical demand.

g. Electric service will have the capacity to provide 125 percent of the demand load.

3. Lighting

a. Interior lighting of the functional activities has been designed to illuminate the working surface 30 inches above finish floor to the following footcandle levels.

Area	Footcandle Level	Lighting Source
Offices, Classrooms	50-60	Fluorescent
Lavatories	30	Fluorescent
Electrical, Mechanical Rooms	30	Fluorescent

b. All fluorescent fixtures will have a lamp and ballast combination which will provide an energy-efficient lighting system. The lamps will be rated at 34 watts and will be lite white in color.

c. The following factors have been used in the lighting calculations:

Lamp lumen output = 2900
LLD = 0.88 (relamped at 18,000 hrs.)
LDD - 0.85
LBO - 1.00
CCR - 0
Reflectances = 80 clg, 50 wall, 20 floor
Ceiling: 8'-0"
LLDxLDDxLBO = .75 = MF (34W lamp fixtures)

d. The lighting in the area of the terrain board will be accomplished with dimmable 250 watt quartz light fixtures recessed in the ceiling.

e. Exterior lights will be controlled by a combination photoelectric controller with a manual switch to override the controller.

f. The parking lot and sidewalks will be illuminated to a minimum of 0.5 footcandles.

g. Exterior lights for security illumination and entrances will provide a minimum of 0.5 footcandles of light for a radius no smaller than 20 feet. Light fixtures will be secured with Lexan lenses to prevent damage from abuse.

h. Fluorescent lighting used for emergency egress will have an integral emergency battery ballast with the ability to provide 1500 lumens of light per lamp.

4. Grounding System

a. The entire electrical power system, including conduit, panels and equipment, will be permanently and effectively grounded in accordance with NAVFAC DM-12.1. An equipment grounding conductor will be included in all raceways, sized in accordance with Table 250-95 of 1987 National Electric Code.

5. Lightning Protection System

a. A lightning protection system will be provided. Air terminals will be installed on the roof, and tied to ground with copper down conductors. Ground rods will be driven at the base of the structure to complete the system.

6. Telephone System

a. The telephone system will consist of an empty raceway system. A 1" diameter conduit with pull wire will be provided from each empty telephone outlet box to the telephone backboard.

b. All telephone equipment, wiring, and its installation will be provided by the Government.

7. Clock System

a. A receptacle outlet will be provided for the clocks. Clocks will be provided by the Government.

8. Cable Tray

a. A cable tray will be provided as shown on the drawings. Cable tray must be coordinated with the trainer supplier to verify adequacy.

9. Wiring System

a. Conductors types will be as follows:

(1) Underground primary conductors will be copper, single conductor, 15 KV cables, shielded, with ethylene propylene rubber insulation and PVC or chlorinated polyethylene jacketed.

(2) Secondary service conductors will be designed on the basis of using copper. Specifications will allow the substitution of equivalent aluminum conductors for copper cable sizes.

(3) Branch conductors will have NEC Type THW, 600 volt, 75°C. insulation of minimum 45 mils thickness.

b. All branch circuit breakers 100 amps and less will have the conductors sized according to 60°C insulation. All branch circuit breakers greater than 100 amps shall have the conductors sized according to 75°C insulation.

c. Color coding for the 120/208 volt system will be as follows:

Phase A - Black
Phase B - Red
Phase C - Blue

Neutral - White
Ground - Green

d. The wiring system will be run in raceways as described below:

(1) In concrete, masonry, and damp or wet locations: galvanized I.M.C.

(2) Interior exposed locations and runs concealed above ceilings or in dry wall construction: electrical metallic tubing (EMT).

(3) In the earth (minimum 24" below grade) or below concrete slabs: Schedule 40 PVC conduit, rigid steel or I.M.C.

e. Armored cable and non-metallic sheathed cable will not be allowed.

f. Power circuits and signal circuits will be installed in separate raceways.

g. All conduit will be run in straight lines with right angle bends parallel to walls, beams and columns even above ceilings. Conduit in offices and finished areas will be concealed in walls and above the ceilings.

h. All receptacles will be of the grounding type.

i. Equipment grounding conductors will be included in all raceways, sized in accordance with Table 250-95 of 1987 NEC. Conduits entering all sheet metal enclosures will be provided with grounding type bushing for bonding the conduit and enclosure to the grounding system.

j. Duplex receptacles for the toilets and exterior will be protected with ground fault circuit interrupters.

10. A risk assessment of lightning protection will be accomplished and submitted for the 100% review.

11. The following information will be required to bring the project documents to 100%:

Susie Rupp answered these questions

a. Specific locations of computer outlets and telephone outlets are required.

b. Specific locations of the computer equipment is required.

c. Specific location of laser outlets is required, along with the dimensions of the laser itself. In addition, will the overhead lights be on while the laser is operating?

d. Specific electrical requirements for each laser outlet (208 volt, 1 phase, 3 wire?).

these questions will have to be answered by Jeff O'Byrne

Neutral - White
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d. Specific electrical requirements for each laser outlet (208 volt, 1 phase, 3 wire?).

Susie Rupert answered this question

e. Size of cable tray is required. Is the termination of the cable tray in the room at the proper location? How will cable make the transition from trench to cable tray? Are the telephone and computer outlets and conduit stub-ups large enough?

f. Are the power conditioners requested for the CPU's in TEECG/OCE and in ARTYR&QT 13N Motor FOC government furnished equipment? Furnished by Government

g. Specific location of power supply for the trainer device is required along with its electrical requirements (208 volt, 1 phase, 3 wire?). 110 V, 60 HZ, 14.4 AMPS

h. Need voltage, phasing and wire sizes of power system at the site. A&E responsibility

i. Need Lightning Protection System specifications. LANTDIV to provide

Susie Rupert answered this question

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E. PLUMBING

1. Basic Analysis

a. Basic Criteria Manuals:

(1) Items listed in Chapter 1, General.

(2) National Standard Plumbing Code.

(3) Mechanical Design, Plumbing, TM 5-810-5.

(4) ASPE Data Book, Vol. 1, 1983-84.

(5) Technical Paper 25, U.S. Department of Commerce, Weather Bureau 1955.

b. Fixture Determination:

(1) The quantity, location, and type of fixtures used on this Project were determined by the requirements of the National Plumbing Code.

(2) Water closets ANSI A112.19.2 white vitreous china, floor mounted, siphon jet, elongated bowl, black solid plastic seat open front, and ANSI A112.19.5 trim, flushometer with 3 inch diameter diaphragm, vacuum breaker, and angle stop.

(3) Urinals ANSI A112.19.2 white vitreous china, wall-mounted, wall outlet, siphon jet, flushometer with 3 inch diameter diaphragm, nonhold open, vacuum breaker and angle stop.

(4) Countertop lavatories ANSI A112.19.1M, white enameled cast-iron, minimum oval dimensions of 19 inches wide by 16 inches front to rear, and stainless steel mounting rim. Provide ANSI A112.18.1M copper alloy centerset faucets with aerator, perforated grid strainer and 1.5-inch adjustable P-traps. Furnish template and mounting kit by lavatory manufacturer.

(5) Electric Water Cooler ARI 1010, wall-mounted, bubbler style, air-cooled condensing unit, 4.75 GPH minimum capacity, stainless steel splash receptor, and all stainless steel cabinet. Provide ANSI A112.6.1M concealed wall hangers with thru-bolts and back plates for mounting.

(6) Service Sink ANSI A112.19.1M, white enamel cast-iron wall mounted and floor supported by wall outlet cast-iron P-trap, minimum dimensions of 22 inches wide by 18 inches front to rear with 9-inch splashback, and stainless steel rim guard. Provide ANSI A112.18.1M copper alloy back-mounted combination faucets with vacuum breaker and 0.75-inch external hose threads.

c. Water Heater:

Quantity	Fixture Type	Gallons Per Hour/Fixture	Total
8	Lavatories	15	120
1	Service Sink	20	20
			140

140 x .40 demand = 56.0 GPH demand

Select a semi-instantaneous, steam to water heater with a minimum steam coil recovery capacity of 60 gallons per hour at 60°F rise and a minimum internal storage capacity of 8 gallons.

The hot water will be circulated throughout the building.

d. Domestic Water Systems:

(1) The domestic water systems will be designed to deliver peak flow as determined on a fixture unit basis. Water will be connected to each fixture or piece of equipment requiring service. Hot water will be provided by steam to water heat exchangers with vertical storage tanks. Water will be heated to 105°F.

(2) Piping Locations and Material:

(a) Sanitary, waste, and vent piping will be routed throughout the facility to each fixture, drain, etc., requiring service. The sanitary sewer will be routed to a point 5'-0" from the building.

Soil, waste, and vent piping will be service weight hub and spigot cast iron for use below floor or grade. Cast iron hubless pipe will be used above floor.

(b) Cold water piping will be concealed above the ceiling or in furred spaces except in the Mechanical Room and will be routed to all fixtures or equipment requiring service from the point of entrance in the Mechanical Room. Hot water piping will be concealed above the ceiling or in furred spaces except in the Mechanical Room where the water heater will be located. Hot water piping will be routed to all fixtures requiring service. All water piping will be Type L hard drawn copper tubing.

(c) Cold water and hot water piping will be insulated with preformed fiberglass, 1" thick, with vapor barrier and jacket.

e. Calculations:

(1) Domestic cold water

Quantity	Fixture Type	Fixture Units/Fixture	Total
7	Water Closets	10	70
8	Lavatories	2	16
5	Urinal	5	25
1	Service Sink	3	3
			114

Total 114 fixture units = 72 gallons per minute

Total domestic cold water load - 72 gpm

f. Miscellaneous:

(1) Roof drains with interior downspouts will be provided and connected to outside storm drainage system.

(2) Guide Specifications to be Used:

(a) Plumbing, NFGS-15400

F. HVAC

1. Design Criteria

The design of the HVAC system is based on the following criteria.

a. DOD CONSTRUCTION CRITERIA MANUAL, DOD 4720.1-M dated December 15, 1983.

b. PREDESIGN CONFERENCE NOTES, dated February 19, 1987, August 19, 1987, and October 23, 1987.

c. GUIDE FOR ARCHITECT-ENGINEER FIRMS, 5 ND LANTDIV 4-4330/89B.

d. HEATING, VENTILATING, AIR CONDITIONING AND DEHUMIDIFYING SYSTEMS, Interim Criteria, May 1986.

e. EXTERIOR DISTRIBUTION OF UTILITY STEAM, HIGH TEMPERATURE SYSTEMS, NAVFAC DM-3.8, July 1981.

f. ASHRAE HANDBOOKS, latest edition.

g. NFPA STANDARD 90A - 1985.

h. INSTRUCTION FOR PREPARATION OF ECONOMIC ANALYSIS, LANTNAVFACCENCOM, Revised January 1986.

i. COMBINED ARMS STAFF TRAINER, CONTRACT DOCUMENT APPENDIX C, dated June 29, 1987.

j. TRAINER INSTALLATION REQUIREMENT REPORT FOR TSFO, Report No. DAAA09-81-C-2441/1, dated November 1981.

k. DETAILED MILITARY CHARACTERISTICS FOR CAST DEVICE 16N8 FOR CAMP LEJEUNE, dated June 1987.

l. EFR PHASE 1, FACILITY REQUIREMENTS IDENTIFICATION FOR 16N8/2 CAST, EFR #N-00401(86), dated 10 August 1987.

2. Design Conditions

a. Outdoor Design Conditions:

(1) Summer 90°F db, 79°Fwb (2½%)

(2) Winter 23°F db (97½%)

b. Indoor Design Conditions:

(1) Summer 78°F db, 50% RH

(2) Winter 68°F db

c. Personnel Load:

(1) 170 persons

d. Ventilation:

(1) Ventilation based on 5 CFM/person.

e. U-Factors:

(1) Walls will have a U-value of 0.10 (per DOD 4720.1-M, Chapter 8).

(2) Roof will have U-value of 0.04 (per DOD 4720.1-M, Chapter 8).

(3) Glass will have U-value of 0.55, and SC = 0.6.

f. Equipment Heat Release Data: The equipment loads have been estimated using the preliminary equipment list furnished in the predesign conferences.

3. Energy Conservation

a. Energy reducing features have been incorporated in the design to the extent feasible. The building is provided with very good insulation (U values of 0.1 for walls and 0.04 for roof). The window will be insulated glass type. All motors will be high efficiency type. An energy efficiency lighting system will be used in this facility. Therefore, no additional special architectural features would be justified.

b. Building Category Code is 171, Training Facility. Project is located in weather region 4, with a design energy budget of 55,000 BTU/S.F./YR. Calculated energy budget is 52,080 BTU/S.F./YR. Refer to part 4.B for detailed calculation.

4. Economic Analysis

a. Economic analysis was performed comparing the following alternative systems. The selected systems have been approved by LANTNAVFACENGCOM. The "TRACE" computer program has been used to simulate the system energy consumption.

Alternative A: Variable air volume system with series fan powered boxes with HW heating coil and with an air cooled packaged chiller.

Alternative B: Multizone air handling system with hot deck and cold deck temperature reset and an air cooled chiller.

Alternative C: Multiple single zone constant volume air handling units (fan coil units) with hot and chilled water coils. This system configuration is fan coil unit in each room. A separate air handling unit is located in mechanical room with air distribution ductwork to provide the minimum air (outside air) to each fan coil unit.

Alternative D: Multiple DX, constant volume units (rooftop packaged units) with hot water heating coils.

b. The existing base central steam distribution system will be used with hot water converters for space and domestic water heating in each alternative system.

5. Basis of System Design

a. Building Heating and Air Conditioning System:

(1) The use of a variable volume system (Alternative A) is recommended as the result of economic analysis. This facility is composite of classrooms and offices with a large diversity of occupancy.

(2) The controls will be pneumatic type. The unit fan will be variable volume type with inlet vane damper control through the duct static pressure sensor. A discharge air thermostat will modulate the 3-way chilled water valve to maintain its setpoint. The system will be automatically started and stopped by the time clock with remote marked time switch to override the programming time clock control. Each room thermostat will modulate the terminal unit volume damper and 2-way hot water valve in sequence to maintain its setpoint. Night setback control will be provided. The outside air damper and toilet exhaust fans will be locked out in night setback mode. The system will have an airside economizer cycle.

(3) The chiller controls will be activated through the outside air thermostat and will be interlocked with the air handling unit.

(4) The appropriate heating system for this project is the base central high pressure steam distribution system. Central steam was selected due to its availability, and to the lack of economically feasible alternatives. The steam/hot convertor controls will be activated by the outside air thermostat. The hot water supply temperature will be reset in accordance with the outside temperature schedule.

6. Air Distribution Systems

a. Ductwork will be low pressure, low velocity (below 2500 fpm and 2" wg). All ductwork will be of galvanized steel, constructed in accordance with the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA). All supply air ductwork will be insulated, except where lined.

b. Air distribution will be through ceiling diffusers in typical areas. In the open structure area, sidewall registers will be used. Return air will be taken through eggcrate grilles to the ceiling plenum.

7. Ventilation Systems

a. Fan powered ventilation/exhaust systems will be provided for toilet rooms, locker rooms, and mechanical rooms as required. The toilet exhaust fan will be interlocked with the air handling unit.

b. The Mechanical Room exhaust fan will be controlled by a thermostat located in the room. The Mechanical Room will be heated by a hot water unit heater.

8. Piping Systems

a. Building chilled and hot water, and steam piping will be standard weight black steel, insulated with fiberglass or cellular glass insulation. Piping will be exposed in the Mechanical Room and concealed above suspended ceilings elsewhere. Underground chilled water piping will be insulated with corrosion protection coating.

b. The underground steam and condensate piping will be a factory pre-insulated piping system. Conduits will be factory spiral, butt-weld, 10 gauge black steel with epoxy coating or coal tar wrap. The carrier piping will be seamless black steel. The steam supply line and the pumped condensate line will be furnished in separate conduits.

9. Description of Equipment

a. Chiller: Package air cooled hermetic type, complete with compressor, cooler, condenser, condenser fans, controls, and associated equipment.

(1) The controls will include positive acting timer to prevent short-cycling of compressors, high and low pressurestats, multiple-step water temperature controller, chilled water safety thermostat, field power and control circuit terminal blocks, fuses, control relays, and oil safety switch. The chiller will be provided with low ambient operation down to 0°F.

b. Air Handling Unit: Draw-through factory fabricated cabinet type, complete with chilled water coil, fan with inlet vanes, V-belt drive, preheat hot water coil (if required), and 4" throwaway filters, all housed in a finished casing with thermal insulation. The fan will be double inlet, forward curved centrifugal type.

c. Pumps: Close-coupled, bronze fitted, 1750 rpm, back pull-out, inline centrifugal type, with stainless steel or bronze sleeved stainless steel shafts, mechanical seals of proper design for the pump service, bronze casing and impeller wearing rings, and impellers of the non-overloading type.

d. Power Roof Ventilators: Centrifugal type aluminum construction, complete with motor, drive, birdscreen backdraft damper, and disconnect switch.

e. Convertor: Shell and U-tube type, with steam in the shell and water in the tube. The unit will be designed, constructed, and ASME stamped for 125 psig working pressure in shell and tubes.

f. Terminal units: Low pressure type. Terminal air blender units (fan powered units) will be used to avoid any reheat operation. All terminal units will be pressure independent, and will be provided with necessary sound attenuation features. Terminal air blender units will be equipped with hot water heating coils.

11. Energy Monitoring and Control System

a. Provisions will be made in the design for future connection of this project to the EMCS system. Sensors and control devices will be provided and wired to the Data Termination Cabinet (DTC). Space next to DTC will be provided for future Field Interface Device (FID) cabinet. A 120V duplex receptacle and J-box at DTC and a 3/4" conduit from telephone backboard to future FID will also be provide for future EMCS connections.

G. FIRE PROTECTION

1. Design Criteria

   a. MIL-HDBK 1008 dated 30 April 1985 - Fire Protection for Facilities.

   b. NFPA 13 - Sprinkler Systems.

   c. NFPA 72A and 72D - Fire Alarm System

2. Fire Extinguishing Systems - Description

   a. The Combined Arms Staff Trainer Facility will be protected by a wet pipe sprinkler system. The building will be classified Light Hazard. Maximum sprinkler spacing will be 225 square feet per head. All piping will be hydraulically sized to deliver 0.10 gpm per square foot over 3000 square feet of floor area. An outside hose allowance of 250 pgm will be included.

   b. Water supply will come from a direct connection to a base water main. Preliminary water test indicate a static water pressure of approximately 60 psi at the site. A two-hydrant waterflow test made in accordance with NFPA procedures will be made at the nearest hydrants. Site plans indicate that water mains will probably be strong enough to supply the light hazard demands.

3. Fire Alarm System

   a. The building will have a manual and automatic fire alarm system consisting of pull stations and smoke detectors. Duct smoke detectors will be located in HVAC systems as required by NFPA 90A.

   b. The fire alarm system will supervise all sprinkler valve monitor switches and waterflow switches.

   c. The system will automatically transmit a signal to the base fire department.

DIVISION 15	MECHANICAL
NFGS - 15011L	MECHANICAL GENERAL REQUIREMENTS
NFGS - 15116	WELDING PRESSURE PIPING
NFGS - 15200	NOISE, VIBRATION (AND SEISMIC) CONTROL
NFGS - 15250L	INSULATION OF MECHANICAL SYSTEMS
NFGS - 15251	INSULATION FOR EXTERIOR PIPED UTILITIES
NFGS - 15330	FIRE-EXTINGUISHING SPRINKLER SYSTEMS (WET PIPE)
NFGS - 15400	PLUMBING (AMENDMENT 1 w/BASIC of MARCH 83)
NFGS - 15521	STEAM SYSTEM AND TERMINAL UNITS
NFGS - 15651	REFRIGERANT, CHILLED WATER, CONDENSER WATER, HOT AND COLD WATER
NFGS - 15652	CENTRAL REFRIGERATION SYSTEM FOR AIR CONDITIONING
NFGS - 15711	HOT-WATER HEATING SYSTEM
TS - 15813	WARM-AIR HEATING SYSTEMS
NFGS - 15850	AIR HANDLING AND DISTRIBUTION EQUIPMENT
NFGS - 15895	DUCTWORK AND DUCTWORK ACCESSORIES
NFGS - 15971	SPACE TEMPERATURE-CONTROL SYSTEMS
NFGS - 15996L	TESTING, ADJUSTING, AND BALANCING OF HEATING, VENTILATING, AND COOLING SYSTEMS
DIVISION 16	ELECTRICAL
NFGS - 16011	ELECTRICAL GENERAL REQUIREMENTS
NFGS - 16301	UNDERGROUND ELECTRICAL WORK
NFGS - 16402	INTERIOR WIRING SYSTEMS
NFGS - 16462	PAD-MOUNTED TRANSFORMERS (75 KVA to 500 KVA)
NFGS - 16510	INTERIOR LIGHTING
NFGS - 16530	EXTERIOR LIGHTING

DIVISION 16

ELECTRICAL (CONTINUED)

NFGS - 16722 INTERIOR FIRE ALARM SYSTEM

NFGS - 16723 FIRE ALARM SYSTEM RADIO TYPE

NFGS - 16760 INTERCOMMUNICATION SYSTEM
LIGHTNING PROTECTION SYSTEM

PART THREE: OUTLINE SPECIFICATIONS

DIVISION 1	GENERAL REQUIREMENTS
NFGS - 01010	GENERAL PARAGRAPHS
NFGS - 01011	ADDITIONAL GENERAL PARAGRAPHS
NFGS - 0140	CONTRACTOR QUALITY CONTROL (CQC) SYSTEM
NFGS - 01560	ENVIRONMENTAL PROTECTION
DIVISION 2	SITE WORK

(OUTLINE SPECIFICATIONS ARE LISTED IN PART TWO, SECTION B - CIVIL)

DIVISION 3	CONCRETE

(OUTLINE SPECIFICATIONS ARE LISTED IN PART TWO, SECTION C - STRUCTURAL)

DIVISION 4	MASONRY
NFGS - 04200	UNIT MASONRY Facing Brick - modular size, concrete masonry units - 8" hollow load-bearing
NFGS - 04230	REINFORCED MASONRY
NFGS - 04270	GLASS UNIT MASONRY 8" x 8" x 4" Glass Block
DIVISION 5	METAL
NFGS - 05500	METAL FABRICATIONS Miscellaneous Metals
DIVISION 6	WOOD AND PLASTICS
NFGS - 06100	ROUGH CARPENTRY Roof Nailer, Blocking
NFGS - 06200	FINISH CARPENTRY Millwork

DIVISION 7	THERMAL AND MOISTURE PROTECTION
NFGS - 07160	BITUMINOUS DAMPPROOFING On outer face of inner wythe of cavity wall.
NFGS - 07220	ROOF INSULATION Rigid roof insulation.
NFGS - 07221	MASONRY WALL INSULATION Rigid boards in cavity wall.
NFGS - 07222	TAPERED ROOF INSULATION Rigid roof insulation at cricket.
NFGS - 07230	PERIMETER AND UNDER SLAB INSULATION At perimeter of building for slab on grade.
NFGS - 07530	ELASTOMERIC SHEET ROOFING SYSTEM (EPDM) All flat roof areas.
NFGS - 07600	FLASHING AND SHEET METAL Metal coping and flashing.
NFGS - 07920	SEALANTS AND CALKINGS
DIVISION 8	DOORS AND WINDOWS
NFGS - 08110	STEEL DOORS AND FRAMES Most frames hollow metal, some exterior and interior doors hollow metal.
NFGS - 08120	ALUMINUM DOORS AND FRAMES All main entrance doors and frames.
NFGS - 08210	WOOD DOORS Some interior doors U.L. labelled as noted.
NFGS - 08800	GLAZING Wire glass in rated walls, tempered glass in doors, and tempered glass in vestibule.
NFGS - 08900	GLAZED CURTAIN WALL SYSTEM 1" tinted insulated glazing with 1/4" glass.
DIVISION 9	FINISHES
NFGS - 09100	METAL SUPPORT SYSTEMS Metal studs and furring channels.

DIVISION 9	FINISHES (CONTINUED)
NFGS - 09150	PLASTERING AND STUCCOING Ceiling at soffits.
NFGS - 09200	LATHING
NFGS - 09250	GYPSUM BOARD Interior partitions, ceiling applications, and wall furring.
NFGS - 09310	CERAMIC TILE, QUARRY TILE, AND PAVER TILE Ceramic tile at Toilet Room floors and walls. Quarry tile at Kitchen floors.
NFGS - 09500	ACOUSTICAL TREATMENT 2 x 2 lay-in ceilings, suspension grids.
NFGS - 09650	RESILIENT FLOORING Vinyl composition tile, resilient base.
TS - 09661	VINYL COMPOSITION TILE ON CONCRETE
NFGS - 09680	CARPET At all office areas.
NFGS - 09910	PAINTING OF BUILDING Exterior metals, all interior walls, stained doors, and millwork, interior trim.
DIVISION 10	SPECIALTIES
NFGS - 10162	TOILET PARTITIONS Painted metal.
NFGS - 10201	METAL WALL AND DOOR LOUVERS Aluminum Louvers.
NFGS - 10440	SIGNS All interior signs.
NFGS - 10800	TOILET AND BATH ACCESSORIES All stainless steel.
DIVISION 11	EQUIPMENT
NFGS - 11400	FOOD SERVICE EQUIPMENT

DIVISION 12 FURNISHINGS

(NO WORK REQUIRED IN THIS DIVISION)

DIVISION 13 SPECIAL CONSTRUCTION

(NO WORK REQUIRED IN THIS DIVISION)

DIVISION 14 CONVEYING SYSTEMS

(NO WORK REQUIRED IN THIS DIVISION)

DIVISION 15 MECHANICAL

(OUTLINE SPECIFICATIONS ARE LISTED IN PART TWO, SECTION E - PLUMBING AND SECTION F - HVAC)

DIVISION 16 ELECTRICAL

(OUTLINE SPECIFICATIONS ARE LISTED IN PART TWO, SECTION D - ELECTRICAL)

STRUCTURAL CALCULATIONS

ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.C.T. FACILITY

SHEET NO. 1
JOB NO. 172070
BY TGB

DESIGN CRITERIA

CODES : CONCRETE : ACI 318-83
STEEL : AISC STEEL DESIGN MANUAL 8th Ed.
JOISTS : STEEL JOIST INSTITUTE STD. SPEC. - 1985
DECK : STEEL DECK INSTITUTE STD. SPEC. - 1984
MASONRY : NAVFAC DM 2.9 - 1982

LOADS : NAVFAC DM 2.2 - 1981
SEISMIC DESIGN : NAVFAC P-355 - 1982

LOADS

GRAVITY LOADS : LIVE LOAD : 20 PSF
(ROOF) DEAD LOADS :

ROOFING	7 PSF	
INSUL	3	
BALLAST	12	
DECK	2	
CLG, LTS & DUCTS	10	→ 25 @ HIGH ROOF OVER TERRAIN ROOM
SPRINKLER	5	
	29 PSF	44 PSF

WIND LOADS

WIND SPEED : 115 MPH $C_h = 1.0$ $h < 30'$

BASIC PRESSURE = $.00256 (115)^2 (1.0) =$ 34 PSF

SEISMIC LOADS

SEISMIC ZONE : 1

$V = ZIKCSW$

$Z = 3/16$
$I = 1.00$
$K = 1.33$
$CS = .18 > .14$ USE .14

$T = \frac{.05 h_n}{\sqrt{D}} = \frac{.05(16)}{\sqrt{96.3}} = .08$

$C = \frac{1}{15\sqrt{.08}} = .23 > .12$ USE .12

$S = 1.5$

→ $V = .035W$

ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.C.T. FACILITY

SHEET NO. 2
JOB NO. 17207.0
BY TGB

ROOF JOISTS

LOW ROOFS: 48 PSF TOT, 20 PSF L.L. } S.P. @ 5'-0" O.C. → 245 PLF TOT, 100 PLF L.L.

SPAN	TYPE	WT/ft	TOT. CAP.	L.L. CAP	REQ'D. BRACING
60'	30K9	13.4	245	141	4 ROWS 1¼ x 1¼ x 7/16
21'	12K3	5.7	273	153	2 ROWS "
42'	26K7	10.9	249	150	3 " "

HIGH ROOF

64 PSF TOT, 20 PSF LL } @ 5'-0" SP → 320 PLF TOT, 100 PLF L.L.

→ 30K11 @ 16.4 lb/ft
319 PLF TOT CAP
272 PLF LL CAP
3 ROWS L 1¼ x 1¼ x 7/16 BRIDGING

ROOF BEAMS

lo ROOF $\ell = 50'$ $w = .245$ KLF + $.05$ KLF $= .295$ KLF $\ell_u = 0'$ - deck braces BM.

@ $\Delta \leq \ell/360$ → $M_R \geq 92.18$ K-1, $I_x \geq 858.$ in^4 } USE W24x55

JOIST GIRDERS :

HIGH ROOF - MAX 36" DEEP → (50 x 33 G / 2 PLF) → {36G-7N-8.4K @

TYP. COL @ B-1 ARCH. REQUIRES TS 5X5 COLS

COL. LOADS : $\left(\frac{31+21}{2}\right)\left(\frac{21+50}{2}\right)(.044+.003) + \sim 4k$

(.044 → STEEL JOISTS; ~4k → STEEL BM, JOIST GIRDERS)

$= 47.4k$

$\ell = 14' + 21' + (42')\left(\frac{21'+21'}{2}\right)(1/4"/ft)/12" = 16.87'$

(14' → TO LOW JOIST BRG.; 21' → TO FDN; 1/4"/ft → STEEL SLOPE)

$k = 1.2$ CONSERVATIVELY $\rightarrow k\ell = 20.25' \rightarrow$ TS 5X5X3/8@

OTHER COLS SIM. BY TRIB AREA — SEE TABLE SHT 3

TYP. COL FOOTING @ B-1

ALLOWABLE BRG. PRESS. = 2500 PSF

$\rightarrow$ 5'-0" SQ $\rightarrow$ CAP = (.25)(2.5KSF) − (.15)(25 ft^3) X 12" THK
= 58.75 k

$\rightarrow$ USE 5'-0" SQ X 12"

REINF : ASSUME 10" SQ BRG ℓ

$\rightarrow M_u = \frac{(2.5)(2.5' - .417')^2}{2} = 5.42\ k\text{-}'$

$\rightarrow d = 12" - 3" - .75" = 8.25"$ $f'_c = 3000$ psi

$\rightarrow K_u = 79.7 \rightarrow \rho_{MIN} = .0018$ ⚠ CONTROLS

$A_s = (.0018)(5)(144)$
$= 1.30\ in^2$

$\rightarrow$ 5#5 EW

OTHER FOOTINGS SIM. FROM COL. LOADS

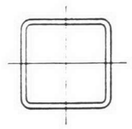
ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 32
JOB NO. 17207.0
BY TGB

F_y = 46 ksi

COLUMNS
Square structural tubing
Allowable concentric loads in kips



Nominal Size		6 x 6					5 x 5				
Thickness		1/2	3/8	5/16	1/4	3/16	1/2	3/8	5/16	1/4	3/16
Wt./ft.		35.24	27.48	23.34	19.02	14.53	28.43	22.37	19.08	15.62	11.97
F_y		46 ksi									
Effective length in feet KL with respect to radius of gyration	0	287	223	189	154	118	231	182	155	127	97
	6	257	201	171	140	107	200	159	136	111	86
	7	251	196	167	137	105	193	153	131	108	83
	8	244	191	163	133	102	186	148	127	104	80
	9	237	186	158	130	99	178	142	122	100	77
	10	229	180	154	126	96	169	135	116	96	74
	11	221	174	149	122	93	160	129	111	92	71
	12	212	168	143	117	90	151	122	105	87	67
	13	203	161	138	113	87	141	115	99	82	64
	14	194	154	132	108	83	131	107	93	77	60
	15	185	147	126	104	80	120	99	86	72	56
	16	175	140	120	99	76	109	90	79	66	52
	17	164	132	113	94	72	97	82	72	60	47
	18	153	124	107	88	68	87	73	64	54	43
	19	142	115	100	83	64	78	65	58	49	39
	20	131	107	93	77	60	70	59	52	44	35
	21	119	98	85	71	56	64	54	47	40	32
	22	108	89	78	65	51	58	49	43	36	29
	24	91	75	65	55	43	49	41	36	31	24
	26	77	64	56	47	36	41	35	31	26	21
	28	67	55	48	40	31	36	30	27	22	18
	30	58	48	42	35	27	31	26	23	20	15
	31	54	45	39	33	26		25	22	18	14
	32	51	42	37	31	24				17	14
	34	45	37	33	27	21					
	36	40	33	29	24	19					
	37		32	27	23	18					
	38			26	22	17					
	39					16					
Properties											
A (in.^{2})		10.40	8.08	6.86	5.59	4.27	8.36	6.58	5.61	4.59	3.52
I (in.^{4})		50.5	41.6	36.3	30.3	23.8	27.0	22.8	20.1	16.9	13.4
r (in.)		2.21	2.27	2.30	2.33	2.36	1.80	1.86	1.89	1.92	1.95
B Bending factor		0.615	0.583	0.567	0.553	0.539	0.773	0.722	0.699	0.677	0.656
*a		7.52	6.20	5.40	4.52	3.54	4.03	3.39	2.99	2.52	2.00

* Tabulated values of a must be multiplied by 10^6.
Note: Heavy line indicates $K l/r$ of 200.

C5

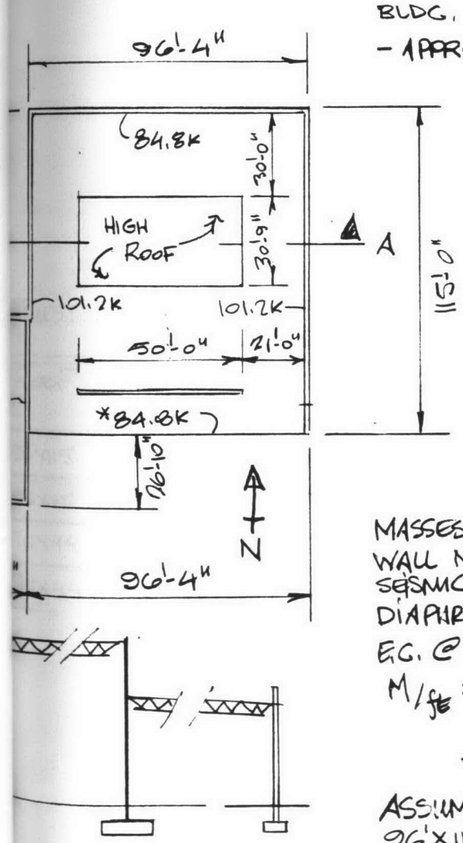
CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 4
JOB NO. 172070
BY TGB

DS

NCE IS PROVIDED BY CMU SHEAR WALLS
I LOCATION BY A BRACED STUD WALL,
BRACED AT THE TOP BY A FLEXIBLE
DIAPHRAGM TRANSFERRING LOADS TO

SHEAR WALL DESIGN.



BLDG. LAYOUT W/ - APPROX. DIMS.

* CONSERVATIVE ASSUMPTION

MASSES SHOWN ARE BASIC WALL MASSES APPLYING SEISMIC LOADS TO ROOF DIAPHRAGMS

E.G. @ EAST WALL

$M/ft = (2+14'-10' + 10\frac{1}{2}) \times .04 + .04$
(8" CMU, BRICK)
$= .880$ K/ft

ASSUME MASS CENTERS AT 96'X115' ROOF & 70X44' ROOF COINCIDENT W/ RIGIDITY CENTERS - BY INSPECTION

66

ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.S.T. BLDG.

SHEET NO. 5
JOB NO. 172070
BY TGB

LATERAL LOAD DESIGN ... /CONT.

96'x115' Roof

TOT N-S SEISMIC LOAD = .035 * TOTAL MASS

ROOF MASS = ((96.33)(115) − (50x31))(.029 + .005) (STEEL)
+ (50x31)(.044 + .005) → HI ROOF MASS TRANSFERRED TO LO ROOF THRU' Col SHEARS
= 400k

→ TOT. MASS = 400 + 101.2 + 101.2 + 84.8 + 84.8
= 771.9k

→ SEISMIC LOAD = 27.0 k

TOT. AVAILABLE SHEAR WALL = (115)(2) = 230'
SHEAR/ft = 117 lb/ft
MORTAR SHEAR STRESS = 117/30 in²/ft = 3.9psi

THUS...

Roof	DIRN.	TOT. MASS k	SEISMIC LOAD k	SHEAR WALL LENGTH ft	SHEAR STRESS psi	SHEAR/ ft
96x115	N-S	771.9	27.0	230'	3.9	117
96x115	E-W	771.9	27.0	146	6.2	185
70x44	N-S	305.3	10.7	140	2.5	76
70x44	E-W	305.3	10.7	88	4.0	121

W/ NO REINF. RESISTING SHEAR
for f'_M = 1350 psi, TYPE S MORTAR (CMU)
W/ FLEXURAL REINF → Allowable shear stress = 54 psi (OK.)

C1

ID CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 6
JOB NO. 172070
BY TCB

DESIGN ... /CONT.

GM 4 SHEAR WALL DESIGN ... /CONT

RESSURE = 34 PSF c.f. sht 1

T 5 FOR BLDG LAYOUT

NG PRESSURE COEFFICIENTS

/L	WINDWARD WALL	LEEWARD WALL	END WALLS
5	.8	-0.5	-0.7
3	.8	-0.5	-0.7

ND = (0.8 + 0.5)(34) * TRIB AREA
= 44.2 * TRIB. AREA

CLERESTORY

B AREA = $(2+4'+\frac{10'}{2})(96.33') + (8'X50')$
= 1460 #

TOT WIND FORCE = 64.5k
TOT SHEAR WALL = 230'
SHEAR/ft = 280.5 lb/ft
MORTAR SHEAR STRESS = $\frac{280.5}{30\ \#/1}$ = 9.35 PSi

TRIB AREA #	- TRIB AREA #	+ FORCE k	- FORCE k	SHEAR WALL	SHEAR ft	SHEAR STRESS PSi
1460	1460	39.7	24.8	230'	280.5	9.35
1513	1029	41.1	17.5	146.3'	400	13.3
473	473	12.9	8.0	140'	149.6	5.0
770	297	20.9	5.0	88'	294.8	9.8

MAX PSi SHEAR STRESS = 13.3 < 56 PSi ALL. (ok)

ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 7
JOB NO.
BY

LATERAL LOAD DESIGN ... /CONT

BY INSPECTION WIND LOAD CONTROLS DESIGN OF ALL MAIN LATERAL LOAD RESISTING COMPONENTS

MAX SHEAR DIAPHRAGM CAPACITY REQ'D = 400 lb/ft

ARMOUR CAPE & POND

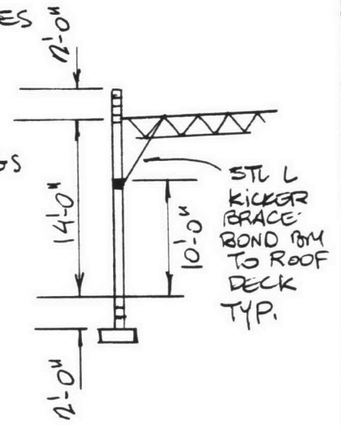
CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 8
JOB NO. 172070
BY TGB

MASONRY WALL DESIGN : WIND & SEISMIC FORCES

BASIC PRESSURE = 34 PSF c.f. SHT 1

INTERNAL PRESS COEFF = ± 0.17 BY INSP. OF % WINDOW OPNGS



EXTERNAL PRESS. COEFF :
TRIB AREA = (10' + 2' = 12') * 1'

→ C_{p_e} ④ = -1.05

C_{p_e} ⑤ = -1.4

TOTAL (NET) PRESS. COEFFS = C_p ④ = -1.05 + -0.17 = -1.22

C_p ⑤ = -1.4 + -0.17 = -1.57

NET PRESSURES : $q_④$ = (-1.22)(34) = 41.5 PSF

$q_⑤$ = (-1.57)(34) = 53.4 PSF

SEISMIC LOAD
$q = ZIC_p w_p$
$= \frac{3}{16} * 1.0 * .3 * 80$
$= 4.5$ PSF (40 + 40 8"CMU+BRICK)
OBV. DOES NOT CONTROL

CMU DATA 8" LT. WT (w_1 = 40 PSF)
f'_M = 1350 psi TYPE S MORTAR
REINFORCED CELLS GROUT FILLED @ 3000 psi

LOADBEARING WALL $N = (\frac{42}{2} \times .0129 + .03) = .672$ k/ft
- CENTERED ON 8" CMU

w_1 = 40 PSF

→ $f_A = \frac{672 + (40 \times 11')}{(24 \times 1.25")} = 37.1$ psi

$F_A = (.225 \times 1350)\left\{1 - \left(\frac{.3 \times 12}{7.625}\right)^3\right\}$
$= 271.8$ psi

→ $f_A / F_A = .137$

ARMOUR CAPE & POND

CAMP LEJEUNE
C.A.S.T. FACILITY

SHEET NO. 9
JOB NO. 172070
BY TGB

MASONRY WALL DESIGN... /CONT

READ M_R per ft $= \left(\frac{M}{1.33 - f_A/F_A}\right) * 1.33 * b * \frac{\perp}{12"}$

b = STIFFNER SPACING IN

↑ INCLUDED IN TABULATED M_R VALUES IN DM 2.9

$= .093\,bM$

MOMENTS : SPAN = 12' → $M_④ = (41.5)(12^2)/8$
$= 747$ lb-ft

$M_⑤ = 961.2$ lb-ft

FOR ZONE ④

SPACING	$M_R \geq$	REINF
12"	747	1#4
24"	1494	1#4
32"	1992	1#5
48"	2988	2#5
→ 56"	3486	2#6

USE

FOR ZONE ⑤

SPACING	$M_R \geq$	REINF
MAX → 56"	4485.6	2#6

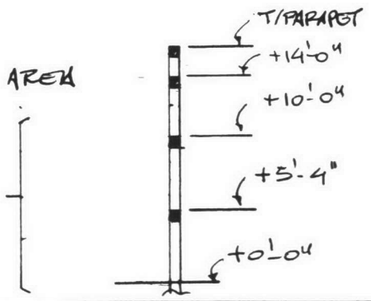
USE

REINF W/ 2#6 @ 56" TYP TO BRACE
1#6 @ 56" ABOVE BRACE

MIN HORIZONTAL REINF

FROM P-355 TABLE 8-5
ZONE 1 TOT A_s REQ'D = .15 % GROSS AREA
MAX VERT. SPACING = 60" (OK)
MAX HORIZ. " = 72"

PROV. BOND BEAMS W/ 2#5 CONT AS SHOWN TYP.



C 11

LIGHTING CALCULATIONS

CAST #87N018

Lighting Calculations

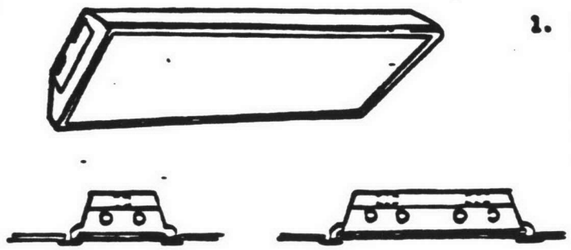
	ROOM NAME	ROOM WIDTH	ROOM LENGTH	DSRD FC	FIXT TYPE	LUMEN /LAMP	MTG HGT	WRKG PLANE	MAINT FCTR	RC RATIO	ZONAL CAVITY	COEFF UTIL	INIT'L FC	MAIN'D FC	NO. FXT	SF /FXT	WATT /SF
1.	BN/BTRY PDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
2.	BN/BTRY PDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
3.	BN/BTRY PDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
4.	CSBE	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
5.	MATGF COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
6.	INF REB COC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
7.	ACE	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
8.	DABC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
9.	INF BN COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
10.	INF BN COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
11.	ELEC. CLOSET	11.5	16	30	F6	2900	12	2.5	.7	7.09	50/50	.39	36.8	25.7	3	61.3	1.63
12.	EWC	16	16	60	F4	2900	9	2.5	.75	4.06	80/50	.49	88.8	66.	4	64	3.12
13.	WORK SPACE	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
14.	INF BN COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
15.	MAN/TACC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
16.	DIV. COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
17.	DABC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
18.	MAN/TACC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
19.	INF REB COC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
20.	INF BN COC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
21.	CSBE	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
22.	BN/BTRY EDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
23.	BN/BTRY EDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
24.	BN/BTRY EDC	8	16	60	F4	2900	9	2.5	.75	6.09	80/50	.4	72.5	54.	2	64	3.12
25.	ARTY. MORTAR FDC	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
26.	CATF	16	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
27.	TECB/DCE	11	14	40	F4	2900	9	2.5	.75	5.27	80/50	.43	64.7	48.	2	77	2.59
28.	ARTY. MORTAR FDC	14	16.5	60	F4	2900	9	2.5	.75	4.00	80/50	.49	86.1	64.	4	66	3.03
29.	TERRAIN BRD.	31	50	25	LS	3220	18	2.5	.75	4.05	80/50	.67	33.4	25.0	24	64.5	3.87
30.	PILOT	5	18	40	FB	2730	14	2.5	.75	14.69	80/50	.28	50.9	38.1	3	30	3.33
31.	PILOT	5	18	40	FB	2730	14	2.5	.75	14.69	80/50	.28	50.9	38.1	3	30	3.33
32.	CORRIDOR	5	87.5	20	FB	2730	9	2.5	.75	6.87	80/50	.39	29.2	21.9	6	72.9	1.37
33.	CORRIDOR	5	87.5	20	FB	2730	9	2.5	.75	6.87	80/50	.39	29.2	21.9	6	72.9	1.37
34.	MEN'S TOILET	18.5	30	40	F7	2900	9	2.5	.75	2.84	80/50	.62	48.5	36.3	5	111	1.35
35.	ENTRY	5	5	20	FB	2730	9	2.5	.75	13	80/50	.28	61.1	45.8	1	25	4
36.	OFFICE	7.5	14	60	F4	2900	9	2.5	.75	6.65	80/50	.38	83.9	62.9	2	52.5	3.80
37.	TAC/WAR ADMIN.	9.5	14	60	F4	2900	9	2.5	.75	5.74	80/50	.42	73.2	54.9	2	66.5	3.00
38.	OFFICE	10	14	60	F4	2900	9	2.5	.75	5.57	80/50	.42	69.6	52.2	4	70	2.85
39.	TACTICAL LIB.	14	17.5	70	F4	2900	9	2.5	.75	4.17	80/50	.49	92.8	69.6	4	61.2	3.26
40.	CORRIDOR	6	103.5	20	FB	2730	9	2.5	.75	5.73	80/50	.44	27	20.2	7	89.7	1.12
41.	ENTRANCE	12	16	40	FB	2730	9	2.5	.75	4.73	80/50	.48	54.6	40.9	4	48	2.08
42.	VESTIBULE	6	15	20	FB	2730	9	2.5	.75	7.58	80/50	.36	21.8	16.3	1	90	1.11
43.	CLASSROOM	25	34	50	F4	2900	9	2.5	.75	2.25	80/50	.6	90	67.5	11	77.2	2.58
44.	TBFO	16	40	70	F4	2900	9	2.5	.75	2.84	80/50	.56	101.5	76.1	10	64	3.12
45.	MECH. RM.	20.5	30.5	30	F6	2900	12	2.5	.7	3.87	50/50	.56	41.5	29.0	8	78.1	1.27
46.	WOMEN'S TOILET	9	16	40	F5	2730	9	2.5	.75	5.64	80/50	.44	50	37.5	3	48	2.08
47.	REAR PROJ.	9.5	15	40	F3	2730	9	2.5	.75	5.58	80/50	.44	50.5	37.8	3	47.5	2.10

Average lighting watts per sq ft 2.68
Total lighting watts 32350
Energy costs @ $.05 per kWH
10 hours per day
5 days per week ..... $4231.5 per year

LIGHTING FIXTURE SHEETS

F3, F4, F5

SKETCH DATE: MARCH 1983



LUMINAIRE REQUIREMENTS

1. HOUSING SHALL BE 0.026" MIN. THICKNESS, 5" MAX. HEIGHT AND SHALL NOT PERMANENTLY DEFORM WHEN LIFTED BY ONE CORNER WITH LENS DOOR IN PLACE NOR WITH LENS DOOR REMOVED. LENS DOOR SHALL NOT OPEN WHEN LUMINAIRE IS LIFTED BY ONE CORNER. LUMINAIRE SHALL HAVE LESS THAN THE FOLLOWING DEFLECTION WHEN LIFTED BY ONE CORNER WITH LENS DOOR REMOVED:

TYPE:	A	B	C, D & E
	3"	2 1/2"	4"

2. HOUSING SHALL BE CHEMICALLY TREATED FOR RUST PREVENTION AND HAVE BAKED WHITE ENAMEL FINISH 85% MIN. REFLECTANCE (INTERIOR). ENDS SHALL BE SECURED BY RIVETS OR SCREWS. PAINT ENTIRE HOUSING AND LENS DOOR WHITE, AFTER FABRICATION.
3. LATCHES SHALL BE 0.032" MINIMUM THICKNESS STEEL OR 0.015" MINIMUM THICKNESS SPRING STEEL. DIRECTION OF TRAVEL TO OPEN SHALL BE STAMPED ON LENS FRAME WHEN NOT OBVIOUS.
4. LENS DOOR SHALL BE 0.032" MINIMUM THICKNESS STEEL, SHALL BE ASSEMBLED WITH SCREWS (FOR LENS REPLACEMENT). PROVIDE LIGHT TIGHT FIT WITHOUT MOVABLE BAFFLES. GASKETING SHALL NOT BE A MEANS OF ACHIEVING LIGHT TIGHT DOOR.
5. LENS SHALL BE 0.156" (FOR TYPES A, C, D, E) AND 0.125" (FOR TYPE B) PLUS OR MINUS 10% OVERALL (0.09 MAX, PRISM PENETRATION) CLEAR PRISMATIC 100% ACRYLIC.
6. DOOR SHALL BE CAPABLE OF HINGING AND LATCHING FROM EITHER SIDE OF LUMINAIRE. PROVIDE SAFETY TYPE HINGES.
7. BALLAST SHALL BE HIGH POWER FACTOR (≥ .9) ETL, CBM APPROVED RAPID START CLASS P ENERGY SAVING BALLAST WITH SOUND RATING OF "A". SECURE BALLAST TO HOUSING WITH AT LEAST ONE SCREW AND SLIP-ON BRACKET OR 2 SCREWS ONE AT EACH END. PROVIDE GROUNDING SCREW ON INTERIOR OF HOUSING.
8. PHOTOMETRICS: MINIMUM COEFFICIENT OF UTILIZATION (CU) FOR THE FOLLOWING CAVITY REFLECTANCES: CEILING = 80% WALL = 50% FLOOR = 20%
   LUMINANCE USING 3100L LAMP WITH AVG:MAX RATIO NOT TO EXCEED 1:5

ROOM CAVITY RATIO	TYPE: CU	A	B	C	D	E	AVG. LUMINANCE (fl)
1		0.67	0.60	0.73	0.68	0.67	45° - 2250
2		0.60	0.54	0.66	0.61	0.60	55° - 1605
3		0.54	0.48	0.59	0.55	0.54	65° - 1125
4		0.49	0.44	0.53	0.50	0.49	75° - 750
MIN. S/MH		1.2	1.1	1.3	1.3	1.3	85° - 495

   PROVIDE MIN. VISUAL COMFORT PROBABILITY (VCP) OF 65 (ASSUME 30'X30'X10'H ROOM). WHEN "OFFICE TYPE" INDICATED, PROVIDE MIN. VCP OF 70.
9. PROVIDE MOUNTING HARDWARE COMPATIBLE WITH CEILING MATERIAL IN WHICH LUMINAIRE IS TO BE INSTALLED.

TYPE A - 2'X2' 2 LAMP
TYPE B - 1'X4' 2 LAMP
TYPE C - 2'X4' 2 LAMP
TYPE D - 2'X4' 3 LAMP
TYPE E - 2'X4'. 4 LAMP

TROFFER

SKETCH No. 16510-3

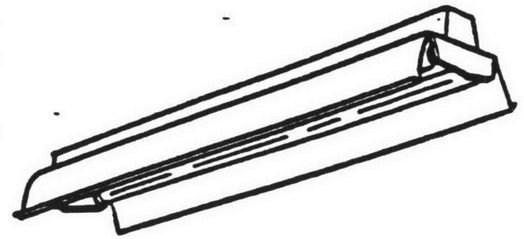
NL- 3

C 15

F6

WPCS-16510 (November 1983)

SKETCH DATE: MARCH 1983



LUMINAIRE REQUIREMENTS

1. HOUSING SHALL BE 0.032" MINIMUM THICKNESS DIE FORMED COLD ROLLED STEEL, CHEMICALLY TREATED FOR RUST PREVENTION AND FINISHED WITH WHITE BAKED ENAMEL OR POLYESTER FINISH. PROVIDE TOP AND END KNOCKOUTS.

2. HOUSING WELDED OR SECURED BY SCREWS OR RIVETS INTO A SINGLE ASSEMBLY. PROVIDE INTERNAL PROVISIONS FOR GROUNDING.

3. REFLECTOR SHALL BE 0.026" MINIMUM THICKNESS STEEL (SOLID WHEN LUMINAIRE IS MOUNTED BELOW CATWALKS, ETC. 10-25% APERTURED WHEN PROTECTED FROM FALLING OBJECTS.) PROVIDE 30° SHIELDING CENTER VEE. CHEMICALLY TREAT FOR RUST PREVENTION AND FINISH WITH WHITE BAKED ENAMEL, PORCELAIN ENAMEL, OR POLYESTER FINISH. MINIMUM REFLECTANCE SHALL BE 85%.

4. THE LUMINAIRE SHALL NOT PERMANENTLY DISTORT WHEN LIFTED BY ONE CORNER.

5. SPACING TO MOUNTING HEIGHT RATIO = 1.3.

6. LUMINAIRE SHALL BE CAPABLE OF CONTINUOUS ROW AND SINGLE UNIT PLACEMENT WITH PENDANT OR SURFACE MOUNTING.

7. PROVIDE SPRING LOADED PLUNGER TYPE LAMP SOCKETS.

8. BALLAST SHALL BE HIGH POWER FACTOR ($\geq$ .9) ETL, CBM APPROVED CLASS P ENERGY SAVING BALLAST WITH A SOUND RATING OF B (RAPID START OR SLIMLINE).

9. MINIMUM COEFFICIENT OF UTILIZATION (CU) WITH THE FOLLOWING CAVITY REFLECTANCE OF: CEILING = 80% WALL = 50% FLOOR = 20%
LUMINANCE USING 3100 LAMP WITH AVG:MAX. RATIO NOT TO EXCEED 1:5

ROOM CAVITY RATIO	CU	AVG. LUMINANCE (fl)
1	0.85	45° - 1350
2	0.73	55° - 1250
3	0.68	65° - 1250
4	0.60	75° - 850
		85° - 600

INDUSTRIAL FLUORESCENT

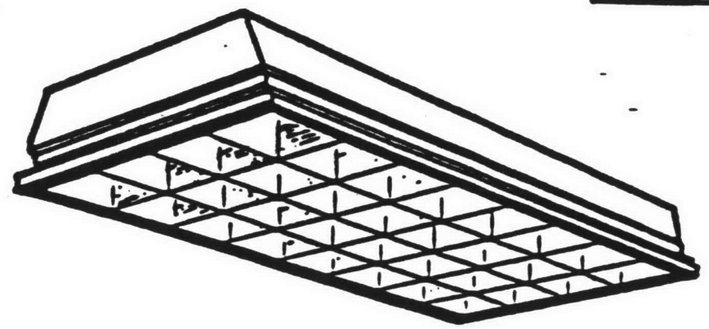
TYPE A - 48" 2 LAMP 430 MA.
TYPE B - 96" 2 LAMP 430 MA.

SKETCH No. 16510-6

NL-6

F8

SKETCH DATE: MARCH 1983



LUMINAIRE REQUIREMENTS

1. HOUSING SHALL BE MINIMUM 0.26" THICK STEEL. HOUSING SHALL BE CHEMICALLY TREATED FOR RUST PREVENTION AND PAINT ADHESION. ENDS SHALL BE SECURED WITH SCREWS OR WELDED. HOUSING SHALL BE COMPLETELY PAINTED AFTER FABRICATION WITH MINIMUM 85% REFLECTANCE WHITE ENAMEL. MINIMUM DEPTH OF HOUSING 6" ±1".

2. LUMINAIRE SHALL HAVE FULL MATTE BLACK REVEAL. FOR FLOATING DOOR EFFECT. PROVIDE MOUNTING TRIM AND HARDWARE COMPATIBLE WITH CEILING MATERIAL.

3. LUMINAIRE SHALL BE HIGH EFFICIENCY, LOW BRIGHTNESS TYPE WITH INTERLOCKED LOUVERS CONTOURED TO A PARABOLIC SHAPE. LOUVERS SHALL BE OF MINIMUM .025" SEMI-SPECULAR ANODIZED ALUMINUM IN NATURAL OR GOLD FINISH AS INDICATED.

4. FIXTURE HOUSING SHALL HAVE INTERNAL GREEN GROUNDING SCREW.

5. NO EXPOSED INTERNAL WIRING.

6. BALLAST SHALL BE HIGH POWER FACTOR (≥ .9) ETL, CBM APPROVED RAPID START CLASS P ENERGY SAVING BALLAST WITH SOUND RATING OF "A". SECURE BALLAST TO HOUSING WITH AT LEAST ONE SCREW AND SLIP-ON BRACKET OR 2 SCREWS, ONE AT EACH END.

7. LOUVER SHALL BE SUITABLE FOR HINGING FROM EITHER SIDE AND SHALL HAVE TWO SAFETY HINGES AND TWO SPRING LOADED LATCHES OR FOUR SPRING LOADED LATCHES.

(TYPE A) - 2'X2' - 2 U-LAMPS - 9 OR 16 CELLS

TYPE B - 2'X2' - 3 U-LAMPS - 9 OR 16 CELLS

TYPE C - 2'X4' - 2 LAMP - 12, 14 OR 32 CELLS

TYPE D - 2'X4' - 3 LAMP - 18 OR 21 CELLS

TYPE E - 2'X4' - 4 LAMP - 28 OR 32 CELLS

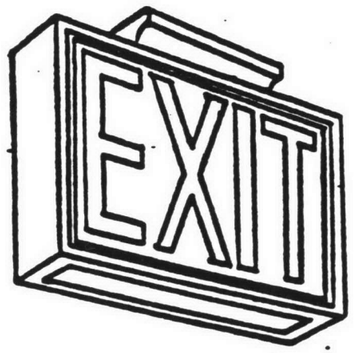
2'X2' AND 2'X4' PARABOLIC TROFFERS

SKETCH No. 16510-9

NL-9

C 17

SKETCH DATE: MARCH 1983



LUMINAIRE REQUIREMENTS

1. LETTERS SHALL BE 6" TALL WITH 3/4" STROKES FORMED BY A STENCIL FACE.
2. PROVIDE RED FIBERGLASS PANEL BEHIND STENCIL FACE.
3. PROVIDE 2 LONG LIFE INCANDESCENT LAMPS.
4. PROVIDE DOWN LIGHT PANEL IN FIXTURE.
5. PROVIDE ILLUMINATED ARROWS AS INDICATED.
6. PROVIDE SINGLE OR DOUBLE FACE AS INDICATED.
7. PROVIDE CEILING, END WALL, BACK WALL OR PENDANT MOUNTING AS INDICATED.
8. UNITS MOUNTED EXPOSED TO THE ENVIRONMENT SHALL HAVE A DAMP OR WET U.L. LABEL AS APPROPRIATE AND SHALL NOT BE CONSTRUCTED OF STEEL.
9. PROVIDE INTERNAL PROVISIONS FOR GROUNDING.
10. PROVIDE INTERNATIONAL SYMBOL OF ACCESS ON SIGN WHEN INDICATED.

TYPE A - ALUMINUM OR PAINTED STEEL HOUSING AND STENCIL FACE. (SEE NOTE 8.)

TYPE B - PLASTIC HOUSING ENCLOSED IN POLYCARBONATE WITH STENCIL ON INSIDE OF POLYCARBONATE HOUSING. (SEE NOTE 8.)

EXIT SIGN

SKETCH No. 16510-48

NL-48

C 18

Luminaire Requirements

1. Rectangular aluminum housing with all seams welded and ground smooth. Chemically treat for rust prevention and provide baked enamel finish (dark bronze unless indicated otherwise).
2. One piece aluminum reflector with impact resistant tempered glass and high temperature gasket.
3. Provide high pressure sodium lamps with high power factor (≥ .9) encapsulated ballast. Lamp as indicated on the Lighting Fixture Schedule.
4. Provide computer generated documentation of maximum, minimum, and average footcandles, average to minimum and maximum to minimum ratios.

Pole requirements

1. High tensile carbon steel tapered square shaft of one piece construction with flattened vertical weld seam.
2. Shaft welded to flat steel anchor base with cast aluminum base cover.
3. Chemically treated for rust prevention and provide enamel finish same as luminaire.
4. Handhole gasketed to prevent water leakage.

TYPE AA - 2 luminaires per pole. Type 3 lighting distribution

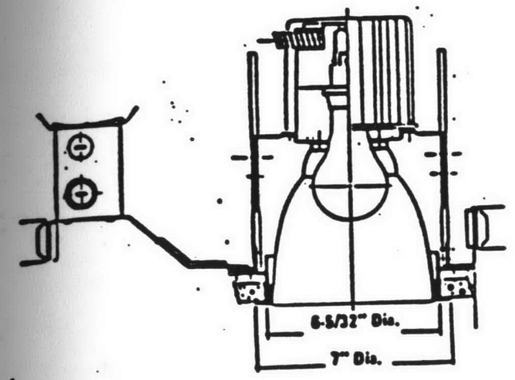
TYPE BB - 1 luminaire per pole. Type 1 lighting distribution.

TYPE CC - 1 luminaire per pole. Type 3 lighting distribution

Pole Mounted Light Fixture

NL-70

L4



Luminaire Requirements

1. Brackets and bar hangers adjust to 25-1/2".
2. Support bracket and prewired junction box with snap-on covers for easy access.
3. Diecast aluminum plaster flange.
4. White polypropylene trim ring for dry ceilings.
5. Black milligrove baffle.
6. Diecast aluminum heat sink.
7. Medium base porcelain socket with nickel plated screw shell.
8. Suitable for damp locations.

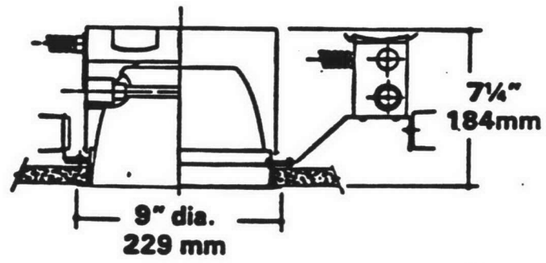
Type A - 150 watt, A-21
Type B - 100 watt, A-19

Incandescent Downlight

NL-72

C 20

F9



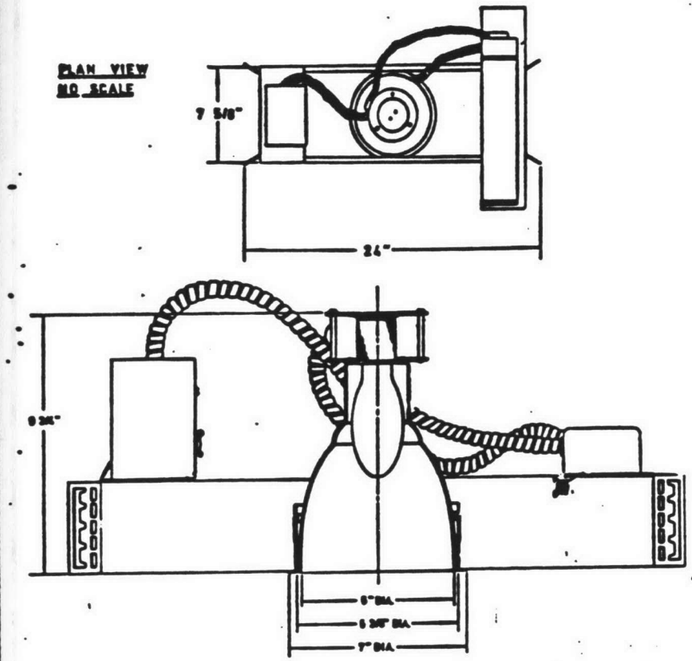
Luminaire Requirements:

1. Diecast aluminum plaster frame
2. Adjustable "C" brackets and bar hangers (to 25-1/2")
3. Clear Alzak reflector
4. Two 9 watt PL lamps
5. 25°F starting temperature

Recessed Fluorescent Downlights

NL-76

C21



LUMINAIRE REQUIREMENTS:

1 Specular clear alzak reflector

2 Medium base socket

3 Extruded aluminum heat sink

4 120V to 277V step-up transformer

5 (1) 32W E-17 metal halide lamp

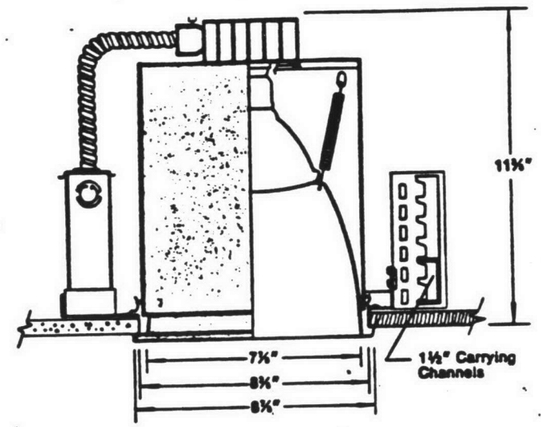
6 Metal halide 277V electronic ballast

7 Slotted adjustment for mounting bars

8 Plaster frame and trim ring

NL-79

L5



LUMINAIRE REQUIREMENTS

1 Semi-specular black alzak paracone with return flange.

2 Die-cast aluminum husk and lamp holder assembly.

3 Adjustable mounting bracket.

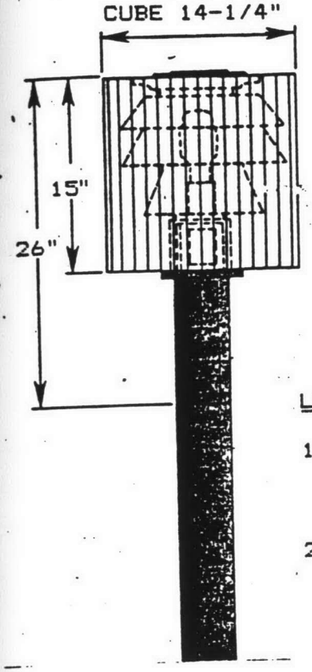
4 (1) 250W PAR 38 quartz lamp.

NL-81

C 23

H1

CYL. 16" DIA.
CUBE 14-1/4"



TYPE A CYLINDER

TYPE B CUBE

LUMINAIRE REQUIREMENTS:

1 Translucent, impact resistant, UV stabilized, virgin acrylic cylinder or cube housing.

2 Multi-disc reflector assembly encompassing lamp, is of spun aluminum specular alzak; designed to obscure lamp from view and control cutoff and glare.

3 Lamp is vertical burning, base down.

4 integrally mounted and concealed ballast with high power factor (> .9)

POLE REQUIREMENTS:

1 High tensile carbon steel non-tapered square shaft of one piece construction with flattened vertical weld seam.

2 Shaft welded to flat steel anchor base with cast aluminum base cover.

3 Chemically treated for rust prevention and provide enamel finish.

4 Handhole gasketed to prevent water leakage.

NL-83

PANELBOARD SIZING

CAST CONNECTED LOAD SUMMARY

208/120 volt
3 ph
4 w

Load	Voltage	Phase	Horsepower	kVA
			78kVA	78
CH1	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
EF	120	1	1/6	.52
EF	120	1	1/6	.52
EF	120	1	1/6	.52
P	208	3	3	3.82
P	208	3	3	3.82
P	208	3	2	2.70
P	208	3	2	2.70
P	208	3	10	11.15
AHU	208	3	2	2.70
CNTRL CMPR	208	3	1/4	.69
AIR DRYER	120	1	19.6kVA	19.6
TRNR	~~208~~ 120	3 1.0	22kVA	22
LASER	~~208~~ 120	3 1.0	22kVA	22
LASER	~~208~~ 120	3 1.0	28kVA	28
HWH	208	3	45kVA	45
LIGHTING	120	1	28kVA	28
RECEPTACLE	120	1	30kVA	30
MISC	120	1		

Total kVA 318.54
Total Amps 884.18

Change

C 26

CAST CONNECTED LOAD SUMMARY

208/120 volt
3 ph
4 w

Load	Voltage	Phase	Horsepower	kVA
			78kVA	78
CH1	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	3/4	1.11
TU	208	3	1/6	.52
EF	120	1	1/6	.52
EF	120	1	1/6	.52
EF	120	1	3	3.82
P	208	3	3	3.82
P	208	3	2	2.70
P	208	3	2	2.70
P	208	3	10	11.15
AHU	208	3	2	2.70
CNTRL CMPR	208	3	1/4	.69
AIR DRYER	120	1	19.6kVA	~~19.6~~ 3
TRNR	~~208~~ 120	~~3~~ 1.0	22kVA	~~22~~ 6
LASER	~~208~~ 120	~~3~~ 1.0	22kVA	~~22~~ 6
LASER	~~208~~ 120	3 1.0	28kVA	28
HWH	208	3	45kVA	45
LIGHTING	120	1	28kVA	28
RECEPTACLE	120	1	30kVA	30
MISC	120	1		

Change

Total kVA 318.54
Total Amps 884.18

C 26

CAST Panelboard Sizing

208/120 Volt
3 Phase
4 Wire

Load	Cntd kVA	Dmnd Fctr	Dmnd kVA
CH1	78	.7	54.6
TU	16.73	.7	11.71
EF	1.58	.7	1.10
P	13.06	.7	9.14
AHU	11.15	.7	7.80
CNTRL CMPR	2.70	.7	1.89
AIR DRYER	.69	.7	.48
TRNR	19.6	.6	11.76
LASER	44	.6	26.4
HWH	28	.7	19.6
LIGHTING	45	1	45
RECEPTACLE	28	.5	14
MISC	30	.6	18

Load Synopsis

Demand kVA 221.51
Demand Amps 614.87
FUTURE CAPACITY..... 768.59 (125%)

∴ 800AMP SERVICE, 100% FULLY RATED WILL BE SELECTED UNTIL LOADS ARE FINALIZED.

FAULT CURRENT CALCULATIONS

SHORT CIRCUIT & VOLTAGE DROP CALCULATION - SCVD
JOB CAST

SOURCE DATA: 500.0 KVA TRANSF., 3.85%Z, X/R RATIO= 12. MTR. HP= 112.

CONDUCTOR TYPES:
 NUMBER: AWG OR MCM OF WIRE, AMPS OF BUSDUCT
 MATERIAL: C=COPPER, A=ALUMINUM
 CONDUIT: M=MAGNETIC, N=NON-MAGNETIC
 BUSDUCT: P=PLUG-IN, F=FEEDER

BUS NO	PANEL NAME	S.C. AMPS	NOMINAL VOLTAGE	FED FROM	******CONDUCTOR***** LENGTH	TYPE	SETS	% VOLTAGE DROP	LOAD AMPS
1	SOURCE	37322.	120.	--	--	--	--	--	--
2	MDP	35465.	120.	SOURCE	25'	500-C-N	3	.2	640.
3	RP1	22695.	120.	MDP	20'	1/0-C-M	1	.4	120.
4	RP2	22695.	120.	MDP	20'	1/0-C-M	1	.4	120.
5	HV1	7024.	120.	MDP	120'	1/0-C-M	1	1.7	120.
6	LASER	8550.	120.	MDP	75'	1-C-M	1	1.0	80.
7	LASER	8550.	120.	MDP	75'	1-C-M	1	1.0	80.
8	CH	13955.	120.	MDP	120'	500-C-M	1	1.4	275.
9	AHU	1809.	120.	MDP	140'	6-C-M	1	2.0	35.
10	TRAINE	13923.	120.	MDP	40'	1-C-M	1	.6	80.

HVAC CALCULATIONS

ECONOMIC ANALYSIS OF SHORE FACILITY

LANTDIV 4-11010/9 (New 1/83)

DATE 11-10-87

ACTIVITY (Name and Location)
Marine Corps Base, Camp LeJeune, North Carolina

PROJECT TITLE
Combined Arms Staff Trainer Facility

P NO. 872

DESCRIPTION OF ALTERNATIVES

A. VAV w/ fan powered box in series w/ air cooled packaged chiller, heating by hot water coil.

B. Multi-Zone Systems w/ hot deck & cold deck temperature reset (or Bypass hot deck) and air cooled packaged chiller.

PROJECT COST PROJECTIONS BY ALTERNATIVES

ALTERNATIVE A VAV w/ Fan Powered Box (Series)

ECONOMIC LIFE 25 YRS.

DESCRIPTION AND YEAR	COSTS ($) ONE TIME	COSTS ($) RECURRING	DISCOUNT FACTOR	PRESENT VALUE ($)
Investment	131,321			131,321
Operations				
Elec. KWH		4,004	8.93	35,756
Elec. KW		15,314	9.08	139,051
Steam (#6 F.O.)		28	13.19	369
Maintenance		3,565	9.08	32,370

TOTAL PRESENT VALUE ALTERNATIVE A - $ 338,867 ÷ DISCOUNT FACTOR 9.08 = UNIFORM ANNUAL COST 37,320

ALTERNATIVE B Multi-Zone Air Handling Systems

ECONOMIC LIFE 25 YRS.

DESCRIPTION AND YEAR	COSTS ($) ONE TIME	COSTS ($) RECURRING	DISCOUNT FACTOR	PRESENT VALUE ($)
Investment	130,520			130,520
Operations				
Elec. KWH		4,072	8.93	36,363
Elec. KW		15,150	9.08	137,562
Steam (#6, F.O.)		205	13.19	2,704
Maintenance		3,544	9.08	32,180

TOTAL PRESENT VALUE ALTERNATIVE B - $ 339,329 ÷ DISCOUNT FACTOR 9.08 = UNIFORM ANNUAL COST 37,371

REMARKS

Recommend Alternative A because of the lowest total present value.

NOTE: EXISTING CENTRAL STEAM SYSTEM WILL BE USED WITH HOT WATER CONVERTERS FOR SPACE AND DOMESTIC WATER HEATING IN EACH ALTERNATIVE.

(Attach separate sheet showing derivation of cost entries)

(CONTINUED)

ECONOMIC ANALYSIS OF SHORE FACILITY

LANTDIV 4-11010/9 (Nov 1/83)

DATE 11-10-87

ACTIVITY (Name and Location)
Marine Corps Base, Camp LeJeune, North Carolina

PROJECT TITLE
Combined Arms Staff Trainer Facility

P NO. 872

DESCRIPTION OF ALTERNATIVES
C. Multiple Single Zone Units (Fan Coil Units) w/ duct & air cooled packaged chiller.

D. Multiple DX, Constant Volume Units (Roof Top Unit)

PROJECT COST PROJECTIONS BY ALTERNATIVES

ALTERNATIVE C Multiple Single Zone Units (Fan Coil Units) ECONOMIC LIFE 20 YRS.

DESCRIPTION AND YEAR	COSTS ($) ONE TIME	COSTS ($) RECURRING	DISCOUNT FACTOR	PRESENT VALUE ($)
Investment	132,122			132,122
Operations.				
Elec. KWH		3,985	8.41	33,514
Elec. KW		13,871	8.51	118,042
Steam (#6 F.O.)		16	11.70	187
Maintenance		5,978	8.51	50,873

TOTAL PRESENT VALUE ALTERNATIVE C. $ 334,738 ÷ DISCOUNT FACTOR 8.51 = UNIFORM ANNUAL COST 39,335

ALTERNATIVE D Multiple DX Constant Volume Units ECONOMIC LIFE 15 YRS.

DESCRIPTION AND YEAR	COSTS ($) ONE TIME	COSTS ($) RECURRING	DISCOUNT FACTOR	PRESENT VALUE ($)
Investment	113,705			113,705
Operations				
Elec. KWH		3,805	7.56	28,766
Elec. KW		14,198	7.61	108,047
Steam (#6 F.O.)		10	9.73	97
Maintenance		5,145	7.61	39,153

TOTAL PRESENT VALUE ALTERNATIVE D. $ 289,768 ÷ DISCOUNT FACTOR 7.61 = UNIFORM ANNUAL COST 38,077

REMARKS

NOTE: EXISTING CENTRAL STEAM SYSTEM WILL BE USED WITH HOT WATER CONVERTERS FOR SPACE AND DOMESTIC WATER HEATING IN EACH ALTERNATIVE.

(Attach separate sheet showing derivation of cost entries)

B. HVAC

1. Investment Costs:

a. Bid opening date: September 1, 1988.

b. Rate of Escalation: 2542/2475 = 1.027 from November 1, 1987 to Bid opening date.

c. Alternative A:

Construction Cost 1 November 1987	$115,718
Escalated to 1 September 1988	x 1.027
First cost of measure	$118,842
5% Cont. 5.5% SIOH	x 1.105
Investment Cost	$131,321

d. Alternative B:

Construction Cost 1 November 1987	$115,013
Escalated to 1 September 1988	x 1.027
First cost of measure	$118,118
5% Cont. 5.5% SIOH	x 1.105
Investment Cost	$130,521

e. Alternative C:

Construction Cost 1 November 1987	$116,424
Escalated to 1 September 1988	x 1.027
First cost of measure	$119,567
5% Cont. 5.5% SIOH	x 1.105
Investment Cost	$132,122

f. Alternative D:

Construction Cost 1 November 1987	$100,195
Escalated to 1 September 1988	x 1.027
First cost of measure	$102,900
5% Cont. 5.5% SIOH	x 1.105
Investment Cost	$113,705

2. Energy Rates Obtain from LANTNAVFACENGCOM Code 403.

a. Electrical costs:

Demand charges:

June through September, peak hours - 10 am to 10 pm.
Summer peak: $15.73/kw/mo.
Off peak: $1/kw/mo.

October through May, peak hours - 6 am to 1 pm
and 4 pm to 9 pm.
Winter peak: $11.07/kw/mo.
Off peak: $1/kw/mo.

Usage charges: $0.02486/kwh on peak
$0.01986/kwh off peak

Holidays and weekends are considered off peak.

b. Steam (#6 Fuel Oil):

c. Discount rate: 10%.

d. Beneficial date: January 1990.

	1 Nov. 87	FY88	FY89	COST
Elec. (On Peak)	$0.02486/kwh	x 1.035	x 1.042	= $0.0268/kwh
Elec. (Off Peak)	$0.01986/kwh	x 1.035	x 1.042	= $0.0214/kwh
Elec. (Summer Peak Demand)	$15.73/kw/mo	x 1.035	x 1.042	= $16.9643/kw/mo
Elec. (Winter Peak Demand)	$11.07/kw/mo	x 1.035	x 1.042	= $11.9387/kw/mo
Steam (#6 F.O.)	$4.19/MBTU	x 1.035	x 1.042	= $4.5188/MBTU

3. Operating Cost From Trace Program.

a. Alternative A:

Elec. Consumpt. (67% On Peak) 107,236 kwh x $0.0268/kwh = $2,874/yr
Elec. Consumpt. (33% Off Peak) 52,817 kwh x $0.0214/kwh = $1,130/yr
Elec. Demand (Summer Peak) 4 mo. x 99 kw x $16.9643/kw/mo = $6,718/yr
Elec. Demand (Winter Peak) 8 mo. x 90 kw x $11.9387/kw/mo = $8,596/yr
Steam (#6 F.O.) 61 Therms x 1 MBTU/10 Therms x $4.5188/MBTU = $28/yr

b. Alternative B:

Elec. Consumpt. (67% On Peak) 109,952 kwh x $0.0268/kwh = $2,947/yr
Elec. Consumpt. (33% Off Peak) 54,145 kwh x $0.0214/kwh = $1,159/yr
Elec. Demand (Summer Peak) 4 mo. x 98 kw x $16.9643/kw/mo = $6,650/yr
Elec. Demand (Winter Peak) 8 mo. x 89 kw x $11.9387/kw/mo = $8,500/yr
Steam (#6 F.O.) 454 Therms x 1 MBTU/10 Therms x $4.5188/MBTU = $205/yr

c. Alternative C:

Elec. Consumpt. (67% On Peak) 106,704 kwh x $0.0268/kwh = $2,860/yr
Elec. Consumpt. (33% Off Peak) 52,555 kwh x $0.0214/kwh = $1,125/yr
Elec. Demand (Summer Peak) 4 mo. x 89 kw x $16.9643/kw/mo = $6,039/yr
Elec. Demand (Winter Peak) 8 mo. x 82 kw x $11.9387/kw/mo = $7,832/yr
Steam (#6 F.O.) 36 Therms x 1 MBTU/10 Therms x $4.5188/MBTU = $16/yr

d. Alternative D:

Elec. Consumpt. (67% On Peak) 101,895 kwh x $0.0268/kwh = $2,731/yr
Elec. Consumpt. (33% Off Peak) 50,187 kwh x $0.0214/kwh = $1,074/yr
Elec. Demand (Summer Peak) 4 mo. x 91 kw x $16.9643/kw/mo = $6,175/yr
Elec. Demand (Winter Peak) 8 mo. x 84 kw x $11.9387/kw/mo = $8,023/yr
Steam (#6 F.O.) 23 Therms x 1 MBTU/10 Therms x $4.5188/MBTU = $10/yr

4. Maintenance Cost

a. Alternative A:

Construction Cost 1 November 1987	$115,718
Escalated to 1 September 1988	x 1.027
Maintenance Allowance	x 0.03
Recurring Cost	$ 3,565

b. Alternative B:

Construction Cost 1 November 1987	$125,023
Escalated to 1 September 1988	x 1.027
Maintenance Allowance	x 0.03
Recurring Cost	$ 3,544

c. Alternative C:

Construction Cost 1 November 1987	$116,424
Escalated to 1 September 1988	x 1.027
Maintenance Allowance	x 0.05
Recurring Cost	$ 5,978

d. Alternative D:

Construction Cost 1 November 1987	$100,195
Escalated to 1 September 1988	x 1.027
Maintenance Allowance	x 0.05
Recurring Cost	$ 5,145

5. Discount Factor

a. Equipment service life: from enclosure (4) and ASHRAE 1980 System Books, Chapter 45, Table 1.

VAV & MZ Air Handling Units: 25 years

Fan Coil Unit: 20 years

Packaged Roof Top Unit: 15 years

b. Discount Rate = 10%

From Table B-4b, Encl.(5). The Discount Factors are listed as follows:

Elec. For 25 years = 8.93
For 20 years = 8.41
For 15 years = 7.56

Steam
(Residual Fuel Oil) For 25 years = 13.19
For 20 years = 11.70
For 15 years = 9.73

From Table A-2, Encl.(6). The Discount Factors are listed as follows:

Maint. For 25 years = 9.08
For 20 years = 8.51
For 15 years = 7.61

6. Backup Cost Estimate

a. The "TRACE" Handbook of Estimated and Maintenance Costs for Heating and Air Conditioning Systems has been used to prepare the construction costs for each alternative system.

Alternative A:
$8.20/SF x 14,112 SF = $115,718

Alternative B:
$8.15/SF x 14,112 SF = $115,013

Alternative C:
$8.25/SF x 14,112 SF = $116,424

Alternative D:
$7.10/SF x 14,112 SF = $100,195

7. Energy Budget Calculations From Trace Program.

KWH Consumption = 160,053 x 3,413 BTU/kwh

= 5,462.6 Therm

Space Heating = 61 Therm

Domestic Water heating = 1,826 Therm

Total 7,349.6 Therm

Gross Floor Area = 14,112 SF

Calculated Energy Budget = $\frac{7,249.6 \text{ Therm}}{14,112}$

= 52,080 BTU/YR/SF

Design Energy Budget = 55,000 BTU/YR/SF

INDICATED DESIGN VALUES ALTERNATIVE A
SERIES VAV

SYSTEM	1
PRIMARY CFM	15342.5
SKIN	0.0
OUTSIDE AIR	1789.3
COOLING TONS	48.1
SKIN	0.0
COOLING SADB	58.0
SKIN	0.0
HEATING MBH	143.0
SKIN	0.0
HEATING SADB	79.0
SKIN	0.0
SQUARE FEET	11531.0

MONTHLY ENERGY CONSUMPTION

MONTH	ELEC KWH PEAK	STEAM THERM PEAK	HTWTR THERM PEAK	DEMAND KW PEAK
JAN	7574.	151.	28.	43.
FEB	7443.	144.	15.	43.
MARCH	11777.	166.	8.	72.
APRIL	12623.	144.	0.	82.
MAY	16135.	158.	0.	90.
JUNE	18759.	158.	0.	99.
JULY	17397.	144.	0.	98.
AUG	19219.	166.	0.	97.
SEPT	15697.	144.	0.	94.
OCT	12705.	158.	0.	79.
NOV	11856.	151.	2.	78.
DEC	8868.	144.	7.	69.
TOTAL	160053.	1829.	61.	99.

BUILDING ENERGY CONSUMPTION = 63759. BTU / CONDITIONED SQUARE FOOT / YEAR.
SQUARE FOOTAGE = 11531.

ENERGY USAGE BY FUNCTION ALTERNATIVE A
SERIES VAV

MONTH		COOL EQUIP ELEC	COOL ACCESS ELEC	HEAT EQUIP HTWTR	HEAT ACCESS ELEC	FAN EQUIP ELEC	LIGHTS ELEC	BASE STEAM
JAN	USE	0	22	28	6	1009	6538	151
	PEAK	0.	0.	1.	0.	8.	35.	1.
FEB	USE	53	126	15	4	1034	6227	144
	PEAK	1.	2.	1.	0.	9.	35.	1.
MAR	USE	2561	538	8	4	1514	7161	166
	PEAK	24.	4.	1.	0.	9.	35.	1.
APR	USE	3980	869	0	0	1548	6227	144
	PEAK	31.	6.	0.	0.	10.	35.	1.
MAY	USE	6111	1215	0	0	1961	6849	158
	PEAK	38.	7.	0.	0.	10.	35.	1.
JUN	USE	8439	1521	0	0	1951	6849	158
	PEAK	46.	8.	0.	0.	11.	35.	1.
JUL	USE	7971	1422	0	0	1779	6227	144
	PEAK	45.	8.	0.	0.	11.	35.	1.
AUG	USE	8421	1565	0	0	2074	7161	166
	PEAK	45.	8.	0.	0.	10.	35.	1.
SEP	USE	6439	1264	0	0	1768	6227	144
	PEAK	42.	7.	0.	0.	10.	35.	1.
OCT	USE	3449	766	0	0	1642	6849	158
	PEAK	29.	6.	0.	0.	9.	35.	1.
NOV	USE	3190	730	2	3	1397	6538	151
	PEAK	28.	6.	0.	0.	9.	35.	1.
DEC	USE	1173	286	7	3	1180	6227	144
	PEAK	21.	4.	1.	0.	9.	35.	1.
TOTAL	USE	51787	10324	60	20	18857	79080	1828
	PEAK	46.	8.	1.	0.	11.	35.	1.

INDICATED DESIGN VALUES ALTERNATIVE B
MULTIZONE

SYSTEM	1
PRIMARY CFM	15560.2
SKIN	0.0
OUTSIDE AIR	1789.3
COOLING TONS	49.8
SKIN	0.0
COOLING SADB	58.0
SKIN	0.0
HEATING MBH	292.4
SKIN	0.0
HEATING SADB	79.0
SKIN	0.0
SQUARE FEET	11531.0

MONTHLY ENERGY CONSUMPTION

MONTH	ELEC KWH PEAK	STEAM THERM PEAK	HTWTR THERM PEAK	DEMAND KW PEAK
JAN	9141.	151.	163.	44.
FEB	8607.	144.	138.	44.
MARCH	12321.	166.	53.	72.
APRIL	12603.	144.	0.	82.
MAY	16053.	158.	0.	89.
JUNE	18811.	158.	0.	98.
JULY	17427.	144.	0.	97.
AUG	19167.	166.	0.	96.
SEPT	15697.	144.	0.	93.
OCT	12721.	158.	0.	79.
NOV	12075.	151.	34.	78.
DEC	9455.	144.	66.	69.
TOTAL	164077.	1829.	454.	98.

BUILDING ENERGY CONSUMPTION = 68363. BTU / CONDITIONED SQUARE FOOT / YEAR.
SQUARE FOOTAGE = 11531.

ENERGY USAGE BY FUNCTION ALTERNATIVE B
MULTIZONE

MONTH		COOL EQUIP ELEC	COOL ACCESS ELEC	HEAT EQUIP HTWTR	HEAT ACCESS ELEC	FAN EQUIP ELEC	LIGHTS ELEC	BASE STEAM
JAN	USE	273	413	163	155	1762	6538	151
	PEAK	2.	2.	2.	0.	9.	35.	1.
FEB	USE	245	332	138	126	1678	6227	144
	PEAK	2.	2.	1.	0.	9.	35.	1.
MAR	USE	2514	658	53	60	1929	7161	166
	PEAK	24.	4.	0.	0.	9.	35.	1.
APR	USE	3850	850	0	0	1678	6227	144
	PEAK	32.	7.	0.	0.	9.	35.	1.
MAY	USE	6114	1245	0	0	1846	6849	158
	PEAK	39.	7.	0.	0.	9.	35.	1.
JUN	USE	8510	1608	0	0	1846	6849	158
	PEAK	46.	8.	0.	0.	9.	35.	1.
JUL	USE	8030	1494	0	0	1678	6227	144
	PEAK	45.	8.	0.	0.	9.	35.	1.
AUG	USE	8469	1610	0	0	1929	7161	166
	PEAK	45.	8.	0.	0.	9.	35.	1.
SEP	USE	6487	1306	0	0	1678	6227	144
	PEAK	42.	7.	0.	0.	9.	35.	1.
OCT	USE	3284	743	0	0	1846	6849	158
	PEAK	29.	6.	0.	0.	9.	35.	1.
NOV	USE	3037	707	34	32	1762	6538	151
	PEAK	28.	6.	1.	0.	9.	35.	1.
DEC	USE	1178	311	66	63	1678	6227	144
	PEAK	21.	4.	1.	0.	9.	35.	1.
TOTAL	USE	51991	11277	454	436	21310	79080	1828
	PEAK	46.	8.	2.	0.	9.	35.	1.

INDICATED DESIGN VALUES ALTERNATIVE C
FAN COIL

SYSTEM	1
PRIMARY CFM	15560.2
SKIN	0.0
OUTSIDE AIR	1789.3
COOLING TONS	46.9
SKIN	0.0
COOLING SADB	58.0
SKIN	0.0
HEATING MBH	143.0
SKIN	0.0
HEATING SADB	79.0
SKIN	0.0
SQUARE FEET	11531.0

MONTHLY ENERGY CONSUMPTION

MONTH	ELEC KWH PEAK	STEAM THERM PEAK	HTWTR THERM PEAK	DEMAND KW PEAK
JAN	9796.	151.	21.	58.
FEB	9634.	144.	9.	58.
MARCH	12333.	166.	4.	66.
APRIL	12237.	144.	0.	75.
MAY	15087.	158.	0.	82.
JUNE	17213.	158.	0.	89.
JULY	16036.	144.	0.	89.
AUG	17610.	166.	0.	88.
SEPT	14348.	144.	0.	85.
OCT	12806.	158.	0.	72.
NOV	11962.	151.	0.	71.
DEC	10198.	144.	2.	63.
TOTAL	159259.	1829.	36.	89.

BUILDING ENERGY CONSUMPTION = 63310. BTU / CONDITIONED SQUARE FOOT / YEAR.
SQUARE FOOTAGE = 11531.

ENERGY USAGE BY FUNCTION ALTERNATIVE C
FAN COIL

MONTH		COOL EQUIP ELEC	COOL ACCESS ELEC	HEAT EQUIP HTWTR	HEAT ACCESS ELEC	FAN EQUIP ELEC	LIGHTS ELEC	BASE STEAM
JAN	USE	2017	539	21	4	698	6538	151
	PEAK	16.	4.	1.	0.	4.	35.	1.
FEB	USE	2162	577	9	4	665	6227	144
	PEAK	16.	4.	1.	0.	4.	35.	1.
MAR	USE	3613	794	4	2	765	7161	166
	PEAK	23.	4.	1.	0.	4.	35.	1.
APR	USE	4382	964	0	0	665	6227	144
	PEAK	30.	6.	0.	0.	4.	35.	1.
MAY	USE	6265	1242	0	0	732	6849	158
	PEAK	37.	7.	0.	0.	4.	35.	1.
JUN	USE	8159	1474	0	0	732	6849	158
	PEAK	44.	7.	0.	0.	4.	35.	1.
JUL	USE	7758	1387	0	0	665	6227	144
	PEAK	43.	7.	0.	0.	4.	35.	1.
AUG	USE	8165	1521	0	0	765	7161	166
	PEAK	43.	7.	0.	0.	4.	35.	1.
SEP	USE	6231	1226	0	0	665	6227	144
	PEAK	40.	7.	0.	0.	4.	35.	1.
OCT	USE	4260	966	0	0	732	6849	158
	PEAK	28.	6.	0.	0.	4.	35.	1.
NOV	USE	3842	883	0	1	698	6538	151
	PEAK	27.	6.	0.	0.	4.	35.	1.
DEC	USE	2665	641	2	1	665	6227	144
	PEAK	21.	4.	0.	0.	4.	35.	1.
TOTAL	USE	59519	12214	36	12	8447	79080	1828
	PEAK	44.	7.	1.	0.	4.	35.	1.

INDICATED DESIGN VALUES ALTERNATIVE D
ROOFTOP

SYSTEM	1
PRIMARY CFM	15560.2
SKIN	0.0
OUTSIDE AIR	1789.3
COOLING TONS	47.7
SKIN	0.0
COOLING SADB	58.0
SKIN	0.0
HEATING MBH	143.0
SKIN	0.0
HEATING SADB	79.0
SKIN	0.0
SQUARE FEET	11531.0

MONTHLY ENERGY CONSUMPTION

MONTH	ELEC KWH PEAK	STEAM THERM PEAK	HTWTR THERM PEAK	DEMAND KW PEAK
JAN	7810.	151.	19.	40.
FEB	7420.	144.	3.	40.
MARCH	11078.	166.	1.	65.
APRIL	11887.	144.	0.	76.
MAY	15165.	158.	0.	84.
JUNE	17764.	158.	0.	91.
JULY	16593.	144.	0.	91.
AUG	18178.	166.	0.	91.
SEPT	14562.	144.	0.	87.
OCT	11611.	158.	0.	73.
NOV	11425.	151.	0.	72.
DEC	8589.	144.	0.	60.
TOTAL	152082.	1829.	23.	91.

BUILDING ENERGY CONSUMPTION = 61076. BTU / CONDITIONED SQUARE FOOT / YEAR.
SQUARE FOOTAGE = 11531.

ENERGY USAGE BY FUNCTION ALTERNATIVE D
ROOFTOP

MONTH		COOL EQUIP ELEC	COOL ACCESS ELEC	HEAT EQUIP HTWTR	HEAT ACCESS ELEC	FAN EQUIP ELEC	LIGHTS ELEC	BASE STEAM
JAN	USE	0	327	19	6	940	6538	151
	PEAK	0.	0.	1.	0.	5.	35.	1.
FEB	USE	0	296	3	4	895	6227	144
	PEAK	0.	0.	0.	0.	5.	35.	1.
MAR	USE	2362	524	1	3	1029	7161	166
	PEAK	23.	2.	0.	0.	5.	35.	1.
APR	USE	3982	784	0	0	895	6227	144
	PEAK	32.	4.	0.	0.	5.	35.	1.
MAY	USE	6296	1037	0	0	984	6849	158
	PEAK	39.	5.	0.	0.	5.	35.	1.
JUN	USE	8667	1265	0	0	984	6849	158
	PEAK	46.	5.	0.	0.	5.	35.	1.
JUL	USE	8243	1230	0	0	895	6227	144
	PEAK	46.	5.	0.	0.	5.	35.	1.
AUG	USE	8690	1299	0	0	1029	7161	166
	PEAK	46.	5.	0.	0.	5.	35.	1.
SEP	USE	6394	1048	0	0	895	6227	144
	PEAK	42.	5.	0.	0.	5.	35.	1.
OCT	USE	3091	687	0	0	984	6849	158
	PEAK	30.	4.	0.	0.	5.	35.	1.
NOV	USE	3254	695	0	0	940	6538	151
	PEAK	29.	4.	0.	0.	5.	35.	1.
DEC	USE	1056	410	0	3	895	6227	144
	PEAK	19.	2.	0.	0.	5.	35.	1.
TOTAL	USE	52035	9602	23	16	11365	79080	1828
	PEAK	46.	5.	1.	0.	5.	35.	1.

AUTOMATED PROCEDURES FOR ENGINEERING CONSULTANTS, INC.

HEATING/COOLING LOAD CALCULATION
(PROGRAM HCCL-I)

CAMP LEJEUNE
CAST FACILITY

PROJECT NUMBER 87N018
ENGINEER WPC
DATE 10/22/87

C 46

DRY BULB TEMPERATURE PROFILES

HOUR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC
1	31.0	38.0	49.0	59.0	71.0	74.0	74.0	74.0	71.0	63.0	53.0	43.
2	31.0	38.0	49.0	59.0	69.0	73.0	73.0	73.0	70.0	62.0	53.0	43.
3	30.0	37.0	48.0	58.0	69.0	73.0	73.0	73.0	70.0	62.0	52.0	42.
4	29.0	36.0	47.0	57.0	68.0	72.0	72.0	72.0	69.0	61.0	51.0	41.
5	29.0	36.0	47.0	57.0	67.0	71.0	71.0	71.0	68.0	60.0	51.0	41.
6	29.0	36.0	47.0	57.0	67.0	71.0	71.0	71.0	68.0	60.0	51.0	41.
7	30.0	37.0	48.0	58.0	67.0	71.0	71.0	71.0	68.0	60.0	52.0	42.
8	32.0	39.0	50.0	60.0	68.0	72.0	72.0	72.0	69.0	61.0	54.0	44.
9	34.0	41.0	52.0	62.0	70.0	74.0	74.0	74.0	71.0	63.0	56.0	46.
10	37.0	44.0	55.0	65.0	72.0	76.0	76.0	76.0	73.0	65.0	59.0	49.
11	41.0	48.0	58.0	69.0	75.0	79.0	79.0	79.0	76.0	68.0	63.0	53.
12	44.0	52.0	63.0	73.0	79.0	83.0	83.0	83.0	80.0	72.0	66.0	56.
13	46.0	54.0	65.0	75.0	83.0	86.0	86.0	86.0	83.0	75.0	68.0	58.
14	47.0	55.0	66.0	76.0	85.0	88.0	88.0	88.0	85.0	77.0	69.0	59.
15	48.0	56.0	67.0	77.0	86.0	90.0	90.0	90.0	86.0	78.0	70.0	60.
16	47.0	55.0	66.0	76.0	87.0	90.0	90.0	90.0	87.0	79.0	69.0	59.
17	46.0	54.0	65.0	75.0	86.0	90.0	90.0	90.0	86.0	78.0	68.0	58.
18	44.0	52.0	63.0	73.0	85.0	88.0	88.0	88.0	85.0	77.0	66.0	56.
19	42.0	50.0	61.0	71.0	83.0	86.0	86.0	86.0	83.0	75.0	64.0	54.
20	39.0	47.0	58.0	68.0	81.0	84.0	84.0	84.0	81.0	73.0	61.0	51.
21	37.0	45.0	56.0	66.0	78.0	81.0	81.0	81.0	78.0	70.0	59.0	49.
22	35.0	43.0	54.0	64.0	76.0	79.0	79.0	79.0	76.0	68.0	57.0	47.
23	34.0	42.0	53.0	63.0	74.0	77.0	77.0	77.0	76.0	66.0	56.0	46.
24	32.0	40.0	51.0	61.0	73.0	76.0	76.0	76.0	73.0	65.0	54.0	44.

WET BULB TEMPERATURE PROFILES

HOUR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC
1	29.3	33.4	41.9	52.6	63.1	70.6	70.6	70.6	64.4	55.7	50.0	38.
2	29.3	33.4	41.9	52.6	63.1	70.6	70.6	70.6	64.4	55.7	50.0	38.
3	28.7	32.8	41.4	52.2	63.1	70.6	70.6	70.6	64.4	55.7	49.6	38.
4	28.1	32.0	40.8	51.8	62.7	70.3	70.3	70.3	64.1	55.3	49.2	37.
5	28.1	32.0	40.8	51.8	62.4	70.0	70.0	70.0	63.7	54.9	49.2	37.
6	28.1	32.0	40.8	51.8	62.4	70.0	70.0	70.0	63.7	54.9	49.2	37.
7	28.7	32.8	41.4	52.2	63.1	70.7	70.7	70.7	64.5	55.7	49.6	38.
8	31.2	35.3	43.5	54.0	64.2	71.0	71.0	71.0	65.5	56.1	51.4	39.
9	32.3	36.4	44.5	54.8	64.9	72.2	72.2	72.2	66.2	56.9	52.3	41.
10	34.2	38.1	45.9	56.0	65.5	73.5	73.5	73.5	66.8	58.5	53.6	43.
11	36.4	41.4	48.3	58.4	67.2	74.9	74.9	74.9	68.4	59.6	56.1	45.
12	38.1	43.4	50.6	59.9	69.1	76.6	76.6	76.6	70.3	61.8	57.2	47.
13	40.3	44.4	51.4	60.6	70.9	78.0	78.0	78.0	71.8	63.6	58.0	48.
14	40.8	44.9	51.9	60.9	72.1	78.5	78.5	78.5	73.0	64.3	58.4	48.
15	41.4	45.3	52.3	61.3	72.4	78.7	78.7	78.7	73.2	64.6	58.7	49.
16	40.8	44.9	51.9	60.9	72.7	79.0	79.0	79.0	73.5	65.0	58.4	48.
17	40.3	44.4	51.4	60.6	72.4	78.7	78.7	78.7	73.2	64.6	58.0	48.
18	39.3	42.3	49.6	59.1	72.1	78.5	78.5	78.5	73.0	64.3	56.4	46.
19	38.2	41.2	48.7	58.3	70.9	77.4	77.4	77.4	71.8	63.6	55.6	45.
20	36.5	38.5	46.3	56.3	69.7	76.9	76.9	76.9	70.6	62.2	53.5	44.
21	34.2	37.4	45.3	55.5	68.1	75.5	75.5	75.5	69.0	61.1	52.6	41.
22	31.5	36.3	44.4	54.7	66.8	74.3	74.3	74.3	67.8	59.6	51.8	40.
23	30.9	35.7	43.9	54.3	66.2	73.7	73.7	73.7	67.1	58.9	51.4	40.
24	29.8	34.6	42.9	53.5	65.8	72.8	72.8	72.8	66.8	57.7	50.5	39.

OUTPUT OPTIONS

A	B	C	D	E
1	0	0	0	0

PROJECT DESCRIPTION DATA

LAT.	ELEV.	PG	CF	-COOLING MONTHS CALC.-- J	F	M	A	M	J	J	A	S	O	N	D	----DAYLIGHT SAVING---- J	F	M	A	M	J	J	A	S	O	N	D
34.1	24.	0.20	0.95	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0

BUILDING DESIGN DATA

SPECIFIED HOURS 7 8 9 10 11 12 13 14 15 16 17 18

HR. AVG	----HEATING DESIGN---- -OUTSIDE-- DB	WB	--INSIDE-- DB	RH	COOLING DESIGN ----INSIDE---- DB	RH	MASTER WALL HEIGHT	MASTER CEILING HEIGHT	NO. OF EXP	BLDG HP
4	23.0	14.0	68.0	50.0	78.0	50.0	13.5	9.0	4	0.

EXPOSURE DATA

EXP. INDEX	1	2	3	4
WALL AZIM.	150.	-30.	-120.	60.
WALL TILT	90.	90.	90.	90.

----------P E O P L E---------- --BTU/HR-- SEN.	LAT.	PFL	SF/ PERSON	MAX NO. PEOPLE	------LIGHTS------ WATTS /SF	PFL	PCT TO RA	-----INFILTRATION----- --AC/HR--- SUMR	WNTR	-DIV FCTR- SUMR	WNTR
255.	255.	1	75.	0.	3.00	1	20.	0.0	0.0	1.00	1.00

-----VENTILATION------ PCT FAN	CFM/ PERSON	A.C. /HR.	CFM /SF	--------DIVERSITY FACTORS--------- ------ZONE------ LGHT	PEOP	APPL	----BUILDING---- LGHT	PEOP	APPL	COOL DT	MIN. CFM/ SF
0.	5.	0.0	0.00	1.00	1.00	1.00	1.00	1.00	1.00	20.0	0.00

ZONE DESCRIPTION DATA

ZONE ID	INSIDE DESIGN COOLING DB	INSIDE DESIGN COOLING RH	INSIDE DESIGN HEATING DB	INSIDE DESIGN HEATING RH	VENTILATION FIXED CFM	VENTILATION PCT FAN	VENTILATION CFM/ PERSON	VENTILATION A.C. /HR.	VENTILATION CFM /SF	COOL DT	MIN. CFM/ SF
1	78.0	50.0	68.0	50.0	0.	0.	5.	0.0	0.00	20.0	0.00
2	78.0	50.0	68.0	50.0	0.	0.	5.	0.0	0.00	20.0	0.00

ZONE DESCRIPTION DATA(CONTINUE)

ZONE ID	DIVERSITY FACTOR LGHT	DIVERSITY FACTOR PEOP	DIVERSITY FACTOR APPL	ZONE HP	ZONE DESCRIPTION
1	1.00	0.80	1.00	10.0	BUILDING
2	1.00	1.00	1.00	0.0	MECH. ROOM

INTERNAL LOAD PROFILES(PERCENT OF PEAK VALUE)

PROFILE NO. 1

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
LOAD	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
HOUR	13	14	15	16	17	18	19	20	21	22	23	24
LOAD	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

EXPOSURE DATA

WALLS

TYPE	DECR. FACTOR	TIME LAG	COLOR FACTR	--U VALUES--- SUMMER	WINTER	BELOW GRADE	PCT TO RA	DESCRIPTION
1	0.45	4.	0.22	0.10	0.10	0.	20.	WALL

ROOFS

TYPE	DECR. FACTOR	TIME LAG	COLOR FACTR	--U VALUES--- SUMMER	WINTER	PCT TO RA	DESCRIPTION
1	0.68	4.	0.30	0.04	0.04	30.	ROOF

WINDOWS

TYPE	--DIMENSION-- HEIGHT	LENGTH	--U VALUES--- SUMMER	WINTER	SHADING COEFF.	INSIDE SHADE	DESCRIPTION
1	4.0	4.0	0.55	0.55	0.60	0	TYP. WINDOW
2	4.0	2.0	0.55	0.55	0.60	0	1/2 WINDOW
3	8.0	5.0	0.55	0.55	0.60	0	GLASS BLOCK
4	7.0	11.0	0.80	0.80	0.90	0	GLASS AT DOOR

WINDOWS(CONTINUE)

TYPE	--------OVERHANG--------					-----LEFT FIN------				-----RIGHT FIN-----			
	DPTH	ABT	BWL	BWR	VPD	DPTH	AWT	BWR	BAB	DPTH	AWT	BWL	BAB
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ROOM	MASTER	ZONE	ROOM	MASTER	ZONE	ROOM	MASTER	ZONE	ROOM	MASTER	ZONE
101	101	1	102	101	1	103	103	1	104	104	1
105	105	1	106	106	1	107	107	1	108	108	1
109	109	1	110	110	1	111	111	1	112	112	1
113	115	1	114	114	1	115	115	1	116	116	1
117	117	1	118	118	1	119	119	1	120	120	1
121	121	1	122	122	1	123	122	1	124	124	1
125	125	1	126	126	1	127	127	1	128	125	1
129	129	1	132	132	1	133	132	1	134	134	1
136	136	1	137	137	1	138	138	1	139	139	1
140	140	1	143	143	1	144	144	1	141	141	1
147	147	1	145	145	2						

TOTAL NUMBER OF MASTER ROOMS = 37
TOTAL NUMBER OF ROOMS = 42
TOTAL NUMBER OF ZONES = 2

ARCH

C 53

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 101 BN/BTRY FDC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	11	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	36.		103.	161.		69.
ROOF SOLAR	204.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2805.	2805.			2805.	
APPLIANCES	550.	0.			550.	
TOTALS	4640.	2805.	364.	161.	4399.	69.
TOTAL HEAT	7445.(TO ROOM ONLY)			161.(TO ROOM ONLY)		
BTU/SF(CHECK)	58.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -4238.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 211. CFM SENSIBLE HEAT RATIO = 0.62
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 0.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.65 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 11.00 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 101
102

ROOM 103 BN/BTRY FDC INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	11	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	APPLIANCES LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	THIRD SHADE AZIM	THIRD SHADE ALT	FOURTH SHADE AZIM	FOURTH SHADE ALT
4	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	97.		54.	437.		109.
WALL SOLAR	120.		**			
ROOF TRANS.	36.		96.	161.		69.
ROOF SOLAR	188.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2805.	2805.			2805.	
APPLIANCES	550.	0.			550.	
TOTALS	4841.	2805.	412.	599.	4399.	178.
TOTAL HEAT	7646.(TO ROOM ONLY)			599.(TO ROOM ONLY)		
BTU/SF(CHECK)	60.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3801.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 220. CFM SENSIBLE HEAT RATIO = 0.63
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.5 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.72 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 11.48 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 103
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 104 CSSE — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	10	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	APPLIANCES LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	AZIM	ALT
4	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	97.		54.	437.		109.
WALL SOLAR	120.		**			
ROOF TRANS.	36.		96.	161.		69.
ROOF SOLAR	188.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2550.	2550.			2550.	
APPLIANCES	550.	0.			550.	
TOTALS	4586.	2550.	412.	599.	4144.	178.
TOTAL HEAT	7136. (TO ROOM ONLY)			599. (TO ROOM ONLY)		
BTU/SF(CHECK)	56.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3546.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 209. CFM SENSIBLE HEAT RATIO = 0.64
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.63 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.87 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 104
NONE

C 56

ROOM 105 MAGTF COC INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR PARTITION TYP	FLR TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	22	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
4	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	194.		109.	875.		219.
WALL SOLAR	241.		**			
ROOF TRANS.	72.		192.	323.		138.
ROOF SOLAR	377.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	5610.	5610.			5610.	
APPLIANCES	0.	0.			0.	
TOTALS	8583.	5610.	823.	1197.	7699.	357.
TOTAL HEAT	14193. (TO ROOM ONLY)			1197. (TO ROOM ONLY)		
BTU/SF(CHECK)	55.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -6502.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 391. CFM SENSIBLE HEAT RATIO = 0.60
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.8 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.53 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 10.17 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 105
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 106 INF REG COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	12	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
4	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	97.		54.	437.		109.
WALL SOLAR	120.		**			
ROOF TRANS.	36.		96.	161.		69.
ROOF SOLAR	188.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	3060.	3060.			3060.	
APPLIANCES	0.	0.			0.	
TOTALS	4546.	3060.	412.	599.	4104.	178.
TOTAL HEAT	7606. (TO ROOM ONLY)			599. (TO ROOM ONLY)		
BTU/SF(CHECK)	59.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3506.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 207. CFM SENSIBLE HEAT RATIO = 0.60
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.62 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.78 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 106
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 107 ACE — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	10	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
4	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	97.		54.	437.		109.
WALL SOLAR	120.		**			
ROOF TRANS.	36.		96.	161.		69.
ROOF SOLAR	188.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2550.	2550.			2550.	
APPLIANCES	0.	0.			0.	
TOTALS	4036.	2550.	412.	599.	3594.	178.
TOTAL HEAT	6586. (TO ROOM ONLY)			599. (TO ROOM ONLY)		
BTU/SF(CHECK)	51.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -2996.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 184. CFM SENSIBLE HEAT RATIO = 0.61
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.0 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.44 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 9.57 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 107
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 108 DASC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	9	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. SUMMR	CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
4	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	97.		54.	437.		109.
WALL SOLAR	120.		**			
ROOF TRANS.	36.		96.	161.		69.
ROOF SOLAR	188.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2295.	2295.			2295.	
APPLIANCES	550.	0.			550.	
TOTALS	4331.	2295.	412.	599.	3889.	178.
TOTAL HEAT	6626.(TO ROOM ONLY)			599.(TO ROOM ONLY)		
BTU/SF(CHECK)	52.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3291.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 197. CFM SENSIBLE HEAT RATIO = 0.65
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.8 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.54 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.27 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 108
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 109 INF BN COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	19	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	5.0	1	68.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	443.		187.	1993.		498.
WALL SOLAR	307.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	4845.	4845.			4845.	
APPLIANCES	0.	0.			0.	
TOTALS	8164.	4845.	916.	2315.	6934.	636.

TOTAL HEAT	13009. (TO ROOM ONLY)	2315. (TO ROOM ONLY)
BTU/SF(CHECK)	51.	9.

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -4619.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 372. CFM SENSIBLE HEAT RATIO = 0.63
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 5.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.45 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 9.68 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 109
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 110 INF BN COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	19	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	17.0	1	230.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	5.0	1	68.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	238.		90.	1069.		267.
WALL SOLAR	121.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	4845.	4845.			4845.	
APPLIANCES	0.	0.			0.	
TOTALS	7773.	4845.	818.	1392.	6934.	406.
TOTAL HEAT	12618. (TO ROOM ONLY)			1392. (TO ROOM ONLY)		
BTU/SF(CHECK)	49.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -5542.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 354. CFM SENSIBLE HEAT RATIO = 0.62
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.38 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 9.21 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 110
NONE

ROOM 111 ELEC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	11.5	13.5	9.0	0	552.	1	184	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. SUMMR	CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	19.0	1	257.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	2.0	1	27.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	2.0	1	27.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	248.		90.	1118.		279.
WALL SOLAR	111.		**			
ROOF TRANS.	52.		148.	232.		99.
ROOF SOLAR	294.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1501.		375.		1501.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	2206.	0.	613.	1350.	1501.	379.
TOTAL HEAT	2206. (TO ROOM ONLY)			1350. (TO ROOM ONLY)		
BTU/SF(CHECK)	12.			7.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -152.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 100. CFM SENSIBLE HEAT RATIO = 1.00
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 12.2 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 184.SF CFM/SF = 0.55 MIN. CFM/SF = 0.00
ROOM VOLUME = 1656.CF AC/HR = 3.64 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 111
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 112 EWC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	3	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	2000.	0.	0.	1	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	765.	765.			765.	
APPLIANCES	2000.	0.			2000.	
TOTALS	5334.	765.	728.	323.	4854.	138.
TOTAL HEAT	6099. (TO ROOM ONLY)			323. (TO ROOM ONLY)		
BTU/SF(CHECK)	24.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -4531.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 243. CFM — SENSIBLE HEAT RATIO = 0.87
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 1.2 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF — CFM/SF = 0.95 — MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF — AC/HR = 6.32 — MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 112
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 114 INF BN COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	19	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	17.0	1	230.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	6.0	1	81.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	248.		90.	1118.		279.
WALL SOLAR	112.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	4845.	4845.			4845.	
APPLIANCES	0.	0.			0.	
TOTALS	7775.	4845.	818.	1440.	6934.	418.
TOTAL HEAT	12620.(TO ROOM ONLY)			1440.(TO ROOM ONLY)		
BTU/SF(CHECK)	49.			6.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -5494.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 354. CFM SENSIBLE HEAT RATIO = 0.62
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.38 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 9.22 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 114
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 115 MAW/TACC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	---ROOF---- TYP	AREA	RA	FLR TYP	PARTITION TYP	HR. LGTH	AVG	--AC/HR-- MIN.	OSA
16.0	8.0	13.5	9.0	10	384.	1	128	30	0	0	0.0	4	0.0	0.0

---PEOPLE--- SEN.	LAT.	PF	-----LIGHTS---- W/SF	PF	RA	INC	--------APPLIANCES-------- SENSIBLE	RAD	LATENT	PF	-INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	-------COOLING LOAD------- SENSIBLE	LATENT	TO RA	-------HEATING LOAD-------- LOSSES	INT. GAIN	TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	36.		103.	161.		69.
ROOF SOLAR	204.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2550.	2550.			2550.	
APPLIANCES	0.	0.			0.	
TOTALS	3835.	2550.	364.	161.	3594.	69.
TOTAL HEAT	6385.(TO ROOM ONLY)			161.(TO ROOM ONLY)		
BTU/SF(CHECK)	50.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3433.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 175. CFM SENSIBLE HEAT RATIO = 0.60
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 0.8 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.36 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 9.09 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 115
113

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 116 DIV COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	22	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	389.		150.	1750.		437.
WALL SOLAR	210.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	5610.	5610.			5610.	
APPLIANCES	0.	0.			0.	
TOTALS	8778.	5610.	878.	2072.	7699.	576.
TOTAL HEAT	14388. (TO ROOM ONLY)			2072. (TO ROOM ONLY)		
BTU/SF(CHECK)	56.			8.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -5627.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 400. CFM SENSIBLE HEAT RATIO = 0.61
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 4.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.56 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 10.41 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 116
NONE

C 67

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 117 DASC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	---ROOF---- TYP	AREA	RA	FLR TYP	PARTITION TYP	HR. LGTH	--AC/HR-- AVG	MIN.	OSA
16.0	8.0	13.5	9.0	9	384.	1	128	30	0	0	0.0	4	0.0	0.0

---PEOPLE--- SEN.	LAT.	PF	-----LIGHTS---- W/SF	PF	RA	INC	--------APPLIANCES-------- SENSIBLE	RAD	LATENT	PF	-INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	-----WALL---- TYP	AREA	RA	--WINDOW-- TYP	NO.	RA	---FIRST SHADE--- AZIM	ALT	AZIM	ALT	---SECOND SHADE-- AZIM	ALT	AZIM	ALT
3	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 4 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	-------COOLING LOAD------- SENSIBLE	LATENT	TO RA	-------HEATING LOAD-------- LOSSES	INT. GAIN	TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	117.		51.	437.		109.
WALL SOLAR	88.		**			
ROOF TRANS.	43.		88.	161.		69.
ROOF SOLAR	162.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2295.	2295.			2295.	
APPLIANCES	550.	0.			550.	
TOTALS	4299.	2295.	400.	599.	3889.	178.
TOTAL HEAT	6594.(TO ROOM ONLY)			599.(TO ROOM ONLY)		
BTU/SF(CHECK)	52.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3291.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 196. CFM SENSIBLE HEAT RATIO = 0.65
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.8 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.53 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.19 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 117
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 118 MAW/TACC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	10	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 4 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	117.		51.	437.		109.
WALL SOLAR	88.		**			
ROOF TRANS.	43.		88.	161.		69.
ROOF SOLAR	162.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2550.	2550.			2550.	
APPLIANCES	0.	0.			0.	
TOTALS	4004.	2550.	400.	599.	3594.	178.
TOTAL HEAT	6554.(TO ROOM ONLY)			599.(TO ROOM ONLY)		
BTU/SF(CHECK)	51.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -2996.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 182. CFM SENSIBLE HEAT RATIO = 0.61
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.0 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.42 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 9.49 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 118
NONE

ROOM 119 INF REG CCC INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	12	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 4 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	117.		51.	437.		109.
WALL SOLAR	88.		**			
ROOF TRANS.	43.		88.	161.		69.
ROOF SOLAR	162.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	3060.	3060.			3060.	
APPLIANCES	0.	0.			0.	
TOTALS	4514.	3060.	400.	599.	4104.	178.
TOTAL HEAT	7574. (TO ROOM ONLY)			599. (TO ROOM ONLY)		
BTU/SF(CHECK)	59.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3506.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 206. CFM SENSIBLE HEAT RATIO = 0.60
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.61 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.70 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 119
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 120 INF BN COC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	19	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	18.0	1	243.	20.	0	0	0.	0. 0.	0. 0.	0. 0.	0. 0.

PEAK LOAD OCCURS AT 4 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	233.		102.	875.		219.
WALL SOLAR	177.		**			
ROOF TRANS.	86.		176.	323.		138.
ROOF SOLAR	324.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	4845.	4845.			4845.	
APPLIANCES	0.	0.			0.	
TOTALS	7754.	4845.	800.	1197.	6934.	357.
TOTAL HEAT	12599.	(TO ROOM ONLY)		1197.	(TO ROOM ONLY)	
BTU/SF(CHECK)	49.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -5737.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 353. CFM SENSIBLE HEAT RATIO = 0.62
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.1 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.38 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 9.19 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 120
NONE

C 71

ROOM 121 CSSE INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	10	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	THIRD SHADE AZIM	THIRD SHADE ALT
3	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 4 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	117.		51.	437.		109.
WALL SOLAR	88.		**			
ROOF TRANS.	43.		88.	161.		69.
ROOF SOLAR	162.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2550.	2550.			2550.	
APPLIANCES	550.	0.			550.	
TOTALS	4554.	2550.	400.	599.	4144.	178.
TOTAL HEAT	7104. (TO ROOM ONLY)			599. (TO ROOM ONLY)		
BTU/SF(CHECK)	56.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3546.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 207. CFM SENSIBLE HEAT RATIO = 0.64
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.62 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 10.80 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 121
NONE

C 12

ROOM 122 BN/BTRY FDC INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	11	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	9.0	1	122.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 4 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	117.		51.	437.		109.
WALL SOLAR	88.		**			
ROOF TRANS.	43.		88.	161.		69.
ROOF SOLAR	162.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2805.	2805.			2805.	
APPLIANCES	550.	0.			550.	
TOTALS	4809.	2805.	400.	599.	4399.	178.
TOTAL HEAT	7614.(TO ROOM ONLY)			599.(TO ROOM ONLY)		
BTU/SF(CHECK)	59.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3801.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 219. CFM SENSIBLE HEAT RATIO = 0.63
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.5 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 1.71 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 11.40 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 122
123

C 73

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 124 BN/BTRY FDC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	11	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	550.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	10.0	1	135.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	6.0	1	81.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 3 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	207.		103.	778.		194.
WALL SOLAR	206.		**			
ROOF TRANS.	43.		73.	161.		69.
ROOF SOLAR	127.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	2805.	2805.			2805.	
APPLIANCES	550.	0.			550.	
TOTALS	4983.	2805.	437.	939.	4399.	264.
TOTAL HEAT	7788.(TO ROOM ONLY)			939.(TO ROOM ONLY)		
BTU/SF(CHECK)	61.			7.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3461.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 227. CFM — SENSIBLE HEAT RATIO = 0.64
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.8 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF — CFM/SF = 1.77 — MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF — AC/HR = 11.81 — MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 124
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 125 ARTY REG/BN/FDC — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	---ROOF---- TYP	AREA	RA	FLR TYP	PARTITION TYP	HR. LGTH	AVG	--AC/HR-- MIN.	OSA
16.0	16.0	13.5	9.0	21	768.	1	256	30	0	0	0.0	4	0.0	0.0

---PEOPLE--- SEN.	LAT.	PF	-----LIGHTS---- W/SF	PF	RA	INC	--------APPLIANCES-------- SENSIBLE	RAD	LATENT	PF	-INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	1100.	0.	0.	1	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	-------COOLING LOAD------- SENSIBLE	LATENT	TO RA	-------HEATING LOAD-------- LOSSES	INT. GAIN	TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	5355.	5355.			5355.	
APPLIANCES	1100.	0.			1100.	
TOTALS	9024.	5355.	728.	323.	8544.	138.
TOTAL HEAT	14379.	(TO ROOM ONLY)		323.	(TO ROOM ONLY)	
BTU/SF(CHECK)	56.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -8221.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 411. CFM SENSIBLE HEAT RATIO = 0.63
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 0.7 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.60 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 10.70 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 125
128

C 75

ROOM 126 CATF INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	16.0	13.5	9.0	14	768.	1	256	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	1100.	0.	0.	1	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	72.		206.	323.		138.
ROOF SOLAR	409.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2089.		522.		2089.	
PEOPLE	3570.	3570.			3570.	
APPLIANCES	1100.	0.			1100.	
TOTALS	7239.	3570.	728.	323.	6759.	138.
TOTAL HEAT	10809.(TO ROOM ONLY)			323.(TO ROOM ONLY)		
BTU/SF(CHECK)	42.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -6436.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 330. CFM SENSIBLE HEAT RATIO = 0.67
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 0.9 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 256.SF CFM/SF = 1.29 MIN. CFM/SF = 0.00
ROOM VOLUME = 2304.CF AC/HR = 8.58 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 126
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 127 TECG/OCE — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
14.0	11.0	13.5	9.0	4	462.	1	154	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. SUMMR	CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	1100.	0.	0.	1	0.	0.	0

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	0.		0.
WALL SOLAR	0.		**			
ROOF TRANS.	43.		124.	194.		83.
ROOF SOLAR	246.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1257.		314.		1257.	
PEOPLE	1020.	1020.			1020.	
APPLIANCES	1100.	0.			1100.	
TOTALS	3666.	1020.	438.	194.	3377.	83.
TOTAL HEAT	4686.(TO ROOM ONLY)			194.(TO ROOM ONLY)		
BTU/SF(CHECK)	30.			1.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -3183.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 167. CFM SENSIBLE HEAT RATIO = 0.78
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 1.1 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 154.SF CFM/SF = 1.08 MIN. CFM/SF = 0.00
ROOM VOLUME = 1386.CF AC/HR = 7.22 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 127
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 129 TERRAIN BOARD RM — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
51.0	50.0	13.5	18.0	72	7650.	1	2550	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	92124.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	0.0	1	300.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.0	1	300.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.0	1	204.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	0.0	1	204.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	806.		340.	3629.		907.
WALL SOLAR	552.		**			
ROOF TRANS.	714.		2050.	3213.		1377.
ROOF SOLAR	4070.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	20808.		5202.		20808.	
PEOPLE	18360.	18360.			18360.	
APPLIANCES	92124.	0.			92124.	
TOTALS	137435.	18360.	7592.	6842.	131292.	2284.
TOTAL HEAT	155795. (TO ROOM ONLY)			6842. (TO ROOM ONLY)		
BTU/SF(CHECK)	61.			3.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -124450.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 6256. CFM SENSIBLE HEAT RATIO = 0.88
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 1.0 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 2550.SF CFM/SF = 2.45 MIN. CFM/SF = 0.00
ROOM VOLUME = 45900.CF AC/HR = 8.18 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 129
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 132 CORR. — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
89.0	5.0	13.5	9.0	0	1335.	1	445	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	5.0	1	68.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	54.		18.	243.		61.
WALL SOLAR	19.		**			
ROOF TRANS.	125.		358.	561.		240.
ROOF SOLAR	710.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	3631.		908.		3631.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	4539.	0.	1284.	804.	3631.	301.
TOTAL HEAT	4539. (TO ROOM ONLY)			804. (TO ROOM ONLY)		
BTU/SF(CHECK)	10.			2.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -2827.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 207. CFM SENSIBLE HEAT RATIO = 1.00
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.5 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 445.SF CFM/SF = 0.46 MIN. CFM/SF = 0.00
ROOM VOLUME = 4005.CF AC/HR = 3.10 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 132
133

C 79

ROOM 134 MEN INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
36.0	10.0	13.5	9.0	0	1080.	1	360	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM SUMMR	INFIL. CFM WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	16.0	1	184.	20.	1	2	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	19.0	1	257.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	2.0	1	27.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	5.0	1	68.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	16.0	1	176.	20.	3	1	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 1 PM, OCT. HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	-119.		0.	1782.		
WINDOW SOLAR	8827.		**			
WALL TRANS.	-171.		43.	2560.		640.
WALL SOLAR	342.		**			
ROOF TRANS.	-30.		-15.	454.		194.
ROOF SOLAR	-4.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2938.		734.		2938.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	11783.	0.	763.	4795.	2938.	834.
TOTAL HEAT	11783.(TO ROOM ONLY)			4795.(TO ROOM ONLY)		
BTU/SF(CHECK)	33.			13.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS 1858.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 536. CFM SENSIBLE HEAT RATIO = 1.00
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 8.1 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 360.SF CFM/SF = 1.49 MIN. CFM/SF = 0.00
ROOM VOLUME = 3240.CF AC/HR = 9.93 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 134
NONE

C 80

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 136 OFFICE — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
14.0	8.0	13.5	9.0	1	336.	1	112	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	APPLIANCES LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	9.0	1	90.	20.	1	2	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	176.		0.	792.		
WINDOW SOLAR	1850.		**			
WALL TRANS.	72.		24.	322.		81.
WALL SOLAR	26.		**			
ROOF TRANS.	31.		90.	141.		60.
ROOF SOLAR	179.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	914.		228.		914.	
PEOPLE	255.	255.			255.	
APPLIANCES	0.	0.			0.	
TOTALS	3502.	255.	343.	1255.	1169.	141.
TOTAL HEAT	3757. (TO ROOM ONLY)			1255. (TO ROOM ONLY)		
BTU/SF(CHECK)	34.			11.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS 86.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 159. CFM SENSIBLE HEAT RATIO = 0.93
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 7.2 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 112.SF CFM/SF = 1.42 MIN. CFM/SF = 0.00
ROOM VOLUME = 1008.CF AC/HR = 9.49 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 136
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 137 TACWAR ADMIN — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	8.0	13.5	9.0	2	384.	1	128	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	APPLIANCES LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	5.0	1	36.	20.	1	2	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	5.0	1	60.	20.	2	1	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 12 AM, NOV. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	-264.		0.	990.		
WINDOW SOLAR	5287.		**			
WALL TRANS.	-91.		-4.	342.		85.
WALL SOLAR	76.		**			
ROOF TRANS.	-43.		-29.	161.		69.
ROOF SOLAR	-24.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1044.		261.		1044.	
PEOPLE	510.	510.			510.	
APPLIANCES	0.	0.			0.	
TOTALS	6495.	510.	228.	1493.	1554.	155.
TOTAL HEAT	7005.(TO ROOM ONLY)			1493.(TO ROOM ONLY)		
BTU/SF(CHECK)	55.			12.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -61.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 296. CFM SENSIBLE HEAT RATIO = 0.93
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 4.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 128.SF CFM/SF = 2.31 MIN. CFM/SF = 0.00
ROOM VOLUME = 1152.CF AC/HR = 15.40 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 137
NONE

C82

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 138 OFFICE — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
15.0	9.0	13.5	9.0	2	405.	1	135	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	5.0	1	36.	20.	1	2	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	5.0	1	60.	20.	2	1	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 12 AM, NOV. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	-264.		0.	990.		
WINDOW SOLAR	5287.		**			
WALL TRANS.	-91.		-4.	342.		85.
WALL SOLAR	76.		**			
ROOF TRANS.	-45.		-30.	170.		73.
ROOF SOLAR	-26.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1102.		275.		1102.	
PEOPLE	510.	510.			510.	
APPLIANCES	0.	0.			0.	
TOTALS	6549.	510.	241.	1502.	1612.	158.
TOTAL HEAT	7059.(TO ROOM ONLY)			1502.(TO ROOM ONLY)		
BTU/SF(CHECK)	52.			11.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -109.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 298. CFM SENSIBLE HEAT RATIO = 0.93
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 4.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 135.SF CFM/SF = 2.21 MIN. CFM/SF = 0.00
ROOM VOLUME = 1215.CF AC/HR = 14.72 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 138
NONE

ROOM 139 TACTICAL LIBRARY INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	PARTITION LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
18.0	14.0	13.5	9.0	20	756.	1	252	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. SUMMR	CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	9.0	1	74.	20.	1	3	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	9.0	1	82.	20.	3	1	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	2.0	1	27.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 12 AM, NOV. HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	-581.		0.	2178.		
WINDOW SOLAR	11632.		**			
WALL TRANS.	-175.		-14.	655.		164.
WALL SOLAR	117.		**			
ROOF TRANS.	-85.		-57.	318.		136.
ROOF SOLAR	-48.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	2056.		514.		2056.	
PEOPLE	5100.	5100.			5100.	
APPLIANCES	0.	0.			0.	
TOTALS	18018.	5100.	443.	3151.	7156.	300.
TOTAL HEAT	23118.(TO ROOM ONLY)			3151.(TO ROOM ONLY)		
BTU/SF(CHECK)	92.			13.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -4006.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 820. CFM SENSIBLE HEAT RATIO = 0.78
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 3.5 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 252.SF CFM/SF = 3.25 MIN. CFM/SF = 0.00
ROOM VOLUME = 2268.CF AC/HR = 21.70 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 139
NONE

ROOM 140 WOMEN INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
16.0	9.0	13.5	9.0	0	432.	1	144	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM SUMMR	INFIL. CFM WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	11.0	1	149.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	119.		40.	535.		134.
WALL SOLAR	43.		**			
ROOF TRANS.	40.		116.	181.		78.
ROOF SOLAR	230.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1175.		294.		1175.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	1607.	0.	450.	716.	1175.	211.
TOTAL HEAT	1607. (TO ROOM ONLY)			716. (TO ROOM ONLY)		
BTU/SF(CHECK)	11.			5.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -459.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 73. CFM SENSIBLE HEAT RATIO = 1.00
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 8.9 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 144.SF CFM/SF = 0.51 MIN. CFM/SF = 0.00
ROOM VOLUME = 1296.CF AC/HR = 3.39 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 140
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 141 CORR. ENTRY — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
141.0	6.0	13.5	9.0	0	2538.	1	846	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
3	6.0	1	4.	20.	4	1	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	6.0	1	4.	20.	4	1	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 5 PM, SEPT — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	986.		0.	5544.		
WINDOW SOLAR	15094.		**			
WALL TRANS.	5.		2.	29.		7.
WALL SOLAR	3.		**			
ROOF TRANS.	190.		509.	1066.		457.
ROOF SOLAR	999.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	6903.		1726.		6903.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	24180.	0.	2237.	6639.	6903.	464.
TOTAL HEAT	24180. (TO ROOM ONLY)			6639. (TO ROOM ONLY)		
BTU/SF(CHECK)	29.			8.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -265.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 1101. CFM SENSIBLE HEAT RATIO = 1.00
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 5.5 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 846.SF CFM/SF = 1.30 MIN. CFM/SF = 0.00
ROOM VOLUME = 7614.CF AC/HR = 8.67 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 141
NONE

C 86

ROOM 143 CLASSROOM INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
32.0	25.0	13.5	9.0	63	2400.	1	800	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	10.0	1	135.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	30.0	1	405.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, JUNE HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	432.		187.	1944.		486.
WALL SOLAR	315.		**			
ROOF TRANS.	224.		643.	1008.		432.
ROOF SOLAR	1277.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	6528.		1632.		6528.	
PEOPLE	16065.	16065.			16065.	
APPLIANCES	0.	0.			0.	
TOTALS	24841.	16065.	2462.	2952.	22593.	918.
TOTAL HEAT	40906.	(TO ROOM ONLY)		2952.	(TO ROOM ONLY)	
BTU/SF(CHECK)	51.			4.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -19641.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 1131. CFM SENSIBLE HEAT RATIO = 0.61
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.4 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 800.SF CFM/SF = 1.41 MIN. CFM/SF = 0.00
ROOM VOLUME = 7200.CF AC/HR = 9.42 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 143
NONE

C87

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 144 TSFO — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	HR. AVG	AC/HR MIN.	AC/HR OSA
40.0	16.0	13.5	10.0	15	1920.	1	640	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PEOPLE PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	19000.	0.	0.	1	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	6.0	1	81.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	43.0	1	581.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, AUG. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	724.		391.	3256.		814.
WALL SOLAR	842.		**			
ROOF TRANS.	179.		481.	806.		346.
ROOF SOLAR	942.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	5222.		1306.		5222.	
PEOPLE	3825.	3825.			3825.	
APPLIANCES	19000.	0.			19000.	
TOTALS	30734.	3825.	2177.	4063.	28047.	1160.
TOTAL HEAT	34559. (TO ROOM ONLY)			4063. (TO ROOM ONLY)		
BTU/SF(CHECK)	54.			6.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -23985.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 1399. CFM — SENSIBLE HEAT RATIO = 0.89
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 2.6 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 640.SF — CFM/SF = 2.19 — MIN. CFM/SF = 0.00
ROOM VOLUME = 6400.CF — AC/HR = 13.12 — MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 144
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ROOM 145 MECH.ROOM — INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
30.5	20.0	13.5	9.0	0	1830.	1	610	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	LIGHTS PF	LIGHTS RA	LIGHTS INC	APPLIANCES SENSIBLE	APPLIANCES RAD	APPLIANCES LATENT	APPLIANCES PF	INFIL. CFM- SUMMR	INFIL. CFM- WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	1

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
1	33.0	1	446.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	23.0	1	311.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	6.0	1	81.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	4.0	1	54.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 6 PM, DEC. — HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	0.		0.	3208.		802.
WALL SOLAR	0.		**			
ROOF TRANS.	0.		0.	769.		329.
ROOF SOLAR	0.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	0.		0.		0.	
PEOPLE	0.	0.			0.	
APPLIANCES	0.	0.			0.	
TOTALS	0.	0.	0.	3976.	0.	1131.
TOTAL HEAT	0.(TO ROOM ONLY)			3976.(TO ROOM ONLY)		
BTU/SF(CHECK)	0.			7.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS 3976.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

****
* HEATING LOAD CALCULATION ONLY FOR THIS ROOM.
****

REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 610.SF CFM/SF = 0.00 MIN. CFM/SF = 0.00
ROOM VOLUME = 5490.CF AC/HR = 0.00 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 145
NONE

ROOM 147 REAR PROJ. INPUT ECHO AND PEAK LOAD CALCULATION

ROOM LENGTH	ROOM WIDTH	WALL HGHT	CLG. HGHT	NO. PEOP	TOTAL WATTS	ROOF TYP	ROOF AREA	ROOF RA	FLR TYP	PARTITION TYP	HR. LGTH	AC/HR AVG	AC/HR MIN.	AC/HR OSA
15.0	9.0	13.5	9.0	2	405.	1	135	30	0	0	0.0	4	0.0	0.0

PEOPLE SEN.	PEOPLE LAT.	PF	LIGHTS W/SF	PF	RA	INC	APPLIANCES SENSIBLE	RAD	LATENT	PF	INFIL. CFM- SUMMR	WINTR	H -
255.	255.	1	3.0	1	20.	0	0.	0.	0.	0	0.	0.	0

EXP NO.	EXP. LGTH	WALL TYP	WALL AREA	WALL RA	WINDOW TYP	WINDOW NO.	WINDOW RA	FIRST SHADE AZIM	FIRST SHADE ALT	FIRST SHADE AZIM	FIRST SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT	SECOND SHADE AZIM	SECOND SHADE ALT
2	18.0	1	243.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	3.0	1	41.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	3.0	1	41.	20.	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.

PEAK LOAD OCCURS AT 5 PM, AUG. HEATING FOR 23. DB AND 14.0 WB OSA

	COOLING LOAD SENSIBLE	COOLING LOAD LATENT	COOLING LOAD TO RA	HEATING LOAD LOSSES	HEATING LOAD INT. GAIN	HEATING LOAD TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		**			
WALL TRANS.	311.		147.	1166.		292.
WALL SOLAR	279.		**			
ROOF TRANS.	45.		96.	170.		73.
ROOF SOLAR	179.		**			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS	1102.		275.		1102.	
PEOPLE	510.	510.			510.	
APPLIANCES	0.	0.			0.	
TOTALS	2426.	510.	519.	1336.	1612.	364.
TOTAL HEAT	2936.(TO ROOM ONLY)			1336.(TO ROOM ONLY)		
BTU/SF(CHECK)	22.			10.		

** LOAD TO RETURN INCLUDES TRANSMISSION AND SOLAR.

HEAT LOSS LESS INTERNAL GAINS -275.
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.

REQUIRED SUPPLY AIR QUANTITY = 110. CFM SENSIBLE HEAT RATIO = 0.83
INPUT SUPPLY AIR TEMP. DIFF. = 20. F
ACTUAL SUPPLY AIR TEMP. DIFF. = 20. F
REQD. HTG. DT FOR SUPPLY AIR = 11.0 F
REQUIRED OUTSIDE AIR QUANTITY = 0. CFM

ROOM AREA = 135.SF CFM/SF = 0.82 MIN. CFM/SF = 0.00
ROOM VOLUME = 1215.CF AC/HR = 5.45 MIN. AC/HR = 0.00

DUPLICATED ROOMS FOR 147
NONE

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

ZONE 1 BUILDING — PEAK LOAD OCCURS AT 6 PM, JUNE

	-------COOLING LOAD-------			-------HEATING LOAD--------		
	SENSIBLE	LATENT	TO RA	LOSSES	INT. GAIN	TO RA
WINDOW TRANS.	2728.		0.	12276.		
WINDOW SOLAR	18431.		(+)			
WALL TRANS.	6589.		2824.	29651.		7413.
WALL SOLAR	4706.		(+)			
ROOF TRANS.	3343.		9600.	15042.		6447.
ROOF SOLAR	19056.		(+)			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS(*)	97414.		24353.		97414.	
PEOPLE(*)	107712.	107712.			107712.	
APPLIANCES(*)	123024.	0.			123024.	
TOTALS	383003.	107712.	36777.	56969.	328149.	13859.

TOTAL HEAT 490714.(RM ONLY,41.BTU/SF) 56969.(RM ONLY, 5.BTU/SF)
(*)INPUT DIVERSITY APPLIED (+)RA LOAD INCL.TRANS & SOLAR
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.
HEAT FROM 10.0 HORSEPOWER MOTOR 25450.
INFILTRATION AIR QUANTITY = 0. CFM(SUMMER) 0. CFM(WINTER)

VENTILATION AIR(AIR QUANTITY USED FOR VENTILATION LOAD MARKED *)
FIXED CFM INPUT AT ---------- 0. CFM
0.00 PCT. SUPPLY AIR X 19721. CFM = 0. CFM
5.00 CFM/PERSON X 422. PEOPLE = 2112. CFM *
0.00 AIR CHANGES/HR X 131032. CF/60. = 0. CFM
0.00 CFM/SF X 11938. SF = 0. CFM
SUM OF OSA REQD FOR ALL RMS IN THIS ZONE = 0. CFM

VENTILATION LOADS		TOTALS INCL. VENT. AND LOADS TO RA		
COOLING, SENSIBLE	23198.	COOLING, SENSIBLE	468427.	
COOLING, LATENT	88977.	COOLING, LATENT	196689.	
HEATING	104390.	HEATING	175218.	(15. BTU/SF)
HUMIDIFICATION	76345.	HUMIDIFICATION	76345.	(6. BTU/SF)

TOTAL COOLING LOAD(SENSIBLE AND LATENT) = 665116.(56. BTU/SF)
OR 55.43 TONS(215. SF/TON)
ZONE SENSIBLE HEAT RATIO = 0.70
SUPPLY AIR QUANTITIES
SUM OF ROOM PEAKS = 19721. CFM 1.65 CFM/SF 9.03 AC/HR
AT ZONE PEAK = 17435. CFM 1.46 CFM/SF 7.98 AC/HR

LIGHTS INSTALLED IN ZONE = 35814. W, AFTER DIVERSITY = 35814. W
NO. OF PEOPLE IN ZONE = 528., AFTER DIVERSITY = 422.

**********DRAW-THRU VARIABLE VOLUME AHU COIL CALCULATION**********

INPUT FAN HP = 10.0	OUTSIDE AIR	EXHAUST AIR	RELIEF AIR	RETURN AIR	COOLING COIL(0.10BF) ENTERING	LEAVING	SUPPLY AIR
CFM	2112.	0.	2112.	15323.	17435.	17435.	17435.
DB TEMP	88.0	78.0	79.9	79.9	80.9	56.7	58.0
WB TEMP	78.6	65.3	65.9	65.9	67.7	55.6	56.1

COOLING COIL LOAD: 463972.BTUH SENSIBLE 660037.BTUH TOTAL 55.0 TONS
ZONE -----DESIGN------ -----ACTUAL------ 217.SF/TON

ZONE 2 MECH. ROOM PEAK LOAD OCCURS AT 6 PM, DEC.

	COOLING LOAD			HEATING LOAD		
	SENSIBLE	LATENT	TO RA	LOSSES	INT. GAIN	TO RA
WINDOW TRANS.	0.		0.	0.		
WINDOW SOLAR	0.		(+)			
WALL TRANS.	0.		0.	3208.		802.
WALL SOLAR	0.		(+)			
ROOF TRANS.	0.		0.	769.		329.
ROOF SOLAR	0.		(+)			
PARTITION	0.			0.		
FLOOR	0.			0.		
INFILTRATION	0.	0.		0.		
LIGHTS(*)	0.		0.		0.	
PEOPLE(*)	0.	0.			0.	
APPLIANCES(*)	0.	0.			0.	
TOTALS	0.	0.	0.	3976.	0.	1131.
TOTAL HEAT	0.(RM ONLY, 0.BTU/SF)			3976.(RM ONLY, 7.BTU/SF)		

(*)INPUT DIVERSITY APPLIED (+)RA LOAD INCL.TRANS & SOLAR
HUMIDIFICATION LOAD DUE TO INFILTRATION 0.
HEAT FROM 0.0 HORSEPOWER MOTOR 0.
INFILTRATION AIR QUANTITY = 0. CFM(SUMMER) 0. CFM(WINTER)

VENTILATION AIR(AIR QUANTITY USED FOR VENTILATION LOAD MARKED *)

FIXED CFM INPUT AT ----------			=	0. CFM
0.00 PCT. SUPPLY AIR	X	0. CFM	=	0. CFM
5.00 CFM/PERSON	X	0. PEOPLE	=	0. CFM *
0.00 AIR CHANGES/HR	X	5490. CF/60.	=	0. CFM
0.00 CFM/SF	X	610. SF	=	0. CFM
SUM OF OSA REQD FOR ALL RMS IN THIS ZONE			=	0. CFM

VENTILATION LOADS		TOTALS INCL. VENT. AND LOADS TO RA	
COOLING, SENSIBLE	0.	COOLING, SENSIBLE	0.
COOLING, LATENT	0.**	COOLING, LATENT	0.
HEATING	0.	HEATING	5107.(8. BTU/SF)
HUMIDIFICATION	0.	HUMIDIFICATION	0.(0. BTU/SF)

** LATENT LOAD SET TO ZERO. HUMIDITY RATIO OF OSA LESS THAN ROOM AIR.

TOTAL COOLING LOAD(SENSIBLE AND LATENT) = 0.(0. BTU/SF)
OR 0.00 TONS(0. SF/TON)
ZONE SENSIBLE HEAT RATIO = 0.00
SUPPLY AIR QUANTITIES

SUM OF ROOM PEAKS =	0. CFM	0.00 CFM/SF	0.00 AC/HR
AT ZONE PEAK =	0. CFM	0.00 CFM/SF	0.00 AC/HR

LIGHTS INSTALLED IN ZONE = 1830. W, AFTER DIVERSITY = 1830. W
NO. OF PEOPLE IN ZONE = 0., AFTER DIVERSITY = 0.
**********DRAW-THRU VARIABLE VOLUME AHU COIL CALCULATION**********
**EXHAUST CFM(0.)IS GREATER THAN SUPPLY CFM

NEWCOMB & BOYD CONSULTING ENGINEERS — APEC HCCL-I PROGRAM
CAST FACILITY — 87N018 — WPC 10/22/87

BUILDING LOAD — PEAK LOAD OCCURS AT 6 PM, JUNE

	----COOLING LOAD----- SENSIBLE	LATENT	---HEATING LOAD---- LOSSES	INT. GAIN
WINDOW	21159.		12276.	
WALL	11295.		32859.	
ROOF	22399.		15810.	
PARTITION	0.		0.	
FLOOR	0.		0.	
INFILTRATION	0.	0.	0.	
LIGHTS(*)	97414.			97414.
PEOPLE(*)	107712.	107712.		107712.
APPLIANCES(*)	123024.	0.		123024.
TOTALS	383003.	107712.		328149.

TOTAL HEAT 490714.(TO ROOM ONLY) 60945.(TO ROOM ONLY)
BTU/SF(CHECK) 39. 5.
TOTAL LOADS TO RETURN AIR 36777.(COOLING) 14991.(HEATING)
HEAT LOSS LESS INTERNAL GAINS -267204.
HUMIDIFICATION LOAD DUE TO INFILTRATION(*) 0.
HEAT FROM 10.0 HORSEPOWER MOTOR 25450.
INFILTRATION AIR QUANTITY(*) = 0. CFM(SUMMER) 0. CFM(WINTER)
TOTAL VENTILATION AIR REQD. = 2112. CFM
(*) DIVERSITY FACTORS, IF INPUT, APPLIED TO THESE LOADS.

VENTILATION LOADS		TOTALS INCL. VENT. AND LOADS TO RA	
COOLING, SENSIBLE	23198.	COOLING, SENSIBLE	468427.
COOLING, LATENT	88977.	COOLING, LATENT	196689.
HEATING	104390.	HEATING	180326.(14. BTU/SF)
HUMIDIFICATION	76345.	HUMIDIFICATION	76345.(6. BTU/SF)

TOTAL COOLING LOAD(SENSIBLE AND LATENT) = 665116.(53. BTU/SF)
OR 55.43 TONS(226. SF/TON)
BUILDING SENSIBLE HEAT RATIO = 0.70
SUPPLY AIR QUANTITIES
SUM OF ROOM PEAKS = 19721. CFM(A)
AT BUILDING PEAK = 17435. CFM(B)
BUILDING AREA = 12548. CFM/SF(A) = 1.57 CFM/SF(B) = 1.39
BUILDING VOLUME = 136522. AC/HR(A) = 8.67 AC/HR(B) = 7.66
LIGHTS INSTALLED IN BLDG = 37644. W, AFTER DIVERSITY = 37644. W
NO. OF PEOPLE IN BLDG = 528., AFTER DIVERSITY = 422.

OUTSIDE AIR CONDITIONS FOR THE PEAK MONTH

HOUR	7	8	9	10	11	12	13	14	15	16	17	18
DRY BULB	71.0	72.0	74.0	76.0	79.0	83.0	86.0	88.0	90.0	90.0	90.0	88.0
WET BULB	70.7	71.0	72.2	73.5	74.9	76.6	78.0	78.5	78.7	79.0	78.7	78.5
W X 1000.	16.2	16.2	16.7	17.3	17.8	18.4	19.0	19.0	18.7	19.0	18.7	19.0
ENTHALPY	34.7	35.0	36.0	37.2	38.5	40.1	41.5	42.0	42.2	42.5	42.2	42.0

BUILDING EXPOSURE SUMMARY

WALLS	TYPE NUMBER	DESCRIPTION	WALL AREA	PERCENT OF GROSS WALL	PERCENT OF T. ENVELOPE
	1	WALL	9128.	95.54	41.30
			9128.	95.54	41.30

WINDOWS	TYPE NUMBER	DESCRIPTION	WINDOW AREA	PERCENT OF GROSS WALL	PERCENT OF T. ENVELOPE
	1	TYP. WINDOW	176.	1.84	0.80
	2	1/2 WINDOW	16.	0.17	0.07
	3	GLASS BLOCK	80.	0.84	0.36
	4	GLASS AT DOOR	154.	1.61	0.70
			426.	4.46	1.93

ROOFS	TYPE NUMBER	DESCRIPTION	ROOF AREA	PERCENT OF T. ENVELOPE
	1	ROOF	12548.	56.77
			12548.	56.77

GROSS WALL AREA = 9554. SF
TOTAL ENVELOPE(*) = 22102. SF
(*) INCLUDE WALLS, WINDOWS, ROOFS AND FLOORS

ROOM	MASTER	ZONE	ROOM	MASTER	ZONE	ROOM	MASTER	ZONE	ROOM	MASTER	ZONE
101	101	1	102	101	1	103	103	1	104	104	1
105	105	1	106	106	1	107	107	1	108	108	1
109	109	1	110	110	1	111	111	1	112	112	1
113	115	1	114	114	1	115	115	1	116	116	1
117	117	1	118	118	1	119	119	1	120	120	1
121	121	1	122	122	1	123	122	1	124	124	1
125	125	1	126	126	1	127	127	1	128	125	1
129	129	1	132	132	1	133	132	1	134	134	1
136	136	1	137	137	1	138	138	1	139	139	1
140	140	1	143	143	1	144	144	1	141	141	1
147	147	1	145	145	2						

TOTAL NUMBER OF MASTER ROOMS = 37
TOTAL NUMBER OF ROOMS = 42
TOTAL NUMBER OF ZONES = 2

NEWCOMB & BOYD CONSULTING ENGINEERS
CAST FACILITY

87N018

APEC HCCL-I PROGRAM
WPC 10/22/87

ROOM NO.	PEAK MO/HR	SENS. C. LOAD	TOTAL C. LOAD	SENS. RATIO	ROOM CFM	HEATING LOAD	ROOM AREA	CFM /SF	NO. PEOP.	DT HTG.
101	6/18	4640.	7445.	0.62	211.	161.	128.	1.65	11	0.7
103	8/18	4841.	7646.	0.63	220.	599.	128.	1.72	11	2.5
104	8/18	4586.	7136.	0.64	209.	599.	128.	1.63	10	2.6
105	8/18	8583.	14193.	0.60	391.	1197.	256.	1.53	22	2.8
106	8/18	4546.	7606.	0.60	207.	599.	128.	1.62	12	2.6
107	8/18	4036.	6586.	0.61	184.	599.	128.	1.44	10	3.0
108	8/18	4331.	6626.	0.65	197.	599.	128.	1.54	9	2.8
109	6/18	8164.	13009.	0.63	372.	2315.	256.	1.45	19	5.7
110	6/18	7773.	12618.	0.62	354.	1392.	256.	1.38	19	3.6
111	6/18	2206.	2206.	1.00	100.	1350.	184.	0.55	0	12.2
112	6/18	5334.	6099.	0.87	243.	323.	256.	0.95	3	1.2
114	6/18	7775.	12620.	0.62	354.	1440.	256.	1.38	19	3.7
115	6/18	3835.	6385.	0.60	175.	161.	128.	1.36	10	0.8
116	6/18	8778.	14388.	0.61	400.	2072.	256.	1.56	22	4.7
117	6/16	4299.	6594.	0.65	196.	599.	128.	1.53	9	2.8
118	6/16	4004.	6554.	0.61	182.	599.	128.	1.42	10	3.0
119	6/16	4514.	7574.	0.60	206.	599.	128.	1.61	12	2.7
120	6/16	7754.	12599.	0.62	353.	1197.	256.	1.38	19	3.1
121	6/16	4554.	7104.	0.64	207.	599.	128.	1.62	10	2.6
122	6/16	4809.	7614.	0.63	219.	599.	128.	1.71	11	2.5
124	6/15	4983.	7788.	0.64	227.	939.	128.	1.77	11	3.8
125	6/18	9024.	14379.	0.63	411.	323.	256.	1.60	21	0.7
126	6/18	7239.	10809.	0.67	330.	323.	256.	1.29	14	0.9
127	6/18	3666.	4686.	0.78	167.	194.	154.	1.08	4	1.1
129	6/18	137435.	155795.	0.88	6256.	6842.	2550.	2.45	72	1.0
132	6/18	4539.	4539.	1.00	207.	804.	445.	0.46	0	3.5
134	10/13	11783.	11783.	1.00	536.	4795.	360.	1.49	0	8.1
136	6/18	3502.	3757.	0.93	159.	1255.	112.	1.42	1	7.2
137	11/12	6495.	7005.	0.93	296.	1493.	128.	2.31	2	4.6
138	11/12	6549.	7059.	0.93	298.	1502.	135.	2.21	2	4.6
139	11/12	18018.	23118.	0.78	820.	3151.	252.	3.25	20	3.5
140	6/18	1607.	1607.	1.00	73.	716.	144.	0.51	0	8.9
141	9/17	24180.	24180.	1.00	1101.	6639.	846.	1.30	0	5.5
143	6/18	24841.	40906.	0.61	1131.	2952.	800.	1.41	63	2.4
144	8/18	30734.	34559.	0.89	1399.	4063.	640.	2.19	15	2.6
145	12/18	0.	0.	0.00	0.	3976.	610.	0.00	0	0.0
147	8/17	2426.	2936.	0.83	110.	1336.	135.	0.82	2	11.0

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ZONE NO.	PEAK MO/HR	SENS. C. LOAD	TOTAL C. LOAD	TONS REFR.	ZONE CFM PEAK	ZONE CFM SUM RM	HEATING LOAD	ZONE AREA	NO. PEOP.
1	6/18	468427.	665116.	55.4	17435.	19721.	175218.	11938.	422.
2	12/18	0.	0.	0.0	0.	0.	5107.	610.	0.

BUILDING LOAD PEAK LOAD OCCURS AT 6 PM, JUNE

SENS. C. LOAD	TOTAL C. LOAD	TONS REFRIG	BUILDING CFM PEAK	BUILDING CFM SUM RM.	HEATING LOAD	BLDG. AREA	NO. PEOP.
468427.	665116.	55.4	17435.	19721.	180326.	12548.	422.