

16213

ATTACHMENT B.

2007-443

Sazan  
Group  
Inc.

**KING COUNTY**  
**Data Center Design Criteria**

Due Date:

February 16, 2007

Prepared For:

King County  
Facilities Management Division  
Seattle, WA

720 Olive Way  
Suite 1525  
Seattle, WA 98101  
Tel (206) 267-1700  
Fax (206) 267-1701

Prepared By:

Sazan Group, Inc.

**INDEX**

GENERAL

ARCHITECTURAL

MECHANICAL

ELECTRICAL

TELECOMMUNICATIONS

---

GENERAL PROVISIONS.....	2
1.0 Scope.....	2
1.1 General Requirements .....	2
1.2 Purpose.....	2
1.3 Design-Build Process .....	2
2.0 Deliverables and Design Qualifications .....	2
3.0 Reviewing Authority and Design Approvals .....	3
3.1 General .....	3
3.2 King County .....	3
3.3 Local Authorities .....	3
3.4 Owners Representative.....	3
4.0 References .....	3
5.0 Definition Of Terms, Acronyms And Abbreviations.....	8
5.1 General .....	8
5.2 Definitions .....	8
6.0 Design Criteria .....	9
7.0 Submittals .....	10
7.1 General .....	10
7.2 Submittal Requirements.....	10
7.3 Disciplines .....	10
7.4 Equipment.....	19
7.5 Specifications.....	19
8.0 Construction Documents Phase .....	20
8.1 Construction Document Submittals: .....	20
8.2 Mechanical .....	20
8.3 Electrical .....	21
9.0 Coordination.....	22
10.0 Material Requirements.....	22
11.0 Installation .....	23
12.0 Owner Acceptance Requirements .....	23
13.0 Record Documents.....	24
14.0 Warranty.....	24

## **GENERAL PROVISIONS**

### **1.0 SCOPE**

#### **1.1 General Requirements**

- A. The following is a summary of the Scope of Work for design and construction of the architectural, mechanical, electrical, and communications cabling of the new consolidated King County Data Center.
- B. The Building Owner is responsible for the design process, including the Owner's Design Architect and Contractor. All lines of communication shall be directed through King County's project manager David Millar, Facilities Management (tel 206/296-0239).

#### **1.2 Purpose**

- A. This document is intended for use by designers who need a comprehensive understanding of the architectural, mechanical, and electrical features of the data center design including the facility planning, the cabling system, and the network design.
- B. The design criteria and standards contained within are the minimums acceptable for efficiency, economy, durability, maintainability, and reliability of the mechanical HVAC, and electrical power supply and distribution systems.
- C. Clarifications of baseline design criteria, standards, policy, and guidance should be obtained through the normal communications channels established between the owner and contractor.

#### **1.3 Design-Build Process**

- A. The Design team is strongly encouraged to recommend cost saving material, equipment, and/or design alternatives.
- B. Provide all labor, materials, equipment, tools, plant, and reproduction services necessary for the development and delivery of complete design and construction for architectural, HVAC, plumbing, fire protection, power, lighting and alarm systems as described hereinafter.
- C. Provide the necessary resources to complete the work expeditiously and within requirements of published project schedule.
- D. Provide all items and work required to implement a fully functional data center. This includes all incidentals, equipment, appliances, services, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems.
- E. Provide all services necessary for startup, commission, and check out each item and system to provide fully operable systems.

### **2.0 DELIVERABLES AND DESIGN QUALIFICATIONS**

- A. Complete engineering plans, specifications, and calculations for the project shall be prepared and submitted to the Owner along with estimates of probable construction costs.
- B. These documents shall be prepared, signed, and sealed by Professional Engineers, Architects, and Registered Communications Distribution Designers (RCDDs) licensed to practice in the State of Washington, and who are regularly engaged in the design of similar facilities and systems.

**3.0 REVIEWING AUTHORITY AND DESIGN APPROVALS**

**3.1 General**

- A. Comply with all applicable governmental regulations. Comply with all Federal, State, City, and other applicable codes and ordinances.
- B. If any conflict arises between the Specifications or codes and ordinances, immediately notify the Owner.

**3.2 King County**

- A. King County will have the final decision with respect to system concepts, visual coordination, and acceptance of proposed products.
- B. Design elements related to the telecommunications physical infrastructure are subject to review and approval by King County OIRM.
- C. See submittal requirements hereinafter.

**3.3 Local Authorities**

- A. Submit engineering plans, specifications, and calculations to local authorities for review in accordance with reviewing agencies instructions.
- B. Obtain and pay for all permits and pay all fees required by authorities having jurisdiction for work. Pay all royalties or fees required in connection with the use of patented devices and systems.
- C. Arrange for and schedule all tests required by authorities having jurisdiction and public or private utilities.
- D. During construction do not deviate from approved drawings and specifications nor install any work that may be in conflict with codes and ordinances.

**3.4 Owners Representative**

- A. Owner will retain Sazan Group, Inc. to act on the Owner's behalf as advisors on technical matters of interest to the Owner. Their involvement in this project shall, in no way, alleviate the statutory and professional requirements and obligations of the design and construction team as the Professional Engineer of Record. The review of designs or installations shall, in no way, reduce or diminish the obligation, responsibility or liability of the design and construction team or their professional consultants.

**4.0 REFERENCES**

- A. The publications listed below form a part of this document to the extent referenced. The publications are referred to within the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (ASHRAE)**

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

**ASTM INTERNATIONAL (ASTM)**

ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(2004) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001) Laminated Thermosetting Materials

**ELECTRONIC INDUSTRIES ALLIANCE (EIA)**

ANSI/TIA-942	(2005) Telecommunications Infrastructure Standard for Data Centers
EIA TIA-455-21-A	(1988) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
TIA/EIA-492AAAA-A	(1998) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAA-A)
TIA/EIA-492CAAA	(1998; R 2002) Class IVA Dispersion-Unshifted Single-Mode Optical Fibers
TIA/EIA-526-14A	(1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)
TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)
TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
TIA/EIA-568-B.2	(2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)
TIA/EIA-568-B.3	(2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
TIA/EIA-598-B	(2001) Optical Fiber Cable Color Coding
TIA/EIA-604-10A	(2002) FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC
TIA/EIA-604-2	(1997; R 2002) FOCIS 2 Fiber Optic Connector Intermateability Standard

---

TIA/EIA-604-3A	(2000) FOCIS 3 Fiber Optic Connector Intermateability Standard - Standard Type SC
TIA/EIA-606-A	(2002) Administration Standard for the Telecommunications Infrastructure (ANSI/TIA/EIA-606)
EIA-310-D	(1992) Racks, Panels, and Associated Equipment
TIA J-STD-607-A	(2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

**INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)**

IEEE C12.7	(1993; R 1999) Requirements for Watt-hour Meter Sockets
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) Normal Measurements
IEEE Std 100	(2000) The Authoritative Dictionary of IEEE Standards Terms
IEEE Std 1100	(IEEE Emerald Book) IEEE Recommended Practice for Powering and Grounding Electrical Equipment

**INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)**

NETA ATS	(2003) Acceptance Testing Specifications
----------	--

**INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)**

ICEA S-83-596	(2001) Fiber Optic Premises Distribution Cable
---------------	--

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C12.1	(2001) Code for Electricity Metering
NEMA C80.1	(1994) Rigid Steel Conduit - Zinc Coated (GRC)
NEMA C80.3	(1994) Electrical Metallic Tubing - Zinc Coated (EMT)
NEMA FU 1	(2002) Low Voltage Cartridge Fuses
NEMA KS 1	(2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA MG 1	(2003; R 2004) Motors and Generators
NEMA ST 20	(1992; R 1997) Dry-Type Transformers for General Applications

NEMA WC 63.1	(2000) Twisted Pair Premise Voice and Data Communications Cables
NEMA WC 66	(2001) Category 5e and Category 6 100 Ohm Shielded and Unshielded Twisted Pairs
NEMA WD 1	(1999) General Color Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional Requirements
NEMA Z535.4	(2002) Product Safety Signs and Labels

**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

NFPA 70	(2005) National Electrical Code
NFPA 70E	(2004) Electrical Safety in the Workplace

**SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. (SMACNA), SEISMIC HAZARD LEVEL AA**

**SEATTLE, CITY OF, REQUIREMENTS**

**STATE OF WASHINGTON BUILDING CODES**

**US FEDERAL COMMUNICATIONS COMMISSION (FCC)**

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)
-------------	---

**UNDERWRITERS LABORATORIES (UL)**

UL 1	(2005) Flexible Metal Conduit
UL 1010	(1995; Rev thru Mar 1999) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1063	(1998; Rev thru Jun 2001) Machine-Tools Wires and Cables
UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit
UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors
UL 1561	(1999; Rev thru Feb 2004) Dry-Type General Purpose Transformers
UL 248-1	(2000) Low-Voltage Fuses - Part 1: General Requirements
UL 248-2	(2000) Low-Voltage Fuses - Part 2: Class C Fuses
UL 248-4	(2000) Low-Voltage Fuses - Part 4: Class CC Fuses



---

UL 248-5	(2000) Low-Voltage Fuses - Part 5: Class G Fuses
UL 248-8	(2000) Low-Voltage Fuses - Part 8: Class J Fuses
UL 248-9	(2000) Low-Voltage Fuses - Part 9: Class K Fuses
UL 248-10	(2000) Low-Voltage Fuses - Part 10: Class L Fuses
UL 248-12	(2000) Low-Voltage Fuses - Part 12: Class R Fuses
UL 248-15	(2000) Low-Voltage Fuses - Part 15: Class T Fuses
UL 20	(2000; Rev thru Jun 2002) General-Use Snap Switches
UL 2043	(1996; R 2001, Jul. 2001) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 360	(2003) Liquid-Tight Flexible Steel Conduits
UL 44	(2005) Thermoset-Insulated Wires and Cables
UL 467	(2004) Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Apr 2004) Wire Connectors
UL 486C	(2004) Splicing Wire Connectors
UL 489	(2002; Rev thru May 2003) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; Rev thru Oct 2002) Attachment Plugs and Receptacles
UL 5	(2004) Surface Metal Raceways and Fittings
UL 50	(1995; Rev thru Sep 2003) Enclosures for Electrical Equipment
UL 506	(2000; Rev thru Feb 2004) Specialty Transformers
UL 510	(2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; Rev thru Mar 1999) Fuseholders
UL 514A	(2004) Metallic Outlet Boxes
UL 514B	(2004) Conduit, Tubing and Cable Fittings
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 67	(1993; Rev thru Nov 2003) Panelboards

UL 797	(2004) Electrical Metallic Tubing
UL 817	(2001; Rev thru Jan 2004) Cord Sets and Power-Supply Cords
UL 83	(2003; Rev thru Mar 2004) Thermoplastic-Insulated Wires and Cables
UL 869A	(1998) Reference Standard for Service Equipment
UL 870	(1995; Rev thru Jul 2003) Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006) Ground-Fault Circuit-Interruption
UL 1286	(1999; Rev thru Oct 2002) Office Furnishings
UL 1666	(2000; Rev thru Jul 2002) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
UL 1863	(2004) Communication Circuit Accessories
UL 444	(2002; Rev thru Aug 2002) Communications Cables
UL 467	(2004) Grounding and Bonding Equipment
UL 50	(1995; Rev thru Sep 2003) Enclosures for Electrical Equipment
UL 910	(1998) Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
UL 969	(1995; Rev thru Nov 2001) Marking and Labeling Systems

**WASHINGTON STATE ENERGY CODE WITH SEATTLE AMENDMENTS**

**5.0 DEFINITION OF TERMS, ACRONYMS AND ABBREVIATIONS**

**5.1 General**

- A. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, TIA/EIA-569-A, TIA/EIA-606-A and IEEE Std 100 and herein.

**5.2 Definitions**

- A. **ADA:** Americans with Disabilities Act
- B. **BICSI:** Building Industry Consulting Service International is a professional telecommunications association.
- C. **County Enterprise Network:** The network commonly used to conduct county business that provides transport of data within and between county facilities and other agencies of county government. This definition also refers to the network used to transport data

between the county, other government agencies and the Internet. It does not refer to networks built for the sole purpose of meeting special operations needs of county business units which include, but are not limited to, process control and supervisory control networks. Nor does it refer to the King County Institutional Network (I-Net) which is required to meet contractual obligations with I-Net customers and the local cable utility.

- D. **Cross Zone Detection:** Cross Zone Detection is part of the National Fire Code. In the case of cross-zone detection, single detector activation shall cause an alarm signal to be generated; second detector activation shall generate a pre-discharge signal and start the pre-discharge condition. No single detector sets off the entire fire suppression system.
- E. **Entrance Facility (EF):** An entrance to the building for both private and public network service cables including the entrance point at the building for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.
- F. **Horizontal Cross-connect (HC):** An intermediate distribution point used to connect horizontal cable and cabling subsystems or equipment.
- G. **HVAC:** Heating, Ventilation and Air-Conditioning
- H. **Main Cross-connect (MC):** A distribution point in which the building backbone cables terminate and at which connections to the wide-area network may be made.
- I. **Open Cable:** Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions of that space.
- J. **Open Office:** A floor space division provided by furniture, moveable partitions, or other means instead of by building walls
- K. **Pathway:** A physical infrastructure utilized for the placement and routing of telecommunications cable.
- L. **TBB:** Telecommunications Bonding Backbone
- M. **TGB:** Telecommunications Grounding Bus-bar
- N. **TMGB:** Telecommunications Main Grounding Bus-bar
- O. **Telecommunications Room (TR):** An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.
- P. **Work Stations:** Defined as any place a person may work. This includes reception areas, conference rooms, lunch rooms, day rooms, copier rooms, printer rooms, etc.

## 6.0 DESIGN CRITERIA

- A. The Subcontractors shall accept direction through the Contractor with respect to performance of their contractual obligations. Subcontractor shall have a designated project representative and a back-up representative, either or both of whom shall attend all meetings, whether regularly scheduled or not.
- B. Subcontractor shall meet with members of local regulatory authorities, utility companies and municipal service boards to coordinate their requirements with the project design and installation.

- C. King County reserves the right to review and comment on the design documents. Their reviews shall be in the form of comments which shall be considered either as interpretations of the design or clarification of the intent of the scope of work. Respond to these review comments with written acceptance or rejection of each comment. King County or its technical representatives will not accept responsibility for the technical design of the project, which remains the responsibility of the design and construction team.
- D. Design team is required to carry, as Architect and Engineers of Record, professional liability insurance (errors and omissions), of sufficient policy value and acceptable deductible, to cover their acts as Architect and Engineer of Record for this project. Furnish evidence of professional liability insurance coverage to the Owner for review and acceptance. Minimum policy coverage shall be \$2,000,000.

## 7.0 **SUBMITTALS**

### 7.1 **General**

- A. Submit all design drawings, calculations, and shop drawings to the Owner for review and comment.
- B. King County shall be the sole judge of a submittal's completeness. Incorporate all required information into the submittal as directed.
- C. Documents shall be reviewed and stamped by Engineer of Record prior to submittal. By virtue of reviewing and commenting on such calculations and shop drawings, King County and its Representatives do not accept any responsibility for the accuracy or appropriateness of the calculations, since that responsibility rests solely with the Design and Construction Team.

### 7.2 **Submittal Requirements**

- A. For Schematic and Design Development phases, submit as indicated below by discipline in accordance with the following:
  - 1. Schematic Phase: As a minimum, a single line layout for at a scale not less than 1:100 (1/8 inch). Submit a complete double line layout of areas of critical importance, at a scale of 1:50 (1/4 inch) including equipment.
  - 2. Design Development: Submit minimum 1:100 (1/8 inch) scale floor plans, new and renovated, incorporating all of the revisions required by comments from schematics.

### 7.3 **Disciplines**

- A. Plumbing
  - 1. Narrative
    - a. Existing plumbing systems to be used and necessary modifications
    - b. New plumbing systems
    - c. New or modified water treatment

2. Floor Plans/Drawings
    - a. Room names
    - b. Identify
      - 1) Existing plumbing fixtures
      - 2) New plumbing fixtures
      - 3) Existing equipment
      - 4) New equipment
      - 5) Plumbing piping
    - c. Size of pipe
    - d. Equipment schedule
    - e. Fire & smoke partitions
    - f. Demolition plans
    - g. Riser diagrams
    - h. Legend, notes, and details
  3. Location and size of sprinkler riser, standpipes, and fire pumps (see fire protection)
  4. Location of emergency eyewash and shower equipment
  5. Calculations (equipment & piping)
  6. List of Required Contract Specifications
  7. Contract Specifications
- B. Sanitary
1. Narratives:
    - a. Existing sanitary systems: underground water, sanitary sewers, storm sewers, and fuel gas with sources, disposal methods, storage pressures, condition, etc.
    - b. New sanitary systems
    - c. Provide water analysis & expected yield if well required
    - d. Circulation study to assess emergency vehicle access
  2. Utility Plans/Drawings showing existing and new sanitary systems:
    - a. Size of pipes
    - b. Invert elevations of sewers
    - c. Locate/size
      - 1) Pumps

- 2) Storage facilities
- 3) Treatment equipment
- 4) Fire hydrants
- 5) Sectional and post indicator valves
- 6) Backflow preventer
- d. Profiles of sanitary & storm sewers
- e. Demolition Plans
- f. Legend, notes, and details
3. Point of connection to sprinkler system
4. Calculations
5. List of specifications
6. Contract Specifications
- C. HVAC:
  1. Description of HVAC systems
  2. Equipment for each functional space
  3. Location/sizes:
    - a. Mechanical equipment room
    - b. Principal vertical shafts
  4. Block layout of equipment
  5. Louvers:
    - a. Outside air
    - b. Exhaust air
    - c. Relief air
  6. Engineering calculations<sup>3</sup>
  7. Selection of HVAC equipment
  8. Catalog cuts of equipment
  9. Room by room heating and cooling loads
  10. Zone by zone heating & cooling loads
  11. Building block heating & cooling loads

12. Psychometric chart for air handling unit
13. Coil entering and leaving conditions
14. Fan motor heat gains
15. Consumption of humidification loads
16. Sound/acoustic analysis
17. Room-by-room air balance charts<sup>4</sup>
18. Chilled water plant:<sup>5</sup>
  - a. Quantity and type of chillers
  - b. Capacity in tons of refrigeration
  - c. Electrical equipment
19. Heating system:
  - a. Total heating load
  - b. Domestic hot water load
  - c. Humidification load
  - d. Equipment steam demand
  - e. Zoning of heating system
20. HVAC floor plan: <sup>6</sup>
  - a. Main supply, return and exhaust ductwork
21. HVAC
  - a. Volume dampers
  - b. Fire and smoke partitions
  - c. Fire and smoke dampers
  - d. Smoke detectors
  - e. Automatic control dampers
  - f. Air quantities for each room
  - g. Air inlets/outlets
  - h. Rises and drops in ductwork
  - i. Expansion loops
  - j. Anchors
  - k. Valves

- l. Drip assemblies
    - m. Balancing fittings
- 22. Interconnection of HVAC equipment with fire protection equipment (see fire protection)
- 23. Plan/section of mechanical equipment rooms
- 24. Schematic flow and riser diagrams<sup>7</sup>
- 25. Schematic control diagrams<sup>8</sup>
- 26. HVAC demolition drawings
- 27. Phasing plan
- 28. Equipment schedule
- 29. Seismic bracing
- 30. Symbols and abbreviation
- 31. Selection of:
  - a. Pumps
  - b. Fans
- 32. Sizing and selection of
  - a. Expansion tanks
  - b. Heat exchangers
- 33. Sound analysis
- 34. Complete selection data
- 35. Outside chilled water and condenser water distribution<sup>9</sup>
- 36. Standard detail drawings
- 37. Automatic temperature control drawings<sup>10</sup>
- 38. HVAC specifications

**Submittal Footnotes:**

<sup>1</sup> Provide specific design recommendations and full back-up data. Include the heating and cooling capacities of each functional area and the block cooling and heating loads for each new and/or existing building.

<sup>2</sup> The locations of these louvers must not allow short circuiting of air from emergency generator exhaust or truck waiting and loading dock areas into air intake etc. Consider factors affecting



lower location such as visibility, historical considerations, wind direction, nuisance and health hazard odors (from emergency generator or truck exhausts).

<sup>3</sup> Include room-by-room, peak zone-by-zone, and building block heating and cooling loads. Provide a tabulation of steam consumption based on data from all sources. Show correlation between each HVAC zone boundary and architectural floor area correlation between the architectural room numbers and abbreviated/coded room numbers used with computer input data sheets.

<sup>4</sup> Show supply, return, exhaust, make-up, and transfer quantities with intended pressure relationships, i.e. positive, negative, or zero with respect to adjoining spaces.

<sup>5</sup> Provide pertinent data on accessories such as pumps and cooling tower etc. Show the extent of the outside chilled water and condenser water piping. Clearly show how the piping will be laid in tunnels, trenches, or by direct burial.

<sup>6</sup> Show ceiling clearances, at locations where ducts cross each other, by providing 1:50 (1/4 inch) scale local sections. Show all ductwork, and piping 150 mm (6 inch) and larger in double line. Show separate floor plans for air distribution and piping unless waived by THE OWNER. Show clearances required for access and maintenance with coil and tube pull.

<sup>7</sup> Show typical air handling systems and all hydronic systems with existing capacities and new estimated loads. Verify actual operating conditions and capacities of HVAC systems prior to design.

<sup>8</sup> Show control devices, such as, thermostats, humidistats, flow control valves, dampers, freezestats, operating and high limit sensors for all air systems and fluids, smoke dampers, duct detectors etc. Provide a written description of the sequence of operation on the floor plans. Detail the scope of work involved with the Central Engineering Center (ECC) and address if enough spare capacity is available or a new ECC is required. Show a point schedule for analog/digital input/output to be included in ECC.

<sup>9</sup> Show pipe sizes and insulation with plans, profile, sections, details, and all accessories, such as, anchors, expansion loops/joints, valves, manholes, capped and flanged connections, interface between the new and existing work (if any). Clearly indicate interferences (if any) with the existing utilities and/or landscape elements on outside piping layout drawings. Show rerouting any utilities, cuttings of roads, pavements, trees, etc., and the extent of new and demolition work. Outside utility drawings shall be based on the study of the latest site drawings, discussions with engineering personnel, and actual site inspection of the existing utility.

<sup>10</sup> Show all duct detectors, control valves/dampers static pressure sensors, differential pressure control assemblies, etc., whose actual physical location is critical for the intended sequence of operation on floor plans.

#### D. Fire Protection

1. Narrative: <sup>1</sup>
  - a. Fire and smoke separation
  - b. Fire sprinkler/standpipe system
  - c. Water supply available/max. demand
  - d. Water flow testing results

2. Fire alarm systems <sup>2</sup>
  - a. Existing to be modernized
  - b. Base loop system for interface of new construction
  - c. Size of air handling units
  - d. Exit paths from each zone
  - e. Distances to stairs
  - f. Occupancy of each area
  - g. Exit calculations for each floor
  - h. Smoke control features
3. Floor Plans/Drawings: <sup>3</sup>
  - a. Sprinkler zones
  - b. Fire alarm zones
  - c. Smoke zones
  - d. Building water supply
  - e. Interior sprinkler supply lines
  - f. Standpipes
  - g. Fire extinguisher cabinets
  - h. Fireproofing of structural members
  - i. Sprinkler/standpipe riser supply piping
  - j. Termination of sprinkler main and inspector test drains
  - k. Sprinkler alarm valves
  - l. Waterflow and tamper switches
  - m. Sprinkler system fire department connections
  - n. Sprinkler design hazards per NFPA 13
  - o. Exit signs and emergency lighting
  - p. Occupied areas not protected by automatic sprinklers
4. Calculations
  - a. Estimated capacities for proposed air handling units in cubic meters (cubic feet) per minute
5. Location of
  - a. Fire alarm system
  - b. Annunciator panels
  - c. Pull stations

- d. Flow switches
  - e. Audio-visual devices
  - f. Smoke detectors
  - g. Duct smoke detectors
  - h. Smoke dampers
  - i. Fire dampers
  - j. Fire alarm risers<sup>4</sup>
  - k. Exit signs
  - l. Emergency lighting
  - m. Fire sprinklers
  - n. Standpipes
  - o. Fire hydrants
  - p. Fire pumps
  - q. Post indicator valves
  - r. Sectional valves
  - s. Fire extinguisher cabinets
  - t. Electromagnetic door hold open devices
  - u. Wall sections indicating fire resistive ratings
  - v. Door and window schedule with fire rating or fire rated glazing
  - w. Zoning of each fire alarm initiating device
6. Details:
- a. Fire pump system (capacity and pressure)
  - b. Elevation and isometric view of fire pump
  - c. Stairwell sign
  - d. Annunciator panel
  - e. Interconnection of fire alarm system with:
  - f. Smoke dampers
  - g. Air handlers
  - h. Elevator controls
  - i. Kitchen fire extinguishing and fire pump system
  - j. HVAC system with smoke duct detectors
7. Single line riser diagram for fire alarm system
8. Height/configuration of storage racks and shelving

9. Specifications
10. Corresponding data for FM200 System

**Fire Protection Submittal Footnotes:**

<sup>1</sup> Indicate NFPA 220 and UBC fire resistive rating of the building, NFPA 101 occupancy type, and fire protection code analysis to access compliance with NFPA 101.

<sup>2</sup> Determine type, features, age, reliability, compliance with present day codes, capacity, zoning, supervision, control panel and power supplies, initiating devices and circuits, and auxiliary functions for existing fire alarm system. Indicate manufacturer, model number, voltage, and wiring style of existing alarm systems and devices. Provide recommendations for the proposed fire alarm work.

<sup>3</sup> At submission, include room names, room numbers, door locations and swings, smoke and fire rated partitions, sprinkler/standpipe risers to floor plans. Add location of all valves (post indicator, sectional) and backflow preventer if provided.

<sup>4</sup> Show new equipment and/or the necessary changes involved if modification to the existing system is required. Include any recommendations where certain requirements of the design criteria might be waived in order to allow the existing equipment to be reused.

E. Electrical

1. Design Narrative
2. Location and size of:
  - a. Electrical equipment
  - b. Electrical closets
  - c. Telephone closets
3. Drawings:
  - a. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation.
  - b. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
  - c. Submit drawings for:
    - 1) Communications systems
    - 2) Proposed electrical system<sup>4</sup>
4. List of drawing symbols
5. List of specialty areas

6. Method of short-circuit calculations
7. Method of voltage drop and demand calculations
8. Load calculations for normal and emergency use

F. Product Data

1. Panelboards
2. Transformers
3. Cable trays
4. Wireways
5. Receptacles
6. Circuit breakers
7. Switches
8. Transformers
9. Enclosed circuit breakers
10. Motor controllers
11. Manual motor starters
12. Combination motor controllers
13. Telecommunications Grounding Busbar
14. Surge protective devices

7.4 **Equipment**

- A. Equipment (on architectural drawing)
- B. Activation Equipment List (Excel format)
- C. Specifications

7.5 **Specifications**

- A. Submit for all technical disciplines the original CSI Master Specification section drafts marked-up with pencil showing the editing for the project. Clearly identify modifications, deletions and insertions. Assure the specification drafts have been edited and tailored in their application to represent accurate coordination between disciplines.

- B. Type specifications in final format and content including any desk copy changes made at the previous review. Submit a complete set of the typed specifications for review. Include one set of full size final drawings of all disciplines, fully coordinated.
- C. Return all draft specifications reviewed to aid the final bid document review. These draft specifications will later be returned.

**8.0 CONSTRUCTION DOCUMENTS PHASE**

**8.1 Construction Document Submittals:**

- A. Submit fully dimensioned, complete, and coordinated 1:100 (1/8 inch) scale floor plans, incorporating all revisions required by comments from previous phases. Submit legend, notes, and details at a scale not less than 1:100 (1/8 inch).
- B. Construction documents shall consist of coordinated drawings and specifications signed and sealed by a Professional Engineer registered in the State of Washington ready for permit submission to the authorities having jurisdiction; containing, as a minimum, the following:

**8.2 Mechanical**

- A. Include the following for each submittal:
  - 1. Heating, cooling and ventilation calculations for server rooms, office space, NOC, mainframe, printers, telecommunication room, lobbies, sprinkler room, MDF, IDF rooms, etc.
  - 2. Equipment schedules defining performance characteristics of all items of equipment. Rotating equipment, such as fans and pumps, shall include efficiencies, brake horsepower and motor sizes.
  - 3. Riser diagrams for plumbing systems showing all locations and areas served.
  - 4. HVAC, plumbing, and fire protection plans, 1/8" scale. Systems distribution and equipment location shall be shown for each floor. Ductwork over 18" shall be shown double line. Number drawings to easily correlate to architectural numbering system; coordinate with architectural drawing list. Plans shall show coordination with all other construction trades.
  - 5. Miscellaneous details and large-scale plans and sections necessary to show coordination in congested areas.
  - 6. Site plans showing extent of contract, work and point of interface with site utilities work.
  - 7. Complete specifications defining a scope of work, equipment items, materials, and means and methods of installation. All drawings and specifications shall be prepared in the format designated by the Contractor.
  - 8. Equipment submittals for all mechanical equipment intended for use on the project (e.g. CRACs, fans, pumps, heaters, etc.) with manufacturer's installation instructions and proposed operating conditions (e.g. fan curves).

9. Documentation suitable for building department approval demonstrating envelope compliance with Washington State Energy Code (with Seattle Energy Code) may be prepared by an Energy Code Compliance Consultant. Obtain a copy of this document from the Architect.

### 8.3 **Electrical**

- A. Submittals shall include performance and characteristic curves.
- B. Submit coordination data for overcurrent protective devices.
- C. Submit testing procedures for:
  1. 600-volt wiring test
  2. Grounding system test
  3. Transformer tests
  4. Ground-fault tests
- D. Submit Manufacturers Shop Drawings for:
  1. Panelboards
  2. Transformers
  3. Cable trays
  4. Wireways
- E. Submit Manufacturers Product Data for:
  1. Receptacles
  2. Circuit breakers
  3. Switches
  4. Transformers
  5. Enclosed circuit breakers
  6. Motor controllers
  7. Manual motor starters
  8. Combination motor controllers

9. Telecommunications Grounding Busbar
10. Surge protective devices

#### **9.0 COORDINATION**

- A. Transmit to other trades, via the Contractor, all information required for work to be provided under this Section in ample time for installation.
- B. Wherever work interconnects with work of other trades, coordinate with these trades to insure that all trades have the necessary information to properly install all connections and equipment.
- C. Provide required supports and hangers for major items of piping and equipment, so that loading will not exceed allowable loadings of structure. Submit equipment weights and loadings, including method of attachment, to the Contractor for review.
- D. Coordinate and schedule work with all trades and the construction sequence. Install and coordinate the mechanical work in cooperation with other trades installing interrelated work. Before installation, take proper provisions to avoid interferences in a manner reviewed by the Contractor. All changes required in the work of the Subcontractor, caused by their neglect to do so, shall be made by them at their own expense.
- E. Required anchor bolts, sleeves, inserts and supports shall be furnished by the Subcontractor as necessary for equipment provided by Subcontractor. Such anchor bolts, sleeves, inserts and supports shall be installed, except as otherwise agreed to, by the trade furnishing and installing them. Location of anchor bolts, sleeves, inserts and supports shall be coordinated by the Subcontractor requiring them to insure that they are properly installed. Any expense resulting from the improper location of anchor bolts, sleeves, inserts and supports shall be paid for by the Subcontractor with the responsibility for directing their proper locations.
- F. Adjust location of pipes, equipment, ducts, etc. to accommodate the work and to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication. Right of Way: Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains normally have right of way. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed. Make offsets, bends and changes in direction of pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on the Drawings.
- G. Install all mechanical work to permit removal (without damage to other parts) of compressors, filters, fan shafts and wheels, belt guards, sheaves and drives and all other parts requiring periodic replacement or maintenance. Provide manufacturer's recommended clearances around equipment for service and proper operation.
- H. Provide access panels in equipment, ducts, etc., as required for inspection of equipment and for proper maintenance.

#### **10.0 MATERIAL REQUIREMENTS**

- A. If products and materials for specific items or systems are specified, use those specified as representative of quality desired. If products and materials are not specified, use first-class high quality products and materials subject to review and acceptance by the Architect and Owner.



- B. All products and materials shall be new, clean, free of defects and free of damage and corrosion.
- C. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged in the opinion of the Architect, Owner's Representatives, or Contractor do not install, but take immediate steps to obtain replacement or repair.

**11.0 INSTALLATION**

- A. The Subcontractor shall prepare shop-drawing submittals in accordance with submittal schedule. These submittals shall be reviewed and stamped by the Engineer of Record. Shop drawings shall show compliance with the Construction documents, coordination with all construction disciplines, accuracy of technical and dimensional data, and of the proposed manufacturer.
- B. Attend regularly scheduled construction coordination meetings and other meetings, as requested by Contractor. Members of the Subcontractor's staff, who have direct knowledge of the mechanical design, shall accompany their respective installation counterparts at these meetings.
- C. The Engineer of Record shall perform periodic site observations, on an average of twice per month basis, and prepare a status of installation report including deficiencies with respect to the contract documents. These site observations shall be performed in the presence of the Architect and/or the Owner's representatives, at their discretion.
- D. Provide a written description of all observed field coordination problems, along with proposed resolutions, to the Contractor for distribution.
- E. The Architect and the owner may perform additional periodic observations, which may generate deficiency comments. Respond to these published deficiency lists within a one-week period.
- F. The Engineer of Record shall perform final punch list inspections and submit to the Contractor.
- G. Perform all system tests required by regulatory or code agencies in the presence of the appropriate local authorities, the contractor and the Owner.

**12.0 OWNER ACCEPTANCE REQUIREMENTS**

- A. Identify equipment with permanent nameplates that agree with subcontractor furnished as-built drawings.
- B. After completion of work and prior to final acceptance, thoroughly clean all parts of the work, remove all debris and surplus equipment and leave installation in perfect condition, ready for use.
- C. Operational and Maintenance Manuals.
  - 1. Maintenance manuals shall be provided to the Owner (minimum of three (3) copies) in three-ring binders, labeled and tabbed, consisting of the following as minimum requirements.
    - a. Manufacturer's literature on all items of equipment.
    - b. Operating and maintenance instructions.

- c. Sequence of operation, wiring, and control diagrams.
- D. Commissioning: Commission all mechanical and electrical systems at the presence of King County's representative. Provide detailed commissioning plan prior to start of TAB and commissioning work for review and approval by King County. Provide 2 week notice in advance of all commissioning and testing activities.

**13.0 RECORD DOCUMENTS**

- A. Deviations: Subcontractor to maintain record drawings of changes to mechanical systems, including locations, sizes, or arrangement. Record drawings to be used by the subcontractor to produce As-Built Drawings.
- B. Location of Concealed Work: Locate accurately to scale and dimension from column lines, concealed piping and ductwork.
- C. At end of construction furnish owner with an "as-built" set of reproducible and electronic disk based on AutoCAD 2006 software.

**14.0 WARRANTY**

- A. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one (1) year from date identified in invitation to bid. Within 24 hours after notification, correct any deficiencies that occur during the guarantee period at no additional cost to the Owner, all to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub trade-specialists.
- B. Be responsible for leaks in pipes during Guarantee Period. Repair such leaks, at no cost to Owner, within 24 hours of notice by the Owner. Repair leaks which occur prior to the completion of this Subcontract at once. Be responsible for any damage caused by such leaks and repair thereof and reimburse Owner for expenses incurred. The subcontractor shall indemnify the owner, the Architect and Contractor against loss liability, damage or expense, including reasonable attorney's fees, in connection with any claim resulting from such leaks, which may be asserted by any other third party. Owner reserves the right to contract with others for remedy of guarantee deficiencies and invoice Sub-contractor for such work.
- C. Fire stop and seal wall and floor penetrations and penetrations with materials that provide the same fire rating as the floor or wall. Provide fire dampers or combination fire/smoke dampers, as required.
- D. The Subcontractor shall provide adequate means for and shall fully protect finish parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Materials and equipment shall be covered in such a manner that no finished surfaces will be damaged or marred, and all moving parts shall be kept perfectly clean and dry.
- E. At conclusion of each day's work, clean up and stockpile on site all rubbish, debris and trash accumulated during the day because of work of this Section. Sidewalks and street adjoining the property shall be kept broom clean and free of debris, rubbish, trash, and obstructions of any kind caused by work of this section, which will affect the conditions of streets, walks, utilities and property.

END OF GENERAL

