THE UNIVERSITY OF CHICAGO

WILLIAM ECKHARDT RESEACH CENTER
ENABLING PROJECTS

ACCELERATOR BUILDING SERVER ROOM

BASIS OF DESIGN

15 NOVEMBER 2010

THE UNIVERSITY OF CHICAGO

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SERVER ROOM
BASIS OF DESIGN

1. OVERVIEW

The Accelerator Building will be used as swing space for the Physical Sciences Division during the construction of the new Physical Sciences Molecular Engineering Project. The building will house EFI, Electronics Shop, the University Central Shop and UCEC Engineers and will house a new Server Room.

The Accelerator Building consists of four floors: sub-basement, basement, first and second floors. The sub-basement was design and used as a Cyclotron and bolt pit. This portion of the sub-basement will house the new Server Room. See structural portion of BOD for information on support and framing of required Server Room live load of 250 psf.

The basement level consists of approximately 24,000 SF, of which approximately 10,500 SF will be renovated to accommodate the University Central Shop, UC Shop Engineers and EFI faculty and structural support for a new floor at the first floor level above the UCEC Central Shop.

The first floor consists of approximately 14,000 SF, of which approximately 7200 SF of space will be renovated into office space. An additional 2600 SF of floor area will be added as unocuppied space.

The second floor consists of approximately 3500 SF of office space. Minor renovation work will be needed on this floor as it will remain office space with minimal reconfiguration.

Accelerator Building

2. ARCHITECTURAL OVERVIEW

The new Server Room will accommodate servers for Atlas, Atlas expansion, HEP and LASR. The current servers are located in several buildings on the PSD campus and will be consolidated into a permanent location in the Accelerator Building.

The sub-basement is accessible via two existing stairs and an existing freight elevator. an area of rescue assistance will be provided in a new rated gypsum board enclosure.

To accommodate the new Server Room and its support spaces, structural remediation will be required to accommodate a required live load of 250 PSF (see structural portion of BOD for more detailed information). The sub-basement currently steps down in four levels. A new raised floor (Tate Concore 1250) will be provided to bring the pit area up to the sub-basement level of -9'-0". New steel stairs will be provided to access the original elevation of -8'-4" at exit stair. New guardrails will be provided at new stair.

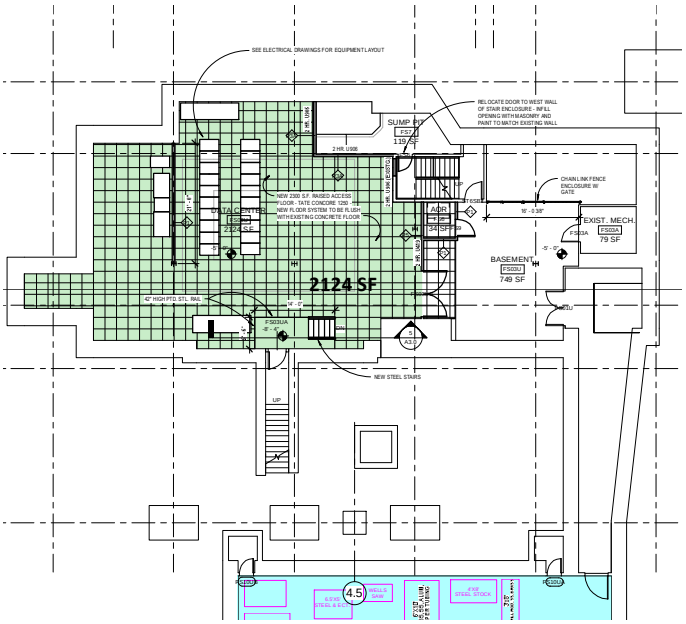
A new acoustic ceiling will be suspended from the existing structure creating a plenum space for return air. A drip pan will be provided at existing hatch over server room. The walls will be rated gypsum board partitions that will extend to underside of structure above. The room will be accessible via new 8'-0"w hollow metal double doors with key card access. An existing second door will provide a second exit from the space. The existing hatch doors will remain, providing access from the high bay above.

The ceiling will be a 2'x2' acoustical tile suspended ceiling with 1'x4' lay-in 3-lamp parabolic troffer fixtures at 80 foot candles. All new lighting will be energy-efficient fluorescent fixtures. The clear ceiling height will be 9'-0".

The finished floor will be static dissipative high pressure laminate.

The space will be designed to comply with the 2010 Chicago Building Code, ADA and ICC/ANSI A117.1 2003.

A protective covering will be provided for refrigerant piping from high-bay floor to top of pipes. See mechanical and electrical sections for detailed Server Room requirements.



Par?al Sub-basement Floor Plan- Server Room

3. STRUCTURAL SYSTEMS

I. STRUCTURAL NARRATIVE

A. Purpose of Study

The purpose of this study is help the Owner establish the Basis of Design and extent of structural modifications required for the University of Chicago Accelerator Building Server Room.

B. Overview

A Cyclotron and Bolt Pit were installed between column lines 2 to 6.7 and between column lines B to C below the basement level as part of the original construction of the Accelerator Building (circa 1947). The pits step down in 4 levels. In approximately 1985 and after the cyclotron had been removed, infill framing was installed at the Basement and Sub-Basement Level. The Server Room will be located at the Sub-Basement Level, elevation -9'-0". The Server Room requires a live load of 250 psf. Structural remediation of the existing Bolt Pit infill framing is required to achieve the design live load. (Refer to Thornton Tomasetti report titled "U of C PSD Cyclotron Pit", dated October 22, 2009, a previous study assessing the infill framing.)

C. Source of Information for Structural Study

This structural study is based on the following existing building architectural and structural drawings for the existing Accelerator Building:

"Accelerator Building", prepared by Schmidt, Garden & Erikson Architects & Engineers, dated May 5, 1947.

Sheet 2	Foundation Plan
Sheet 3	Basement Plan
Sheet 11	Details – Cyclotron Pit
Sheet S-3	Beam Schedule and Misc. Details
Sheet S-5	Foundation Details

"Accelerator Building", prepared by the University of Chicago, Office of Physical Planning and Construction and Harry E. Marshall Ltd, structural Engineers, dated July 1985.

2	Basement Floor Plan
S1	Elevation -9'-0" Floor Framing Plan
S2	Elevation +7'-0" Floor Framing Plan

"Accelerator Bldg", prepared by Guardian Construction Products, Inc. (shop drawings), dated October 1, 1985

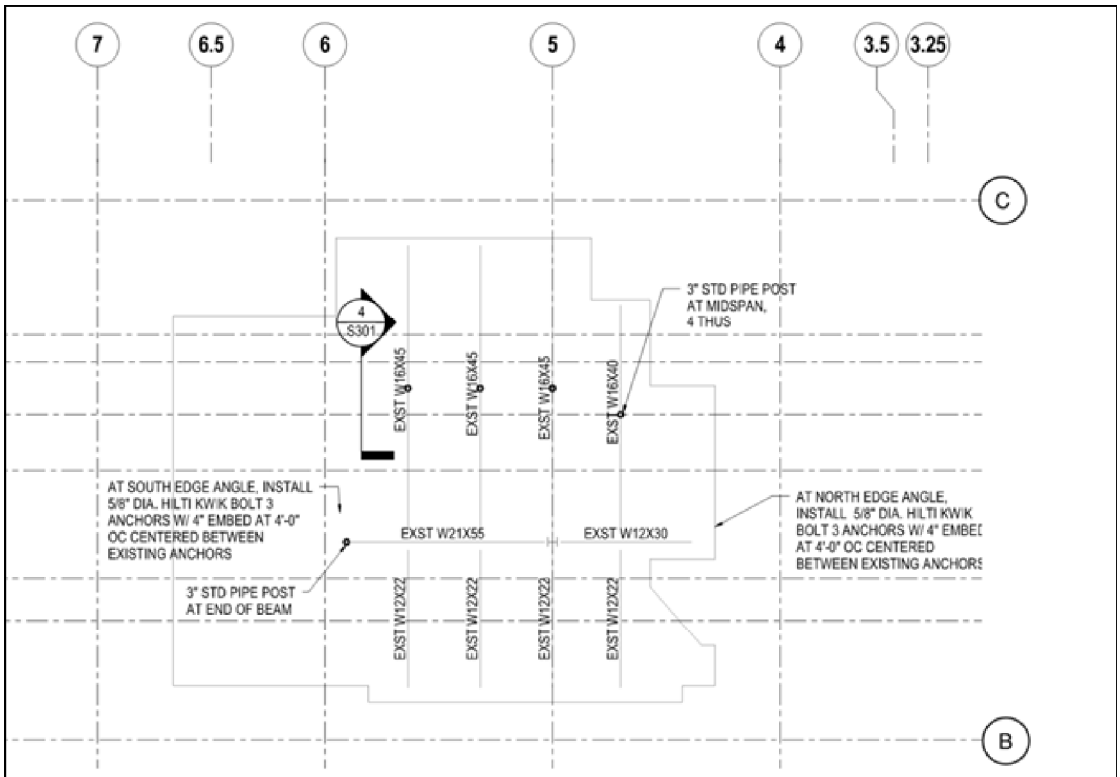
E1, 1- 6

D. **Structural Remediation for Server Room**

Based on loading information provided by AEI, a design live load of 250 psf is warranted for the Server Room. This is a weighted average of equipment weights and aisle loads. Some expansion (wedge) anchor connections and deck edge support angle connections require remediation.

All steel beams are supported off the concrete pit wall at one end. The connection to the concrete is an end plate with expansion anchors. When loaded with the full design load of 250 psf, the existing anchors supporting the W16 and W21 beams exceed the manufacturer's published allowable capacity. Posts are to be added below these beams, decreasing the span. Locations are shown in SSK1, below. Thus the load on the expansion anchors is also reduce to be within or below manufacturer's allowable capacity. The posts will bear on the bolt pit foundations, with an anchor plate assembly, grout bed and post installed anchor bolts. The existing bolt pit foundations have the reserve capacity to sustain the post loads.

The deck edge support angles on the north and south edge of the bolt pit have expansion anchors at 4'-0" O.C. When loaded with the full design load of 250 psf, these anchors exceed the manufacturer's published allowable capacity. These connections will be reinforced by adding new anchors at 4'-0" O.C., midway between existing anchors. Refer to SSK1 for locations.



SSK 1 BOLT PIT FRAMING REMEDIATION PLAN

II. STRUCTURAL MATERIALS

A. Structural Steel

Rolled Shapes	ASTM A992, GRADE 50
Base Plate	ASTM A36, MINIMUM
Plates and Angles	ASTM A36, MINIMUM
Anchor bolts	ASTM F1554
Hilti Kwik Bolt 3	

III. STRUCTURAL DESIGN CRITERIA

A. Applicable Codes

All construction shall be performed in conformance with the following building and design codes:

1. Building Code – Chicago Building Code, 2010 (CBC)

2. Structural Steel – LRFD Specification for Structural Steel Buildings, (AISC – LRFD)

3. Concrete – Building Code Requirements for Structural Concrete – The American Concrete Institute (ACI 318)

B. Wind Loads

Modifications are to interior spaces, then examination of external wind loads in not required.

1. Internal wind pressure = 5 psf

E. Design Loads

Design live loads for occupancies are based on the CBC unless otherwise noted.

1. Server Room (based on equipment and aisle load weighted average) 250 psf

4. MECHANICAL SYSTEMS

A. Base Design Criteria

1. Applicable Codes
   a. The Mechanical Systems will be designed in accordance with the following Codes:
      1). City of Chicago Mechanical Code
2. Applicable Guidelines and Standards
   a. The Mechanical Systems will be designed in accordance with appropriate portions of the following Guidelines and Standards:
      1). Data Center Design Guidelines
      2). National Fire Protection Association (NFPA) guidelines and standards including the following:
         a). NFPA 72 - National Fire Alarm Code.
         b). NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems, Current Edition.
         c). NFPA 101 - Life Safety Code, 2000 Edition.
      3). Occupational Safety and Health Administration (OSHA)
      4). ASHRAE Standard 62 Ventilation for Acceptable Indoor Air Quality, 2001 Edition
      5). FM Global Property Loss Prevention Data Sheets, as determined and defined by Owner.
3. Outdoor Design Conditions
   a. Summer
      1). Dry-Bulb Temperature = 98.5°F
      2). Wet-Bulb Temperature = 76.7°F
   b. Winter
      1). Dry-Bulb Temperature = -10°F
4. Indoor Design Conditions
   a. Support Space
      1). Dry-Bulb Temperature
         a). Summer = 75°F ± 3°F
         b). Winter = 72°F ± 3°F
      2). Relative Humidity
         a). Summer = 50% maximum ± 5%
         b). Winter = no minimum
   b. Data Center
      1). General Dry-Bulb Temperature
         a). Summer = 74°F ± 3°F
         b). Winter = 74°F ± 3°F
      2). Cold Aisle Dry-Bulb Temperature
         a). Summer = 72°F to 75°F
         b). Winter = 72°F to 75°F
      3). Hot Aisle Dry-Bulb Temperature
         a). Summer = 80°F to 95°F
         b). Winter = 80°F to 95°F
      4). Relative Humidity
         a). Summer = 50% maximum ± 5%

b). Winter = 20% minimum ± 5%

c. Electrical Room

1). Dry- Bulb Temperature = 75°F Maximum

2). Relative Humidity = No requirement

5. Heating and Cooling Loads

a. Electrical

1). Data Center

a). Lighting = 1.5 watts per sq ft

b). Future Total Equipment= Floor space for 30 future racks-- Cooling for these racks may be provided with alternate #1 CRAC unit.

a). Day One Equipment = RI Racks: 8 kW/rack, 20 racks

= Total = 160 kW

b). Day One Equipment = UPS = 12.5 kW

c). Day One Equipment = Lighting = 2.5 kW

= **Total = 175 kW**

2). Transformer Room

a). Lighting = 1.0 watts per sq ft

b). Equipment = 15 kW

b. Infiltration

1). The building heat loss calculations will include infiltration load based on the project area being located in an unconditioned space. The space will be positively pressurized and infiltration is assumed to be minimal.

6. Equipment List

a. All existing APC racks to be modified with solid side and back panels. This work is part of this project.

b. For Alternate #3: Provide cold aisle containment system to include top panels and end panels with doors.

7. Area List

a. Data Center = 1,600 square feet

b. UPS/Electrical = 500 square feet

B. Systems Descriptions

1. Server room location

a. New server room is to be installed in sub-basement level of the Accelerator building.

2. Computer Room Air Conditioning Units

a. Two existing DX CRAC units and condensers are to be relocated from existing server room to provide cooling for the new server room. Existing units are 20 tons (70 kW) and 30 tons (105 kW). Total cooling capacity is limited to 175 kW which includes cooling of UPS and lights.

b. Outside air will be ducted to each CRAC unit to provide ventilation and make-up air to the space. Air will be exhausted from the space by an exhaust fan described below in part 3b.

c. Existing units are down flow units with airflow towards the back of the units. The units will be provided with turning vanes under the raised access floor to allow airflow towards the front of the unit. Ducted return up to the ceiling return plenum will be provided. New alternate #1 computer room unit will also be a down flow unit with ducted return up to the ceiling plenum.

d. Ceiling plenum will be used as return path, with hot air from servers discharged into ceiling return grilles in the hot aisle. For alternate #1, active rack containment units will discharge air directly into the ceiling plenum.

e. All air-cooled condensers will be located on the second floor roof at the south side of the building. New roof curbs will be provided for these units.

f. Equipment and Material

The computer room air conditioning units will consist of the following components:

1) Merv 7 Efficient Pre-filters (as rated on ASHRAE Standard 52.1)
2) DX Coil
3) Supply fan
4) Smoke Detector at return air ductwork
5) 42" floor stand with supply plenum and discharge grilles
6) Condensate pump
7) Spot leak detection

g. Duct System Distribution Criteria

1) Supply air will be discharged from the bottom of the CRAC units and distributed directly into the 42" high raised floor.

2)Computer room cooling units will be on a stand with open discharge.

3. Alternates

a. Alternate #1: Installation of one additional new 30 ton DX CRAC unit and condenser to provide additional cooling capacity for future loads and redundancy.

b. Alternate #2: Active Heat Containment based on OpenGate

1). Control system will have multiple sensors to monitor rack inlet and exhaust temperature, humidity and airflow.

2). System will have two ECM fans that can be replaced without turning off the active heat containment system. Ethernet RJ45 port for connection to the BAS. Dual power input at 120 Volt. Painted galvanized sheet metal enclosure to above the lay-in ceiling.

3). Day one build-out:

a). Total day one cooling will be capable of cooling 160 kW of data center equipment. This will provide an average of (8) kW/rack. With some racks capable of higher load than others.

b). Ever two racks will be proved with an OpenGate active heat containment system.

4). Future capacity:

a). Space for (30) future server racks.

b). With Alternate #1 30 ton CRAC unit, additional 3.5kw per rack possible if all 30 future racks installed. There will be no cooling redundancy with future build out.

c. Alternate #3: Cold Aisle Containment

1). Provide complete APC cold aisle containment system with top and side panels with doors. System shall totally enclose the cold aisles to increase the cooling effectiveness of the CRAC units.

4. Reserve Capacity and Redundant Systems

a. Computer room units will not be on UPS power and there will be no electrical redundancy in the event of power loss. If alternate #1 CRAC unit is installed, it will provide N+1 cooling redundancy to the server room at the current equipment density. If additional future server racks are added to the room, this unit will provide additional cooling for the racks, however this redundancy will be reduced or eliminated as more heat load is installed in the room.

5. Exhaust Fans

a. An existing exhaust fan located near the new electrical room will provide cooling for the transformers. Fan will maintain the transformer room less than 95 deg. F.

b. A new in-line exhaust fan will exhaust the server room.

1). Reserve Capacity and Redundant Systems

a). The exhaust fan will have no redundancy and not be on emergency power.

b). The exhaust fan will provide 3 ACH (1,000 CFM) for the server room space.

6. Building Automation System

a. System Description

1). Mechanical systems will be controlled and monitored through a DDC based Building Automation System (BAS) with distributed processing at the local level. The overall building controls will be Johnson Controls Metasys. Electric actuation will be utilized for all valves and dampers. Controls will be on emergency power.

b. Design Criteria

1). Building Automation System (BAS) will integrate with the existing facility's Building Systems Automation Center.

2). DDC controllers will utilize distributed architecture and will not rely on "front-end" or higher level controller to perform required control sequence.

3). Each DDC controller will have a minimum of 10% spare points of each type (DI, DO, AI and AO) at each panel. For universal joints, the spares will be divided evenly between the analog and digital types of points.

4). All control panels, DDC controllers, and control air compressors will operate on emergency power.

c. Control

1). Temperature sensors will be provided at the return of each CRAC unit. Supply air temperature will be controlled to maintain return air temperature below 95°F with supply air temperature not to exceed 68°F.

5. ELECTRICAL SYSTEMS

A. Base Design Criteria

1. Applicable Codes

a. The Electrical Systems will be designed in accordance with the following Codes and Standards:

1) Chicago Building Code, Chapter 18 – Latest Edition
2) Chicago Energy Conservation Code
3) IEEE — Institute of Electrical and Electronics Engineers
4) IESI — Illuminating Engineering Society of North America
5) NECA — National Electrical Contractors Association
6) NEMA — National Electrical Manufacturers Association
7) UL — Underwriters Laboratories
8) NFPA — 72, 101, 110
9) IAC — Illinois Accessibility Code 1997
10) University of Chicago and NSIT Construction Standards

B. Load Calculation Criteria

1. Load Calculation Criteria

a.

Functional Area	Demand
1) Data Center Floor	10kW/Rack
2) UPS Distribution	40 kW (Existing)
3) UPS Distribution	100 kW
4) Non-UPS Distribution	160 kW
5) Lighting	1.1w/SF
6) Mechanical	300kW
7) General Receptacle	2.0w/SF

b. Expected Load:

1) Initial utility peak demand — 650 kVA Servers Racks plus Mech

C. System Descriptions

1. Electric Service

a. System Description

1) Electric service will be derived from one existing 2400 Volt circuit breaker in the main switchgear located in the Main Electrical Room in the first floor electrical mezzanine.

b. Design Criteria

1) The service capacity is limited to the available capacity of the 1200 Amp circuit breaker and 3000 Amp main switchboard.
2) Standby generator support is not available at the accelerator site and will not be required.
3) Backup power will be provide by an uninterruptible power supply system.
4) ComEd utility service is provided by a networked service composed of two 3750 kVA transformers located in a ComEd transformer vault on the north west side of the building, in the first level. These transform utility voltage at 12kV into building utilization voltage of 2400 V.
5) The existing 2400V switchgear is of original vintage construction but has ample

capacity to serve the data center loads.

6) There are four (4) available spare 1200 Amp frame circuit breakers (2 per each side of the split bus). The new feeder to the data center service will be from one side of the split bus, from one of the available circuit breakers.

7) Feeders from the existing switchboard to the new data center switchboard will be copper conductors routed in Intermediate Metal Conduit (IMC). Conduits will be routed exposed on the west side of the high bay area and routed in existing floor trenches in the basement to the location of the transformer and switch inside, on the sub-basement level.

2. Normal Power Services and Distribution

a. System Description

1) Refer to Drawing E-5.0DC.

2) Available service voltage is 2,400 V.

3) The secondary utilization voltage for the facility will be 208Y/120 Volts.

4) A primary medium voltage switch will provide 2400V to a 208Y/120V step down transformer that will provide utilization voltage to the Data Center loads. The data center transformer capacity is estimated at 750 kVA. It will be of dry-type construction. Both will be located inside of the building on the sub-basement level.

5) The primary and secondary distribution equipment will be of unitized power center construction for space savings due to limited space in the sub-basement level.

6) The mechanicals loads are fed from a separate 800 Amp distribution board connected to the 3000 Amp main switchboard. This mechanical distribution board is isolated by a 225 kVA transformer from the rest Server room.

7) The normal and UPS data center rack loads are fed from a separate 1000 Amp distribution board connected to the 3000 Amp main switchboard.

8) The lighting and general purpose loads are fed from a 225 Amp panelboard connected to the 3000 Amp switchboard.

b. Design Criteria

1) The initial design consists of 300 kW of rack mounted equipment is expected on the data center floor. 20 racks at 10-15 kW/rack.

2) Server rack distribution will consist of 140 kW of UPS power (40kW existing) and 100 kW new)

3) Mechanical loads will include 2 existing relocated CRAC refrigeration units plus one new unit located in data center with associated condensing units.

4) Additional loads include lighting and general receptacle.

5) All new distribution equipment will be located in the sub-basement.

c. Equipment and Material

1) The new switchboard will be rated 3000 Amp, 208 Volts. A single NEMA type 3 section for the insulated-case main breaker, TVSS feeder breaker and customer meter and two NEMA type 1 sections for group-mounted branch devices. The switchboard will be free-standing, floor mounted on a concrete housekeeping pad. The switchboard main breaker is to be insulated-case type with microprocessor trip. The main breaker will be individually mounted in a type 3 enclosure.

2) All switchboard branch circuit breakers are to be group mounted, molded-case type with electronic adjustable trip settings for long time delay and pick-up, short time delay and pick-up, instantaneous pick-up. The switchboard will be provided with an externally mounted TVSS to help prevent transient voltages produced by external sources from damaging the UPS.

3) The switchboard will utilize Schneider ION metering equipment on the main circuit

breaker.

4) Panelboard circuit breakers will be molded-case type. Circuit breakers rated 225 Amps and larger will have electronic trip with adjustable settings for coordination with downstream devices.

5) Distribution panels will contain bolt-on or I-Line type branch circuit breakers. The capacity of the panels will be sufficient for the addition of 25% future connected load. Feeder circuit breaker space will be provided for the addition of 25% future circuit breakers.

6) Branch circuit and lighting panelboards will contain plug-on branch circuit breakers. The panelboards will be rated at 225 amperes, and the connected load will be limited to provide 25% future connected load. The panelboards will contain 25% spare 20A branch circuit breakers, and space will be provided for the addition of 25% future circuit breakers.

7) Point-of-use power connection devices will include specification, grade, receptacles (120V, 20A, single-phase).

8) Dry type transformers used for deriving general receptacle and lighting voltage will have a 115°C rise over ambient, 220°C insulation with copper or aluminum windings.

9) Feeder and branch circuit conductors will be copper with THHN/THWN insulation rated 90°C and routed in GRSC or EMT depending on the installation environment.

3. Uninterruptible Power System and Rack Power Distribution

a. System Description (Refer to Sheet E-5.0DC)

1) Two UPS systems will be required to supply the capacity of the data center. One existing UPS system is rated at 40kW and a new 100 kW UPS module will be provided.

2) The existing UPS is a 40kW module with external bypass by APC. This will be moved from the existing server room 050 in the Research Institutes building.

3) The new module will be a 100 kW model, with external bypass and battery support for a minimum of one minute. It shall be modular and scalable with minimum power factor of 0.95.

4) An Emergency-Power-Off (EPO) System will be provided to comply with Art. 645 of the Chicago Electrical Code. The system will remove power to all electronic equipment in the data center and power to dedicated HVAC equipment serving the data center area. This system will also close all required smoke/fire dampers. The EPO initiation devices will be grouped at a location near a main exit door and will consist of break-glass push buttons to prevent accidental initiation.

b. Design Criteria

1) Initial server capacity is anticipated at 300 kW.

2) UPS load is anticipated to be 140 kW (100 kW new, and 40 kW existing).

3) Non-UPS distribution will provide remaining 160 kW capacity.

c. Equipment and Material

1) New UPS systems are to be rated at 100kW.

2) Batteries are valve regulated, lead-acid type mounted in free standing or integral cabinets. Battery quantity is sufficient to supply loads for at least one minute.

3) External maintenance bypass is key-interlocked to the UPS.

4) Rack Distribution

a) Provide at each rack three (3) L21-20R receptacles (208V, 3 phase, 20 Amp, 5 wire), mounted below the cable tray system in a conduit and cable system via trapeze hangers.

b) One L21-20R receptacle will be fed from the UPS distribution system.

c) Remaining two L21-20R receptacles will be fed from the non-UPS power distribution panels.

5) Feeder and branch circuit conductors will be copper with THHN/THWN insulation rated 90°C and routed in GRSC or EMT depending on the installation environment.

4. Mechanical Equipment Distribution

a. System Description

1) All mechanical cooling and ventilation systems supporting the data center area are supported by the normal power system.

2) CRAC units will provide cooling in the sub-basement electrical room.

b. Design Criteria

1) The combined mechanical load is approximately 300 kVA..

2) The mechanical loads are fed from a separate distribution panel connected to the main switchboard and not the UPS system. This mechanical distribution board is isolated by a 225 kVA transformer from the rest Server room.

3) All motors are to be 208 Volt, 3 phase.

4) All 3 phase motors will be furnished with variable frequency drives or solid state starters.

c. Equipment and Material

1) See the Mechanical BOD for variable frequency drive and motor information.

2) Distribution panels will contain bolt-on or I-Line type branch circuit breakers. The capacity of the panels will be sufficient for the addition of 25% future connected load. Feeder circuit breaker space will be provided for the addition of 25% future circuit breakers.

3) Branch circuit panelboards will contain plug-on branch circuit breakers. The panelboards will be rated at 225 amperes, and the connected load will be limited to provide 25% future connected load. The panelboards will contain 25% spare 20A branch circuit breakers, and space will be provided for the addition of 25% future circuit breakers.

4) Feeder and branch circuit conductors will be copper with THHN/THWN insulation rated 90°C and routed in GRSC or EMT depending on the installation environment.

5. Grounding System

a. System Description

1) A low-impedance grounding system for the data center equipment will be added to the existing grounding system. The existing system will be tested during the design phase to determine suitability and improvement requirements. The main bonding location is in the existing main electrical room.

2) All feeders and branch circuits will be provided with an equipment ground conductor.

3) All equipment racks and cable tray will be bonded to the grounding system.

4) A copper grounding bus bar will be mounted on the west wall of the data center to bond equipment racks, and cable tray Each of these bus bars will be bonded to a master ground bus bar located in the basement. This master ground bus bar is bonded to the main bonding location for the building.

b. Design Criteria

1) The grounding electrode system will be designed in accordance with the Chicago Electrical Code Article 250.

2) System resistance to ground will be 5.0 ohms or less.

c. Equipment and Material

1) #4/0 bare copper conductor used for main bonding connections from bus bars to master bonding location and delta grounding system.

2) #6 green insulated copper conductor for rack, cable tray, and raised floor pedestal grounding.

3) Copper bus bars to be 1/4"X4" of different lengths depending on location. Bus bars will be pre-drilled and include insulated stand-offs and clear plastic covers.

4) Pedestal grounding clamps specifically designed for the application.

5) Indoor connections from cable to bonded device or bus bar are to be compression lug and through bolted.

6. Lighting Systems

a. System Description

1) A complete lighting system for the data center area will be provided. The lighting system will consist primarily of energy-efficient fluorescent lighting fixtures.

2) In general, indoor lighting controls will consist of occupancy sensors and line voltage switches. The rack equipment area of the data center is to be designed to supply equipment maintenance and installation lighting only with minimal occupation during normal operation.

3) Life safety egress lighting will be provided by un-switched branch circuits. These un-switched branch circuits will be fed from an emergency lighting panel.

4) All lighting is to be 120 Volt

b. Design Criteria

1) Design Lighting Levels, Average Maintained Footcandles:

a)	Data Center Aisles	-	80
b)	Mechanical/Electrical:	-	40
c)	General	-	10-20

c. Equipment and Material

1) Lighting Fixture Types:

a) Mechanical/Electrical and Burn-in:

- 4', 2-lamp, recessed mounted, parabolic fluorescent fixture; 1-lamp ballasts.

c) Equipment Rack Area:

- 4', 3-lamp, recessed mounted, parabolic fluorescent fixture with lens; 2-lamp ballasts.

2) Lamps and Ballasts:

a) In general, fluorescent lamps will be 32 watt, T8, 3500K color temperature, with a color rendering index of 75 or greater.

b) Fluorescent ballasts will be high-frequency electronic type with less than 10% total harmonic distortion. High-intensity discharge ballasts will be high power factor, constant wattage type.

3) Lighting Control:

a) Occupancy sensors will be utilized in select spaces to minimize energy consumption. Occupancy sensors will be passive infrared or a combination infrared/ultrasonic type.

7. Voice/Data System

a. System Description

1) The extent of the work will consist of a pathway system, consisting of conduit, cable

tray and cable management system.

b. Design Criteria

1) Based on University of Chicago NSIT (Network Services and Information Technology) Project Guidelines for Voice and Data Services.

2) Owner will provide system cables, and infrastructure will be provided for the system, including service cables, distribution cables and branch cables.

3) A rough-in for one phone jack will be provided adjacent to main entrance inside the data center.

c. Equipment and Material

1) Minimum raceway size to be 1-1/4" conduit, with end bushings and metallic grounding clamps to terminate conduit to cable tray in the ceiling space.

2) Cable Trays will be aluminum, ladder type manufactured by Legrand, (Cablofil Cable tray System) or equal. Cable trays shall be 18inch wide, 4 inch deep.

d. Distribution

1) Provide one 4 inch conduit between sub-basement and first floor to activate fiber link at existing cable tray in first floor. All connections by UC NSIT. Systems and power separation will be maintained.

8. Fire Alarm System

a. System Description

1) Fire alarm system modifications and additions will be made to the existing building fire alarm system.

2) Additional alarm appliances will be added to the space to meet code requirements.

b. Design Criteria

1) The additions to the existing fire alarm system will comply with requirements of NFPA 72 for a protected premises signaling system except as modified and supplemented by this document.

2) Audio/visual devices will be installed in all areas of the building in accordance with the NFPA and the ADA Guidelines.

3) Smoke/heat detectors shall be installed as required by the National Fire Protection Association, the Chicago Building Code, and the Uniform Fire Code. Smoke detectors will be installed in, but not limited to, the following locations: electrical equipment rooms.

4) Heat detectors will be installed in areas that are not feasible for smoke detectors.

5) Manual Pull Stations will be installed adjacent to all exit doors.

c. Equipment and Material

1) New fire alarm system components are to be compatible with the existing system.

2) All components are to comply with the City of Chicago Building Code and University of Chicago Standards.

3) The system will utilize individual, addressable photoelectric smoke detectors; heat detectors; addressable manual pull stations; air sampling smoke detection; and addressable monitor and control modules. The system will monitor all sprinkler supervisory and water flow switches and will interface with elevators, HVAC smoke control, and smoke fire dampers.

9. Security/Access Control System

a. System Description

1) A security system will be provided that will consist of the following items:

a) Card Readers

b) Door Contacts

c) Request to Exit Sensors

d) Electric strike, electric mortise, and magnetic lock devices

e) Auxiliary Power Supplies

f) Wiring

b. Design Criteria

1) All devices will report to the Master Control Panel (MCP) which will be programmed to define zones of protection and to initiate responses required by corresponding apparatus.

2) Security system drawings will be provided by a specialty oriented Sub-contractor and included in the Contract Drawing set. Electrical drawings are to show line voltage power connection locations and device rough-in locations to be included in the electrical contractor's scope of work.

3) System voltage will be 24 Volts.

c. Equipment and Material

1) The manufacturer will match current University of Chicago standards. MCP will be wall mounted in a location to be determined.

d. Distribution

1) All wire and cable required to install the systems will be provided. Wire and cable will be sized to provide minimum voltage drop and minimum resistance to the devices being supplied and to comply with the equipment manufacturer's recommendations. Color codes will be consistent in cables used for the same purpose.

WERC
W.E. O'Neil Construction Co.
Transition Plan for Relocation of Server Room in RI 050 to Accelerator Sub-Basement
11/16/10

Summary:

Both existing Liebert CRAC to be refurbished and relocated to the new Sub-Basement Server Room. The new server room will be fully functional and commissioned prior to relocation of any servers. Temporary Cooling will be provided for RI 050 while this work is being performed.

Temporary Cooling will be utilized to maintain the required climate control in the Server room 050. The temporary cooling system will supply 50 tons of cooling to the existing server room so that the existing CRAC units can be relocated to the new location. The temporary cooling will be installed prior to removal of the existing CRAC units servicing room 050. We anticipate that the temporary cooling will be in for 3 to 4 weeks while the existing Lieberts are being relocated. Temporary cooling could be provided to RI 050 for an additional 2 weeks if necessary while the server relocation takes place.

Temporary cooling equipment for the space will be provided by Carrier, a company that specializes in heating and cooling. The unit will be a single 50 ton capacity unit. A unit containing the fan and cooling coil will be installed in the room adjacent to room 050. The compressor unit will be placed outside of the building at the Low Temp Building dock. Power for the unit will be supplied from the Low Temp Building. Carrier is available to repair the temporary cooling unit 24hrs/day, 7 days a week should there be a problem with the equipment.

Flexible ductwork will connect the fan coil unit and room 050. Mechanical Inc. will create new duct openings into the plenum currently servicing the room 050. Dust containment will be utilized when creating the new duct openings into the existing plenum. After the temporary cooling units are installed, operating and tested, the existing Liebert CRAC units will be shutdown and relocated to the new Sub-Basement server room. The temporary cooling units will be put into service for a minimum of 12 hrs prior to the existing CRAC units are removed.

The temporary cooling unit will maintain the temperature in room 050 for the 3 week period during the installation of existing CRAC units in the Subbasement Server. The temporary cooling units will be controlled by temporary thermostats. An alarm dialer will be installed on the temporary cooling unit to notify all parties if a problem should occur with the units.

The existing CRAC units to be relocated will be serviced and upgraded prior to being placed back into operation in the new Sub-Basement server. The existing CRAC units will be tested and commissioned prior to shutdown and the relocation of the existing servers from room 050 to the new Sub-Basement server.

Liebert Unit 2 Week Shutdown

	Day	***Description***	
	Prior to Shutdown of Units		
Setup Week	Monday	Receive Set - Temp Cooling Equipment	1 Day
	Tuesday	Finish set up of Temp Cooling	1 Day
	Wednesday	Ductwork tie in to existing Trunk lines	1 Day
	Thursday	Ductwork tie in to exisiting Trunk lines Electrical - Connect Power - Temp Units	1 Day
	Friday	Insulation on Temporary Ductwork Electrical - Connect Power - Temp Units	1 Day
Week #1 Shutdown	Monday	Startup of Temporary Cooling Units	1 Day
	Tuesday	Electrical - Disconnect Units Disconnect Ductwork from Units Evacuate refreigerant from unit's	1/2 Day 1/2 Day 1 Day
	Wednesday	Move Existing Liebert Units - #1 & #2	1 Day
	Thursday	Install Liebert Units - #1 & #2	1 Day
	Friday	Tie In Refregieration Piping for Liebert Units	1 Day
Week #2 Shutdown	Monday	Charge Liebert Units Tie In Ductwork for Liebert Units	1 Day
	Tuesday	Electrical - Connect Units Tie In Ductwork for Liebert Units	1 Day
	Wednesday	Therm Flo - Repair A/C #1 - Extra Change order work - University needs to approve this	1 Day
	Thursday	Therm Flo - Repair A/C #2 - Extra Change order work - University needs to approve this	1 Day
	Friday	Run a heat load on the system - Therm Flo to perform	1 Day

THERM FLO INC. **Contractors • Engineers**

251 Holbrook Dr. Wheeling Illinois 60090-5826 **Heating • Ventilation • Service Air**
Tel: 847-541-0029 • Fax: 847-541-0272 **Conditioning • Electrical • Generators**

November 16, 2010

Paul Billingsley
University of Chicago
5555 South Ellis Avenue
Chicago, IL 60637

Re: University of Chicago – Repairs

Dear Paul,

We, herewith, submit our quotation for the following work:

We will provide Labor and Materials to Repair A/C #1:

- Replace Humidifier Lamps.
- Replace Blower Shaft and Bearings.
- Replace V-Belts and Motor Sheave.
- Replace Contactors for Two (2) Compressors, Three (3) Reheats, One (1) Humidifier, and One (1) Fan.

Your cost will be..... $ 3,875.00

We will provide Labor and Materials to Repair A/C #2:

- Replace Humidifier Lamps.
- Replace Motor Mount Bracket.
- Replace V-Belts and Motor Sheave.
- Replace Contactors for Two (2) Compressors, Three (3) Reheats, One (1) Humidifier, and One (1) Fan.

Your cost will be..... $ 2,350.00

We will provide a One (1) Year Preventative Maintenance Agreement, Including the Following:

- Twelve (12) Inspections.
- Four (4) Filter Changes.
- All Materials and Labor to Make Any Repairs - 24 hours per day, 7 days per week, 365 days per year.

Your cost will be..... $ 6,250.00

We have *not* included the following work:

- Overtime

Thank you for the opportunity to quote your requirements. If you have any questions, please feel free to call.

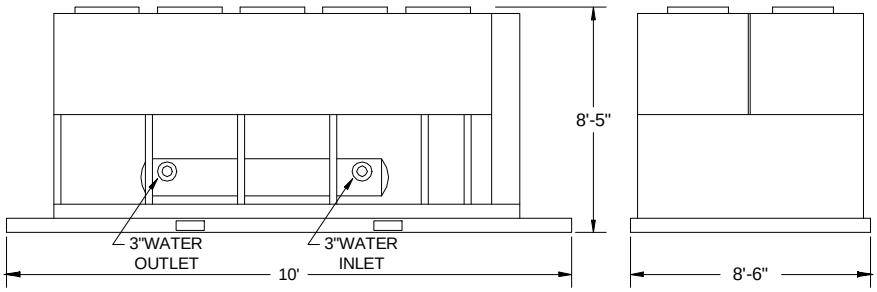
Sincerely,
Therm Flo, Inc.
Kevin J. O'Brien
Kevin J. O'Brien
Vice President
KJO/ec

Accepted by _____ Date _____

If the above proposal meets your approval, please sign and fax back to us along with a purchase order. We will schedule work as soon as possible.

Thank You For Choosing Therm Flo Inc. Where We Do What We Say We Are Going To Do.

Carrier Rental Systems



Unit Arrangement and Approximate Physical Dimensions

50 Ton Packaged Air Cooled Chiller

General System Description

Fully packaged system, completely assembled, arrives on job site ready for installation in minimal time. Each unit is self-contained, with a single point power connection, fully charged with refrigerant and designed for outdoor (roof or ground level) use. The chiller comes complete with accessible semi-hermetic compressors, liquid cooler, air cooled condenser and a microprocessor control center. All mounted on a steel base.

Performance Specifications

Actual cooling capacity will vary according to chilled water and outdoor ambient temperatures. The chart below lists expected capacities under various job conditions.

LVG FLUID	% EG	OUTDOOR AMBIENT TEMP. 75°	85°	95°	105°
50°		62	59	56	53
45°		57	54	51	48
40°		53	50	47	44
30°	25	43	40	38	35
20°	25	35	33	31	28
15°	25	32	29	27	25

Approximate Capacity (Tons)

Manufacturer's suggested ethylene glycol brine percentages are: 25% for 30° to 15°F applications.

Options

Low Ambient (0°F)	O	Explosion Proof	O
Fork Liftable	X	Trailer Mounted	O
Hot Gas Bypass	O	Circulating Pump	O

Equipment Data

Model Number	30GT050
Unit Number	
Refrigerant / Charge	R-22 / 108 lbs
# Compressors/# Circuits	2/2
Minimum Load	13 tons

Physical Data

Operating Weight	5,800 lbs.
Cooler Connection	3", 150# Flange
Minimum Flow	38 GPM
Maximum Flow	220 GPM
Maximum Water Pressure	150 PSI
Water Volume	14 Gallons

Electrical Requirements

Nominal Voltage	460/3/60
Full Load Amps	101
Minimum Circuit Ampacity	113

*Unit provided with a disconnect and control transformer.

Notes

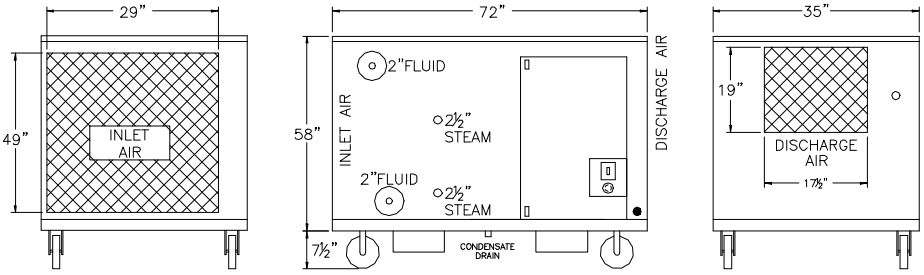
1. Adequate space for clearance to air coil must be maintained.
2. Unit must be leveled.
3. Standard rental package includes flow switch, pressure and temperature gauges, and block valves.

24 Hour Hotline: 800·586·8336

CarrierRentals.com

050208

Carrier Rental Systems



Unit Arrangement and Approximate Dimensions

6,000 CFM Air Handling Unit - Steam/ Cooling

General System Description

Fully packaged system, completely assembled, arrives on job site ready for installation in minimal time. Each unit is self-contained, with a single point power connection, and designed for indoor or outdoor (roof or ground level) use. The air handler comes with front discharge and mounted disconnect.

Electrical Requirements

Power Supply	208-230V / 1PH / 60 hz
Motor Horsepower	5 HP
Power Load (FLA)	21(208V)/ 16(230V)

Physical Data

Operating Weight	1,200 lbs.
Overall Length	72ò
Overall Width	35ò
Overall Height	66ò

Options

Explosion Proof	O
Fork Liftable	☒
Casters	☒
Mounted Disconnect	☒

Notes

1. Adequate space for clearance to air coil must be maintained.
2. Steam application requires solenoid or stop valve and trap.

Equipment Data

Model Number	NTAH-6S
Unit Number	
Nominal Flow	6,000 cfm @ 0.5òH_2O

Cooling

Cooling Coil	6 row / 8 fpi
Cooling Connection	2ò 150# Flange
Max. water pressure/temp	250 psig/ 300F
Nominal Cooling Rating*	14 Tons
Air Entering Condition:	80°db / 67°wb
Air Leaving Condition:	58°/ 56°wb
Chilled Water Required	40 GPM (2 psid) @ 45°F

Heating

Steam Heating coil	2 row / 12 fpi
Steam Heating Connection	2-1/2òMPT flange
Max. Steam pressure	150 psig

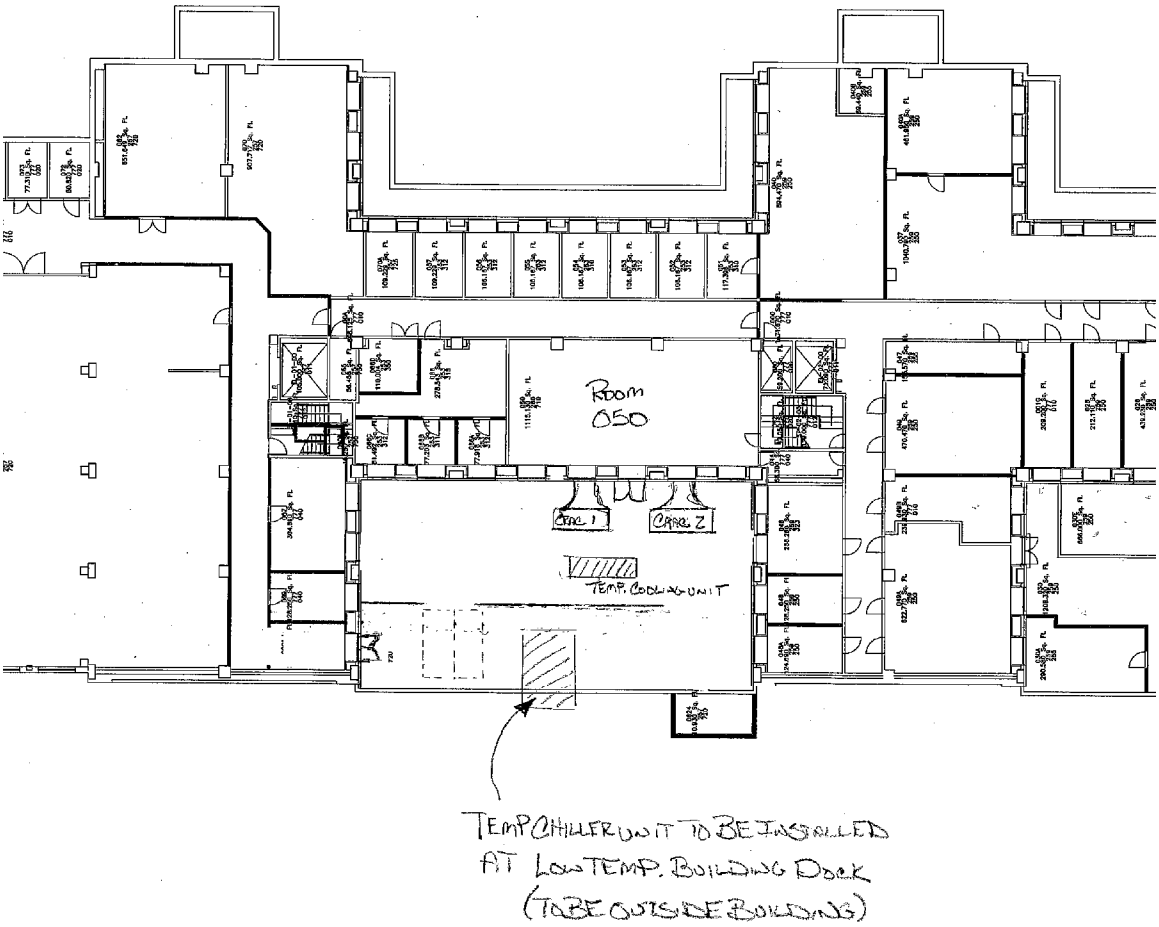
Steam Heating Capacities with 50°F entering air*

Steam @ 5 psig	515 MBTUH, 129 °F air
Steam @ 10 psig	549 MBTUH, 134 °F air
Steam @ 15 psig	578 MBTUH, 138 °F air
Steam @ 25 psig	627 MBTUH, 146 °F air
Steam @ 50 psig	716 MBTUH, 159 °F air
Steam @ 60 psig	744 MBTUH, 163 °F air
Steam @ 75 psig	781 MBTUH, 169 °F air

*Unit can be rated for a wide variety of airflows and condi-

24 Hour Hotline: 800·586·8336

CarrierRentals.com



Temporary Cooling Layout