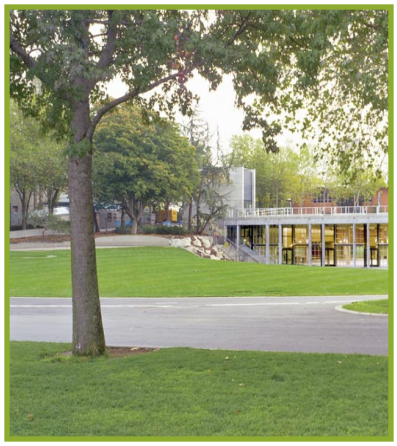
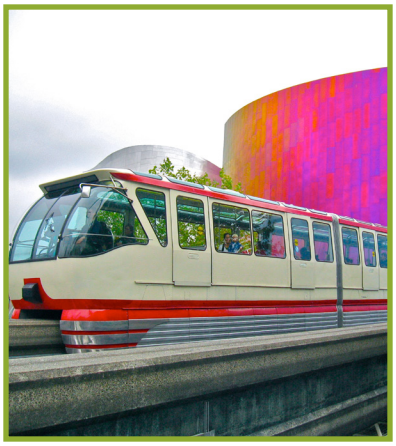
seattle center





site standards

September 2022

seattlecenter

Seattle Center -

our vision is to delight and inspire the human spirit in each person and bring us together as a rich and varied community

Welcome to our 74-acre campus - with 17 acres of open space.

On-site destinations include the Seattle Center Armory, Pacific Science Center, The International Fountain, The Children's Museum, Seattle Children's Theatre, Seattle Repertory Theatre, Intiman Theatre, Museum of Popular Culture, Climate Pledge Arena, McCaw Hall, Space Needle and more…

More than 30 resident organizations make Seattle Center their home -- Northwest Folklife, Pacific Northwest Ballet, Seattle Opera, Seattle Kraken, Seattle Storm, Theatre Puget Sound, Seattle Shakespeare Theatre and a myriad of other arts, cultural, educational and sports entities.

Seattle Center Productions, a division of Seattle Center, develops, manages and delivers more than 50 free and low cost public programs accessible to everyone and designed to provide joy, laughter, inspiration and enrichment in a way that mixes generations, interests and cultures.

Over 5,000 shows and events are presented on campus annually, including all of the activities of Seattle Center Winterfest, outdoor movies and concerts, many and varied community events and over 24 world cultural festivals with music, dancing, exhibits and foods.

Seattle Center is the region's top tourist destination and more than 12 million people visit annually to enjoy arts, sports, tourism, educational and recreational pursuits.

Seattle Center employs 250 full-time and hundreds of intermittent staff, who work in all aspects of campus operations - from maintenance, landscaping, security and event production to marketing, communications, sales and finance.

$1.864 billion in business activity is generated on campus annually and $681 million in labor income for King County.

Seattle Center Campus Map

* When you park at these Garages, your fees support Seattle Center free programs and campus grounds.

Last Revised: 07/13/2022

APPENDICES

End of Table of Contents

Seattle Center Site Standards

Division 01 – General Requirements

A. The purpose of the Seattle Center Site Standards is to provide guidelines to architects and engineers designing facilities for the Seattle Center. It is intended to summarize information that may be unique to the Center either by choice or by the specialized nature of the facility, and to avoid historical issues with construction, operations and maintenance. The Site Standards may include information of a repetitive nature, more or less common to most Seattle Center facilities and projects.

It is recognized that all standards indicated herein are not universally applicable to every project. Further, these standards do not replace professional design analyses.

Also, it is not intended that these standards be used directly as contract specifications. For simplicity they are devoid of the legal qualifications and language needed by contract specifications. However, the included specifications are for the purpose of specifying exact technical requirements which must be met for certain specialty systems or for requirements that are routine.

The material presented in in the sections of the Site Standards are organized similarly to the CSI Masterformat™ division numbers and titles and intended to relate to the unique requirements of the Seattle Center and, although specific, may be more general than found in comparable sections in a design specification. As such the following site standard sections may include most if not all of the following categories of information:

- Scope: will simply state the subject and content of the section. It may also contain a description of an existing Seattle Center system.
- Design Review/Submittals: will address any special agenda for design reviews and submittal requirements.
- Codes Regulations & Standards: will note specific requirements for codes, regulations and industry standards
- General requirements: will address general design guidelines.
- Specific requirements: will address requirements for design implementation.
- Products, Materials and Equipment: will address general concerns for material choices and equipment and item types, and may also include specific manufacturer and product requirements.
- Execution: will cover both installation procedures and long range expectations for operation and maintenance requirements. It will also include any particular testing procedures and final maintenance information. In some cases there will be standard specifications for quality assurance.
- References will be made to applicable reference documentation or documentation included in the Appendices.
- Other categories may be included to provide additional or clarifying information for that specific specification division.

B. ADMINISTRATIVE REQUIREMENTS

1. Project Management and Coordination

a. A Preconstruction meeting is mandatory prior to mobilizing. Once construction begins, anticipate weekly or bi-weekly construction progress meetings with the design and construction teams

2. Plans & Specifications

The Seattle Center Project Manager will work with consultants on drawing requirements. Consultant drawings must include the Seattle Center Redevelopment office address in the title block and reference the Seattle Center Project Identification number for the specified project on each sheet.

The consultant shall make all provisions required by codes, regulatory agencies, and industry practices for high quality installations. Utility distribution and connection drawings must meet the minimum acceptable size and be consistent with Seattle Center existing connections and may be increased as design calculations may dictate. When design calculations have been completed, consultants shall verify that service requirements can be met at the Seattle Center's proposed points of service connection.

The consultant's documents shall be complete for this project. Reference to other drawings and specifications is not acceptable except for nationally and locally accepted industry standards and codes. Due to the inherent complexity of facilities, it is preferred that piping and duct work not be shown on the same drawings when the scale is less than one quarter inch to the foot.

Complicated areas requiring careful coordination of trades in order to install all systems and maintain maintenance access shall be detailed with cross section drawings at one quarter inch to the foot or larger scale, showing all systems. Cross sections shall be provided for all mechanical equipment rooms to show the vertical relationship of important components. Such drawings shall ensure accessibility to routine operation, maintenance and repair. Burying apparatus requiring operation, maintenance and repair above or behind fixed piping, conduit, duct work, etc., is unacceptable.

3. Record Information

The Seattle Center has facilities drawings, specifications, design computations, maintenance manuals, air balance records, etc. Consultants are expected to fully utilize these resources, in conjunction with thorough hands on review of existing conditions, to ensure that alterations of and additions to existing facilities do not over tax existing systems to meet new requirements. The Project Manager will provide assistance as available to allow consultants to obtain all necessary information germane to the project program.

It is mandatory that consultant field verify all reference information and purported as-built conditions since the RPM cannot guarantee that all conditions have remained static since last "officially" altered or documented.

C. QUALITY REQUIREMENTS

1. Regulatory Requirements

Consultants are expected to comply with all requirements indicated and implied by the Site Standards, applicable codes and ordinances, and record information.

Deviations must be approved in writing by the Seattle Center's Project Manager prior to implementation.

Consultants are required to make themselves aware of all applicable codes and ordinances and assure compliance thereto. Deviations must be agreed to in writing by the Project Manager with written concurrence from the related regulatory agency. If a conflict arises between program requirements and codes and ordinances, such conflict must be resolved to the satisfaction of all interested parties prior to completion of the Design Development phase.

2018 Seattle Building Code

2018 Seattle Energy Code

2010 Americans with Disabilities Act (ADA) Standards for Accessible Design

Washington State International Building Code for Barrier-Free Accessibility

2. Definition of Terms

The following are abbreviations and terms frequently used in the Site Standards text.

CSI	Construction Specifications Institute
IBC	International Building Code
SS	Site Standards
RPM	Redevelopment Project Manager
SBC	Seattle Building Code
SD	Standards Drawing
SEC	Seattle Electric Code Supplement
SFC	Seattle Fire Code
SFD	Seattle Fire Department
SC	Seattle Center
Client	The Seattle Center for whom the project or program is being developed or the consulting service is being performed.
Consultant	Architectural or engineering firm, in a prime or subordinate role, under contract with the Seattle Center to perform a specific consulting service.
Engineer	An engineering firm, in a prime or subordinate role, under contract with the Seattle Center to perform a specific consulting service.
Owner	The Seattle Center, generally represented by a Project Manager.
Project Manager	The person designated by the Redevelopment and Project Management Office to officially represent the Seattle

Center throughout all study, design and construction phases of a project or program.

D. TEMPORARY FACILITIES AND CONTROLS

1. Vehicular Access and Parking

In order to service any facility it is imperative that service vehicles have direct access to the facility. Vehicular access for delivery and service vehicles is mandatory -- it simply has to be thoughtfully integrated into the overall design philosophy for the building and the site. Owner shall determine the amount of service vehicle traffic to be generated by the facility and the appropriate access for that traffic. Any On-Grounds campus access (long or short term) will require a permit which will be distributed by the Redevelopment Office.

Over the years it becomes necessary for service, delivery or construction vehicles to access buildings in ways different than planned. Pedestrian pathways, plazas, etc., shall be designed for HS20 vehicular loads just the same as all streets.

2. Facility or Building Access

Keys or access cards can be provided with a $50 refundable deposit per key or access card. Deposit will be refunded once all keys and access cards are returned at the close of the project.

3. Loading Dock/Seattle Center Warehouse

The loading dock is intended to provide a convenient, all weather location for delivery trucks to load and unload products that cannot be delivered and received conveniently via general purpose circulation areas. To be satisfactory they must include adequate turn around space for trucks accessing the dock. They must also provide adequate space for simultaneous access of several vehicles. Since facilities inherently require frequent delivery of large, heavy items of equipment, loading docks must accommodate truck bed level unloading, allow for highway standard clearances, have level access for maximum length vehicles, etc. The dock and surrounding area must provide a weather protected enclosure for the safety and comfort of the users and the protection of the products being delivered.

A common misuse of loading docks is the belated installation of bottled gas handling facilities. Bottled gas requirements should be considered early and accommodated in a properly protected area adjoining the loading dock (without sacrificing loading dock capacity). Another intrusion on loading docks results from inadequate planning for service vehicle and short term load/unload parking.

Loading docks should have flat, smooth walls and ceilings, with light fixtures, pipes and conduits recessed and hidden to deny bird places to roost and nest.

One week (1) advanced notice must be given for deliveries made to the Seattle Center Warehouse loading dock. Deliveries should be scheduled between the hours of 6:30am and 2:30pm unless otherwise notified. Any deliveries made outside these hours are at the Client's risk.

4. Temporary Project Signage

At the commencement of construction, the general contractor as directed by the Client shall furnish and install at minimum two (2) construction signs to identify the project at a prominent location at or near the construction site with the following guidelines:

a. The construction signs for identification of the project will be installed prior to the commencement of construction at a location which is near the project site and amenable to public viewing.
b. The signs will be adequately supported with regard to site conditions and will be an adequate distance above the prevailing grade to permit public viewing.
c. The signs will be constructed of an exterior quality sign material at a minimum dimension of 48" x 72".
d. The lettering will be of professional quality and proportionate to information displayed and with the Seattle Center logo prominently featured.
e. A proof of the signs must be reviewed and approved by the Project Manager.
f. The signs must be maintained and in good condition by the Client until completion of the project.
g. The signs will be removed and appropriately disposed of when construction is complete and accepted by the Owner.
h. Additional signage proposed by the Client must first be reviewed and approved by the Project Manager.

Please refer to **Appendix A-8** for examples

F. PRODUCT REQUIREMENTS

1. Waste Handling

a. Effective waste management must be carefully considered at the very beginning stages of design. Waste handling provisions must be carefully developed and in such a way as to not negatively affect or diminish the aesthetics or functional provisions required for site standard presentation and consistent with established process use on Seattle Center grounds.

b. Recycling is an integral component of waste handling and at Seattle Center we divide waste into 7 streams, 6 of which are recyclable. Effective recycle management provisions must be included in the design of the facility and the waste handling area of the facility. Specifically the facility must accommodate recycling for mixed paper and cans and bottles. This means space must be allocated for two (2) extra containers at each location where waste is collected and removed.

c. Dumpster Enclosures: Space for three standard dumpsters must be provided. A footprint of the standard front load dumpster is 82" wide by 36-

70” deep, depending upon the yardage capacity. All front load dumpsters are 82” wide. Driveway access to dumpsters must be provided. The total width of dumpster hauling trucks is 10’ minimum. In addition, the following amenities shall be provided:

- Sufficient lighting
- Access to water supply should be recessed into wall
- Surrounding area shall be composed of smooth surfaces that lead to a sewer catch basis drain

All facilities must have a designated area for dumpster storage. This area will require screening such as walls, fencing, and gates and landscaping, depending upon the area. Windows, roofs and ledges should be designed to discourage nesting and perching birds

Seattle Center Park Maintenance staff shall be consulted early in the design process to determine design requirements.

d. Site Receptacles: Waste collection and source separation begin with the proper selection and placement of equipment and the functional design of integrated recycling collection systems. Waste receptacles shall be a minimum of 48 gallon capacity with easy customer access. Containers must be of enclosed design to prevent pest access. Recycle containers shall have a capacity of not less than 32 gallons and match the waste receptacle in design.

Waste receptacles shall be spread conspicuously throughout the grounds and with a density sufficient to support heavy customer use.

2. Elevators, Vertical Access

A vertical transportation consultant will to need provide an adequate technical specification that follows all applicable building, safety, and accessibility codes.

Different from many owners, Seattle Center staff maintains nearly all of the Center elevators. Therefore, it is imperative that all elevator system documentation and maintenance equipment be provided to the Seattle Center. Elevator providers resist releasing certain information and equipment to the owner. The requirements must be clearly spelled out in the contract documents.

3. Telecommunications

The most rapidly growing and changing building utility is communications systems. The Site Standards must be the primary resource for technical program requirements and related decision making in Communications Facility Design. Seattle Center Site Standards follows the guidelines and requirements from the City of Seattle Information Technology (SeaIT). Refer to Appendices C.

The client shall include a SeaIT communications engineer – in the design of any new building to ensure telecommunications requirements are considered.

E. EXECUTION AND CLOSEOUT REQUIREMENTS

1. Operation and Maintenance manual and electronic files (CAD & PDF) of as-built drawing sets are to be provided to Seattle Center Redevelopment office.

F. PERFORMANCE REQUIREMENTS

1. Sustainable Design Requirements

The City of Seattle and all departments, aims to maximize the environmental quality, economic vitality, and social health of our city through the design, construction, operation, maintenance, renovation, and decommissioning of our buildings and sites. Sustainable buildings and sites support overall City objectives by making efficient use of limited energy, water, and material resources; reducing climate change; minimizing pollution and hazardous materials; creating healthy indoor environments; reinforcing natural systems; providing habitat; creating vibrant spaces for people; and contributing to their neighborhoods.

- New construction and major renovations 5,000 square feet or greater must meet LEED Gold, as well as key performance requirements for energy and water efficiency, waste diversion and bicycle facilities.
- Tenant Improvements 5,000 square or greater, with a scope of work that includes mechanical, electrical and plumbing, must meet LEED Gold, as well as water efficiency and waste diversion requirements.
- Small projects, either new construction, renovations or tenant improvements, less than 5,000 square feet are to utilize Capital Green, a green design and construction evaluation tool developed by FAS, in project planning and development. Please click on the link to be directed to the City's Capital Green website or refer to **Appendix B** for additional reference materials.
- All new and existing sites projects shall follow best management practices.

The Capital GREEN Toolkit consists of two linked Excel files – "capital green form.xlsm" and "toolkit.xlsx". These two files must both be downloaded and should remain together. Each time you begin a project, download both source files into their own project specific folder. Note that both files will need to be open for the Toolkit macros to run. The Toolkit can be accessed from the City's Capital Green site. The two excel files are also linked to the Table of Contents.

2. Serviceability

Every building built on the Center's grounds is intended to serve its purpose over a long period of years. The initial design and construction is only a brief moment in time and cost for the facility. The true value and quality of a building is measured over the years by its ability to adjust to the needs of the end users and the cost of servicing the components and systems within the building.

A building cannot function if it cannot be serviced. Although it is important to get the "front door" right, it is the "back door" that determines how well the building will work. When building services can be provided to meet all requirements and

be virtually transparent to the end users, then the building is most likely a success.

3. Safety & Security

Safety and security provisions are becoming more complex as concerns for personal safety increase, equipment becomes more sophisticated and costly, and security systems of all types become more readily available at reasonable cost. All too frequently such considerations have been overlooked at what could have been the optimum point in the design process, resulting in belated consideration with poor results. More often than not, security requirements conflict directly with convenient access for maintenance, custodial care, and response to emergencies. Early security planning may directly influence the design and location of many strategic mechanical and electrical components to the benefit of all concerned.

It is incumbent upon the owner and the design team to thoroughly consider crime prevention (anticipation, recognition and appraisal of crime risk and the initiation of some action to remove or reduce it) in the development of the overall design of facilities

The environmental design of facilities must result in a "natural surveillance" characteristic for surrounding areas that will reinforce behavioral patterns of normal users and be a hostile environment for behavioral patterns of abnormal users (those who may be prone to criminal behavior).

4. Structural Considerations

It has been common practice to design to international building code minimum structural requirements for floor loading, seismic zone, etc. Operational experience indicates that designing to code minimums is not in the owner's long term best interests. One example is floor load capacity. The other major consideration is vibration. A great deal of instrumentation is extremely sensitive to vibration which leads to more rigid structures or inclusion of vibration isolation pads, etc.

Floor to floor heights is the other major concern (for purposes of this discussion). It is no longer realistic to think that a facility can be held to a twelve foot floor to floor dimension. Although there would be some variation based on the intent of the ceiling space, no matter what is originally intended, anything less than fifteen feet will, over the long haul, be a disservice to the owner. Further, the depth of the structure for each floor should be carefully controlled to be as uniform as possible throughout and not broken up by major beams. Although not mandatory, concrete waffle slab construction seems to offer several advantages over most other forms of construction; e.g., no deep beams; a uniform/modular surface to work under; opportunity for patterns for hangers, sleeves, etc.; rigidity; etc.

5. Seismic Considerations

All consultants must include appropriate seismic provisions. For the most part, this will involve earthquake bracing for objects which might be dislodged; fall and either injure building occupants or disrupt emergency systems included in the facility. It is reasonable to expect that today's discussions will become tomorrow's requirements. Hence, due in large part to the disproportionately high cost of retrofitting facilities to bring them into code compliance, future requirements should be anticipated and included now.

6. Acoustic Control

Articles in technical journals and field observations clearly indicate that many facilities with "heavy" ventilation and air conditioning requirements are becoming too noisy for sustained occupancy. Thus, it is mandatory that careful attention be given to thorough acoustic management of all noise sources. Because of the complexity and the problems (e.g., structural transmission) computerized analyses should be employed when there is reason to be apprehensive about acoustic control.

7. Internal Accessibility

One of the most important requirements in facilities is accessibility to services distribution systems. Pipe and duct shafts should be provided floor landings or platforms with lighting, electric outlet and doors -- not access panels. Suspended ceilings should only be provided where highly desirable in offices, conference rooms, etc. There are a lot of nice-looking building interiors in this country that don't have suspended ceilings. Where suspended ceilings are appropriate, they must be lift out exposed T bar type systems. Hidden spline type ceilings are unacceptable. Suspended ceiling material must be able to withstand a lot of handling and be easily cleaned. Where hard finish ceilings are required, extensive access panel provisions must be included, carefully sized and located to provide effective access to the equipment above.

END OF SECTION 01 00 00

Seattle Center Site Standards

Division 02

Existing Conditions

A. TREE PROTECTION

1. A Seattle Center Landscape Supervisor (Arborist) or a Certified Consulting Arborist must review all aspects pertaining to the preservation of trees and plants. If a Certified Consulting Arborist is to be contracted, this Arborist shall be mutually agreed upon by the Contractor and by the Owner. The Contractor shall hire and pay for the Certified Consulting Arborist.

2. The Arborist will conduct a pre-construction tree inventory. The tree inventory will determine the following information about each tree within the proposed construction limits: exact location, species, DBH, relative health, appraised value, maintenance needs, and any other special tree concerns.

3. All contractors and sub-contractors, including all personnel, shall be made aware that the trees are valuable and need to be protected. The general contractor is ultimately responsible for the protection and value of the trees in the area of construction.

4. The Arborist is to determine the tree protection zone(s). Plywood boxes 8’ high of plywood a minimum 5/8” thick shall be constructed 360 degrees around each tree. Single-strand wires, rope or plastic flagging is not considered an acceptable barrier. Tree protection zones may be established by the drip line or branch spread for small trees. For larger spreading trees, a one foot radius for each inch of tree diameter. Leaving the fence open on one side, moving the fence limits, or temporarily removing the fence and working around the tree is unacceptable.

5. The Arborist is to oversee any root pruning of roots over 2 inches in diameter, the tree root shall be cleanly cut under the direction of a Seattle Center Arborist. Arborists are on site and available at short notice, during regular working hours. Prevention of tree root damage by construction equipment is a priority. To prevent roots being ripped by equipment excavating and/or grading, the roots are to be pruned 6” -12” closer to the tree than the construction limit. The Arborist may need to specify the use of equipment manufactured by the arboricultural industry for root pruning.

6. Construction materials or stockpiling fill are not to be stored over root zone area at any time. Parking of vehicles or construction equipment is not permitted over root zone area. Where installation of utilities is to disturb root system, auguring is to be done as recommended by the Arborist. Any equipment traveling between trees shall only proceed while traveling on ¾” or thicker plywood to prevent undue compaction of tree root systems. The Arborist will determine if severing roots close to the trunk will make the tree subject to the windthrow hazard.

7. The Arborist is to review and approve the routing for all trenching in vicinity of trees and tree roots prior to commencement of trenching in order to minimize impact to existing trees which will remain after the project is done. No hand digging is allowed in the vicinity of trees without prior approval of the Arborist. Use air spade or vactor truck.

8. Contractor shall keep all exposed roots moist and protected with mulch or burlap bags. Methods shall be reviewed and approved by the Arborist.

9. All irrigation systems on the periphery of the construction project shall be kept operational throughout the project. If portions of that irrigation system were tied to the portion of the irrigation system being demolished as part of the project, Contractor shall consult with Arborist and Seattle Center plumbers as to the best way to cap and temporarily restore operation of remaining system for duration of construction.

10. When backfilling, if subsoil and fill material is unsuitable for root growth. All construction debris is to be removed and backfilled with clean topsoil as specified in soil section specifications. Backfill is to be replaced to the original root crown level. Any grade changes in the tree

protection zone, no matter how minor, are undesirable and must be pre-approved by the Arborist.

11. To reach the Seattle Center Arborist, call the Landscape Office at (206) 615-0880.

END OF SECTION 02 01 00

A. Scope

These standards apply to the procedures and responsibilities of the contractor completing subsurface investigations of a site. The contractor shall be capable, following a thorough investigation of the site and related documents, to accurately anticipate the conditions to be encountered.

To assure the most complete investigation, the work shall be facilitated in the following manner:

1. Before any work begins, the contractor should request and participate in a meeting arranged by the Seattle Center Project Manager with Seattle Center's plumbers, electricians, and plant engineers to review the site.

2. The contractor shall uncover all existing city utility lines being tied into to verify their type, condition, location, invert, slope, and any other information needed to determine that the utility connection will function as designed. The contractor is responsible for making any repairs necessary to the lateral or main lines of the city water, reclaimed water, sanitary sewer, and/or storm drain system necessary for the connection to function as designed. The contractor shall locate or have located all existing underground private utilities (electric, telephone, pipelines, etc.) and structures in advance of construction and shall eliminate all conflicts prior to start of construction.

3. Examine Seattle Center's and the City of Seattle's utility record plans. Old and new utility drawings are available through the Seattle Center Redevelopment.

4. The Contractor shall request scheduling of utility or system shutdowns through the Seattle Center Project Manager, who shall give adequate notice of the requirements to the shops and supervisors. Seattle Center will perform all utility shutdowns and resumption of service.

5. The Contractor shall verify with the Seattle Center Project Manager work hour limitations on noise and the use of heavy equipment on the Seattle Center campus.

6. Utility record drawings and soil boring records are solely for the convenience of the Contractor and Architect. Seattle Center does not assume any responsibility for the sufficiency or completeness of the drawings or soil boring (Geo-technical) reports.

7. Contractor shall prepare as-built CAD drawings of ALL exposed underground utilities before covering. This drawing shall be stamped by a Licensed Surveyor and shall include horizontal and vertical (X, Y and Z values) survey coordinates for all maintenance hole covers at finished grade and invert elevations of all pipes within structures. The drawing shall be clearly labeled "AS-BUILT DRAWING."

END OF SECTION 02 06 30

A. Scope

These standards and procedures apply to topographic surveys involving the field location and plotting of all natural objects and surface improvements.

B. Design Criteria

General Requirements

1. Surveying

a. Survey accuracy shall be limited to that required for mapping purposes and shall, in general, be three times the map plotting accuracy.

b. Horizontal control shall be State Plane coordinate system North Zone and grid lines shall be shown on the drawings.

c. Vertical control shall be City of Seattle datum. (NAVD88)

d. A base line, when shown on location plan, will be physically located in the field and shown on the topographic map. It shall be referenced by coordinates and a bearing. Base lines will generally be established parallel to a face or major axis of proposed or existing buildings.

e. Where existing survey data adjacent to or within the work area is available, Seattle Center will furnish such information to the surveyor. The surveyor must verify the present day accuracy of all data prior to incorporation into the work.

2. Mapping

a. Preferred mapping scale is one inch to 20 feet with a scaler accuracy between random points on the map of 6 inches. Contour intervals shall be one foot, two feet allowable on steep slopes for clarity of drawing, with average allowable errors of one quarter the interval or six inches for improved ground surfaces. Unimproved surfaces may be twice this amount.

b. All new work will be matched to existing survey maps to provide topographic continuity wherever possible.

c. All one foot ground surfaces shall be represented on the drawings by means of contours with spot elevations shown in addition to contours at critical locations. Contours shall be shown at 1'-0" intervals.

d. All ground floor elevations of existing buildings and slab structures shall be noted on the drawings to the nearest hundredth of a foot.

e. Verify all storm and sanitary sewer inlet and outlet invert elevations at manholes by field measurements and enter such elevations on the map. Show underground storm and sanitary pipes.

f. All buildings shown wholly or partially on the finished drawing shall be identified by name and accented by shading or crosshatching. In tubular form show major building corner coordinates.

g. Field locate, record location and identify on map all surface improvements and natural conditions.

h. Field locate all trees and major vegetation and record location on map. Identify tree size and type on map.

i. Locate all tunnels and manholes, show floor elevation of tunnels and tunnels coordinates.

j. Use Seattle Center monuments, show coordinates.

k. A general vicinity map, small scale, shall be included on the finished drawing.

l. Show all existing property lines, right-of-ways, and easements.

C. Products - Not Applicable

D. Execution

1. Existing shrubs, trees and lawn areas shall be protected during the progress of the work and under no circumstances will their removal, pruning, grubbing or trimming be permitted without the consent and under the supervision of the Seattle Center Landscape Supervisor.

2. Drafting and Layout Standards (See SPU/SDOT Standard Plans).

END OF SECTION 02 21 00

Seattle Center Site Standards

Division 03

Concrete

A. Scope

The standards and procedures apply to the design and execution of all reinforced concrete construction.

B. Codes, Regulations and Standards

All work shall conform to the following codes:

1. Seattle Building Codes and International Building Code, latest edition.

2. American Concrete Institute Building Code Requirements for Reinforced Concrete (ACI 318), latest edition.

3. American Concrete Institute Standard Specifications for Structural Concrete for Buildings (ACI 30l), latest edition.

4. Manual of Standard Practice for Detailing Reinforced Concrete (ACI 3l5), latest edition.

C. Design Review and Submittals

1. All plans, specifications and computations shall be completed by an Engineer/Architect licensed by the State of Washington.

2. All project designs and specifications shall be submitted to the owner on a progressive basis as the design develops.

   a. A schematic design review should include schematic plans for a structural system and a written description of its applicability.

   b. A review during the design development phase should minimally include a structural section, typical floor framing plan, and main member sizings.

3. Final drawings shall show all expansion joints, construction joints, concrete strengths, finishes, and load limits for floors, ramps, and decks.

4. Detailed reinforcing shop drawings showing and identifying all bars and tendons shall be prepared by the Contractor's supplier and submitted to the engineer for formal review and approval before fabrication.

5. All building permits and vacations, and fees associated therewith, conveying permanent construction rights and occupancy to the owner, will be obtained and paid for by the owner. Construction permits of a temporary usage nature shall be obtained by the contractor at no expense to the owner. It shall be the consultant's responsibility to see that all permanent permit requirements are included in the final contract documents.

D. General Requirements

While projects and completed structures may vary widely, the principles of design must be cost effective in design and construction. General guidelines include:

1. Standardize bar grades, sizes and lengths as far as possible.

2. Beam and girder sizes and spacings should be uniformly chosen.

3. Stories should be of uniform height, with lower floors of greater height if needed.

4. Maintain column cross-sectional areas constant for at least two stories. When necessary, change column thickness only with an inside face setback.

5. Free standing interior columns should be circular and of constant diameter per story. Reinforce with spiral hoops rather than with isolated ties.

6. Provide the maximum reuse of forms for all cast-in-place concrete work. This requires repetition of design features throughout the project.

7. Minimal dimensions of column and beam sides should be in multiples of 2 inches.

8. Locate cold joints so that shoulders are available to anchor subsequent concrete lifts.

9. Provide keyways at all construction joints and include continuous water stops wherever subjected to hydrostatic pressures.

10. Slope the top of all exposed concrete surfaces and include drip grooving underneath all cantilevered leading edges.

11. Major transitions in section, such as occurs at a tunnel/building interface, shall be squared-off and isolated. Provide a bossed wall opening to support and laterally restrain the tunnel end. Allow for differential tunnel movement and water stop if necessary.

12. All below grade exterior wall pipe penetrations shall be made with special cast iron flange to mechanical joint wall castings of matching length with integral intermediate flange. Interior face flanged with a mechanical joint exterior for flexibility and shall extend beyond the wall line with at least one length of ductile iron pipe.

    Sleeve and curb all floor slab openings.

E. Specific Requirements

1. Concrete mix batch weights along with bulk specific gravity determinations shall be required for all selected aggregates based on saturated surface dry (SSD) conditions. This mix information must be sufficient to verify through absolute volume calculations the concrete's yield, cement factor, water/cement ratio, and mortar to voids ratio as a primary basis for mix acceptance.

2. Mix ingredients and proportions shall be such as to work readily into corners and around reinforcing without segregation and undue shrinkage while achieving the standard deviation in specified strength. Final mix shall be based on either laboratory test batches or field experience with standardized mixes.

3. All admixture usage must be justifiably cost effective and result oriented. Admixture usage is not a substitute for sound concreting practices.

    a. Admixtures containing compounds either accelerating or retarding set times without water reduction are discouraged.

    b. Water reducing admixtures may be used to increase slump and workability without increasing mix water-useful when placing concrete by pumping.

    c. The use of superplasticizers to temporarily increase mix fluidity above the specified maximum design slump must be considered whenever strength dictated low water/cement ratios interfere with successful concrete placement

and consolidation. Such applications include all of the higher strength concrete mixes, pumped concrete placements, and thin section construction wherein shrinkage must be minimized.

The job site addition of a superplasticizer shall be specified and monitored by the structural engineer.

d. Air entrainment admixtures shall be specified for all slabs exposed to natural weathering and freeze-thaw cycling. Do not use with high early, strength type III cement. Reduce mix water by approximately one gallon per sack of cement whenever air entrainment is used; a vinsol-resin type at 1/2 to 1-1/2 fl. oz. per sack of cement.

e. Fly ash, a resource conservation and recovery material, used as a direct substitute for Portland cement in mix quantities of 20% to 30% of the weight of cement improves workability while allowing a corresponding percentile reduction in mix water; and maintaining the same cement to water ratio.

Today, when most concrete placements are by pump, the use of fly ash is strongly recommended as a viable alternate to sand. Set time may double for comparable strengths and this may require fly ash mix reductions where early entry slab work is concerned.

4. Concrete strengths shall be as noted on the drawings, but in no case less than 4000 psi at 28 days.

Fill concrete of 2000 psi compressive strength shall be used to reestablish base of footing elevations in all cases of footing over excavation.

5. All cold joints that are exposed to the weather or subject to hydrostatic water pressure must be water stopped All below grade walls and slabs subject to hydrostatic water pressure must also be protected with a two to three ply layer of membrane waterproofing, otherwise dampproof. All slabs-on- grade must include a below-slab gravel capillary break and a foundation ground water collection and drainage system.

a. Expansion joints or contraction joints shall be provided at periodic intervals and at all changes in concrete section to offset member restraint, and shall be continuous throughout the breadth and depth of the effected member. Interrupt all exposed slab-on grade and other thin wall sections at 20 feet or less - a simple construction joint with a suitable delay in adjacent placements will suffice for interior work. All others must be full depth separations with appropriate clearances and means for shear transfer. Fully locate and detail on the drawings.

b. Seismic joints closely parallel expansion joint, with the notable exception of providing total structural freedom across the joint.

c. Construction joints shall be uniformly spaced at forty foot intervals throughout the structure to facilitate the work and limit shrinkage, and shall be located and detailed on the drawing. Key for shear transfer and carry reinforcing through the joint. Always provide sufficient temperature/ shrinkage reinforcing to uniformly distribute shrinkage cracks. Waterstop as dictated by the presence of ground water.

Locate joints perpendicular to beam center lines whenever possible and carry through into walls and footings with minimum offsets.

6. Reinforcing shall be continuous across construction joints. Terminate reinforcing with appropriate setback at all expansion/ contraction joints. Provide integral key ways for shear transfer across any and all such joints.

7. Clear span requirements may require pre and or post tensioning of long span members. Special design attention must be given to the long term effects of member shortening and creep cambering, and particularly so in the case of continuous members. If continuity must be established at the supports, weld only at the top to avoid compromising the member's gravity load-carrying ability or design the bearing support members for full longitudinal load ductility.

F. Products

1. Cement shall conform to the Standard Specification for Portland Cement ASTM Designation C150, Type I or Type III.

2. Aggregates shall be composed of clean and natural crushed gravel complying with ASTM Designation C 33. Maximum size of coarse shall not exceed one-fifth of the minimum concrete section or three-fourths of the minimum clear distance between reinforcing bars.

3. Mix water shall be of potable quality, free from oils, acids and injurious amounts of organics or salts.

4. Ready-mix concrete shall be utilized wherever locally available, subject to plant approval. Fully executed and signed trip tickets shall accompany each load and shall be logged in at the job site by the inspector with the time of entry. Re-tempering of concrete that has taken its initial set will not be tolerated, nor shall the adding of mix water without authorization be allowed.

5. Deformed bars shall be of appropriate ASTM A305 designation or cold drawn welded wire fabric of ASTM A185 specification. All hard grade reinforcing shall be marked with red paint at the bar ends, in addition to the standard tagging. Store on platforms off the ground.

6. Use polyvinyl chloride hollow dumbbell waterstops with continuous splicing where joint is spaced and subject to movement. Use flat ribbed polyvinyl chloride with continuous splicing all other cases.

G. Execution

1. Forms may be of wood, steel or fiberglass. Exposed surfaces shall be equal in appearance to that of plywood. Forms shall be mortar- tight and sufficiently strong and rigid to resist deformation.

   Form ties shall be steel rods of adequate strength, providing a minimum 1-inch break back from the surface.

2. Form all vertical footing surfaces. Remove all water from form work - by pump from an outside sump, if necessary. Forms shall be true, rigid, tight and clean.

3. A non-staining mineral form oil compound must be applied before any reinforcing is installed.

   Wood forms shall be oiled and, except in freezing weather, wetted immediately prior to concrete placement.

4. All reinforcement and embedded items shall be securely fastened, inspected, and approved by the inspector before pouring operations may be started.

5. Runways or other means of conveyance shall be provided to allow placement of the concrete in its final location.

6. Existing concrete surfaces to receive new concrete shall be cleaned, roughened and given a 1/2" coat of cement grout prior to placement of new concrete. Grout shall be of same cement and fine aggregate proportions of the concrete to be placed.

7. Vibrate concrete in its final location to a uniform and homogeneous mass. Vibration by means of approved portable vibrators shall be done only to the degree necessary to produce a dense well-compacted concrete free from honeycomb and voids. The contractor must have on hand at all times at least one spare vibrator equal in performance to that in service.

8. Curing of formed surfaces shall be accomplished by moistening with forms left in place for the full curing period. Bulkheads may be removed to permit forming and pouring of adjacent wall sections.

   Unformed surfaces shall be covered with burlap or sand and kept wet. Slabs may also be spray-coated with a membrane curing compound. The pigmented curing compound shall be applied in two transverse coats of not less than one gallon per 200 square feet of surface each.

9. Forms shall be removed at such times and in such manner as will guarantee the safety of the structure. Primary supports for elevated slabs shall not be removed before 28 days in the case of regular cement usage. Other mix ingredients may affect this time and any such primary shoring removals must be verified by break strength tests of at least two job cured cylinders. Note that equivalent strength for pozzalamic (fly ash) concrete mixes may require 58 days.

10. Forms sufficiently free from damage may be reused after being cleaned.

11. Finishing shall follow immediately upon form removal and patching. Patch with mortar of same proportion as the concrete and minimum water content after saturating the area to be patched.

    Standard finishes are of two classes and all finishes shall be noted on the drawing.

    a. Class A: A dry surface honed to a uniform and even color and texture throughout, followed by a wet bagged (burlap) rub with 1 part Portland cement and 1-1/2 parts fine sand. When dry, remove excess grout with a second sacking.

    b. Class B: Remove irregularities by chipping and grinding. After wetting, bag as before.

END OF SECTION 03 31 00

Seattle Center Site Standards

Division 04

Masonry

A. Scope

This site standard is directed toward all masonry wall material, that is, brick, stone, terracotta, ceramic tile, CMU, etc. The Seattle Center has a number of masonry designed buildings consisting of single and double wye composite masonry bearing walls, shear walls and veneer masonry. This section highlights good masonry practices for Seattle Center buildings.

B. Design Criteria

During the Design Development phase of new buildings, an overall scheme/theory shall be presented. This scheme shall anticipate locations of horizontal, vertical and seismic expansion, contraction, control, and building movement joints and address drainage of all surfaces. In addition, it shall anticipate thru wall flashing and the protection of parapet masonry. The architect, structural engineer, and masonry consultant shall coordinate their design effort to provide a cohesive design solution through an understanding of masonry interaction with other building materials.

C. Specific Requirements

1. All masonry units shall be above grade.

2. Masonry roof parapets shall have their roof face protected.

3. All masonry walls shall have expansion/contraction joints.

4. Joints for expansion, contraction, building movement and seismic design criteria shall be sealed to prevent weather and water from penetrating to the interior of the building. All vertical and horizontal joints shall be drained to daylight above all horizontal surfaces. There shall be both a primary (architectural) weather seal and a secondary weather seal where water and moisture could penetrate the wall, i.e. "Emseal, J-M. Bellows.

5. Stainless steel and copper thru-wall flashing shall be provided at wall caps, window heads, ledger angles, base bearing, etc.

6. All masonry anchors shall be Hohmann and Barnard DW-10HS®, DW-10® (2+2), hot galvanized, 12 gauge, Vee Wall Tie, hot galvanized, 3/16" or 1/4".

D. Products

1. All masonry unit design mixes shall be proven design mixes with a minimum of 15 years of product history. The unit shall have been tested for water absorption and freeze/thaw cycling which is compatible with the local weather extremes. The masonry wall shall meet the Seattle Building Code requirements as well as the design criteria set forth by the structural engineer for bearing, shear, expansion, and contraction.

2. Care shall be taken in the installation of the masonry units to prevent structural and face damage as well as discoloration from excessive concrete and mortar slobbering, staining and discoloration from moisture and adjacent materials. On completion of the masonry and a reasonable setting and drying period, the masonry shall be cleaned with products acceptable to the masonry manufacturer. Upon completion of cleaning the masonry walls shall be sealed with a water seal which is compatible with the masonry units and compatible with the cleaners used.

3. Masonry water sealing should be specified as part of masonry contract.

4. Masonry units used for flooring, deck, and courtyards shall be units specifically designed for pedestrian and vehicular traffic. These units shall be set and sloped in a logical and positive manner away from all buildings and to drains. The paver design shall include expansion joint where required and at all vertical planes.

    a. All structural slabs substrata above all spaces shall slope and shall have perimeter curbing at building walls, seismic joints and other openings where water proofing substrata will terminate and protect spaces below. Drains shall be so designed that they are either sumps within or below the structural substrata or shall have their flow line at the low point of the sloped structural substrata.

    b... All surfaces shall be sloped 1/4" per foot away from the building and shall be designed to free flow water to an exterior surface. The masonry walking surface shall also be sloped to drains and away from building walls. Interior drains should be avoided.

    c. All walls resting on masonry curbing shall rest on and over said curb providing an adequate drip and cover cap for this curb. It shall simulate flashing.

    d. Seismic joints in all structural slabs shall have curbs. The seismic joint shall have a gutter drain system attached below the structural slab, a secondary water seal between structural slabs, and a primary (architectural) water seal at the visible surface. At the walking surface the seismic joint should be armor plated and meet the requirements of disabled persons.

END OF SECTION 04 00 00

Seattle Center Site Standards

Division 05

Metal

A. Scope

These standards and procedures apply to the design and erection of structural steel.

B. Codes, Regulations and Standards

All work shall conform to the following codes, regulations, and standards:

1. Seattle Building Code and International Building Code, latest edition.

2. Manual of Steel Construction, American Institute of Steel Construction, Inc. (AISC), latest edition

3. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest edition.

4. Code of Standard Practice for Steel Buildings and Bridges, AISC, latest edition.

5. Specification for Structural Joints Using ASTM A325 or A 490 Bolts, latest edition.

6. Tower designs shall be in accordance with latest issue of ANSI/EIA/TIA-222G or latest issue or the Seattle Building Code, whichever is the more stringent.

7. Arc welding electrodes shall conform to AWS D1.1 for filler metal. Use as recommended by manufacturers for the actual positions and conditions of use.

8. A Guide to Shop Painting of Structural Steel by AISC/SSPC, latest edition.

C. Design Review and Submittals

1. Shop drawing reviews shall focus particularly on fabrication methods to assure that changes in this area do not affect the design mode of failure.

D. General Requirements

1. The use of higher strength steels with their higher yield points and reduced sections should force the designer's attention on variables other than strength, such as: lack of ductility and susceptibility to corrosion; unbraced lengths of compression elements, and width/thickness of plate elements (compact section). In these regards:

   a. Control web buckling by selecting appropriate beams rather than stiffening the web panel. The unstiffened girder may weigh more, but its overall cost will be less.

   b. Lateral buckling of the compression flange is usually resisted in simple beams by diaphragm slab resistance. Continuous beams may require supplemental bottom flange bracing at the point of support. When the support is a free-standing column, they both are in need of lateral support at this point.

2. Design all bolted connections (such as coped webs of simple beams or gussets in shear) so that the net areas of connecting elements equate favorably with the members gross section.

3. Connections

a. Use ASTM A490 high alloy strength bolts for high strength steel jointing. Tighten to specified AISC tensions. Use ASTM A325 bolts with mild steels such as ASTM A36.

b. Maintain same bolt size throughout job with constant 3-inch spacing.

c. Rigid frame connections should be welded to develop joint for full ductile frame action under seismic loading.

d. Welded joints subject to impact and fatigue shall be butt (grooved) welded. Square butt up to 3/8-inch. Single bevel up to 1/2 inch with welds from both sides over 1/2 inch in thickness, may be combined gravel and fillet for economy. Fillet weld for static loads only.

Welds shall be designed for transverse loading rather than longitudinal shear whenever possible.

e. Avoid embrittling weldments perpendicular to rolled surfaces whenever possible. Studs 1/2-inch and over must be annealed to induce stress relief during cooling.

Avoid weld combinations of higher strength steels in thicker sections, requiring a large amount of weld material and joint restraint. When unavoidable; select more ductile electrodes, press and weld from the center of mass outward.

D. Material

Select ASTM A36 steel whenever possible. Where higher strength is needed, use ASTM A441 for its improved weldability and consider ASTM A572-50 for heavier sections. Avoid the use of all high strength steels in corrosive atmospheres.

E. Execution

1. Field welding shall be shielded metal arc. Shop welding shall be submerged arc. Use law hydrogen, dry, electrodes only.

2. Work shall be executed by certified welders only.

3. Clean all surfaces and paint with one coat of shop paint per SSPC except for surfaces to be encased or fire protected.

END OF SECTION 05 00 00

Seattle Center Site Standards

Division 07

Thermal & Moisture Protection

A. Scope:

It is the responsibility of the Contractor to coordinate work of this Section with the work of related Sections, which may include concrete work, masonry work, joint sealers, drywall, and mechanical, plumbing, and electrical work. It is the responsibility of the Contractor to identify all locations requiring firestopping and coordinate installation of the firestopping. Provide firestopping and smoke seals as indicated on the drawings as well as the areas listed below:

1. All openings in fire-rated floors and wall assemblies, both blank (empty): and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

2. Curtain wall openings between exterior walls and connecting floor assemblies.

3. Expansion joints in fire-rated walls and floors.

4. Openings at each floor level in shafts or stairwells.

B. Codes, Regulations and Standards

All work shall confirm to the following codes, regulations and standards:

1. Seattle Building Code, latest edition

2. Seattle Fire Code, latest edition

3. U.L. Fire Resistance Directory, *Through Penetration Firestop Devices and Systems*, latest edition

C. Quality Assurance, Submittals and Product Handling

1. Firestopping materials shall conform to Flame (F) rating as required by local building code and as tested by nationally accepted test agencies per ASTM E-814 or UL 1479 fire tests. The Flame rating must be a minimum of one (1) hour, but not less than the fire resistance rating of the assembly being penetrated.

2. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of the UL illustration of each proposed system or a manufacturer-approved illustration. (See Application Schedule below).

3. Submit copies of manufacturer's specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

4. Deliver materials undamaged in manufacturer's unopened containers, identified with brand, type, grade, and UL label where applicable. Coordinate delivery with

scheduled installation date to minimize storage time at site. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

D. Project Existing Conditions and Environmental Requirements

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

2. Provide adequate ventilation if using solvent. Provide forced air ventilation during installation, if required by manufacturer.

3. Keep flammable materials away from sparks or flame.

4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

E. Products

1. Subject to compliance with requirements, provide products of one of the manufacturers listed in the Systems and Applications Schedule in this Section.

2. Provide materials classified by UL to provide fire barrier equal to time rating of constriction being penetrated.

3. Provide 100% asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.

F. Execution

1. Inspect and verify that the surface and condition of the substrates have no defects or errors that would interfere with the installation of the firestopping materials. Notify the Project Manager of any defects or errors in surface conditions. Do not proceed with work until all unsatisfactory conditions have been corrected. Installation of firestopping shall constitute the Contractor's acceptance of surfaces and conditions of substrates.

2. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory, manufacturer's instructions, or architectural detail as indicated on the application schedule.

4. Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other materials referenced by the Application Schedule are installed.

5. Install firestop with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.

6. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting the same loading as floor.

7. Immediately notify the Project Manager if the specified firestopping systems cannot meet the requirements of the specification.

8. All areas of work must be accessible until inspection by the Seattle Fire Department Fire Marshall. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

9. Clean spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged and clean condition.

G. Systems and Applications Schedule

1. See U.L. Listing or manufacturer's specifications for associated components not listed (i.e. sleeves, collars, mineral wool, etc.).

2. Insulated cable, bus ducts, glass pipe and other penetrations and construction conditions not listed below shall be firestopped with an approved U.L. system as defined by the Fire Resistance Directory.

Construction Condition	Manufacturer/Product	Installation Specification
Metal pipe or conduit through framed walls.	Bio Fireshield/BIOTHERM™	
Metal pipe or conduit through concrete &masonry walls and floors.	Bio Fireshield/BIOTHERM™	
Insulated metal pipe through framed walls.	3M/FS195, CP25N/S	U.L. System No. 147
Insulated metal pipe through concrete & masonry walls and floors	3M/See appropriate listing	U.L. Systems Nos. 91, 152, 203
Plastic pipe through framed walls Bio Fireshield	3M/FS195, CP25N/S, RCI OR Manufacturer’s Spec	U.L. System No. 148
Plastic pipe through concrete & masonry walls and floors	3M/CS195, FS195, CP25N/S, CP25S/L OR Bio Fireshield	U.L. System No. 64 Manufacturer's Spec
Cable tray through concrete & masonry walls and floors.	Bio Fireshield/K10	U.L. System No. 40, 41

Framed walls OR Alternately, terminate cable tray prior to firewall	Bio Fireshield/K10 Bio Fireshield	(1 hr.)
Telephone, fiber optic, and other small misc. framed walls	Bio Fireshield conductors through 3M/ CP25N/S	U.L. System 247 OR U.L. System 149
Control joints, wall/floor joints masonry.	Bio Fireshield framed, concrete, and 3M/ CP25N/S, CP25S/L	Manufacturer's specs OR
Curtain wall/ construction gap	Bio Fireshield OR 3M/ CP25N/S, CP25S/L	Manufacturer's specs
Non-insulated HVAC ducts	Bio Fireshield OR 3M/ CP25N/S, CP25S/L	Manufacturer's specs
Seismic and other large building joints	Any U.L. Listed system	

END OF SECTION 07 84 00

Seattle Center Site Standards

Division 08

Openings

A. Scope

These standards and procedures apply to the selection and installation of finish hardware.

B. Codes, Regulations, and Standards

All work shall conform to the following Codes, Regulations and Standards:

1. International Building Code, latest edition
2. Seattle Building Code, latest edition
3. National Fire Protection Association Standards, latest edition
4. Requirements of the State Fire Marshal.
5. All hardware installed on UL doors or frames shall be as approved by the National Board of Fire Underwriters.

C. Design Review and Submittals

1. The consultant shall prepare a door schedule and a finish hardware schedule.
2. Finish Hardware Schedule:
   a. Upon being awarded the finish hardware contract, the finish hardware supplier shall submit for approval six copies of a complete schedule of finish hardware.
   b. Schedules must be completely detailed in vertical form including all quantities, stock numbers, finishes, and sizes. List hardware for each opening separately. Schedules in horizontal on coded form are not acceptable.
   c. A sample format for the hardware schedule is shown below:

      HW 1 ONE SINGLE DOOR 101, CORRIDOR100 FROM OFFICE 101, LHR 90, 3'0" X 7'-0" X 1-3/4 W X HM 20 MIN

1-1/2 pr Butts	BB179 US26D 4-1/2 X 4-1/2
1 Lockset	796L-L9555 US 32D X CLS X WBX
1 Closer	P120 SBL X SNB
1 Kick plate	5014 - 8 x 34 - 410
1 Wall stop	W 9 US26D
3 Silencers	33

   d. Approval of the finish hardware schedule shall not relieve the hardware supplier of the responsibility of errors or omissions.
   e. After the schedules have been approved, make any necessary corrections and send two revised copies to the Contractor for use during construction.

f. At the completion of the project, send three (3) copies of the as-built hardware schedules, including keying, to the Owner. Send copies of the transmittal letter to the General Contractor and the Architect. As-built specifications shall include information for doors, closures, locks, controls, and related hardware, including model, make, manufacturer, and supplier.

3. After receipt of the approved finish hardware schedule, the hardware supplier shall prepare a keying schedule. The keying schedule shall then be reviewed with the Architect and Seattle Center to ensure all locksets are functionally correct and keying meets Seattle Center requirements. Make any required corrections and resubmit to the Architect and Seattle Center for final review and approval.

4. Hardware for application to metal shall be made to template. After receipt of the approved finish hardware schedule, provide metal door and frame manufacturers with two (2) copies of the finish hardware schedules and blueprint templates (or template numbers if the manufacturers have template catalogs). Templates and hardware schedules shall be provided no later than ten days after approval of the hardware schedules.

D. Specific Requirements

1. Doors

Total door type with rod/cable hinge entire length with full latching.

2. Locksets and Latchsets

To diminish the damage to and subsequent expense of replacing bored or cylinder locks, all doors and handles/spindles most susceptible to abuse shall be heavy-duty mortise type.

3. Locking Systems

The number of lock functions shall optimally be restricted to the least possible number that will permit proper functioning and use of the building.

4. Panic Hardware

Provide panic exit hardware as required by the International Building Code, NFPA pamphlet #101, or, if more restrictive, by the Seattle Building Code. Avoid the use of pairs of doors with vertical exit devices wherever possible. Provide single doors with fixed or removable mullions and heavy duty rim type devices.

5. Keys and Keying

a. Keying Schedules are already established for Seattle Center by the Emergency Services Lock Technician restricting all Master Keys to designated groups and/or utilizing operating keys to cover more area in lieu of Master Keys.

b. All locksets for an individual project shall use the current standard keyway at the time of project, provided to the contractor by the Emergency Services Lock Technician

c. Insofar as possible, restrict the number of master key groups for each building to the least number that will permit convenient operation. If at all possible, no more than 10 master key groups should be specified for one building.

d. Avoid maison keying when possible. Instead of maison keying, provide additional change keys for distribution to different departments or individuals as required.

e. Provide Schlage 7 pin cylinders (small format SFIC type) for all locks.

f. Mechanical rooms, electrical rooms, toilet rooms and access doors shall be keyed alike to the Seattle Center (Schlage) maintenance key.

g. The exterior doors of new buildings shall not be passed by interior keys.

h. All locksets for an individual project shall have one keyway.

i. All coring and keying of locksets shall be coordinated through Seattle Center Emergency Services Unit (ESU).

6. Keying Schedules

Keying schedules for all Seattle Center Building will be provided to the Key and Core Supplier (who must carry Seattle Center site standard products) by the Seattle Center Emergency Services Unit (ESU) lock technician. Deliver finish keys and cores to the Seattle Center's lock technician for installation.

7. Templates

Hardware for application to metal shall be made to template. After receipt of the approved finish hardware schedule, provide metal door and frame manufacturers with two revised copies of the finish hardware schedules and blueprint templates (or template numbers if the manufacturers have template catalogs).

Provide templates and hardware schedules no later than ten days after approval of hardware schedules.

8. Electronic Security

a. Seattle Center's access control standard is Schlage.

b. Software product name is Pinnacle.

c. Contact Seattle Center for current Pinnacle software version.

d. The access control system is a campus-wide networked system utilizing fiber optic and copper cabling. Coordination of specific building plans and design with Seattle Center's Emergency Services Unit can assist the architect or engineer in correctly specifying the transmission and network services components.

e. Access control card readers are by Schlage.

f. Proximity cards are a Schlage proprietary type.

g. All exterior entrances to facilities should, at a minimum, be roughed in for access control during construction.

h. Electric locks and latches for Seattle Center should be coordinated through Seattle Center's Emergency Services Unit. Typically, electro-mechanical exit devices or electric strikes are used. If electric strikes are used, the products shall be manufactured by Von Duprin or Folger Adams. Only ANSI Grade One strikes are approved for installation at Seattle Center.

i. Door position switches are required in all exterior doors so that they can be monitored through the access control system

j. "Request to exit" devices are used on an as needed functional basis and should be coordinated through the Emergency Services Unit as to the need and function of the door. Typically, "request to exit" devices are manufactured by Bosch Security Products (formerly Detection Systems) and door position switches are manufactured by GE Interlogix (formerly Sentrol)

k. CCTV shall be color with digital video recording. Fixed and pan-tilt-zoom cameras shall be by Aviglion. Camera placement, coverage and function shall be coordinated and reviewed with Seattle Center's Emergency Services Unit.

7. Door Closers

a. All doors on exiting corridors shall be rated 20 minutes with self-closing devices and latching hardware.

b. Janitor closet doors and other doors that generally require 20-minute ratings shall have 180 deg. hold open devices tied into the fire panel and self-closing device with fused arm links. This will facilitate their closure, but discourage the propping open of doors.

c. Non-rated doors with closing devices shall be provided with a hold open function. i.e. LCN H-Cush arm.

d. Offices and other rooms with a common hallway leading to an exit corridor shall have doors rated 20 minutes, lock sets, and no door closers. Hallway doors to exiting corridors shall be rated 20 minutes, self closing and latching. In most cases, provide a magnetic hold-open feature with adjacent smoke detectors connected to the fire alarm system. These standards apply to arrangements with one hallway exit for less than 30 people or two exits for a maximum of 50 people.

e. Door closers are not required on access doors and panels which are only open under Physical Plant supervision. This include access panels in public corridors, doors in shafts or pipe chases, and electrical/telephone closets (3 feet deep or less).

E. Products

1. Comply with "Quality Assurance" qualifications for suppliers.

2. No substitutions of material will be accepted unless reviewed and accepted by the Architect ten days prior to bid opening.

3. All hardware schedules and blueprints shall be available for review and acceptance by the Seattle Center Carpenter Crew Chief.

4. The following lists accepted manufacturers:

Item	Manufacturer
Cylinders	BEST or Schlage
Butts/Hinges	Stanley, Mckinney
Exit devices	Sargent or Von Duprin
Kick plates	Cipco Sargent or Von Duprin

Locksets and latches	Sargent or Best
Closers	LCN, Sargent, Von Duprin, or Rixon
Door stops	BBW or equivalent
Overhead door stops	Glynn-Johnson
Push/pull plates	Cipco or equivalent
Magnetic hold opens	Sargent or Rixson
Flush bolts	Use same manufacturer as other hardware so finishes match
Door coordinators	Use same manufacturer as other hardware so finishes match
Thresholds/weather-stripping	Pemko

4. All hardware shall be furnished with proper fastening devices to coordinate with conditions of the work.

5. All hardware shall be an ANSI Grade I.

6. All hardware items shall be packed in their original factory shipping cartons. The hardware supplier shall mark each item of hardware individually for each opening as to location of installation in accordance with approved hardware schedule.

7. Hardware items vary in finishes. Discuss finishes for the following with the Architect and Seattle Center Project Manager:

   Butts
   Locksets
   Exit devices
   Closers
   Door stops
   Kick plates

8. Butts

   a. Butts sizes vary.

   b. Out swinging exterior doors shall have NRP feature.

   c. Doors under 90" shall have 3 butts per leaf. Doors over 90" shall have 1 butt added for each 30" of height

9. Locksets and Latchsets

   a. Locksets and latchsets shall be heavy duty mortise type with 3/4" antifriction latchbolt.

   b. Provide curved lip strikes sufficient to protect trim.

   c. All locks shall have wrought box strikes.

d. Dead bolt functions shall be 1" projection.

10. Exit Devices

a. Exit devices shall be push bar type.

b. Exit devices shall have reinforced crossbars.

c. Exit devices for labeled fire doors shall be fully UL approved and furnished less dogging feature.

11. Closers

a. All closers shall be sized as recommended by manufacturers catalog, though consideration should be given to any wind conditions or mechanical ventilation systems that might affect sizing requirements.

b. If, after the closers are installed, a larger size closer is required, the hardware supplier shall furnish the larger size at no additional cost to the owner.

c. Closer for wood and mineral core doors shall be furnished with barrel-nut and bolt type fasteners.

d. Closers shall be guaranteed against mechanical defects for a period of five years.

12. Door Stops

a. Contractor shall provide proper backing for all wall-type stops.

b. Stops applied to concrete shall be fastened with steel tampins and machine screws.

c. Where wall stops are specified, but cannot be used because of a construction detail, floor stops shall be furnished.

13. Pushes and Pulls

Push and pull plates shall be cut for cylinders or fitted with thumb knobs as required to fit deadlocks or night latches.

14. Kick Plates, Mop Plates and Armor Plates

a. Exterior plates shall be stainless steel, 0.05" minimum thickness.

b. Interior plates shall be stainless steel, .125" minimum thickness.

c. Kick plates shall be a minimum of 8" high and 2" less door width.

15. Key Cabinet

Provide one key cabinet with capacity for all specified keys plus 50 percent expansion.

F. Execution

1. For most projects, Contractor shall deliver blank cores to Seattle Center’s Emergency Services Unit Lock and Key Technician. Please confirm with Owner.

a. Furnish all standard cylinder items with construction cylinders and/or a construction master key system (and 6 keys).

b. Upon completion of the work, the hardware supplier, in the presence of the Owner, shall verify fit and operation of each lockset with the proper change key which voids the construction key. The keys shall then be tagged with the door number and delivered to the Owner.

2. Provide two sets of any special tools required for installation and maintenance of hardware to the owner.

3. Send all master keys and change keys via registered mail to the Seattle Center.

4. All hardware shall be located as recommended by ASAHC, BHMA, SDI, and NAAMM and/or per the manufacturers' instructions.

G. Quality Assurance

1. Finish hardware shall be supplied by a recognized builders' hardware supplier who has been furnishing hardware in the Seattle area for a period of not less than 5 years.

2. The suppliers' organization shall employ consultants who are available at all reasonable times during the course of construction to meet with the Owner, architect, or contractor for hardware consultation.

3. The supplier shall maintain a stock and parts inventory of all items supplied for future service to the Owner.

4. Provide manuals with model numbers, parts "blow-up", installation instruction, warranty information and name of local supplier.

END OF SECTION 08 70 00

Seattle Center Site Standards

Division 09

Finishes

A. Scope

These standards and procedures apply to the design, selection, and installation of carpet tile. Carpet tile offers considerable flexibility in design and maintenance and is the preferred carpeting material for Seattle Center facilities.

B. Design Review and Submittals

1. Layout Drawings: Submit floor plans showing layout and placement of carpet tiles at 1/8 inch scale. Indicate various colors and pattern direction, start points, and locations and types of edge strips. Indicate columns, doorways, enclosing partitions, built-in cabinets and locations where cutouts are required in carpet tile.

2. Samples: Provide for final approval carpet samples, full sized samples for each color/style and type selected prior to beginning work. Label back of each sample with manufacturer, product, color/style name and number. Include 6 inch long sections of molding in each color type required.

3. Submit manufacturer's material specifications and installation instructions, including preparation of substrate and recommended releasable adhesive.

4. Submit data on edge moldings.

5. Certification: Submit written certification from carpet tile manufacturer certifying that the carpet materials and construction provided under the specification section meets or exceeds requirements specified, including static control, flammability properties, and odor emissions.

C. Delivery, Storage & Handling

1. Deliver in unopened original cartons clearly labeled with manufacturer's name, brand, size, and related information.

2. Store in dry, clean, well ventilated spaces; protected from damage, soiling, fading and moisture.

D. Warranty

1. Contractor shall guarantee work, agreeing to repair or replace defective materials, up to one year period following date of Substantial Completion.

2. Manufacturer shall provide written non-prorated 10 year warranty for each carpet type, agreeing to furnish FOB project site replacement carpet which exhibits any of the following product defects: edge ravel, delamination, fading, shrinkage and curling, and maximum face weight loss of 10 percent.

E. Products

1. Quality: All material shall be of "first quality" (I.e., free from visual blemishes and physical defects). No irregulars, promotional goods, mill ends or remnants shall be accepted.

2. Sustainability: Carpet material must contain at minimum 25% Total Recycled Content (TRC).

3. Indoor Air Quality (Carpet & Adhesive): Meet or exceed current CRI Green Label Plus Certification.

4. Adhesive: Non-flammable pressure sensitive, releasable carpet adhesive as furnished or recommended and approved by carpet tile manufacturer in writing for compatibility with carpet backing AND as certified by the CRI Indoor Air Quality Adhesive Testing Program.
   a. Carpet adhesive shall have a flame spread of 75 or less when tested in accordance with ASTM E84
   b. All floor sealers, seam sealers, and adhesives shall contain no calculated solvents per OSHA Regulation 29 CFR 1910.1200, and have no calculated VOC's.

5. Underlayments & Patching Compounds: Latex modified, Portland cement based formulation approved by carpet tile manufacturer for conditions of installation.

6. Vinyl Transition Strips: Types as follows manufactured by Johnsonite (Division of Duramax, Inc.), or approved equal. Exact depth of transition strips shall accommodate actual thickness of carpet. Colors as selected by the Architect from manufacturer's full range of standard colors. Provide the following types as indicated on drawings:
   a. Carpet to resilient flooring: "CDB-00-A" Track Base, "CD-XX-A" Transition Strip."
   b. Carpet to concrete: "EG-XX-H" Edge Guard"

7. Miscellaneous Materials: As recommended by manufacturers (prefer Mohawk® brand from the Accountable series in darker shades) of carpet tile; and selected by Installer to meet Project requirements.

F. Extra Stock

1. Turn over to Seattle Center Redevelopment office replacement materials from same manufactured lot as materials installed. Package extra materials in manufacturer's original unopened cartons and clearly label. Furnish not less than 5% extra carpet tiles of each type and color installed.

G. Execution

1. Examine areas where installation of carpet tile will occur. Verify that substrates and conditions are satisfactory for installation and comply with carpet tile manufacturer's requirements. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved. Commencement of work constitutes acceptance of sub-floor conditions.

2. Preparation should include removal of all dirt, oil, grease, and other contaminants that may affect bond. Vacuum surfaces thoroughly using industrial power vacuum immediately before installation. If necessary, damp mop floors with warm water. After cleaning, inspect substrate for visual evidence of moisture, alkaline salts, or dust. Verify that slab substrates are free of materials which would interfere with bonding of adhesive. Fill minor holes, cracks, and transition areas with approved latex-type underlayment. Trowel on to smooth surface and allow to fully dry before applying carpet tile.

3. After installation has been completed, carefully protect the carpet from soiling and damage until final acceptance. Protection can be accomplished by using specified building paper. Covering shall be kept in repair and damaged portions replaced during the construction and move-in period.

END OF SECTION 09 68 13

A. Scope

These standards and procedures apply to preparing, painting and finishing of all new or existing surfaces, including application of anti-graffiti coatings on exterior surfaces of all buildings.

B. Codes, Regulations and Standards

Comply with the requirements listed below. When there are conflicts between standards, references, specifications and manufacturer's data, the most stringent requirements govern.

1. ASTM D 2200-(latest edition) Pictorial Surface Preparation Standards for Painting Steel Surfaces.

2. Green Seal™ Standard GS-11 for Paint and Coatings

3. Master Painters Institute. *Architectural Painting Specification Manual*. BC, Canada: MPI, latest edition.

4. Steel Structures Painting Council (SSPC): *Steel Structures Painting Manual Good Painting Practice.*

C. Submittals and Mock-ups

1. Provide for final approval paint drawdown color samples, sized not less than 12" x 12", for each color selected prior to beginning work. Label back of each drawdown with manufacturer, product, color name and number, and gloss level.

2. Product Data: Submit complete list of manufacturers, products, and colors used, including Product Data Sheets and MSDS. Include performance characteristics, limitations, and volatile organic compounds (VOC) emissions information.

3. Provide up to 3 mock-ups of each accepted color over 24"x24" area for final acceptance as directed by Architect or Seattle Center Redevelopment. One surfaces requiring anti-graffiti coating (Concrete Sealer – Luster Seal WB150 or WB300), apply the coating over half of the mock-up so that the effect on the color can be determined. Protect and retain accepted mock-ups as standard of quality for work of this Section. Accepted mock-ups may become part of finished work.

D. Delivery, Storage and Handling

1. Deliver in unopened containers, bearing Manufacturer's original labels, and store per manufacturer's recommendations and as required by governing Codes and ordinances.

2. Take all necessary precautionary measures to prevent fire hazards and spontaneous combustion. Take regular appropriate safety precautions when storing and handling toxic and explosive materials. Conform to Manufacturer's recommendations and applicable "Regulatory Requirements".

3. Contractor shall be responsible for removing all unopened or partially used paints from Project Site and properly disposing of them in accordance with local regulations.

E. Warranty

1. Contractor shall guarantee work of this Section against ordinary wear and use for two (2) years from date of Final Acceptance of the work.

2. Manufacturer shall provide a 5 year warranty on material.

F. Products

1. Paints and coatings shall meet the VOC and chemical component limits of Green Seal Requirements.

2. Paint products must contain no more than 1.0% by weight the sum total of aromatic compounds. Testing for the concentration of these compounds will be performed if they are determined to be present in the product during a materials audit.

3. Finishes shall have flame spread ratings which do not exceed those permitted by IBC

4. Furnish ready-mixed products whenever possible.

5. Paint shall be Premium Grade, except as otherwise specified.

6. Sherwin-Williams has been specified for type, quality, and VOC/chemical composition compliance. Substitutions that do not meet VOC/chemical composition compliance will be rejected.

7. Use Luster Seal WB150 or WB300 for anti-graffiti protection on the exterior of all buildings and exposed exterior surfaces such as concrete retaining walls, etc TagGuard is not an acceptable product for use at Seattle Center.

G. Execution

1. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Verify required lighting, temporary heat, and ventilation. Conduct substrate-moisture content test using an approved electronic moisture meter. Beginning work constitutes acceptance of conditions as satisfactory.

2. For surface preparation, comply with the latest edition of the MPI Architectural Painting Specifications Manual, SSPC, manufacturer's instructions, and as needed for substrates free of conditions that may impair adhesion and uniformity. Include provisions to prevent bond breakers, dust, and foreign matter; bleed-through of substrate material; and surface irregularities.

3. Adequately protect other surfaces from damage. Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, fastenings, and the like prior to starting work. Provide drop cloths, shields, and other protective material.

4. Do no work of this Section when surface or air temperatures are below 40 degrees or below manufacturer recommended temperatures for installation. Verify adequate continuous ventilation as recommended/required by Manufacturer. Also provide temporary lighting to attain surface lighting level/minimum 15 foot candles per square foot.

5. All work shall be "Premium" quality.

6. In multiple coat work, provide each coat of paint of slightly different color to achieve required finish. Do not apply finishes on surfaces not sufficiently dry. Include as many coats as necessary for complete coverage and acceptable appearance, but not less than the number of coats scheduled. Each paint coating shall provide uniform color, texture, and coverage. Back roll paints that are sprayed on walls.

7. Place cotton waste, cloths, and other hazardous materials in containers, and remove daily from site.

8. As Work is completed in room areas, repair surfaces damaged by other trades and requiring touch-up or refinishing.

9. As Work proceeds, and on completion of work promptly remove all spilled, splashed, or splattered products so as not to damage surfaces. Clean up overspray, drips, and splatters from surfaces not scheduled to be painted.

10. At conclusion of Project, thoroughly clean paint and splatters from glass, mirrors, and other surfaces. Take care not to scratch surfaces. Clean residue of work of this Section from any other surfaces. Leave premises neat and clean.

11. At conclusion of Project, provide a paint drawdown color, sized not less than 12” x 12”, for each color used on the project. Label back of each drawdown with manufacturer, product, color name and number, and gloss level.

END OF SECTION 09 90 00

Seattle Center Site Standards

Division 10

Specialties

A. Scope

Toilet room locations shall be easily located and visible with Crime Prevention through Environmental Design (CPTED) considerations. Convenience and adequacy are important to the people who work in a facility, and can improve morale. Restrooms also influence visitors' impressions of Seattle Center. It is, therefore, important that the Seattle Center and its resident organizations correctly assess restroom needs of each area before construction plans are finalized. Restrooms must be functional, bright, clean, and easy to maintain. They must be easily accessible to the disabled, particularly those in motorized wheelchairs, and must meet all requirements of the latest ADA standards. Pay particular attention to the mounting height of accessories and the turning radius within each ADA stall.

B. Design Criteria

1. Restrooms shall be located in a manner which will logically serve the projected population. They should generally be:

    a. Accessible to and convenient for everyone, employee or visitor;
    b. Not more than 75 yards from any work station;
    c. On the same floor as the population they are intended to serve;
    d. Separated by sex when more than 3 employees are to be served;
    e. In a location with visibility to prevent crime/vandalism;
    f. Accessible to the disabled.

2. When remodeled areas or redefined work areas require construction work, existing restroom facilities will be reviewed to assure they continue to meet the needs of those they are intended to serve. Expanded facilities may be required. If possible, restroom sizing should take into account present and future occupancies.

3. Minimum Requirements

    a. Comply with the appropriate sections of the current International Association of Plumbing and Mechanical Officials (IAPMO).
    b. The appropriate sections of the Uniform Plumbing Code, current edition, shall be the basic reference and guide for the number and type of fixtures. For areas used by the public, assume a fixture split of 60% women minimum and 40% men.
    c. In toilet rooms used by the public, hard ceilings rather than drop-in ceilings are preferred.
    d. Men's toilet rooms shall contain a minimum of 1 urinal, 1 toilet and 1 lavatory in addition to the standard items.
    e. Women's toilet rooms shall contain a minimum of 2 toilets and 1 lavatory in addition to the standard items. Urinals shall not be used.
    f. Fixtures, (except lavatories and urinals) shall be separated from each other by partitions for privacy and to minimize splash. Partitions or dividers between urinals are optional.
    g. Toilet rooms should be designed for and equipped to use paper towels; electric hand dryers may be used (in addition to paper towels) for high usage areas. Do not use battery powered faucets or other fixtures.
    h. Room design shall include locked storage space for paper products. This room or closet shall be large enough to hold cases of the following: toilet paper, paper towels, toilet seat covers, liquid soap, etc.

4. Seattle Center prefers to standardize design of restroom facilities and fixtures and facilities as much as possible to minimize the types of materials, including paper towels, toilet paper, etc., which Seattle Center has to stock. Standard restroom design shall include:

a. Wall-hung low flush toilet(s) and urinal(s). Do not use commercial chemical urinals.
b. Wall hung lavatories;
c. Hard, slip resistant. water resistant, easily cleanable floors;
d. Water resistant, easily cleanable walls to at least 6 feet high); if the walls are tiled, the tile shall be butted as close as possible to minimize exposed grout. Never use white grout.
e. Easy to clean and maintain textured partitions, not stainless steel, that are graffiti resistant and, in heavily used public areas, are supported from the floor rather than the ceiling unless specifically requested otherwise by Seattle Center. In restrooms not heavily used by the public, ceiling supported partitions are preferred because of easy of cleaning the floor underneath.
e. Exhaust ventilation sufficient for the cubic feet of each restroom;
f. Attractive, energy efficient lighting, and possibly occupancy sensors. In areas used by the public, restroom fixtures shall be vandal proof.
g. Roll-type paper towel dispenser(s); surface mounted, 1 per every two lavatories. Paper towel dispensers shall not extend more than 4” into travel path of disabled people, particularly the blind.
h. Free-standing waste receptacles, 1 per paper towel dispenser;
i. Surface mounted liquid soap dispenser(s); 1 per lavatory;
j. Mirrors. Shelves are optional. Mirrors may be full-length instead of installed above sinks.
k. Fire sprinkler(s), if specifically requested by Seattle Center, plus strobes and heat detectors
l. Jumbo roll toilet paper dispenser, surface mounted, free flowing to comply with ADA requirements, 1 per toilet;
m. Sanitary napkin disposal containers; surface mounted; 1 for each woman’s stall. Sanitary napkin and tampon dispensers are optional and generally not recommended because of problems with theft.
n. Door push plates; plastic laminate, of adequate size (12"x18" or 12"x24")
o. Door kick plates, stainless steel (12" high by door width minus 1")
p. Toilet stall doors with coat hooks on the interior side. In ADA stalls, bottom of hook shall be no more than 48” above finished floor.
r. Interior door locks

C. Products

All toilet rooms vary somewhat. The following are preferred for purposes of standardizing maintenance, spare parts, and consumable products management. Verify specific requirements with Seattle Center Redevelopment.

1. Plumbing Fixtures and Trim:

Wall hung WC	Kohler 4 bolt or Sloan ST-2000 wall hung series
Wall hung WC	American Standard “Afwall” No. 2257.103 or Kohler “Kingston” K-4325-L
Floor mount WC	American Standard “Madera” Aquameter #2234.015 or Kohler “Welcomme” #K-4350
Floor mount WC w/tank	American Standards “New Cadet Aquameter” #3081, 017 bowl, #4086.025 tank
WC seat	Bemis 19555SC – Black
Urinals	Zurn 0.125 gallon per flush

Flushometers - WC	Sloan Royal #115-15 or Regal #111
Flushometers - urinal	Zurn
Lavatories, wall hung	American Standard “Lucerne” No. 0355.012; Kohler “Kingston” K-2005
Lavatories, wall hung, ADA	Kohler Morningside K-12636 or Kohler Kingston K-2005
Lavatory faucet	Sloan Solar EFX or Chicago Push Button
Lavatory sink	Trough style sink to be selected by Architect.
Service sinks	American Standard “Florwell” #7740.020 with drain fitting; Kohler “Whitby” k-6710 with drain fitting.
Service sink faucet	Chicago #897; or Chicago #305-VB-R
Scullery sink	Elkay Weldbilt WNSF-8248-LR w/Elkay LK-25-RT drains
Scullery sink faucet	Chicago #445-L8
Kitchen sink	Elkay “Lustertone” LR-3322
Kitchen sink	Elkay “Lustertone” LR-3322
Kitchen sink faucet	Chicago #201-GN8A-E3-317
ADA drinking fountain	Elkay or Haws, in hallway outside restrooms
ADA water cooler	Elkay or Haws, in hallway outside restrooms

2. Toilet Rooms Accessories:

Most accessories shall be surface mounted.

Mirror, non-ADA	Bobrick B-290 or equivalent, with stainless steel frame
Mirror, ADA lavatories	Bobrick B-293 or equivalent, with stainless steel frame
Bookshelf (optional, for mirrors on separate walls)	Bobrick B-292 or equivalent
Soap dispenser	GOJO 8530-01 Counter Mount Foam Soap Dispenser or equivalent ***install may need to be modified to be used with certain trough style sinks.***
Paper towel dispenser	Bobrick Automatic Dispenser or equivalent, sized to fit 800’x 8” rolls.
Toilet seat cover dispenser	Standard size 1/2 fold, 5000 Bobrick, B-221 stainless steel or equivalent.
Toilet tissue dispenser	Bobrick Satin-Finish Stainless Steel Dispenser BOB-2892 or equivalent, sized to fit two 10” (255mm) diameter rolls with 2-1/4” (55mm) diameter core rolls.
Sanitary napkin dispenser	Bobrick B2800 surface mounted or Bobrick B35007 (if requested by Seattle Center) recessed
Sanitary napkin disposal	Bobrick B-270 or equivalent, one per each women's stall
Grab bars	Bobrick B-6237; B-6206 or equivalent; (coordinate with dispensers).
Mirror with shelf	Bobrick B-292/1830, or equivanlent
Waste receptacle	Free standing stainless steel trash can, Rubbermaid SR14SS 25

	gal or equivalent.
Drinking fountain	Elkay or Haws. No drinking fountains in restrooms.
Baby Changing Station	Surface mounted “Koala Bear Kare” or, preferred, built-in laminated shelf or counter
Partition	Bobrick Sierra Series® 1090 (Trespa SC04-QZ Forest Green), or equivalent
Bookshelf (optional)	Bobrick B-298 or equivalent; 42 inch

END OF SECTION 10 28 13

Seattle Center Site Standards

Division 11

Equipment

A. Scope

The Work in this Section is defined as the planning and design of all Section 11 40 00 food service and/or laundry equipment by the Food Service Consultant. This excludes work by other division or trades, including but not limited to millwork, interior design elements, i.e. furniture, bars, bar tops and dies, service stations, graphic, signage, lighting, and audio/visual systems work and the like, as well as structural, programs, and all base project mechanical, electrical, and plumbing requirements not directly associated with Section 11 40 00 equipment and not specifically called out in the project construction documents as part of Section 11 40 00. Prior to installation all Food Service Consultant work shall be field verified by the General Contractor or the General Contractor's Kitchen Equipment Contractor.

The following information is provided for reference only and may not be totally inclusive for each specific trade noted. It is each trade's responsibility to ensure that it covers all elements of its work that may affect the final food service equipment installation.

1. Furnish and install includes the work as follows, but not limited to:

    a. Provide all labor, materials and services necessary for the assembly and setting in place of the equipment in strict compliance and in accordance with the contract documents.
    b. Coordinate requirements for wall reinforcements and special support locations.

2. Provide stands and supports for equipment requiring stands and supports. In areas requiring seismic bracing, provide special support to comply with seismic standards. Such supports shall be approved by the structural engineer.

3. Cut holes and provide sleeves for pipes in equipment, for drains, electrical work, plumbing work, etc., as required for proper installation. Any base building work that is required shall be coordinated through the General Contractor.

4. Repair any damage to equipment or to work of other trades resulting from installation.

5. Remove all debris resulting from this installation, clean, repair, and adjust all equipment for operation, as well as provide an acceptance test to the Owner.

B. Contract Documents

1. Equipment drawings are for reference and guidance only. They indicate preferred final locations of equipment, but the exact final location will be dictated by building conditions. Do not use the drawings as construction documents or shop details.

2. Drawings and equipment specifications are intended to complement each other. Therefore, neither should be considered complete without the other. Items or drawings that are referenced to other specification or drawing sections are not part of the Food Service Equipment Contract.

C. Substitutions - Alternate Equipment

The base bid shall include all prime equipment including specific manufacturer, model number, size, utilities requirements, capacities, etc., as well as options and accessories. Supplemental to the base bid for the prime equipment as specified, the Contractor may propose substitution (alternate) equipment other than that specified. The Contractor must clearly and separately state that the Contractor is offering an alternate. The Contractor shall submit complete illustrations, specifications, capacities, and utilities, as well as all applicable operational data for all proposed alternates as well as applicable price differences. It is the Contractor's responsibility to prove that the item or items submitted as alternates are equal to the prime specified items. The Owner with counsel from the Food Service Consultant will be the final determining authority as to acceptability or equality of alternates. Items of standard equipment must be the latest model and new at time of delivery. Approval prior to the bid date to submit alternates is not required. At a time requested in writing by the Owner and/or the Foodservice Consultant, the Contractor will be responsible for determining all relative costs associated with the use of alternate equipment. The net savings (gross foodservice equipment price deduct less base building/engineering modifications) resulting from the use of alternate equipment will be a factor in the evaluation of the acceptability of the alternates.

D. Laws and Ordinances

All work and material shall comply with Federal, State and local laws, ordinances and regulations and be accepted by the local inspector having jurisdiction. When in conflict, the more stringent of the requirements shall be followed. Work and materials must be, when appropriate, listed as acceptable with the following agencies:

1. U.S. Public Health Service
2. Local Health Department
3. National Board of Fire Underwriters
4. OSHA
5. National Sanitation Foundation (NSF)
6. Underwriter Laboratories (U.L.)
7. ASME
8. AGA
9. NFPA - 96 for exhaust system
10. ASTM

E. Guarantee and Warranty

1. Fully warrant all equipment by manufacturer's warranty for parts and labor for ninety (90) days after Substantial Completion.

2. Fully guarantee all equipment against defects in workmanship and material for thirteen months after substantial completion. Make all repairs and replacements without charge.

F. Equipment Access

Verify all building conditions and coordinate with the General Contractor proper access

of large equipment to the building. Costs for any specific items or equipment required for the movement of large, heavy or bulky equipment including rigging, cartage, etc. is solely the full responsibility of the Contractor.

G. Submittals

1. The shop details, rough-in drawings, cut sheet book and any other submittals for this section are to be submitted at the same time in a single package. Partial submittals will be held without action until the remainder of the submittals has been received.

2. Shop Details: Submit one (1) blue line set and one (1) high quality, reproducible paper set of shop drawings of all custom fabricated equipment at minimum 3/4-in. (1:20) scale. Include with all custom fabrication drawings dimensions, fabrication methods, materials, thickness, details of construction, installation and method of field joints noted. Shop details must indicate reinforcements, methods of anchorage and quality of finishing. The sepias will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution. Contractor shall verify all field dimensions and incorporate them into shop drawings.

3. Rough-in Drawings: Submit two (2) blue line set and one (1) high quality, reproducible paper sepia set of complete and detailed rough-in drawings. Drawings shall show every piece of equipment, all dimensions for rough-in points for electrical, plumbing, steam, exhaust, gas, thermo-fluids, refrigeration, wash down hoods, as well as concrete curbs, sleeves, supports, etc. and all core drilling needed. The sepias will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution.

4. Cut Sheet Book: Assemble and bind three (3) sets of Equipment Brochure books as part of the submittal. Show all specified accessories, utility requirements and all other pertinent information on equipment cuts. One (1) book will be reviewed, marked, stamped with required action noted and returned with other books for appropriate action and copying for distribution.

H. Start-up Demonstration and Manuals

1. Provide factory trained engineers for start-up and demonstration of equipment. Demonstration shall be done in two stages: one for operation and the second to maintenance personnel.

2. Return to the job site within ten (10) days after the demonstration for final adjustment and calibration of equipment.

3. Furnish eight (8) service/parts and maintenance manuals for all equipment supplied as part of this contract.

4. Prepare a list of service agencies authorized by each manufacturer to service its equipment. Include within this listing the name of the person to contact and a telephone number for reference purposes.

I. Materials and General Requirements of Fabrication

Fabrication methods shall conform to all generally accepted conventions and requirements of the food service industry and shall meet or exceed the latest National Sanitation Foundation standards including all revisions.

1. Stainless Steel: Stainless steel shall be of U.S. Standard gauges as indicated, but not less than 20 gauge, Type 304 with No. 4 finish.

2. Galvanized Steel: Galvanized Steel shall be of 14 gauge or as otherwise indicated on drawings or specifications and shall be electro-galvanized. Galvanized steel shall be used in all non-exposed areas, areas with no contact with food or serving items and in framework. When used in framework, galvanized steel shall be of welded construction (welding is to be done before galvanizing).

3. Insulation Materials: For normal temperature applications, such as custom fabricated under counter refrigerators, use extruded polystyrene material 2 in. thick, bonded at all joints.

4. For heated-type application, such as plate warmers, use block-type rock wool, minimum 1 in. thick.

5. For low temperature applications, such as ice bins, cold pans, or custom fabricated under counter freezers, use urethane, rigid foam board or foamed-in-place, not less than 2 in. thick, except that vertical surfaces of cold pans and ice bins may be 1 in. thick. Bond insulation at joints to prevent condensation on exterior.

6. At counter tops subject to heat from cooking equipment and/or refrigeration compressors, use 1 in. thick Manville Martinite 36, or equal, to insulate underside of top. Also add Martinite material between freezer or refrigerator and 14 gauge stainless steel top.

7. Fiberglass insulation materials shall not be used. Insulation shall be bonded to all surfaces.

8. Food Service Cabinets, Laminate Clad

   a. Fabricate woodwork to dimensions, profiles and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.

   b. Complete fabrication, assembly, finishing, hardware application and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming and fitting.

   c. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible to receive hardware, appliances, food service equipment,

plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

d. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

e. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

f. Quality Standard: Comply with AWI Section 400 and its Division 400B.

g. Laminate Clad Cabinets: Comply with the following requirements:

1) Grade: Premium
2) Type of Cabinet Construction: Flush overlay
3) Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3.
4) Colors, Pattern and Finishes: Colors as selected by Architect.

h. Laminate Grade for Exposed and Semi-exposed Surfaces: Provide laminate cladding complying with the following requirements:

1) Horizontal (other than tops), Vertical Surfaces and Edges: GP-50 (0.050" normal thickness).
2) Core: High density wood fiber board.

i. Quality Certification: Submit woodwork Manufacturer's (Fabricator's) certification, stating that fabricated woodwork complies with quality grades and other requirements indicated.

j. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

k. Wood Moisture Content: Comply with requirements of AWI for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

l. Single Source Fabrication and Installation Responsibility: Engage a qualified fabricator to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing and installation.

m. Fabricator Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

n. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Coordinate and dimension all requirements for pre-cut openings and for built-in items such as food service equipment, appliances, plumbing fixtures, electrical devices, grommets and other equipment/components.

o. Samples: Submit the following samples:

1) Plastic laminate, 8" x 10" for each type, color, pattern and surface finish.
2) Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
3) Cabinet hardware and accessories, one unit of each type and finish.

p. Plastic Laminate Manufacturer: Subject to compliance with requirements, provide products from one of the following:

1) Formica Corp.
2) Lamin-Art.
3) Nevmar Corp.
4) Wilsonart.

q. Screws (Cabinets, Laminate Clad): Comply with the following requirements:

1) Select material, type and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
2) For metal supports, provide screws as recommended by metal framing manufacturer.

r. Nails: Comply with the following requirements:

1) Select material, type and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
2) Provide stainless steel or aluminum nails for woodwork exposed to high relative humidity and is to receive transparent finish. Provide any type of non-corrosive nail for woodwork exposed to high relative humidity and has finishes other than transparent.

s. Anchors: Select material, type and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

t. Installation Food Service Cabinets, Laminate Clad: Comply with the following requirements:

1) Install woodwork plumb, level, true and straight with no distortions. Shim, as required, using concealed shims. Install to tolerance of 1/8" in 8'-0" for

plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
2) Scribe and cut woodwork to fit adjoining work and finish cut surfaces or repair damaged finish at cuts.
3) Anchor woodwork to anchors, blocking or backing built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
4) Install cabinets without distortion so that doors and drawers fit opening properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

u. Adjustment, Cleaning, Finishing and Protection: Comply with the following requirements:

1) Repair damaged and defective woodwork where possible to eliminate defects functionally and visually. Where not possible to repair, replace woodwork. Adjust joinery for uniform.
2) Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

9. Metal Top Construction: Metal tops shall be one-piece 14 gauge stainless steel welded construction or as indicated on drawings or specifications, including field joints. Tops to be secured to a full perimeter galvanized steel channel frames except at wood top tables, drain boards and dish table where channel frames shall be stainless steel and cross braced not farther than 30 in. on center. Fasten top with stud bolts or tack welds. Coat underside of tops with a minimum 1/16 in. thick approved hard-drying, sound-deadening, mastic material. Apply all coatings by spreading after top has been secured to frame, such that top and frame are covered and sealed.

10. Enclosed Cabinet Bases

a. Fabricate bases from not less than 18 gauge steel reinforced by forming metal ends and shelves. Partitions to be constructed of stainless steel. The ends and vertical partitions can be of single wall construction, with 2 in. face partitions, and sides shall be welded at intersections and be flush with the bottom edge of the bottom shelf.

b. Unexposed backs and structural members may be constructed of galvanized steel.

c. Intermediate shelves shall be removable. Bottom shelves shall be non-removable.

11. Legs and Cross Rails

a. Legs and cross rails to be of 1 5/8 in. diameter, 16 gauge seamless stainless steel tubing. All cross rails to be continuously welded, ground and polished.

Tack welds or other methods of connection are not acceptable. Bottoms of legs to be wedged inward and fitted with a stainless steel bullet-type foot with not less than 2 in. adjustment. Freestanding legs are to be pegged to floor with 1/4 in. diameter stainless steel rods.

b. Stainless steel gussets shall not be less than 3 in. diameter and 3/4 in. long. Outer shell to be 16 gauge stainless steel reinforced with 12 gauge mild steel insert welded to interior of shell. Gusset to be large enough to accommodate a 1-5/8 in. tube and shall have an Allen screw fastener.

c. Low counter legs shall be constructed of stainless steel exterior and shall be 5 3/4 in. minimum height or 7 in. maximum height with 3 1/2 in. square plate with four countersunk holes, welded to the top for fastening.

d. Adjustable feet to be constructed of stainless steel 1/2 in diameter tapered at the bottom to 1 in. diameter, fitted with a 3/4 in. cold-rolled rod threaded for minimum of 1/2 in. for fitting into a threaded plug welded to leg. A push-in foot is not acceptable.

e. When legs are fastened to equipment, the following methods must be used:

f. Sinks: Gussets shall be welded to triangular stainless steel plates which in turn shall be welded to the underside of sink.

g. Metal Top Table or Dish Table: Gussets shall be welded to 14 gauge or heavier channel reinforcing.

h. Wood Top: Gusset shall be welded to a stainless steel channel of not less than 14 gauge stainless steel, secured to the top with screws through slotted holes.

12. Shelves: When shelves are part of the fixture, the open base type shelf shall be notched around the leg and continuously welded to the leg. The cabinet base type shelf shall be turned-up 2" on the back side with a minimum of 1/4 in. radius to insure a tight fit to enclosure panels.

13. Sinks, Steam Tables and Bain Maries

a. When multiple compartments are part of the design, they shall be continuous on the exterior without applied facing strips or panels. Bottoms of each compartment to be creased to ensure complete drainage to waste opening.

b. Partitions between compartments to be double thickness, continuous and welded.

c. Where sink bowls are exposed, the exterior shall be polished to a number 4 finish.

d. Furnish following drains, wastes and faucets manufactured by Fisher Mfg. Co. or equal by Standard Keil, T&S or Chicago loose for installation by Plumbing Contractor:

e. Basket strainer drains shall be Fisher Model 6555 with 3 1/2 in. basket.

f. Rotary drains shall Fisher Model 6100 rotary type waste with connected overflow. Valve to be 2 in. chrome plated.

g. Water stand bain-maries shall be fitted with 2 1/2 in. waste with basket strainer with connected overflow and adapter to connect to 1/2 in. drain line. Use Standard Keil box pattern basket, drain number 4161-Cp with 458-X overflow head.

h. Furnish faucets for all sinks, bain-maries, water stations and other fixtures as specified.

i. Provide vacuum breakers on equipment requiring them as furnished under this contract in accordance with governing codes.

14. Other Custom Fabricated Components

a. Casters: Shall be heavy-duty type, ball-bearing, solid or disc wheel with non-marking greaseproof rubber, neoprene or polyurethane tires as specified.

b. Wheels shall be 5 in. diameter or as specified, minimum width of tread 2 1/2 in., with a minimum capacity per caster of 250 lbs.

c. Solid material wheels shall be provided with stainless steel rotating wheel guards.

d. Shall be sanitary, have sealed wheel and swivel bearings and polished plate finish (per N.S.F.).

e. Doors: Metal doors shall be double-cased stainless steel. Outer pan shall be 18 gauge stainless steel with corners welded, ground smooth, and polished. Inner pan shall be 20 gauge stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or extruded polystyrene used as a core. The two pans shall be tack-welded together and joints solder-filled. Doors shall be finished approximately 3/4 in. thick, and be fitted with flush recessed type stainless steel door pulls.

f. Sliding doors shall be self-closing, mounted on large, quiet ball-bearing rollers in 14 gauge stainless steel overhead tracks and be removable without the use of tools. Bottom of cabinet to have stainless steel guide-pins and not channel tracks for doors.

g. Wood doors to be custom fabricated as detailed. All sides and edges shall be laminated.

h. Hinged doors to be mounted on heavy-duty N.S.F. approved hinges, Model #2970-1010-1250 by Standard Keil or as noted on plans or specifications.

i. Hardware: Shall be solid, heavy-duty type.

j. Identify manufacturer's name and number so that broken or worn parts may be replaced.

k. Submit samples for approval, when requested.

l. Pulls shall be Standard Keil Hardware, or approved equal

m. Disherwells: Disherwells shown on drawings or specified shall be Fisher Mfg. Co. or Standard Keil.

n. Drawer Assemblies: Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with padlock hasp.

o. Slide assembly shall consist of one pair of stainless steel roller bearing extension slides with side and back enclosure panels, front spacer angle, two drawer carrier angles secured to slides and stainless steel front.

p. Slides are to be Model No. 3320-22 (250 lb. capacity fully extended) made by Grant Pulley and Hardware Co., or equal.

q. Drawer bodies for general storage shall be 20" X 20" or as specified with Royalite containers as manufactured by United States Rubber Co.

r. Drawers intended shall hold food products to be removable type with 12" x 20" stainless steel assembly.

s. Drawer fronts shall be double cased, 3/4 in. thick, with 18 gauge stainless steel welded and polished front pan. Stainless steel back pan shall be tightly fitted and tack welded. Sound deaden with rigid insulation.

t. Provide all drawers with replaceable soft neoprene bumpers or, for refrigerated drawers, a full perimeter soft gasket.

15. Custom Fabricated Workmanship

a. Items of specialty custom fabricated equipment must be custom fabricated by an acceptable manufacturer, who is N.S.F. approved and custom fabricated in an approved manner to the complete and final satisfaction of the General Contractor.

b. Welding and Soldering: Materials 18 gauge or heavier, shall be welded.

c. Seams and joints shall be shop-welded or soldered as the nature of the material will require.

d. Welds shall be ground smooth and polished to match original finish.

e. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high-grade aluminum paint.

f. Fasteners and Joints: The following will not be accepted:

1) Exposed screw or bolt heads.
2) Rivets.
3) Butt joints made by riveting straps under seams and then filled with solder.

g. Rolled Edges: Rolled edges to be as detailed, with corners bull nosed, ground and polished.

h. Coved Corners: All stainless steel food service equipment shall have 1/2 in. (13 mm) or larger radius coves in all horizontal and vertical corners and intersections per N.S.F. standards.

i. Closures: Where ends of fixtures, backsplashes, shelves, etc. are open, fill by forming the metal, or weld sections, if necessary, to close entire opening flush to walls or adjoining fixtures.

16. Operation Requirements

a. Insure quiet operation of food service and related equipment. Provide sound deadening on all tables, counters, under shelves, sinks and drain boards.

b. Insure bumper gaskets, stops, and any other protection is installed on all custom fabricated equipment as needed.

17. Connection Terminals: All custom fabricated equipment shall be provided with standard connection terminals to allow other contractors to make final connections on job site.

18. Exhaust Hoods, Walk-in Coolers and Dish machines

a. Verify size and location of all connections required before fabrication.

b. Check job site prior to installation of walk-in coolers to verify proper dimensions and for required trim.

c. Provide all stainless steel duct connections and collars.

19. Insert Pans

a. All cut-outs, openings, drawers, and equipment specified or detailed to hold stainless steel insert pans shall be provided with a full complement of pans as follows:

b. One (1) stainless steel, 20 gauge minimum, solid insert pan for each space, sized per plans, details, and specifications.

c. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size pan to securely fit each opening.

d. Provide a maximum depth pan to suit each application and space allocated for same.

e. Provide 18 gauge removable stainless steel adapter bars where applicable.

20. Tray Slides

a. Verify the following before fabrication of counters with tray slides:

1) Configuration of all corners, turns, and shape of tray slides for proper support and safe guidance of trays.
2) Size and shape of tray to be used in operation.

21. Enclosures: Provide and install enclosure panels secured or removable as specified for any item which houses equipment with movable parts, i.e. compressors, pumps, etc. Also, cover and provide protection for any exposed steam line or condensate line which may be within reach of operating personnel.

22. Dispenser (Self-leveling): Verify make of ware, their dimensions, and weight and submit to the dispenser manufacturer at earliest possible date so that springs may be properly calibrated.

23. Water Filter Purifier: Furnish in-line water filter-purifiers to remove materials, taste, and odors from beverage system, coffee urns, and icemakers, manufactured by Everpure or equal. Provide proper size filter - purifier for equipment being supplied. Locate to insure easy access for cartridge replacement.

24. Electrical Work – General Requirements

a. Before ordering equipment, confirm with the General Contractor, all pertinent electrical requirements such as actual voltages available, number of phases and number of wires in the system.

b. Electrical work for custom fabricated equipment shall be completely wired by this Contractor to a junction or pull box, easily accessible, mounted on the equipment. Wiring shall be labeled for outlet or item served.

c. Components and assemblies shall bear the U.L. label or be approved by the prevailing authority.

d. Provide custom fabricated and standard refrigerated units with vapor tight receptacles, shatterproof lamps and automatic switches. All wiring to be concealed.

25. Internal Wiring of Fixtures and Equipment

a. Contractor shall be responsible for internal wiring of electrical devices, and shall build them into or form them as an integral part of the custom fabricated equipment items. Wiring to be placed in metal conduit to a pull box tagged for intended use. Check with the General Contractor for color coding of wiring.

b. Each standard item shipped in sections shall be properly connected internally and verified.

c. Provide dishwashers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.

d. Where light fixtures are specified or detailed as part of counters, cases or fixtures, light fixtures and lamps to be provided unless otherwise specified. If fluorescent light fixtures are specified, all ballasts shall be included.

e. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:

f. In heat zone, have U.L. approved insulation and not less than 300 volt rated with nickel wire.

g. Connection wiring extended in raceway or conduit to junction or pull box shall not be less than 600 volt rated A.V.A. insulation covered wire, U.L. approved, or equal.

h. Wiring for custom fabricated refrigerator and freezer cabinets shall be U.L. approved, insulated cable from exterior junction box to internal components within insulation, unless code requires metallic conduit:

i. Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal Tite Flex or approved equal shall be used.

j. Internal wiring shall be U.L. approved rubber covered 600 volt rated conductor except door heaters, which shall be Nichrome wire with silicone braided jacket having resistance of 10.4 watts per lineal foot.

k. Convenience outlets, lighting receptacles (rubber or porcelain), and door switches shall be mounted in approved boxes. Convenience outlets for evaporators shall be twist-lock type. Solid connections as for freezer evaporators shall be made vapor tight.

l. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed "Seal-Tite" conduit equal to Anaconda type "UV" U.L. approved, complete with approved liquid-tight connectors on each end, designed to provide electrical grounding continuity.

m. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) will not be permitted for wet areas. Exposed outlet boxes shall be liquid-tight with thread hubs.

26. Convenience and Power Outlets

a. Make cut-outs and install appropriate boxes or outlets in custom fabricated fixtures complete with wiring conduit, outlet and cover plate.

b. All outlets and plugs shall conform to N.E.M.A. standards.

c. All electrical outlets and devices shall be first quality "Specification Grade."

27. Plugs and Cords: Where cords and plugs are used, they must comply with National Electrical Manufacturer's Association (N.E.M.A.) requirements.

28. Heating Equipment

a. Electric and heating equipment to be installed so as shall be readily cleanable or easily removable for cleaning.

b. Steam-heated custom fabricated equipment shall be of self-contained assembly complete with control valves located in an accessible position.

29. Starters, Switches and Controls

a. Furnish all starters, motor controls, remote controls and transformers as required.

b. Locate all switches out of heat zone.

c. All starters, switches and controls shall have white on black phenolic plastic identification plates with stainless steel screws conspicuously located on adjacent surfaces.

30. Refrigeration: Refrigeration systems shall include start-up and thirteen month service and maintenance contract in addition to the regular thirteen month guarantee as stated herein before plus an additional four- year guarantee on all condensing units and compressors. This includes refrigerators, ice cream cabinets, ice makers, freezers, dispensers, and all other refrigerated items.

31. Cold Pans: Ice pans, refrigerated pans and cabinets to be provided with breaker strips where adjoining top or cabinet face materials, to prevent transfer of cold.

32. Ventilation of Refrigerated Equipment

a. Adequate air supply and exhaust shall be provided for all self-contained refrigeration condensing units, both custom fabricated and standard, as required for proper operation.

b. If additional ventilation is required to ensure correct operating temperatures, so state in a letter to the General Contractor for evaluation and decision before purchase/fabrication.

33. Components

a. Coils: Coils for standard and custom fabricated refrigerators to have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.

b. Expansion Valves: Standard reach-in refrigerators and freezers, for remote refrigeration systems, shall be complete with thermostatic expansion valves at the evaporator.

c. Thermometers: Refrigerated compartments, custom fabricated and standard, shall be fitted with flush dial-type thermometers with chrome-plated bezels.

1) Thermometers to be adjustable and shall be calibrated after installation.
2) Thermometers shall have an accuracy of± 2°F.

d. Hardware: Refrigerator hardware for standard and custom fabricated refrigerator compartments shall be solid, heavy-duty components.

1) Hinges must be self-closing.
2) Latches shall be magnetic edge mount-type unless specified or detailed otherwise.

e. Locks: Doors and drawers for reach-in refrigerated compartments, both custom fabricated and standard, to be fitted with cylinder locking type latches, and provided with master keys.

J. Execution – General Installation of Equipment

1. Trimming and Sealing of Equipment

a. Any space between units to walls, ceilings, floors and adjoining non-portable units shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material suitable to the nature of the equipment and acceptable to Architect.

b. Sealer, when not exposed to extreme heat, shall be single part neutral curing silicone sealant.

c. Ends of hollow sections shall be closed.

2. Cutting and Fitting

a. Do all cutting and fitting required on the equipment during installation and hook up. Should any repairs to food service equipment be required due to neglect of other contractors, all extra charges are to be approved and all repairs are to be noted in writing before work is performed, stipulating the price and to whom the extra expense is to be paid. In case this Contractor does not secure such extra order, the expense will be borne by him.

b. No cutting, notching, drilling, or altering of any kind will be done to the building by any Contractor without first obtaining permission from the General Contractor.

3. Protection of Equipment

a. Contractor will be responsible during the progress of the work to protect equipment against theft and/or damage until final acceptance by the Owner. All items delivered to the job site prior to final acceptance shall be signed for, as delivered, by the Kitchen Equipment Contractor. Responsibility for safekeeping will rest with Kitchen Equipment Contractor in coordination with General Contractor's requirements.

b. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment, are not to be used for general storage by other trades and shall be locked by this contractor before leaving the site. It is the Contractor's responsibility to insure proper ventilation is provided during the cleaning and curing of masonry wearing floors inside the walk-in boxes. Damage and/or theft resulting from failure to secure boxes will be repaired or replaced at Contractor's expense.

END OF SECTION 11 40 00

Seattle Center Site Standards

Division 21

Fire Suppression

A. Scope

The following are guide specifications for fire protection, which at Seattle Center is part of a Simplex Fire Alarm Network. Refer also to Section 28 31 00 ***Fire Detection and Alarm***, particularly Paragraph F, *Fire Watch and Fire Suppression System Shutdown*.

Generally, fire protection systems at Seattle Center are design-build installations by a Contractor with a valid Washington State Contractor's license for the installation of fire sprinkler systems.

B. General Requirements

Designer shall describe basic details of the system. Include: wet or dry system, calculated or pipe schedule, density/area if calculated, hazard classification, revision to existing system or new system, complete new system or individual areas to be covered, not covered, etc.*

Existing Sprinkler Equipment: Existing sprinkler equipment shall be maintained fully operational until the new equipment has been tested and accepted by the Seattle Center and Seattle Fire Department, left in service, re-piped], or removed as indicated in the contract drawings.

Equipment Removal: After acceptance of the new system by the Seattle Center and Seattle Fire Department, all existing equipment so indicated shall be removed and all damaged surfaces shall be restored as herein specified.

C. Codes and Standards

This installation shall conform to the latest edition at the time of bid of each of the following. The system shall be designed by a NICET Level 3 or 4 certified sprinkler designer. The field installation shall be supervised at all times by a journeyman sprinkler fitter.

1. NFPA 13, all appendices, Installation of Sprinkler Systems,
2. NFPA, Automatic Sprinkler System Handbook,
3. NFPA 14, all appendices, Standpipe and Hose Systems,
4. NFPA 24, all appendices, Private Fire Service Mains,
5. International Building code, include Seattle Amendments, latest editions.
6. International Fire Code, including Seattle Amendments, latest editions.
7. International Mechanical Code, including Seattle Amendments, latest editions.
8. Underwriters Laboratories Fire Protection Equipment Directory,
9. Factory Mutual Approval Guide.
10. DPD DR 17-2005 – Sprinkler Systems and Fire Alarms for Elevator Machinery Rooms, Control Rooms, Hoistways and Pits

D. Approvals

For purposes of code compliance, the Authority Having Jurisdiction (AHJ) for this installation will be the Seattle Fire Department. Where there are conflicts between the AHJ and the referenced codes and standards, the more stringent shall apply. If there is a question of interpretation as to which is more stringent, it shall be decided by the Owner.

E. Submittals

Material Submittals: Within 28 days of the Notice to Proceed furnish to the Project Manager six (6) copies of a complete list of equipment and products, and a manufacturer's catalog sheet for each item to be included in the project. All material submittals shall include all items listed in the product section and all additional items necessary to provide a complete installation. Partial submittals are not acceptable and will be rejected without review. Where more than one item appears on a manufacture's catalog sheet, the item or items to be used shall be indicated.

Welding Submittals: Within 28 days of the Notice to Proceed submit welding procedures that comply with NFPA 13 section 3-12 and Specification for Qualification of Welding Procedures and Welders for Piping and Tubing, American Welding Society, Inc. (AWS) D10.9 Standard for Building Service Piping, level AR-3. Submit the following forms:

1. Typical Welding Procedure Specification (WPS)
2. Typical Contractor's Procedure Qualification Test Record (PQR)
3. Typical Contractor's Welder Qualification Tests Record

Unless approved otherwise, all welding shall be done in-shop, not in the field.

Shop Drawings: Prior to any installation or fabrication of the system components, Contractor shall submit six (6) sets of shop drawings and hydraulic calculations for review approval by the Project Manager or designated representative. Incomplete shop drawings will be rejected unless prior approval is requested and received from the Project Manager for partial submittals. Shop drawing shall conform to, and include all items as set forth in NFPA 13.

After approval is received from the A/E and Owner, submit shop drawings to DPD for Seattle Fire Department approval. Deliver copies of the shop drawings bearing the approval stamps to the Owner.

F. As-Built Drawings

Updated Field Drawings: Provide and keep up-to-date, a complete record set of approved shop drawings, corrected daily to show every change from the approved shop drawings. Keep this set of prints on the job site and use only as a record set. The up-to-date drawings shall be reviewed each month by the A/E prior to the application for payment.

Final Record Set: Refer to Division 01 ***General Requirements***.

G. Operations and Maintenance Manuals

Manuals shall include an index, copies of all approved shop drawings and submittal materials (updated to reflect as-built conditions), and a complete parts list of all components. The manual shall also include, for each item, the manufacturer’s name, the serial number of the part, an ordering number, if appropriate, and a physical description of and all data describing the part. Also refer to Division 01 ***General Requirements***.

H. Products and Materials:

1. General:

   All materials and equipment in the system shall be new and current products of a manufacturer regularly engaged in the production of such materials and equipment. Where two or more pieces of equipment are required to perform interrelated functions, they shall be products of one manufacturer. Unless otherwise indicated, all products shall be listed in the latest publication of Approval Guides for Underwriters Laboratory and Factory Mutual for the service intended. Manufacturer of sprinkler specialties shall be; Central, Grinnell, Reliable or Viking.

2. Pipe:

   a. Provide piping, valves, and fittings, approved for 175 or 300 psi working pressure, in accordance with NFPA 13. Conceal piping in areas with suspended ceilings. Other piping may be exposed as approved by Project Manager or designated

representative. Provide fittings for changes in direction of piping and for connections. Make changes in piping through tapered reducing pipe fittings; bushings will not be permitted. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Side outlet tees using rubber gasketed fittings shall not be permitted.

b. Galvanized Pipe: Discuss with Project Manager or designated representative the use of galvanized pipe.

c. Underground Pipe: All piping upstream of the double backflow preventer shall be ductile iron class 52 and cement-mortar lined whether inside or outside of the building.

d. Rust Inhibitive Paint: All exposed threads on galvanized pipe are to be coated with rust inhibitive paint.

e. Color Coding: Color coding and identification of the piping is required.

3. Fittings and Couplings

a. Rust Inhibitive Paint: Grooved Fittings and couplings shall be coated with a rust inhibiting paint.

b. Threaded Fittings: Threaded fittings shall be cast iron class 125, rated for 175 psi. cold water working pressure and shall conform to ANSI B16.4, ASTM 126 and ANSI B2.1 NPT. Malleable threaded fittings will not be permitted.

c. Nipples: No close nipples will be permitted. Use standard short nipples for short pipe connections.

d. Adjustable Nipples: Adjustable drop nipples may be used on flush or concealed type sprinklers only and must be of double o-ring seal design.

e. Thread-O-Lets: Shop welded Thread-O-Lets may be used where a certified welder is used, meeting the requirements of paragraph 1.04.B. and the Thread-O-Lets are listed.

f. Grooved Fittings: 90's, 45's, Tees, and reducers shall be malleable iron or ductile. The fittings shall be by Gustin-Bacon, Gruvlok, Victaulic, or approved equal.

g. Adapter Flanges: Adapter flanges (fittings) shall be cast iron/class 125 conforming to ANSI B-16.1, with a rust inhibiting coating. The adapter flanges shall be by Gustin-Bacon, Gruvlok, Victaulic, or approved equal.

h. Grooved Couplings: Grooved couplings and reducers shall be malleable or ductile iron conforming to ASTM A-47. Coupling gasket shall be molded Elastomer (EPDM) per ASTM D2000, Victaulic grade "E" (type A) or equal. On dry pipe systems a "FlushSeal" or "Flush Gap" gasket shall be used. Grooved couplings and reducers shall be of the same manufacturer as used for the grooved fittings.

i. Plain End Couplings: No plain end couplings (Roust-A-Bouts, Plainloks or similar couplings) may be used on either new or existing sprinkler systems.

j. Hole Cut Outlets, New Systems: No hole cut outlets may be used on new sprinkler systems.

k. Hole Cut Outlets, Existing Systems: Hole cut bolted branch outlets couplings may be used on existing sprinkler systems only in isolated locations as approved by the Owner. Hole cut outlets shall be a full bodied outlet (U-bolt outlets will not be permitted) style 920 by Victaulic or approved equal by Gruvlok or Gustin-Bacon.

l. Use of Roust-a-Bouts is prohibited

4. Hangers and Supports

a. Hangers: Provide hangers to support all piping: in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of NFPA 13.

b. Pipe Rings: Pipe rings to be zinc coated Grinnell figure 69 or approved equal.

c. Hanger Rods: Hanger rods to be electro-galvanized.

d. C-Clamps: All c-clamps (beam clamps) shall be equipped with earthquake retaining straps.

e. Riser Clamps: Riser clamps shall not protrude more than 2" beyond the edge of the hole. The riser clamps need be only UL listed, Grinnell figure 261 or approved equal

f. Concrete Anchors: Concrete expansion anchors shall be Hilti, Phillips, Impex, ITW, or approved equal.

g. Explosive Anchors: Explosive type fasteners are not permitted.

5. Earthquake Bracing

a. Earthquake bracing shall be with a pipe clamp and pipe with a swivel type anchor or similar to those illustrated in NFPA 13.

6. Valves

a. Outside Screw and Yoke (OS&Y) Valves: OS&Y valves shall be cast iron, flanged and rated for 175 psi, non-shock cold water working pressure.

b. Supervised Valves 2 Inches and Smaller: Sprinkler controlling valves 2 inches and smaller shall be Slow-Close Supervised Butterfly valve from Milwaukee Valve Company, model BB-SC. No exceptions.

c. Valves Controlling Sprinklers in Elevator Machine Room and Top of Elevator Shaft: Sprinklers located in elevator machine rooms and at the top of the elevator shaft shall be controlled by a normally closed supervised Butterfly control valve from Milwaukee Valve Co., model BB-S02-R.

d. Drain Valves: Drain valves need only be UL Listed, screw-in bonnet bronze globe valves, rated to 175 psi non-shock cold water working pressure by Nibco, United or approved equal. Low point drain valves shall have, in addition, a 3/4" brass nipple with 3/4" male hose threads and cap.

e. Check Valves: Check valves shall be: grooved, iron body, bronze seat, stainless steel clapper with a replaceable rubber seal (a rubber seal integral with the seat is not acceptable), and 175 psi non-shock cold water working pressure. Viking model D, Central model 90 or approved equal.

f. Double Detector Check Valve Assembly: Assembly shall be Ames 3000 DCDA, Febco 856, 876 or 876V, or Watts 709 DCDA or 770 DCDA.

Provide a weighted clapper double check valve assembly including the two OS&Y gate valves. The assembly shall be an approved double check valve assembly on the latest listing from the Washington State Department of Social and Health Services for cross connection devices. Double check valve assembly shall be by Viking, Febco or Watts.

7. Sprinklers

a. Sprinklers: Provide ordinary temperature rated sprinklers with a 1/2" orifice. Areas subject to high temperatures exceeding 110 degrees Fahrenheit or as noted in NFPA 13 shall have sprinklers rated for 212 degrees Fahrenheit or as required.

Provide semi-recessed sprinklers are in all finished lay-in or plaster ceilings. Provide chrome sprinklers with a white escutcheon. Provide Reliable model F1 Recessed, Viking Micromatic Model M with escutcheon model E-1, Gem model F985, or approved equal.*

b. Spare Sprinklers: Provide spare sprinklers and escutcheons shall for each type and style of sprinkler used in accordance with NFPA 13 and proportioned based upon the number of each type and style of sprinkler used on the job. Spares of dry-pendant sprinklers are not required.

8. Spare Sprinkler Cabinet

a. Provide a spare sprinkler cabinet to accommodate the required number of spare sprinklers and escutcheons. Include a wrench for each type of sprinkler in the cabinet. Paint the cabinet fire red and keyed to a BEST Lock AA16. Label the cabinet with a riveted or screwed laminated plastic nameplate indicating "SPARE SPRINKLER CABINET" in white letters on a red background, letters to be 1/4" high.

9. Sprinkler Headguard

a. Provide UL Listed sprinkler headguards for sprinkler heads subject to mechanical damage or for any sprinkler lower than 7'-0" above the floor.

10. Fire Department Connection

b. A sign indicating "Auto Sprinkler" or similar shall be provided as a part of the escutcheon or as a separate sign permanently affixed to the building. Lettering for the sign shall be a minimum one inch high. Choose either chrome or polished brass for the FDC and escutcheon.

c. Provide a fire department connection (FDC) with horizontal type connections, dual clapper, 2-1/2" inlets, with rocker lug caps, and chains.

11. Ball Drip

a. Provide a bronze ball drip for the fire department connection inside of the building and pipe to the nearest floor drain.

12. Roof Fire Department Connection

a. Provide a wall type indicator post and gate valve for the roof indicator post, with a two-way roof fire department connection with rocker lug caps and chains, Potter-Roemer 5870 series or approved equal, or as stipulated by Seattle Fire Department for a roof FDC

13. Post Indicator Valve

a. Provide a post indicator valve (PIV) on the fire service water main into the building.

14. Hose Valve

a. Provide 2-1/2" polished brass hose valves with a cap and chain. Turn the outlet at an angle of 45 degrees from the wall. The cap is to have a 1/8" diameter hole drilled in the face to relieve any water pressure. Potter-Roemer model 4065 with model 4626 (cap and chain) or approved equal.

15. Sight Drain

a. Provide a single piece sight drain by Grinnell or approved equal.

16. Pressure Gauge

a. Provide a 3-1/2" diameter, bourdon type pressure gauge, 0-300 lbs, 1/4" soft metal seat globe valve with arrangements for draining pipe between gage and valve, located near each main or floor control valve assembly on the main line or near each test location.

17. Drum Drip

a. Provide a cast iron drum drip at the low drain points on a dry system.

18. Splash Block

a. Provide a splash block at the point of discharge for the drains outside of the building, if the ground will be disturbed by the flow of water.

19. Sleeves

a. Provide 24 gauge galvanized sheet metal with lock seam joints or 1/2 inch overlap sleeves in floors, partitions, ceilings, and in construction without waterproof membranes. Provide schedule 40 galvanized steel pipe sleeves in exterior walls. Provide schedule 40 pipe sleeves with clamping rings in slab-on-grade or exterior walls having below grade penetrations. Provide sleeves through roofs with flashing collars.

20. Link Seals

a. Provide link seals when underground pipe passes through an exterior wall or slab. Flexible couplings, located within one foot of each side of the wall must be included with the link seal installation. This is a requirement of NFPA 13 and the Seattle Fire Department.

21. Wall Escutcheon

a. Provide plastic split ring type escutcheons and paint to match the wall. Escutcheons are only required with exposed pipe installations.

22. Dry Pipe Alarm Valve

    a. For dry systems, provide a dry pipe alarm valve, trim package, accelerator and air maintenance device, all by the same manufacturer.

23. Air Compressor

    a. For dry systems only, provide an air compressor, sized to completely refill the system within 30 minutes*

24. Fire Alarm and Related Equipment

    Equipment in this section shall be provided, installed, and adjusted by the sprinkler Contractor. Conduit, wiring, and terminations, shall be by others.

    a. Vane type water flow switches shall contain double pole, double throw contacts and screw terminals for each conductor. Devices shall also be equipped with a time delay feature which is field adjustable from zero to at least 90 seconds. The time delay shall be initially set to 30 seconds.

    b. Pressure type water flow switches shall contain double pole, double throw contacts and screw terminals for each conductor. The device must have a time delay feature which is field adjustable from zero to at least 90 seconds. The time delay shall be initially set to 30 seconds.

    c. Supervisory (Tamper) Switch: Provide a tamper switch for each interior sprinkler system control valve, as well as outside post indicating valves. Tamper switches shall have two sets of single pole, double throw contacts with screw terminals for each conductor. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 20, whichever is less.

    d. Provide a Potter Bleeder Valve BVL-1000018, no exceptions, for dry systems.

    e. Supervised Valves 2 Inches and Smaller: Provide slow-close supervised butterfly valve from Milwaukee Valve Company, model BB-SC. No exceptions.

    f. Valves Controlling Sprinklers in Elevator Machine Room and Top of Elevator Shaft: Sprinklers located in elevator machine rooms and at the top of the elevator shaft shall be controlled by a normally closed supervised Butterfly control valve from Milwaukee Valve Co., model BB-S02-R. No exceptions. Note: These valves activate the elevator shunt trip only and are not associated with the fire alarm system.

25. Signs

    a. Provide all control, drain and test valves with signs identifying the type of valve and the area (floor or portion of the building) affected by the valve. Signs shall be three layer etched plastic with red letters on a white background. Letters are to be minimum 1/4" high. Submit the wording for approval, for example "CONTROL VALVE FOURTH FLOOR NORTH". The signs are to be hung by a chain from the valve. If the system is a calculated system provide a sign in accordance with NFPA 13.

26. Firestopping Material

a. Firestopping material is to be UL classified Bio Fireshield BFS100, 200 caulk or approved equal.

27. Pipe Thread Sealant

a. Provide a brush-on pipe thread sealant with Teflon, Grinnell Tuff-Loc or approved equal. Teflon tape will not be permitted.

I. Execution

1. General

a. Do not order, fabricate, or install any material prior to receipt of all approvals as stipulated in Part 1 of this Section.

b. All installation work shall be performed in accordance with the reference standards without exception. All piping shall be installed straight, true and plumb.

c. Install all piping as shown on the approved shop drawings. Minor deviations shall be carefully noted on the record drawings before making significant deviations from the approved drawings, obtain written approval from the Project Manager or designated representative.

d. Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting the performance standards herein.

2. Any shutdowns of existing water distribution systems, fire sprinkler systems, domestic water systems or fire alarm systems shall be approved by the Project Manager. Advance written notice of at least 14 days prior to the shutdown must be provided to the Project Manager.

3. Penetrations

a. Required Clearance Around Pipe: Piping passing through fire rated assemblies, including fire rated GWB assemblies shall be provided with clearance around the entire circumference of the pipe as required by NFPA 13, paragraph 3-5.3.4 Piping 3-1/2" and smaller shall have a minimum one inch clearance around the entire circumference of the pipe and pipe larger than 3-1/2 shall have a minimum two inch clearance around the entire circumference of the pipe. No exceptions. Penetrations of walls, floors or ceilings shall be made in a neat manner using properly sized hole saw or masonry/concrete coring as necessary.

b. Fire Rated Assemblies: The annular space between the wall or pipe sleeve and the sprinkler pipe in fire rated assemblies shall be filled with UL classified firestopping material in accordance with the manufacturer's recommendation, also see paragraphs 2.19 and 2.26. Apply firestopping material over a noncombustible backing material (fire safing), oakum is unacceptable.

c. Escutcheons: Split wall plates or escutcheons shall be installed where exposed piping or hangers pass through a finished floor, wall or ceiling and shall fit snugly, securely and cover the opening.

4. Install all control valves, supply valves and test valves in easily accessible locations, with the valve handle or wheel no higher than seven feet above the finished floor.

5. Inspector's Test and Drains

   a. Provide inspectors test valves for each floor of each system. For buildings two stories or less the inspector's test assembly shall be piped to discharge outside the building and shall be located at the hydraulically most remote part of the system. For buildings higher than two stories, the inspector's test assembly shall be piped from the end of a branch line located near the system riser. Discharge shall be into a drain riser located adjacent to the system riser or to a drain for a remote inspectors test valve when provided i.e. dry systems. The valve shall be readily accessible, at a location no higher than seven feet above finished floor.

   b. Provide main drains at all system and floor control valves. Discharge shall be into drain risers for a multi-story building. Drain risers and main drain for single story buildings shall discharge to a safe location outside the building wherever possible. Splash blocks shall be provided to limit damage to landscaping. Where outside discharge cannot be achieved, discharge shall be to minimum 6" floor drain, with a funnel. No sprinkler system drain line is to be piped directly into a drain; there must be at least a 1/2" gap between the pipe and the funnel/drain.

   c. Provide auxiliary drains at all low points of the system, where the trapped section of pipe exceeds five gallons. The drain shall consist of, as a minimum: a valve, a 3/4" brass nipple with 3/4" male hose threads, and cap. Locate auxiliary drains in unfinished areas without suspended ceiling wherever possible. In finished areas, with lathe and plaster or GWB locate the hose bib within six inches of an access panel, minimum 12" x 12". If located in bathrooms the panel is to be stainless steel.

6. Provide gauges at the main system riser and each floor control valve. Tap gauges from the main piping, not from the drain piping.

7. For lay-in suspended acoustic ceilings, sprinklers shall be located between the one-quarter and three-quarter points of the tiles in both directions and shall be carefully aligned.

8. Install earthquake bracing in accordance with NFPA 13 and as clarified in the ***Handbook of Automatic Sprinkler Systems***. Provide earthquake bracing as follows, but is not limited to these locations:

   a. Lateral Bracing: Provide lateral bracing at least every 40 feet, regardless of length of hanger.

   b. Longitudinal Bracing: Provide longitudinal bracing at least every 80 feet for long straight runs of main.

   c. Flexible Couplings: Brace all flexible couplings, except for risers where flexibility is required. Provide four way bracing for all tees, elbows, and offsets.

9. Inspection, Testing and Punch List

   a. Partial System Test or Inspection: Perform tests with the sprinklers installed in their final positions. Where it is critical to the continuance of the project as a whole to cover portions of the piping with ceilings or walls prior to the completion of the entire system, partial testing of the system may be performed after receiving written approval from the Owner. In this case "partial" indicates an entire zone or floor of one system. A satisfactory partial test does not relieve Contractor from performing all final testing procedures.

b. Required Inspections/Tests: The contractor shall satisfactorily complete the inspection and tests listed below before final approval of the system will be granted. The contractor is responsible for providing all equipment and labor necessary to perform all inspections and tests. Submit request for inspection/testing to the General Contractor at least 15 days prior to the test date.

   1) Flushing of underground piping
   2) Hydrostatic testing of underground and aboveground piping
   3) Inspection of piping before installation of wall/ceiling material
   4) Final piping inspection
   5) Functional test

c. Flushing and hydrostatic inspections and tests shall be witnessed by Seattle Center Engineers, Project Manager and the General Contractor. All other inspections and tests shall be witnessed by the Seattle Center Engineers, Project Manager, and General Contractor.

d. Flushing of underground piping: Underground piping and lead in connections to system risers shall be flushed thoroughly before connection is made to sprinkler piping, in order to remove foreign materials which may have entered the underground during the course of the installation or which may be been present in existing piping.

   1) Testing procedures: Underground piping shall be flushed in accordance with the latest edition of NFPA 24. The minimum rate of flow shall not be less than the water demand rate of the system which is determined by the system design, or not less than that necessary to provide a velocity of 10 fee per second (3 m/s), whichever is greater. For all systems, the flushing operations shall be continued for a sufficient time to ensure thorough cleaning. Provisions shall be made for the disposal of water issuing from test outlets to avoid property damage.

      a) Exception: When the flow rate cannot be verified or met, underground piping shall be flushed at the maximum flow rate available to the system under fire conditions.

   2) Flushing shall be considered satisfactorily completed when no debris emanates from the piping or the piping has been flushed for a time period acceptable to the Seattle Center and General Contractor representatives.

e. Hydrostatic testing of underground piping: A hydrostatic test shall be performed on the underground piping, including the fire department connection, in accordance with NFPA 13 and 24. Piping between the check valve in the fire department inlet pipe and the outside connection shall be tested in the same manner as the balance of the system.

   1) Test procedures: Test the complete system for not less than 2 hours at a pressure of 200 PSI (or 50 psi above static pressure, whichever is greater) without the addition of any water. Piping shall be covered in such a manner as to keep the joints and thrust blocks visible. Take special precautions to detect and stop water leakage so that any water damage will be minimal.

      a) Exception: Piping may be covered so long as all joints and thrust blocks are visible.

   2) Whenever a test blank is used, it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The installer shall have all test blanks numbered

so as to keep track of their use and assure their removal after the work is completed.

3) Refer to NFPA 24 for permissible leakage in underground piping. The amount of leakage shall be measured by pumping from a calibrated container. Any leaks or drips shall be repaired immediately by the Contractor. Additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals shall not be used for testing systems or stopping leaks.

f. Hydrostatic testing of aboveground piping: A hydrostatic test shall be performed on all aboveground piping in accordance with NFPA 13.

1) Test procedures: The test procedures for preliminary and final testing shall be identical. Test the complete system for not less than two hours at a pressure of 200 psi (or 50 psi above static pressure, whichever is great) without the addition of any water. The test pressure shall be read from a gauge located at the low elevation point of the individual system or portion of the system being tested.

Whenever a test blank is used, it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The installer shall have all test blanks numbered so as to keep track of their use and assure their removal after the work is completed.

2) Aboveground piping shall be installed in such a manner that there will be no visible leakage or drop in gauge pressure when the system is subjected to the hydrostatic pressure test. Any leaks or drips shall be repaired immediately by Contractor. Additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals shall not be used for testing systems or stopped leaks.

g. Inspection of piping before installation of wall/ceiling material: All piping and related material shall be inspected for proper installation before wall and/or ceiling material is installed.

1) Inspection procedures: Inspection of piping shall consist of verification of correct pipe size, length and fittings in conformance with the Contractor's approved shop drawings. Pipe, hangers, and sway bracing shall be inspected for proper installation methods.

2) Piping, hangers and sway bracing shall be considered satisfactorily installed when the installation is in conformance with the Contractor's approved shop drawings and NFPA 13. Deviations from the approved shop drawings shall be approved by the Seattle Center Engineer and the Project Manager. When, in the opinion of the Seattle Center Engineer or Project Manager the installation deviates greatly from the approved shop drawings, revised shop drawings and hydraulic calculations may be required to verify the installation.

h. Final piping inspection: After installation of all wall/ceiling material and all sprinkler heads, the sprinkler system shall be inspected for proper sprinkler coverage, valve location and signage.

1) Inspection procedures: Inspection of the system shall consist of verification of proper sprinkler head coverage throughout the entire building. Valve locations shall be verified to ensure proper height and clearance. Signage of all concealed valves shall be verified.

2) Final sprinkler head placement shall be considered satisfactorily complete when all sprinkler heads are installed in accordance with their listing or approval and the Contractor's approved shop drawings. The Contractor may be required to relocate or add additional sprinkler heads if proper sprinkler coverage is not provided due to unforeseen or modified architectural conditions.

i. Functional test: All valves, switches and test connections shall be operated to ensure conformance with the Contractor's approved shop drawings and the manufacturer's specifications.

1) Test procedures: Operate all control valves to verify proper operation of the valve and associated tamper switch. Operate all test connections to verify water flow switch operation.

a). Dry pipe valves: The clapper of a differential type dry-pipe valve shall be held off its seat during any testing excess of 50 psi to prevent damage to the valve.

b) Dry-pipe system air test: All dry system piping shall be pressurized to 40 psi of air pressure for 24 hours in order to verify leak tight installation.

c) Dry pipe valve operation: Operate the dry system inspector's test connection. The following information shall be recorded on the Contractor's Material And Test Certificate during the valve operational test: time for valve to operate, time to receive water at inspector's test connection, static supply water pressure, system air pressure and air pressure at valve release.

2) The final functional test shall be considered satisfactorily complete when all valves and switches perform in accordance with the contractor's approved shop drawings and the test procedures above.

a) Dry pipe system air test: The piping system shall not allow a loss of pressure over 1 psi in 24 hours. All leaks resulting in a loss over 1 psi shall be repaired and the system retested.

b) Dry pipe valve operation: Water shall be received at the inspector's test connection within 60 seconds of operation of the test connection.

c) The high/low supervisory switch shall activate when system air pressures are 10 psi above the air maintenance shutoff pressure or 10 psi below the air maintenance starting pressure. The air maintenance device shall be set to start and stop in accordance with NFPA 13 and the manufacturer's recommendations.

d) Floor or zone water flow switches shall be received at the Fire Alarm Control Panel within 20-35 seconds after operation of the inspector's test connection. The maser water flow switch shall be received at the Fire Alarm Control Panel within 40-60 seconds after operation of the inspector's test connection.

e) Valve tamper switches shall activate within the first two complete revolutions of the valve hand wheel.

j. Punch List: Should the results of the inspection/test not be satisfactory to the Seattle Center representatives, deficiencies will be recorded on a punch list and delivered to

the Contractor. Corrections will be made within two weeks of receipt of the punch list, no exceptions, at the Contractor's expense and a re-inspection/test will be made.

k. Certificate of Completion: A completed contractor's test and materials certificate shall be delivered to the Owner upon satisfactory completion of the work.

END OF SECTION 21 00 00

Seattle Center Site Standards

Division 22

Plumbing

A. Scope

These standards and procedures apply to the design and installation of potable water systems. Most buildings will include a water header, hot water heater, and hot water circulating lines.

B. Codes, Regulations and Standards

All work shall conform to the latest issue of the Uniform Plumbing Code or the Seattle Plumbing Code, whichever is more stringent.

C. Design Review and Submittals

1. The contract documents must include complete riser diagrams showing all fixtures, valves, recirculation lines, pipe sizing, etc. A detail of each water header is also required.

2. Submittal information shall include catalog cuts of all fixtures, valves, fittings, pipe, hangers, solder, etc.

D. Specific Requirements

1. The Seattle Center is served by the City of Seattle pressure system with a reservoir elevation of three hundred sixteen (316) feet.

2. When incoming water pressure exceeds eighty (80) psig, provide a pressure reducing station with two pressure reducing valves (PRVs), each sized at 2/3 of total flow, in parallel, and each valved to operate independently. A minimum pressure of twenty five (25) psig should be provided at the highest point of the building. The assembly shall include appropriate valves, strainers, gauges, drains, etc. and include a bypass.

3. Each building service shall include a water meter and be valved off for maintenance.

4. The building non-potable water headers shall have reduced pressure back flow preventers.

5. Non-potable water provided by double check valves shall be limited to low hazard fire sprinkler and irrigation systems. Irrigation and fire system backflow preventers shall be located inside the building mechanical room rather than outside. High hazard irrigation and fire systems shall have reduced pressure principal backflow devices (RPBDs) or reduced pressure detector assemblies (RPDAs) for fire. Drains off these devices shall be connected indirectly to a receptor capable of handling the full flow of drain as desired.

6. The plumbing system should be divided into smaller systems with isolation valves separating them. This will allow a section of the building to be worked on without affecting the remainder of the building.

7. Systems shall have hot water storage tanks and use low pressure central plant steam whenever possible. The unit should be sized for seven (7) psig steam. Electric hot water heaters or booster heaters will be used during central plant shutdown plans.

8. Provide booster heaters for dishwashers and other equipment requiring higher hot water temperatures. Do not raise the temperature of the building system.

9. The potable hot water system shall be designed to heat water to 125^{O}F.

10. Provide dielectric unions whenever dissimilar piping materials are used.

11. Provide shock absorber type water hammer arresters in lieu of pipe air chambers. Provide each shock absorber with an isolation valve to allow for its removal without affecting the rest of the building. Each shock arrestor and its isolation valve shall have an access panel.

12. Provide access doors for all plumbing system components that require maintenance. Show the access doors on both the architectural and mechanical plans and coordinate.

13. Seismic bracing must be provided and coordinated with the structural engineer.

14. Do not install water piping below slabs-on-grade except for trap priming lines, which shall be sloped to the fixture.

E. Materials

1. The building water header shall be constructed type L copper pipe.

2. All building distribution piping shall be type L copper tubing.

3. Fittings on copper tubing shall be wrought copper or cast brass, solder pattern. All connectors 2” or larger in diameter shall be Victaulic or equivalent.

4. Solder shall be 95-5 tin antimony or approved equal. No lead type solders shall be allowed on the job site.

5. Plumbing fixture partition stop connections, through the wall, shall be brass pipe.

6. Use dielectric unions between copper and zinc coated materials.

F. Execution

1. Provide access doors for all plumbing system components or valves that require maintenance.

2. All piping shall be installed on the warm side of the insulation for freeze protection. No pipe shall be installed in an area that could experience below freezing temperatures.

3. All piping shall be sloped to allow the system to be drained. Provide a drain valve at the low point of the system and a drain to take the water away.

4. All water piping should be insulated and painted as described in other sections of the Site Standards.

END OF SECTION 22 10 00

A. Scope

These standards and procedures apply to the design and installation of waste and drain lines inside and within five (5) feet of the building envelope only. All sanitary and storm drain systems beyond five (5) feet of the building lines shall be covered under Sections 33 40 10 Storm Sewers and 33 30 00 Sanitary Sewers.

B. Design Criteria

Codes, Regulations and Standards

Comply with the requirements listed below. When there are conflicts between standards, references, specifications and manufacture's data, the most stringent requirements govern.

1. Uniform Plumbing Code, latest edition
2. Washington State Plumbing Code with Seattle amendments, latest edition
3. Seattle Plumbing Code, latest edition

Design Review and Submittals

1. Schematic drawings shall include fixture locations.

2. Include riser diagrams in drawings.

3. Show invert elevations of all sanitary drain lines leaving the building on drawings.

4. Indicate acceptable slope of piping both inside and outside.

Specific Requirements

1. The minimum size of side sewers shall be six (6) inches.

2. All waste drains shall be gravity systems. Sump pumps and sewage pumps shall not be used without specific approval.

C. Materials

1. Waste piping and drainage systems under slabs on grade shall be extra heavy cast iron soil pipe.

2. Roof drains shall be cast iron or brass, with cast iron or brass high dome strainers. The first section of pipe below the drain must be cast iron or brass.

3. No CPVC, ABS or galvanized piping shall be used within the building envelope except restaurant and concession waste drain piping and fittings. Restaurant and concession waste drain piping and fittings shall be Schedule 40 PVC solid core pipe and PVC drainage fittings.

D. Execution

1. All pipes, valves, clean-outs, and particularly waste piping, must be accessible for maintenance. Those recessed in wall cavities must have access doors, removable panels, or other approved methods for access.

2. Food preparation and service areas require extensive piping. Access is extremely important. Such areas shall not be located on a slab on grade. Where located above a suspended ceiling, the ceiling must be 100% accessible.

3. Wastes and clean water drains shall be collected independently in each building and carried separately to the city sanitary sewer and storm drains respectively. If no storm drain exists within 200 feet of the building, connect clean water drains to sanitary sewers and provide for future connection to storm drains.

4. All footings shall have footing drains connected to the storm drain system. Footing drains shall not be connected to an interior sump pump.

5. All area drains, yard drains, window well drains, and the like shall be connected to the storm drain system.

6. Invert elevations of sanitary sewer lines leaving the buildings shall be of sufficient depth to permit future connection of a waste line from any point in the basement area.

7. Drains from transformer vaults having oil-filled transformers and shop areas where oil is present shall connect to sanitary sewers through a City of Seattle approved oil interceptor.

8. Crosses shall not be used in waste piping.

9. Connections in waste piping for food service areas shall turn down with a 1/8 bend at the connection to the next branch.

10. Waste piping from garbage disposals shall be carried separately to a major waste pipe, with as few bends as possible and completely accessible clean outs.

11. Floor drains shall be connected to the sanitary sewer. Drains for fire sprinkler system shall be six (6) inches minimum and shall be connected to storm drains.

12. Mechanical rooms, pipe trenches, tunnels and other areas with piping shall be equipped with floor drains. Provide primed floor drains.

13. Avoid installing drain lines in complicated architectural work; if installed, use brass pipe with bronze fittings.

14. All floor drains shall have a trap primer (use timer type).

15. Waste and drainage piping crossing excavated areas shall be supported on precast concrete beams supported by the building structure and undisturbed earth.

16. Clean outs shall be the full size of the piping served.

17. Drainage from flammable or hazardous chemical/liquid storage rooms must not be connected to the sewer systems. Coordinate a special drainage system with the Fire Marshal.

18. P-traps for all fixtures other than lavatories and similar usage sinks shall have integral clean outs. Drum traps shall not be used.

19. Pipe bedding under floor slabs shall be Type IV.

END OF SECTION 22 13 00

Seattle Center Site Standards

Division 23

HVAC Systems

A. Scope

These standards and procedures apply to the design and installation of steam and hot water heating systems, air moving and cleaning systems, and cooling, humidifying, and dehumidifying systems to appropriately interface with existing resources/ systems. Only the Playhouse and Exhibition Hall use steam. Other Seattle Center buildings use heat exchanges and hot water.

Electric heat may be used as a supplement for a heat pump. Radiant heating is acceptable. Do not use mechanical constant volume mixing boxes without review and approval by Seattle Center's plant operating engineers.

B. Codes, Regulations and Standards

All work shall conform to the following codes, regulations and standards:

1. International Fire Code, latest edition, with Seattle amendments
2. Seattle Energy Code, latest edition
3. Seattle Building Code, latest edition
4. International Refrigeration Code, latest edition, with Seattle-King County amendments,
5. SMACNA, latest edition
6. ASHRAE Standards, latest edition
7. National Fire Protection Association Standards and Code, latest edition
8. ARI, latest edition
9. U/L, latest edition
10. NAFM, latest edition
11. ASME current Boiler and Pressure Vessel Code
12. Current International Mechanical Code with City of Seattle amendments
13. Building Codes and Indoor Air Quality

C. Design Review and Submittal

Schematic Design (SC) drawings shall identify all systems, and include single line flow diagrams and heat balance and load calculations based on occupancy. Special occupancy zones shall be called out and all systems identified. Design Development (DD) drawings shall include single line duct layouts; equipment layouts which confirm that there is adequate room to pull filters and to do other maintenance of equipment; and fresh air intake calculations. The DD set shall also include outline specifications. All schematic design drawings, design development drawings, and construction drawings shall be submitted to Seattle Center Redevelopment and to the Seattle Center Chief Plant Operating Engineer

D. General Requirements

1. Central heating, ventilating, and air conditioning [cooling water] systems are preferred with equipment located in basement and penthouse mechanical rooms. All due consideration should be given to using the Seattle Center Central Utility Plant to provide heating and cooling to campus facilities.

2. Independent heating and cooling shall be used for applications requiring year-round comfort control of temperature.

3. Provide separate metering or sub-metering for the heating and cooling system in each building and each tenant space.

4. Avoid roof-mounted equipment if possible. Aesthetic and community concerns may make rooftop units problematic. If rooftop units are used, equipment shall have weatherproof enclosures and screening.

5. Give careful consideration to air intake and exhaust discharge requirements and locations. Air intakes shall be a minimum of eight (8) feet above grade, if possible. Air exhaust discharges shall be at the highest point of the building, if possible.

6. Seattle Center's direct digital control (DDC) system is a Siemens system. All control actuators must be able to be operated by the Siemens system.

7. Provide independent isolation valves or bypass valves for all devices, regardless of system.

8. Any and all flanged joints shall use Flexitallic gaskets.

E. Specific Criteria

1. Heating

   a. Heating shall be by circulating hot water using the campus central utility plant (CUP) as the heat source whenever possible.

   b. Steam is available at a maximum of 75 psig from the Seattle Center Central Utility Plant and equipment must be capable of taking steam at this pressure. Contact Seattle Center's Chief Plant Operating Engineer to verify system pressure at individual buildings on campus. Operating pressure at buildings is usually 9-12 psig.

   c. State assumptions regarding radiation losses when sizing systems and selecting equipment.

   d. Hot water systems shall be zoned according to building orientation with flow water temperature reset by outdoor temperature.

2. Cooling Water

   a. General cooling shall be by cooling water from the campus Central Cooling Water (CCW) system. The discharge temperature (set point) off the chillers is 39 ° F.

   b. Use cooling water design temperature rise of 10-12°F.

   c. Air cooled condensers or cooling towers shall be used in lieu of City water cooled condensers.

d. Cooling water is available from the Central Utility Plant (CUP) on a seasonal basis. Flow is obtained by a pressurized differential between supply and return mains. Differential pressure must be metered and monitored using equipment compatible with Seattle Center's EMCS DDC Siemens system. See Section 23 60 00 ***Central Cooling Water System*** and consult with Seattle Center's Chief Plant Operating Engineering regarding the CUP operating scheme.

e. On all new installations and existing systems, install two-way differential pressure valves unless the unit is at the end of a run. Ensure installation of isolation valves to and from two-way differential pressure valves.

f. Provide bypass relief valves across isolating valves in branch lines from CCW flow and return.

3. Ventilation

a. All building spaces suitable for present or future occupancy shall be served by mechanical ventilation.

b. All supply air systems shall be designed for 100% outdoor air intake capability to be available for cooling during moderate weather, but design shall also allow for recirculation when exhaust air quality is suitable. CO_2 levels must be monitored and controlled per air quality codes.

c. Do not use fan rooms as supply or exhaust air plenums in new construction.

d. Ventilation shall be provided through centrally ducted systems, or individual ventilating assemblies such as fan coil units or unit ventilators.

F. Products

All products and materials shall be industrial grade. No items already obsolete or know to become obsolete within one to two years shall be installed in new construction.

Also refer to Section 23 07 00 ***HVAC Insulation***.

1. Heating Materials and Equipment

a. Steam piping shall be designed in accordance with all applicable Codes, references, and standards listed in Paragraph B of this Section.

b. Condensate black iron piping shall be Schedule 40 or Schedule 80, welded or screwed, depending on location and/or service.

Commented [LJ1]: Black iron pipe?

Commented [NM2R1]: "YES" Black Iron

c. Hot water piping shall be Schedule 40 or Schedule 80, welded. No Victaulic fittings are allowed on new systems.

d. Hot water converter steam control valves shall be Siemens DDC controlled. .

e. Hot water heating systems shall be closed loop type, with means to chemical treat system.

f. Converters shall be ASME approved, stamped and State Boiler Inspector's certificate forwarded to central plant.

2. Cooling Water Materials and Equipment

a. Cooling water piping shall be the same as for hot water and shall be welded.

3. Ventilation Materials and Equipment

a. Preferred fan design is single inlet, single width centrifugal type with backwardly inclined air foil blades, however, utilization of airfoils, propellers, and duct axial flow fans is encouraged where appropriate.

b. Fan volume control shall be provided when the system has features to cause a variance in volume.

c. Provide rigid structural steel base for both fan and motor with slide rails for drive adjustment. Inertia bases are required for fans not on grade floors. Hinged motor bases are acceptable.

d. Fan units shall be designed to accommodate MERV 13 or better filter systems. Comply with codes and other special regulations when selecting filters for specific applications, such as grease ducts.

e. Also refer to Section 23 30 00 ***HVAC Air Distribution***.

G. Execution

1. Heating

a. Sectionalize down-feed hot water piping systems with isolating and drain valves to simplify servicing without draining large volumes of water during routine maintenance and repair.

b. Provide a condensate meter for each building and each tenant space.

c. Hot water converter location shall allow for tube removal.

d. All major system components, including filters, shall have reasonable access for servicing.

e. Steam headers shall have valved branches to each specific load, hot water, storage heater, converter, heating coil, etc.

f. Pressure reducing stations shall include at least two valves sized for 1/3 - 2/3 of total load. Show loads on drawing.

g. High pressure steam (75 psig) condensate shall be flashed in condensate tanks/pumps to the condensate return system.

h. Do not provide strainers ahead of traps, drains, coils, converters, or other heat exchangers, but provide adequate static head above traps.

i. Do not install steam or hot water piping below slabs on grade.

j. Cast iron radiation, finned radiation, and air heating coils shall not be installed on the same pumped circuit.

k. Locate valves for hot water coils or other major heating components so that each unit and its control valve can be serviced without draining an entire system or riser.

l. Provide a hose end drain valve on each hot water coil.

m. Provide gate valves at all air vents.

n. Locate expansion tanks at the highest point possible, and fit with gauge glass, drain, vent, and shut-off valve.

o. Convectors and radiation shall be valve controlled, dampers will not be accepted.

p. All steam and hot water controlled valves shall be arranged to be normally closed.

2. Ventilation

a. Fan bearings shall be ball type (selected for extended life) lubricated with grease fittings extended through fan casing for easy access, sealed ball bearing type permanently lubricated or sleeve type oil lubricated.

b. Provide each fan drive with an easily removable guard assembly protecting drive and shaft, with access for tachometer use.

c. Each air filter shall have a dedicated DDC differential pressure sensor installed to indicate filter pressure drop.

d. Locate all air heating and cooling coils so that water jet or steam cleaning may be employed. Provide ductwork access panels on each side.

3. Cooling Water

a. Provide a balancing valve in the return piping from each individual cooling coil.

b. Provide gate valves at the inlet and outlet of each cooling coil, or other major component. Locate valves so that each cooling unit, and its control valve, can be serviced without draining an entire system or riser.

c. Provide access panels in ceilings or partitions for servicing concealed valves or vents.

d. Provide a Btu meter in the building system served from the CCW System. Meter shall have a Btu computer, temperature differential indicator, and 6 digits Btu and gallon registers. Btu register shall read in "Hundred Thousands."

e. Cooling water piping shall have pressure gauges and thermometers at evaporator inlet and outlet.

f. Provide a flow measuring device such as "Barco" or "Rinco" venturis in the coil piping of each supply fan.

H. Training

1. Mechanical contractor shall work with Siemens controls representative to offer training to Seattle Center plant operating engineers and any additional Seattle Center personnel after all commissioning, including testing, adjusting, and air balancing is complete. See Section 23 05 93 ***Testing, Adjusting and Balancing for HVAC*** and Section 25 50 00 ***Integrated Automation Control of HVAC*****.**

I. Close Out

1. Submit complete as-built drawings at the end of the project.
2.

END OF SECTION 23 00 00

A. Scope

These standards and procedures apply to the tagged and nameplate identification of piping, duct work, and equipment.

B. Design Criteria

1. Piping and ducts shall indicate the name of the service and direction of flow, and steam lines (with pressure greater than 10 psi), gas lines, and air lines shall indicate pressure.

   a. All exposed piping shall carry a system designator, that is, in indication of whether it is steam, high pressure condensate, chilled water, etc.

   b. Steam lines shall be labeled to indicate high or low pressure steam service. All valves shall be tagged with individual, unique valve numbers.

   c. All domestic non-potable water lines shall be labeled. On the downstream side, indicate whether each line is a feed water or make-up non-potable water line, condensate line, or chilled water line.

   d. All air lines shall be labeled to indicate pressure and function. For example, indicate if each line is for shop air, controls air, or general services.

2. Each major piece of equipment or system shall be tagged with its name and I.D. # (as specified in contract drawings). Contact Seattle Center's Chief Plant Operating Engineer for the required naming convention used on the campus. Consistency in using naming conventions is critical.

3. Each main control and relief valve shall be tagged to indicate the service and line that it controls, the pressure, and its I.D. #. For example, pressure relief valves dropping pressure from 75 psig to 9-12 psig shall be labeled with the "Steam 9-12 psig" designator.

C. Products

1. Equipment nameplates and valve tags shall be laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2. Equipment nameplates shall be inscribed with block style lettering, two (2) inches high. Use smaller lettering only when equipment is too small to accommodate nameplates with two (2) inch high lettering.

3. Valve tags shall be 1" x 2-1/2" inscribed with lettering 5/16" high.

4. Valve tag fasteners shall be sturdy metal wire. Do not use plastic fasteners.

D. Execution

1. In finished areas, use color banding. Two-inch bands shall appear every 15 feet on all exposed and concealed piping and/or at least once on piping in each space. All piping and valves inside manholes shall be labeled and identified.

2. Where piping and ductwork are concealed, they should be color banded minimally at each access point, where the line penetrates a wall or floor, and every 15 feet along horizontal and vertical lines.

3. Paint and color code all exposed valve hand wheels on major systems as required by Code and as designed by Seattle Center's Chief Plant Operating Engineer.

4. Post a laminated single-line diagram in each mechanical space.

END OF SECTION 23 05 53

A. Scope

These standards and procedures apply to the testing, adjusting and balancing (TAB) of all equipment and components to assure the optimum performance of mechanical systems. They can be used to solicit bids from TAB firms on specific projects. They also describe required coordination and cooperation between the Contractor and the TAB firm and the assistance that the Contractor must provide to accomplish testing, adjusting, and balancing, such as starting up and operating the mechanical systems for the TAB firm.

B. Quality Assurance Qualifications

1. Balancing and testing of the heating, ventilation and air conditioning (HVAC) systems shall be performed by a qualified firm specializing in HVAC systems testing, adjusting, and balancing and noise level measurement.

2. The TAB firm shall be a certified member of the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Submit a current list of projects, including references and phone numbers, and the name of principal technician.

3. All work shall proceed under the general direction of Seattle Center Redevelopment, which shall provide coordination between the Contractor, architect/engineer team, and Seattle Center's Central Utility Plant engineers.

C. Codes, Regulations and Standards

All work shall conform to the following Codes, Regulations, and Standards.

1. Associated Air Balance Council (AABC), "National Standards for Field Management and Instrumentation Total System Balance," Volume One, No. 81266, latest edition

2. ASHRAE Handbook, HVAC Systems and Applications, Chapter 57, latest edition.

3. AMCA Publication 203 Fan Application Manual, Part 3, Field Performance Measurement, latest edition.

4. National Institute of Health (NIH)

5. Industrial Ventilation Guide, American Conference of Governmental Industrial Hygienist, latest edition.

6. National Environmental Balancing Bureau (NEBB)

D. Design Reviews, Submittals, and Reports

1. The testing, adjusting, and balancing (TAB) firm shall prepare and submit, prior to any balancing work, a work schedule following but not limited to the one outlined in Execution. All requirements for design review meetings and submittals shall be adhered to according to the Schedule of Work.

2. Report Submittals

a. Submit two copies of the draft balancing report, to include narratives describing (1) all problem areas that may require major construction or design changes; and, (2) the building control systems to demonstrate comprehension of the job system operation.

b. Submit as an intermediate submittal three copies of the complete report for review and approval by Seattle Center's Project Manager, Seattle Center's Central Utility Plant engineers, and the design Engineer of Record.

c. Provide three copies of the approved final report. Each copy shall be a single volume, bound into a 3-ring binder. Imprint the bound edge of each volume with the name of the building and the words "Testing, Adjusting, and Balancing Report". Imprint the front of the volume with the name of the building, project name, project number, and the names of the Owner, General Contractor; Mechanical Subcontractor, Architect, Mechanical Engineer, and the TAB firm.

3. The report shall include a narrative and the data necessary to describe the system(s), operating equipment, and how they function. Such systems may include, but not necessarily be limited to, chilled water; supply, return, and exhaust air; condenser water, heat recovery; air cooled condensers, and heating hot water. Leak tests may also be required. Identify equipment using the construction drawing identifiers. Provide ventilation and heating hot water piping riser diagrams if either one is not already a part of the construction drawings. Include the following data, as appropriate to the project:

a. Fans:

1) Installation data:
   a) Manufacturer and model
   b) Size and type
   c) Arrangement, discharge, class
   d) Motor HP, voltage, hertz, frame, and full load amps
   e) Identification data, serial number.
2) Design data:
   a) Total cfm (for exhaust hoods fan flow must agree with hood design requirement)
   b) Static pressure (total), and maximum possible.
   c) Motor HP, rpm and amp
   d) Fan rpm
   e) System or service
3) Fan recorded/measured data:
   a) cfm
   b) Static pressure
   c) rpm
   d) Motor operating amp, volts
   e) Motor operating BHP (calculated)
   f) Drive sizes (sheaves, belts & shaft)
   g) Fan curve cfm based on fan data
   h) Date of readings

b. Duct Systems:

1) Duct cfm - mains:
   a) Duct size (s)
   b) Number of pressure readings
   c) Tabulation of velocity measurements
   d) Average velocity
   e) Duct measured cfm (each)
   f) Duct design cfm

c. Individual Air Terminals:

1) Supply, return, or exhaust terminal identification (room number, name location and number designation)
2) Manufacturer's catalog identification and type
3) Application factors (velocity, effective area, flow direction), etc.
4) Design and recorded velocities - fpm
5) Design and recorded quantities - cfm

d. Controllable Air Devices/Boxes:

1) Identification (room or suite number and name)
2) Manufacturer's catalog identification and type
3) Applicable controller
4) Effective flow area
5) Maximum measured velocity or flow and static pressure
6) Minimum measured velocity or flow and static pressure

e. Fume Hoods:

1) Identification (room or suite number and name and number designation) and location
2) Manufacturer's name, model, or size, and type (i.e., fume, perchloric, walk-in, canopy, or bio-safety)
3) Inlet face area of hood with sash at maximum height (with sash stop released)
4) Design is inlet flow at 100 fpm through inlet face

f. Pumps:

1) Installation data:
   a) Manufacturer and model
   b) Size
   c) Type drive
   d) Motor HP, voltage, phase and full load amp
   e) Identification data, serial number.
2) Design data:
   a) gpm
   b) Head
   c) rpm
   d) BHP and amp
3) Recorded data:
   a) Discharge pressure (full-flow and no-flow)
   b) Suction pressure (full-flow and no-flow)
   c) gpm from pump curve
   d) Operating head
   e) Operating gpm (from pump curves if no meter)
   f) No-load amps (where possible)
   g) Full-flow amp
   h) No-flow amp
   i) Calculated BHP
   j) Seal water flow, gpm

g. Heat Reclaim Unit:

1) Design data and recorded data
   a) Manufacture, model, and type
   b) Size
   c) Design flows, temperatures, and efficiencies

d) Air pressure drop across unit supply and exhaust
e) Entering and leaving temperatures
f) Calculated CFM through sections
g) Calculated heat gain or rejection and efficiency

h. Fan Coil/Unit Heater:

1) Design data and recorded data:
a) MBH
b) gpm
c) Entering and leaving water temperature
d) Entering and leaving supply air temperature
e) Supply air cfm
f) Exhaust air cfm
g) Water pressure drop
h) Identification data
i) Motor, hp, frame, rpm, amps, phases, and volts
j) Fan rpm, bhp, and amps
k) System static pressure, in H_2O

i. Fan Drives and Pump Impellers

1) Provide final drive size information and necessary pump impeller changes for each fan or pump.

a) Driven pulley pitch diameter, bushing and shaft size.
b) Belt size and quantity.
c) Drive pulley pitch diameter, bushing and shaft size.
d) Impeller diameter and type.

E. Execution

1. Before starting the mechanical systems, provide a certificate stating that the systems are ready for start-up and the following conditions have been met:

a. Safety controls are installed and fully operational;

b. Qualified personnel are available to operate the systems;

c. Permanent electrical connections are made to all equipment;

d. Chiller has been started up and adjusted by factory technicians;

e. Clean air filters are installed;

f. Pump and fan drives are properly aligned;

g. Mechanical equipment rooms, including plenums, have been vacuum cleaned;

h. Control devices calibrated, including air terminal unit volume controllers;

i. Verify that the minimum overload relay rating is not less than the full load current of each motor to allow the motor to be operated at full load current;

j. Fire dampers and volume dampers are open;

k. Manual valves have been positioned for normal system operation.

2. All preparations and execution of work shall proceed according to the following schedule to include, but not be limited to, the following items:

   a. Provide a complete set of work sheets to specify each piece of equipment and show each terminal device.

   b. Make a "first pass" through the entire system (approximately one month prior to beginning any work) to determine the critical path and to locate possible construction or design problems.

   c. Following this inspection, the TAB firm shall immediately submit a report, if necessary, to Seattle Center Redevelopment and Seattle Center Central Utility Plant engineers of any construction or design deficiencies that could delay or affect balancing, and meet with them to discuss the results and determine the scope of work to be completed by the Contractor and/or Engineer of Record.

   d. Project Management will meet with Contractor and A/E to determine schedule to complete work and resolve problems.

   e. A/E ensures that work is properly and sufficiently completed to the extent that testing, adjusting and balancing shall continue uninterrupted to completion.

   f. Meet with A/E to determine scope of work to be completed in "second pass."

   g. Make additional pass through system and complete the majority of the balancing. The area should be ready for complete occupancy at the end of this phase of the work.

   h. Meet with Seattle Center Project Manager, Seattle Center Central Utility Plant engineers, and Engineer of Record to discuss the report and determine the scope of work to complete the work.

   i. Complete the field work so that the system is completely balanced and mark all dampers to show the final settings.

   j. Meet with Seattle Center Project Manager, Seattle Center Central Utility Plant engineers, and Engineer of Record for final review comments.

   k. Final acceptance of the general construction contract shall occur when all testing, adjusting, and balancing work is completed.

3. Notify the Owner at least thirty (30) days before beginning the balancing work. Do not begin balancing until all systems have been cleaned and treated and startup requirements have been completed.

4. Contractor and its subcontractors shall coordinate its work with, and assist with, the Owner's TAB firm as required, to include, but not limited to:

   a. Furnish ladders, scaffold, staging, and accessories as required; change fan drive, provide sheaves and pump impellers as required; arrange for access to all dampers, valves, and balancing devices and operate equipment during time TAB work is being performed. Control contractor and sheet metal contractor shall be made available as their services are required.

b. Remove and replace ceiling tile as necessary. The extent of ceiling tile removal for access and the time schedule of removal and replacement shall be as directed by the TAB firm.

c. Work with the TAB firm to:

1). Provide sufficient time for testing and balancing prior to substantial completion;
2). Make corrections to achieve system balance without delay;
3) adjust fan drives, and provide sheaves and belts as directed by the TAB firm to achieve system balance;
4) Maintain all systems in full operation during the complete testing and balancing period;
5) Employ control technicians to make necessary adjustments to the control systems to facilitate the balancing process;
6) Check and realign any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process; and
7) Provide pump-impellers to achieve the specified flow rates.

d. Allowable deviation in the measured quantities shall not exceed plus/minus 5% of the design. Contractor shall correct any part of the air and water systems affecting balancing and/or temperature control.

5. Testing Equipment

Instrumentation shall be provided by Contractor as necessary and appropriate to perform the work. The type and number of instruments utilized shall be determined by the type of systems involved and the number of personnel required to complete the work by the time stipulated. The instruments shall be recently factory calibrated and shall be used with the factory-determined application factors. This instrumentation shall include, as appropriate, but not be limited to the following, or approved equal:

a. Ammeter, clamp-on type, Amprobe

b. Anemometer, 4" Biram type

c. Anemotherm, Anemostat Model 60

d. Pitot tube and air velocity meter, Dwyer Model 400

e. Pyrometer, contact type Alnor Type 4200

f. Speed indicator, J.B. Biddle "Jagabi"

g. Static pressure gauges, Dwyer "Magnehelic", 0 to 4" wg; 0-10" wg

h. Velometer, Alnor Type 3002

i. Terminal (cfm) flow measuring hood

6. General Testing, Adjustment, and Balancing Procedures

a. Care shall be exercised while performing the work so as to avoid damaging the work of other trades, particularly paint and ceilings. Where damage is inevitable to gain access to the various devices, the Contractor shall be notified so that appropriate corrections can be made and proper accessibility provided. Damage incurred by the TAB firm shall be its responsibility to correct.

b. Records shall be maintained at all times which shall readily indicate all steps, adjustments, and intermediate and final readings. The records shall indicate on each trial whether a damper or balancing device was cut or opened. The records shall be maintained on reproducible type forms which shall include measurement locations, design capacities, appropriate manufacturers' performance factors, and dates and names of personnel involved.

c. Final settings shall be clearly marked on each balancing valve, quadrant, etc.

d. Frequently work will have to be performed in areas that are partially or fully occupied, which may require the work to be accomplished during other than normal working hours. Such occupancy shall not be considered justification for any deviation for the requirements outlined herein or any extra payments. Where overtime work is required for expeditious completion of the balancing work, payment of premium rates for such work shall not be allowed without specific approval of the Seattle Center Project Manager in writing, in advance.

e. System operation will be by the Seattle Center Engineers to suit the requirements of the balancing work. System filters shall be new at start of testing, adjustment, and balancing work.

f. Resourcefulness is frequently required in order to properly balance some of the more complex and intricate systems. This may dictate the use of methods and techniques not herein before stated. Where "standard" balancing procedures cannot, due to physical conditions or other circumstances be employed, alternate methods shall be determined and approved by Seattle Center Redevelopment, Seattle Center Central Utility Plant engineers, and the Engineer of Record,

7. Air System Procedures

a. Measure and adjust all ventilation openings on all systems to produce the air flow rates shown on the contract drawings. Air flow rates, as adjusted, shall be within a tolerance of plus or minus 5% from the design rates shown on the contract drawings. Where this is not possible or reasonable the reasons should be clearly documented in the final report. In addition to physical problems, energy consumption and noise reduction should be considered in recommending possible deviations.

b. When complete, at least one air path from each fan, or each high pressure mixing box, to an air outlet or inlet shall have all volume dampers wide open. This path shall be clearly identified. This is to ensure minimum static pressure buildup in the system as a result of balancing.

c. Determine the minimum operating static pressure required to deliver the required air volumes, for each inlet vane controlled fan or other automatic static pressure regulator, and note the setting adjacent to the regulator and on the record sheets.

d. The total air volume handled by each system shall be measured, and recorded, by readings taken at appropriate locations in the fan intake or discharge plenums. These measurements shall be compared with the design system volumetric rate and the individual inlet or outlet readings to correlate and substantiate the system measurements.

e. Determine drive ratio changes required in order to obtain the optimum operating fan speeds, review in detail with the A/E and Plant Engineering, and recommend such

changes in writing. Fan speed changes shall not be made without the approval of Plant Engineering.

f. After final drive ratio changes have been completed, make a final set of readings, and adjustments if necessary to ensure the system balance. Record the final fan rpm, pulley sheave and belt sizes, and motor amperage.

8. Water System Procedures

a. Measure and adjust all radiation, coils, heat exchangers, etc., that constitute a part of the heating and/or cooling system, to produce the capacities shown on the contract drawings.

b. Flow rates may be determined by temperature differentials between the entering and leaving water conditions or by total energy transfer calculations involving air volumes, entering and leaving air temperatures, and entering and leaving water temperatures.

c. All measurements shall be made with the design air flow rates air entering temperatures, and flow water temperatures existing during the balancing process. If this is not possible, review with the Project Manager and A/E and Plant Engineering and agree on an alternate scheme, in writing.

d. Capacities, as adjusted, shall be within a tolerance of plus or minus 5% from the design ratings shown on the contract drawings or, when leaving water temperatures are used to indicate a balanced condition, within a tolerance of plus or minus $1^{o}F$.

e. When complete, at least one path from the pump discharge to the pump intake, except for the balancing valve used to set the pump operating head, shall have all balancing valves wide open. This is to ensure minimum friction drop in the system as a result of balancing.

f. Using appropriately located flow meters or pressure gauges and the pump manufacturer's pump curves, set the operating pressure differential across the pumps to develop the correct flow rates.

g. Recommend the necessary pump impeller changes to balance the system

END OF SECTION 23 05 93

A. Scope

These standards and procedures apply to the insulation of piping, ductwork and associated mechanical equipment, and liquid storage vessels.

B. Codes, Regulations, and Standards

All work shall conform to the following codes, regulations, and standards:

1. Factory Mutual Standards
2. Seattle Energy Code, latest edition
3. Seattle Fire Code, latest edition
4. Seattle Mechanical Code, latest edition
5. Seattle Plumbing Code, latest edition
6. Underwriters Laboratories Standards
7. Washington State Energy Code, latest edition

C. General Requirements

1. All surfaces which can be insulated when it is desirable to reduce energy loss or gain, avoid undesired condensation, and reduce corrosion shall be insulated.
2. Insulation of ducts shall conform to the requirements of the Seattle Energy Code.
3. Minimum pipe insulation requirements shall be as required by the current Seattle Energy Code or the current Washington State Energy Code, whichever is more restrictive.

D. Specific Requirements

1. A vapor barrier jacket is required for chilled water piping, equipment, refrigerant suction piping, domestic cold water piping, rain leader piping, and air handling ducts, and equipment with air temperatures of 55 ^{o}F or less.
2. All new direct-buried chilled water, steam, and condensate return piping shall be a pre-fabricated piping system, Perma-Pipe/Ricwil or approved equal, suited to the temperature and pressure of the existing system. System shall be factory fabricated and assembled, airtight and watertight, ventable, drainable, pressure tested piping system with jacket, insulated conduit, inner pipe supports, and insulated carrier piping. Fabricate so that carrier piping insulation can be dried in place by forcing air through conduit.

    a. Joints are a common point of failure. After initial inspection of joints, a second independent inspection shall be conducted with Seattle Center Chief Plant Operating Engineer or, in his absence, designated central plant shift personnel.

3. Replacement insulation on existing steam, chilled water and condensate return lines shall be pre-formed, rigid cellular glass insulation, Pittsburgh Corning or approved equal, and shall include field-applied aluminum jackets. Replacement insulation shall be equal to or an upgrade to existing insulation, such as Insul-Tek 400 HT Composite.

4. Fittings, valves, and flanges shall have an insulation thickness no less than the adjacent piping but must be removable without damage for easy reapplication.

5. Demolition (removal) of carcinogenic insulation containing asbestos shall follow procedures outlined in the Asbestos Abatement chapters of OSHA/DOSH.

6. Pipe insulation in maintenance areas (mechanical rooms, accessible shafts, etc.) is subject to mechanical damage (crushing, abrasion and laceration) resulting from maintenance activities. Rigid insulation materials protected with appropriate casings and vapor barrier linings are required in these spaces.

7. Install the pipe insulation and jacket so that they extend through oversize pipe hanger rings. Provide an extra high density insulation insert and metal shield within each hanger, except where pipe covering protection saddles are welded to the pipe.

    a. Insulating Inserts: Extra high density insulating inserts shall be the same thickness as pipe insulation, and shall be Pittsburgh-Corning "Foamglas" or Pipe Shields "Thermal Hanger Shield" and shall cover not less than the lower 40 percent of the circumference of the insulation. The insulating inserts shall be a minimum of 6 inches in length up to 6 inches outside diameter. The insulating inserts shall be a minimum of 8 inches in length for larger sizes. Do not use "Foamglas" for high pressure steam. Install the insulating insert section to replace a cutout section of insulating material within the insulation jacket, with tightly fitted butt type joints. For pipe on trapeze channel hangers, provide Pipe Shield Model A3000 insulated pipe support that covers 100 percent of the circumference of the pipe.

    b. Metal Shields: Except where pipe-covering protection saddles are specified, provide outside of the jacket and inside of each hanger, a metal shield of 18 gage sheet metal, minimum, covering the lower 40 percent of the circumference of the insulation, length not less than that specified for cut-in section of high density insulating insert. On 6 inch and larger pipe, shields shall be 14 gauge minimum, two pipe diameters in length.

E. Products

All insulation, facings, coatings, adhesives and other accessories shall have a fire hazard rating not exceeding 25 for Flame Spread and 50 for Fuel Contributed and Smoke Developed; ratings determined by UL Standard No. 723, NFPA Standard No. 255. Test results from the approved testing laboratory shall be available to indicate that fire hazard ratings for materials do not exceed the above limits.

F. Execution

Insulation shall have a durable finish suitable for painting for color coding or for applying other identification marking.

END OF SECTION 23 07 00

A. Scope

These standards and procedures apply to the selection and installation of pumps for hot water circulation, sump and steam condensate return systems. Not included are vacuum pumps, heat pumps, sewage lift stations, ejectors, air pumps, or piston pumps. See related Section 21 00 00 ***Fire Suppression***, Section 22 10 00 ***Plumbing Systems***, and Section 23 60 00 ***Central Cooling Water (CCW)***.

B. Codes, Regulations and Standards

All work shall conform to the latest editions of all applicable codes, regulations and standards:

C. Design Review and Submittals

Design submittals shall include pump data showing impeller diameter and complete pump curves through full operating range.

D. General Requirements

1. Use Armstrong pumps or approved equal.

2. Piping system design shall be based on ensuring lowest brake-horsepower per unit flow rate at maximum flow and head.

3. Pumps shall be located where easily accessible for service, yet isolated to prevent pumping or vibration source noise from disturbing occupied areas.

4. To preserve flexibility for future requirements, whenever possible select pumps so that one size larger impeller can be installed.

5. Discharge head information for pumps shall be calculated by the Engineer of Record.

6. Provide stand-by pumps only where a short duration shut down for repairs and maintenance cannot be tolerated.

E. Specific Requirements

1. Pumps shall not operate at more than 1800 rpm.

2. Centrifugal type pumps should be selected so that shut-off head is not more than 25% greater than operating head.

3. The pump head shall be calculated and included in system design computations.

4. Where the pump inlet is above water supply level, both suction and total head shall be included in design computations.

5. Motors for pumps shall be sized so they will not be overloaded at any point on the operating curve.

6. Pump casings for Central Cooling Water (CCW) service shall have pressure ratings as follows:

   125 psi class when located at 150 foot elevation or above. (Refer to Seattle Datum.)

   250 psi class when located below 150 foot elevation.

7. "In- line" circulators or booster pumps shall only be used for extremely small capacity requirements and operate based on local cooling requirements, that is, fan coils, etc.. If used, “in-line” circulators or booster pumps shall be located where they may be conveniently maintained.

F. Products, Materials, and Equipment

1. The pump shall be a complete, integrated unit consisting of pump, motor, shaft, frame, and base; as manufactured at the factory.

2. Provide spare mechanical seals or packing glands on all pumps.

3. Mechanical seals for hot water heating pumps shall be certified by the pump manufacturer to be suitable for the maximum expected water temperature and chemical treatment used.

4. Provide suction discharge gauges and/or differential pressure gauges and shut-off valves for gauge installations.

5. Sump-type condensate pumps shall be vertical shaft type with the motor located above the sump; submersible pumps shall not be used.

6. Condensate pumps shall be floor mounted, cast iron type, and guaranteed for 210 °F. water without flashing.

17. Hot well type condensate pumps shall have a cast iron or concrete sump.

G. Execution

1. Locate pumps in mechanical spaces whenever possible.

2. Floor mounted pumps shall be on concrete bases, four (4) inches minimum height, and grouted to the base.

3. Provide guards over shafts and couplings in accordance with DOSH/OSHA requirements.

4. Pumps shall be accessible for service and maintenance: with a minimum of 18 inches on two adjacent sides.

5. Each pump shall be isolated with full size gate valves and unions or flanges for easy removal for service, and hose fitted drain valves.

6. Provide balancing valve in the pump discharge piping so the design flow rate can be set.

7. Provide check valves in the pump discharge piping when pumps are operating in parallel, standby, or whenever a reverse flow may occur.

8. Controls for condensate pumps shall provide for "lead-lag" start and shall automatically alternate the pumps on the "lead" start. Using the Siemens DDC.

9. Provide all pumps with inlet strainers as part of the piping or pump inlet accessories.

10. Flexible connections are not acceptable.

11. Submit as-built drawings of systems with pump installations clearly shown.

12. Submit operation and maintenance or service manuals at job close out.

END OF SECTION 23 20 00

A. Scope

These standards and procedures apply to the design and installation of air distribution and ventilation systems, materials, and equipment. These shall include air terminal units involving heat transfer and forced air supply.

B. Codes, Regulations and Standards

Work shall conform to the following codes and standards:

1. Duct construction details shall conform to the recommendations of the ASHRAE guide and data book, latest edition, and SMACNA.

2. Rectangular, round, and oval ductwork sheet metal gauges and construction shall conform to the appropriate tables in the ASHRAE guide, latest edition, and SMACNA.

3. Fire dampers shall be provided in accordance with the International Building Code and the National Fire Codes, latest editions.

C. Design Review and Submittals

1. Drawings shall show the specific location of fire dampers.

D. Specific Requirements

1. Balancing dampers shall be provided in each duct to a single outlet or inlet and be located adjacent to the connection to the main branch.

2. Quadrants (easily accessible) shall be provided for each balancing damper for adjusting and locking. Balancing dampers above hard ceilings shall have rod extension with quadrant in ceiling.

3. Balancing orifice type dampers behind grills (such as opposed blade dampers) shall not be used without approval of Plant Engineering.

4. Each plenum area shall be provided with a light. All lights in a single fan system shall be switched as a group. Switch shall include an "ON" pilot light.

5. On units that use outside air the coils must be arranged with the cooling coil following the heating coil. (Outside air must go through the heating coil before contacting the cooling coil.)

E. Products

1. Perforated plate ceiling diffusers should not be used without approval from Plant Engineering.

2. Do not use light troffer diffusers with return air incorporated in the light fixture.

3. Air deflection must be adjustable for all types of ceiling supply diffusers.

4. Flex ductwork is acceptable as connecting duct to diffusers but shall not exceed two (2) feet in length. Flexible connections at fan inlets and discharges in general shall be made with fire resistant neoprene impregnated fiberglass cloth, per Code.

F. Execution

1. Provide access doors to ducts (hinged, latched, with sponge plastic seals) upstream and downstream from all coils and elsewhere where frequent access is required.

2. Provide access doors for all plenum areas with latches operative from both inside and outside the plenum.

3. Provide access panels at all fire dampers. These access panels shall be held in place with sponge plastic seals. For large size access panels, use hinges and/or latches.

END OF SECTION 23 30 00

A. Scope

Work specified in this Section includes air filters used in HVAC systems.

B. Codes and Regulations:

Test Method for All Particulate Filters: ASHRAE Standard 52-76.

C. Products

1. Fixed Media Type Filters, General.

2. Prefilters: High-Flow Pleated.

3. Final Filters MERV 13 Final Box Filters.

4. Filter Airflow Resistance sensor, Siemens DDC Pressure Differential.

5. Initial Resistance: Shall not exceed resistance scheduled.

6. Prefilter, Fixed (Pleated) Media Type Filters, with Cabinet:

7. Manufacture: By a firm specified for Fixed (Pleated) Media Type Filters, General.

8. Filter Media: Same as specified for 2" Fixed (Pleated) Media Type Filters.

9. Filter Cabinets: American Air Filter Type SA "Dri-Pak" or Farr "Glide-Pack" cabinet; 18 gauge metal filter casing, slide-in airtight sealing tracks; access doors, duct connected filter cabinet inlet and outlet.

10. Filter Airflow Resistance Gauge: Same as Fixed (Pleated) Media Type Filters, General.

D. Installation

1. Temporary Filter Media: Install during supply system balancing in fixed filter media frames; upper limit resistance of temporary media to be 125% of combined initial design resistance across the fixed media filter sections.

2. Also provide a temporary filter in system when fan is in operation prior to balancing in order to keep the ductwork clean; resistance shall be as scheduled for permanent filters. Temporary filters shall be equivalent to permanent filters in style and Media.

3. Airflow Resistance Gauges: Connect gauges with copper tubing per manufacturer’s recommendations; connections at gauge with a vent valve assembly to permit zeroing adjustments. Install a separate gauge across both the prefilter and final filter, i.e., one across the prefilter and one across the final filter.

4. Filter access and clearance: Provide 2'-6" minimum access to filter bank that

allows for replacement of filter elements, without the need for special tools. Provide clearance downstream of bag filters to preclude early bag failure from contact with structure. Provide a fixed cat walk for filter bank over 6'-0" tall.

5. Permanent filter media shall consist of the following:

6. Preferred combination of roll media and extended media bag filter with initial static pressure drops at 500 FPM of 0.10" and 0.39" of w.g, respectively.

7. Alternate combination of 2" pleated media prefilter and extended media bag filter with initial static pressure drops at 500 FPM of .38" and .39" w.g. respectively. (Must be approved by Plant Engineering.)

8. Heating and Cooling coils shall be protected by 2" pleated media.

9. Where geometry or use dictates, prefilters shall be cabinet type.

END OF SECTION 23 40 00

A. Scope

These standards and procedures apply to the utilization and interface requirements of Seattle Center's Central Cooling Water (CCW) system. Its use is limited. Operation is restricted to the summer, approximately March through November. Projects located outside of this area, or those areas of buildings requiring year-round air conditioning, such as computer rooms, must be cooled by other systems.

The consultant shall discuss the proposed system with the Seattle Center Project Manager and plant engineers before design begins and shall work collaboratively with the Project Manager and plant engineers to develop a satisfactory design. In particular, consult with Seattle Center's Plant Operating Engineering regarding operating sequences and schemes and the types and capacities of equipment in Seattle Center's Central Utility Plant (CUP).

Note that buildings on campus that are owned, operated and maintained by others, that is, the Space Needle, the Pacific Science Center, the Chihuly Garden and Glass Exhibit, and the Experience Music Project and the Mercer Arena (SOAC), are not connected to Seattle Center's CUP cooling water system. The International Fountain Pavilion, , Center Park and the Seattle Center Gift Shop, also maintained by Seattle Center, are not connected to either the steam or chilled water system.

Consult with Seattle Center's Chief Plant Operating Engineer during design of all systems connecting to the CCW.

B. Description of the System

Central Cooling Water (CCW) is the terminology used for the Seattle Center distribution system, which generates and distributes chilled water for summer cooling. The CCW system has one (1) Trane 900 ton centrifugal chillers and one (1) Trane 1200 ton centrifugal chiller located in the central plant with cooling towers. Each unit has its own associated condenser and chilled water circulating pumps with Siemens interface for controls. The system is load designed based on campus cooling needs. The central plant also has two main chilled water pumps. The system is operated as a primary pumping system (distributing the water through mains, most of which are direct buried), with the pressure differential across the system based on differential pressures measured at various locations throughout the campus. Normal chiller discharge temperature is maintained at 39 °F.

C. Codes, Regulations, and Standards

All work shall conform to the latest editions of all applicable codes, regulations and standards:

D. Specific Requirements

1. All future designs shall be energy efficient two-way delta-P systems based on the current design of Seattle Center's CCW system, which uses the farthest away cooling coil to measure and monitor differential pressure and then send that information to controls on the main CCW system. Incorporate metering and three-way valves at the farthest coil.

2. Each building should be provided with a flow meter, pressure and temperature gauges, a pressure differential valve, and other equipment as required to allow testing and balancing of the system. The flow measuring devices shall be a venturi type that equates flow in gallons per minute to the pressure differential across the meter. Install each pressure gauge with a valve between it and the pipe so that the pressure gauge can be replaced or recalibrated without shutting the system down. Install thermometers in dry

wells so that the thermometers can also be removed from the system and replaced without shutting the system down

3. System Interfaces

   The CCW system operation varies due to seasonal cooling requirements. Contact Seattle Center's Chief Plant Operating Engineer for more information on seasonal operational requirements.

E. Products

1. All piping in the CCW system shall be black iron, Schedule 40 steel with welding pattern fittings. Distribution from the Mechanical Room header shall be the same as for hot water heating.

2. Pipe insulation requirements are covered under Section 23 07 00 ***HVAC Insulation***.

F. Execution

1. When making final connections to the CCW system at the end of construction, coordinate with the Chief Plant Operating Engineer for shutdown. Follow all Seattle Center shutdown and tag out procedures.

   a. Engineering plant personnel only will operate valves.

   b. Preferably, connections to the system will be made during winter operation when this will cause minimal disruption to the system.

2. After the CCW piping, coils and equipment have been installed in the building, they should be pressure tested and all leaks repaired before the valves to the central system are opened.

   a. The pressure test must be performed in the presence of Plant Engineering who will then provide written approval to allow the system to become operational.

   b. Additional information on testing and balancing is covered in Section 23 05 93 ***Testing, Adjusting, and Balancing for HVAC***.

   c. While the system is being tested for leaks, the makeup water should be obtained from a source inside the mechanical room and not from the Central Cooling Water System which has chemically treated water not to be wasted.

   d. Only after all repairs have been made and the system has been approved by Plant Engineering will the valves connecting the building to the Central Utility Plant be opened (by Central Utility Plant engineers).

3. Once the building system has been put in operation, the balancing engineer should complete flow and temperature measurements to verify that the system is meeting design conditions.

   a. The differential pressure of the system will be set by Central Utility Plant engineers to complete these tests.

b. Flow tests should be performed during summer. Temperature tests can only be made on a design day. It is the responsibility of the balancing engineer to return to the site on a design day to complete these tests.

END OF SECTION 23 60 00

Seattle Center Site Standards

Division 25

Integrated Automation

A. Scope

These standards include requirements to provide a completely operational HVAC control system which shall include all software and equipment necessary for full stand-alone operation of the building HVAC system. Provide all equipment and software necessary to make the Central Host PC act as Operator's Stations. Provide all equipment and hardware necessary to fully integrate this central system into the existing network. The designer shall consult and work closely with Seattle Center's Chief Plant Operating Engineer to select components and describe the operating sequence.

This Section includes controls for heating, ventilation, air conditioning (HVAC) and ice floor systems, actuated valves, actuated dampers and interface to other building systems such as the fire alarm system. All materials and equipment used shall be new, standard components, regularly manufactured and not custom designed or fabricated specifically for this project. All components and software shall have been previously tested and proven in regular use. The HVAC control system shall possess a fully modular architecture, permitting expansion through the addition of more distributed processing units, input/output units, sensors, actuators or operator stations.

B. Approved Manufacturer

1. The HVAC control system shall be provided by Siemens. Design, component selection, installation, custom programming, documentation, and testing, training and warranty service shall be the direct responsibility of Siemens or its local representative.

C. Submittals during Design and Construction

1. Provide sequences of operation, programming flow sheets, and graphs to describe exactly how the completed HVAC system shall operate including initial set points. Work closely with the local Siemens representative and Seattle Center's Chief Plant Operating Engineer during design and installation of the controls system. The system architecture shall be approved by the Owner before the Owner will review any other submittals.

2. Provide a complete set of reproducible control drawings prepared using CAD. Include the following information:

    a. Show all field wiring and interconnecting equipment and devices.

    b. Identify the type and size of wire and assign unique numbers and colors to every wire.

    c. Identify equipment and devices by the reference designations shown on the drawings and by unique point identification used in system software. Provide material list on each drawing.

    d. Block diagrams, isometrics, and schematics showing the layout of equipment, communication cabling, and wire type, count and conduit fill.

    e. Schematics showing the general mechanical system layout with all sensors/devices of each mechanical system shown with corresponding detail and labeling.

    f. Floor plans showing the location of equipment and devices.

    g. Provide panel schedule showing location, systems served and point count.

    h. Show internal wiring of control panels.

i. Show general physical arrangement of component devices installed in the panels.

3. Furnish a complete list of equipment to be furnished including a manufacturer's catalog sheet for each item on the material list.

4. Provide a test plan describing the specific procedures used to complete and document the "Owner Witnessed Testing" described as the Final Acceptance requirement.

D. Post Installation Instruction and Materials:

1. The manufacturer of the units that are controlled and the control contractor shall instruct operating personnel in the operation of the system as follows:

a. Provide a minimum of thirty-two (32) hours of classroom and on-site training in the operation and maintenance of the installed system to all Seattle Center plant operating engineers and additional personnel who might require training, up to a total of 12 people. Such training shall occur only after all commissioning and all testing, adjusting and balancing are complete.

b. Provide the standard manufacturer's training that would be provided for programming engineers working for the manufacturer's representatives. This training shall be provided at Seattle Center. Include all travel and lodging expenses for trainer in original contract. A local trainer, if qualified and experienced, is preferred.

d. Provide bound training materials and manuals for each person attending the training, plus an additional three (3) manuals and an electronic copies.

E. Final Acceptance Requirements

1. The Siemens representative shall work with the Contractor to do all trending for commissioning analysis. Training must be included as part of the commissioning and shall not be the responsibility of the Owner.

2. Drawings

a. Submit shop drawings reflecting final "as-built" condition. Deliver five (5) copies of drawings plus an electronic copy of CAD files. All devices shall be identified with Seattle Center naming conventions as instructed by Seattle Center’s Chief Plant Operating Engineer.

b. Contractor and Siemens shall provide to Seattle Center copies of field red-lined drawings at end of project.

c. Provide five (5) copies of reproducible record drawings and an electronic copy of CAD files. These record drawings shall accurately depict the final as built conditions and shall be on Architectural/Mechanical backgrounds provided by the A/E as computer disks. These drawings shall include accurate depiction of wire runs including cable identification, conduit size, location of junction boxes, terminal boxes, sources of power, devices, sensors, controlled equipment (motor starters, valves, chillers, dampers, AHUs, etc.). All devices shall be identified with the Seattle Center acronyms and unique software identification as described in the above paragraph.

3. Operation and Maintenance (O&M) Manuals

Provide five (5) bound copies of the O&M manual and an electronic files describing operation, maintenance and servicing requirements of the HVAC control system and associated equipment. Provide the following information in separate sections, each with tab index:

a. Material list

b. Technical literature for all equipment including catalog sheets, calibration, adjustments and operation instructions, and installation instructions, (the operator's instruction portion may be separately bound)

c. Schematic diagrams of proprietary hardware adequate for repair work down to the component level (Nondisclosure agreements will be signed by the Seattle Center as required.)

d. List of spare parts (with model numbers) recommended for purchase by the Owner

e. System description and complete sequence of operation

f. Reduced size (11” X 17”) copies of record drawings

g. Input/output (I/O) summary forms for the system listing all connected analog and binary input and output functions and the number types of points

h. Control programs specific to this system

i. Point to point checkout list used in commissioning

4. Owner Witnessed Testing

After receipt of all system documentation by the Owner, system testing shall be performed by the Manufacturer or their local representative, witnessed by the Owner, and include, as a minimum, the following:

a. Installation

1) Check proper installation and connection of each control device.
2) Verify operation, location and identification of power sources.
3) Verify each control device connection to Input/output Unit.

b. Local Operator Station Operation

1) For point tests, check that terminal operates devices or receives information from sensors, verify calibration of each sensor, and verify manual operation of each actuator.

2) For control logic, exercise all control logic packages, check response to reset or change in set point, and check full and partial load operation.

3) For supervisory function, verify time clock schedules, verify reset control, and verify alarms.

4) For failure modes, verify all stand-alone operation by disconnecting communication lines between DPUs and from IOUs, and disconnect and reapply 120 VAC power to confirm proper recovery from power failure

c. Remote Operator Station Operation

1) Verify communication with each field device installed.
2) Make end-to-end sensor and actuator checks.
3) Verify transmission and reporting of alarms.
4) Verify acquisition of data.
5) Duplicate local operator's station functions.

d. Other Software Tests

1) Test trend logging.
2) Test report generation.
3) Test remote access.
4) Test and verify system documentation.

F. Service and Guarantee:

1. After completion of the installation of the fully operational control system, including technical data and software, it shall be warranted as free against defects in manufacturing, workmanship and materials for one year. Temperature sensor accuracy shall be warranted for three (3) years. The system shall be repaired or replaced, including materials and labor, if, in the Owner's reasonable opinion, the system is other than as warranted. Software shall be revised as necessary to reflect system changes required to meet warranty obligations. A separate written contract stipulating this service and guarantee coverage shall be provided to the Owner before final acceptance.

2. During the warranty period, provide a 24 hour emergency service telephone number where a qualified service technician familiar with the installed system may be reached. This technician shall have the capability of remotely communicating with the control system for troubleshooting and program alterations. A fully equipped, qualified repair technician shall be at the job site within four (4) hours of a request for emergency service.

3. All replacement parts must be available on site within forty eight (48) hours during the term of the warranty.

4. Provide, free of charge during the warranty period, two (2) DDC software sequence modifications as instructed by the Owner. Modification shall be in software only.

G. System Description

1. General

a. The HVAC control system specified herein shall control HVAC and auxiliary equipment as required in this specification without intervening pneumatic controls (except where specifically indicated) or "add on" transducers.
b. Provide all software, hardware, input/output devices, wiring and control power not shown in electrical bid documents, actuated dampers, actuated valves, actuators, operation and maintenance training, special maintenance tools and aids, supervision installation labor, and warranty. It is the responsibility of the general contractor to coordinate among mechanical, electrical and controls contractors to assure that all equipment and software necessary to provide a fully operational system and make the Owner-provided PCs act as Operator's Stations are provided. Provide all equipment and hardware necessary for communication among Distributed Processing Units and Operator's Stations via telephone, hardwires and campus ETHERNET. Contact the current Seattle Center Siemens representative regarding how to connect existing control systems to the Seattle Center network.

2. Basic system features shall include:

   a. Zone by zone control of space temperature, usage scheduling, and equipment failure reporting. A zone is the area served by one HVAC terminal unit (fan coil, heat pump, air terminal).

   b. Totally tamperproof room sensors, with no set points. All temperatures are to be set from an operator's station or portable terminal, except when it is appropriate to include limited adjustment by the occupant.

   c. Equipment monitoring and alarm function including information for diagnosing equipment problems.

   d. Auto-restart after power failure.

   e. Equipment runtime totalization of motor driven equipment, with lead-lag operation set on duplicate equipment.

3. Sensors

   a. Temperature Sensors: Sensors shall be completely pre-calibrated with no electrical adjustments or calibration required. The temperature displayed at an Operator terminal shall be accurate to within one degree F.

   b. Air Velocity Transmitter: Shall provide air velocity information independent of the effects of static pressure. Transmitter shall operate from 0 to 120 °F.

   c. Humidity Transmitter: Shall be of the solid state type using a hygroscopic sensing element. The sensor shall operate from 40 to 100 °F.

   d. Differential and Static Air Pressure Switch: Shall use a diaphragm to operate a SPDT snap action switch. Provide a field adjustable pressure set point with a range no greater than 150% of the intended maximum set point and a pressure tolerance of 150% of the maximum pressure to which it may be exposed. The switch voltage and current rating shall be double the load requirements. Provide bulkhead fittings for sensing tubes.

   e. Proof of Flow Pressure Switch: May be a pressure differential switch piped in parallel across water circuit pumps or may be a single insertion flow sensing device (paddle switches are not acceptable). Snap action SPDT switches shall be operated by a slack neoprene, stainless steel or copper diaphragm that can be adjusted through the total pressure range. Switches shall withstand at least twice the working pressure of the system including any standing head, and have a temperature range exceeding the worst case liquid and ambient conditions. Install the switch with valve isolation at each liquid line penetration. Use copper for connection to pressure taps in liquid lines.

   f. Differential and Static Pressure Transmitter: Transmitter shall operate from 50% to 150% of maximum anticipated pressure.

   g. Freeze Protection Thermostat: Provide DPDT contacts. One set of contacts will wire directly to controlled mechanical equipment. The second set of contacts will be wired to a digital input as annunciation of freeze protection alarm condition.

4. Controlled Devices

   a. Actuators

      1) Whenever appropriate for the application, all actuators shall be 24 VAC and shall be by Siemens. The use of any other actuator must be approved by the owner. Proportional actuators shall use 0 to 10 VDC or 4 to 20 mA control inputs. Provide in sufficient size, quantity and type to assure reliable operation throughout the normal aging process of valves and dampers. Actuators shall stop automatically at end of travel, include a permanently lubricated gear train and tolerate a full time stall without damage. Actuator torque shall exceed 150% of installed requirement. The shaft to which an actuator(s) is coupled shall be square or hexagonal. Multiple actuators may be powered by one 24 VAC transformer providing the transformer size does not exceed 100 VA.

      2) Damper and VAV box actuators shall directly couple around damper shaft or an actuator crank arm may be linked directly to damper blades but not to another crank arm.

      3) Large damper assemblies shall be made of individually driven segments that are small enough to insure reliable operation and uniform closure across the entire damper assembly.

      4) Provide spring return where noted or where required for freeze protection and smoke control.

      5) Permanently stamp or scribe position indication on the end of driven shafts when position is not obvious.

   b. Actuated Dampers: Provide low leakage control dampers where not furnished with packaged units. Damper leakage rate shall not exceed 6 CFM/sq. ft. at 4" wg and 1% of full flow rate. Dampers shall have blade seals and stops. Provide American Warming and Ventilation, Ruskin or approved equal dampers. The shaft to which the actuator(s) is coupled shall be square or hexagonal.

   c. Actuated Valves: The valves shall be selected to meet CV and pressure requirements. Valve body and actuator selection shall be sufficient to handle system pressure, and shall close against the system differential pressures. Valve service rating shall be 125 psig. or greater except that valves in the campus chilled water piping shall be rated at 250 psig or greater. All valves shall have field manual positioning capability to allow manual positioning of valve in absence of control power. Provide position indication by end switches or output proportional status. The shaft to which the actuator(s) is coupled shall be square or hexagonal.

   d. Control Relays

      1) Panel relays shall be plug in type with contacts twice the amperage rating of circuit requirements: minimum temperature range -25 to +70 °C. Enclosure: clear dust cover and shock resistant, rated for minimum of 2.5 million mechanical operations and 100,000 electrical operations at full load.

      2) Remote/interposing relays shall be used for all remote switched loads and elevator interface. They shall be housed in a NEMA 1 enclosure and be socket mounted. Where two or more relays are mounted in the same enclosure, provide a hinged cover. Besides meeting panel relay requirements (2.5.11.1), they shall have 24 VDC coils and form C dry contacts with a minimum rating of 5 amps @

240 VAC. Relays should be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. When applicable, use IDEC RH series relays or directly interchangeable and approved equal.

e. Ability to command individual devices, IE. Fans, Compressors, pumps, ETC., using the front end remotely.

f. While most manufacturers utilize control sequencing within HVAC units, A/C Units Heat Pumps etc., Seattle Center Requires additional controls to each device within the unit.

5. Enclosures

All enclosures shall be required by Code for the environment in which they are installed. All controls and instruments shall be logically assembled at one or more panels, shall have hinged doors, and shall be marked with engraved melamine labels. No more than two keys shall be necessary to operate all locks.

6. Wiring and Conduit

a. Aluminum wire is prohibited.

b. No conduit shall be filled such that the maximum bundled cross sectional dimension exceeds 65% of conduit inside diameter. No raceway shall be filled to more than 40% and maximum fill for "wiremold" (surface raceway) shall be 20%. Over size conduit to 1.5 times that required by Code.

c. No wire run or circuit shall be longer than 80% of the maximum allowable length or power consumption for the wire size and application. No output circuit shall exceed 80% of the maximum load capacity specified by the manufacturer.

d. Wiring & Conduit: Shall comply with Division 26 Specifications.

e. All wire in or through mechanical rooms or where subject to incidental damage, shall be installed in conduit and properly supported. All wire not part of a jacketed cable shall be installed in conduit and properly supported.

f. Wire runs shall be parallel or perpendicular to walls, pipes and sides of openings. Right angle turns shall be used and passage ways for access and servicing shall not be blocked. Open wiring in ceiling areas and plenums shall be U.L. listed for plenum use.

g. All data cables shall be 100% backed up with an unused parallel set of conductors.

h. All conduits entering and leaving terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner. A number shall be used only once.

i. All conductors shall be tagged, labeled, and color coded. Color coding shall be by wire insulation, not taping or banding. The numbering and color coding shall be continuous from each circuit wire. Tag numbers shall agree with wire numbers assigned on wiring diagrams and the installation drawings.

j. Wires shall be numbered at each connection, termination, and junction box.

k. Numbering shall show the terminal number at the control panel.

7. Devices Installed by Others

   Under the vendor's direction, the Mechanical Contractor shall install controlled valves & dampers, thermowells and pressure taps with isolation valves.

H. Sequence of Operation and Points Description

1. General

   a. Program as a minimum the following:

      1) Control of equipment as specified, The Designer shall provide the sequence of operation

   b. The programming shall also include the following, with close coordination and cooperation between the Design Engineer, Seattle Center's Plant Operating Engineer, and the Contractor:
      1) Alarm limits and histories

      2) Summary of data for each zone

      3) Trend logs and historical data

      4) All set points

      5) Freeze protection, assuming chilled water coils have not been drained.

      6) Dynamic color graphic interface

2. Specific Requirements

   The following Sequences of Operation and Points Descriptions shall be enhanced as necessary and included as part of the control drawings to expand and clarify information shown in the drawings. Points information shall be displayed and organized by system in dynamic graphic form at the Operator Stations. It shall be possible to "disconnect" any output or set point from the AUTOMATIC control logic and enter a MANUAL value or state from any Operator Station. It shall be possible to replace certain inputs with MANUAL values from any Operator Station. All control loop parameters for each loop shall be displayed on one display.

3. Minimum Points, Display and Programming Requirements

   The following commands, displays and data shall be available at the central or local operator's terminal:

   a. Air Handling Unit

      1) Fan status (differential air pressure switch)
      2) Outside air temperature
      3) Mixed air temperature
      4) Supply air temperature
      5) Return air temperature
      6) Directly measured total supply air flow (CFM)
      7) Directly measured total return air flow (CFM)
      8) Calculated total outside air flow (CFM)
      9) Independent return air damper control

10) Independent outside air damper control
11) Independent exhaust air damper control
12) Coldest and warmest zone, all zones sampled
13) Duct and space static pressures
14) Fan speed (% of full speed)
15) Damper positions (% of full open)
16) Heating and cooling valve position (% of full open)
17) Freeze protection status
18) Duct smoke detector status
19) Alarms (temperature, air flow, pressure)

b. Hot Water Steam Convertors and Pumps

1) Status of pumps (pressure differential switch)
2) Supply and return temperature
3) Entering and leaving temperatures
4) Valve positions (% of full open)
5) Differential pressure (if used)

c. Air Terminals/VAVs

1) Current space temperature
2) Occupied heating/cooling set point
3) Unoccupied heating/cooling set points
4) Current status (heating/cooling)
5) Current mode (day/night)
6) Minimum and maximum air flow setting (CFM)
7) Current air flow reading (CFM)
8) Valve position (% of full open)
9) High/low temperature alarm

d. Chilled Water System

1) Supply and return temperature
2) Entering and leaving temperatures
3) Supply temperature reset
4) Pump status (pressure differential switch)
5) Chiller status
6) High/low temperature alarms

4. Points Description

The Points Description list implies minimum functional expectations and may require enhancement and expansion by the control contractor to meet all specifications. Use the following Points Description Glossary:

I/O TYPE (Input/output)

AI	Analog Input
DI	Digital Input
AO	Analog Output
DO	Digital Output
PI	Pulse Input
SW	Software Point (Virtual, Calculated, Set point, Etc.)
X	Devices followed by the same number require attachment to the same IOU for effective stand alone function

RANGE/SP & ACCURACY - Abbreviated Values

CFM	Cubic Feet per Minute
F	Degrees Fahrenheit
FPM	Feet Per Minute
"WC	Inches of Water Column
MA	Milliampere
RH	Relative Humidity
VAC	Volts Alternating Current
VDC	Volts Direct Current

ACTION

NO	Normally Open
NC	Normally Closed
SR	Spring Return
2POS	Two Position
FPC	Floating Point Control
A/M	Auto/Manual - This feature allows selection between automatic control by the control logic and manual input of a value from an Operator Station.
MI	Manual Input - If the A/M selector is in the manual mode, this input will be used to provide the desired value
SP	Set point

DEVICE - Sensed or Controlled

CONT	Dry Contact
PS	Pressure Switch
PT	Pressure Transmitter
RHT	Relative Humidity Transmitter
RTS	Resistive Temperature Sensor
TS	Thermostat
TT	Temperature Transmitter
VT	Velocity Transmitter
ACT	Actuator
INT RLY	Interposing Relay using a 24 volt (AC or DC) coil input from the IOU and switching non-"energy limited" loads
VFD	Variable Frequency Drive

I. Interface with Other Systems and Equipment

Design DDC system as appropriate to interface with fire alarm, smoke control, low voltage lighting and security systems.

END OF SECTION 25 50 00

Seattle Center Site Standards

Division 26

Electrical

A. Scope

These standards and procedures contain the design criteria for electrical systems and architectural provisions, general requirements for submittals, equipment approvals, and post-installation instruction and reference materials. Also included are important areas of design to coordinate with Plant Engineering and Cross References to electrical information in other sections.

B. General Requirements

1. All work shall conform to the following latest edition of codes, regulations and standards other applicable codes; and industry standards:

   a. National Electrical Code

   b. National Electrical Safety Code

   c. State of Washington Electrical Construction Code

   d. State of Washington Department of Labor and Industries Regulations

   e. Seattle Fire Codes

   f. Seattle Building Codes

   g. Seattle Electrical Code Supplement

   h. Seattle Energy Code

   i. NEMA

   j. NFPA

2. The majority of Seattle Center construction is for permanent installation. Therefore, all electrical systems must be designed for an anticipated 30 to 40 year life before requiring major repairs or replacements.

3. Systems and components must be designed with maximum reliability, maximum flexibility, and minimum operation and maintenance costs in mind.

   a. Flexibility is important in the system design. Full consideration must be given for future system alterations and additions with a minimum of system shutdowns.

   b. Normal preventive and routine maintenance must be accomplished without major building shutdowns.

4. Where a detailed analysis of the program reveals an inadequate budget to provide the appropriate system design, notify the Owner, in writing, of the budget deficiency, the recommended system and its cost, and the alternatives if a budget revision is not provided.

5. Logistics

a. Contractor access to the Seattle Center facilities may be restricted. Planning should be done to verify that the Contractor has space for construction trailers and materials storage within a reasonable distance of the project.

b. Unloading space near the project can also be a problem. Loading docks are generally in heavy use for facility servicing and event load-in and load-out, so construction materials typically cannot be left on the loading dock for any length of time.

c. Any necessary road closures for unloading or crane work needs to be carefully coordinated with Center personnel.

d. Locations of construction equipment producing exhaust or fumes may be restricted to eliminate nuisance and hazards to interior spaces.

6. Construction Limitations

a. Primary switch cubicles can exceed the height of standard doorways. Allowances should be made for installation, and changes or additions to switchgear sections during the life of the building.

b. Weights of transformers could exceed floor loadings if other than slab-on-grade basement areas are necessary for installation. Make sure that lifting eye and floor loading are accommodated in the design. Seismic supports and restraints are necessary.

c. Temporary fire alarm measures may be necessary to avoid disruption of exiting patterns, and during shut downs for additions to the fire alarm system. Be sure to evaluate the cost of such temporary measures in the project estimate.

d. In remodel projects, shutdowns of existing feeders and services may be necessary. These shutdowns may have to occur after normal working hours to prevent interruption of critical operations. The cost of such premium working hours can have a major impact on the construction estimate. Also, temporary power may be necessary to maintain service to critical loads.

e. Operation of power tools may have to be scheduled with the owner to reduce the noise impact on day-to-day operations of the facilities.

7. Controls

There are several existing control systems on the grounds from energy management to fire alarm systems. Interfacing new systems with existing systems must be carefully coordinated by the design team and Contractor.

8. Equipment Identification nomenclature shall be coordinated with the Project Manager and Seattle Center engineers and electricians.

9. Design Considerations

a. Identify and evaluate any necessary alternates early in the design process.

b. Constructability: The construction sequence may need to be itemized as part of the contract so that the Owner and the Contractor may reliably predict and schedule outages, space access and business interruptions. If there are long lead items that impact the construction schedule, they should be identified early for possible owner

purchase. Specific areas of coordination need to be identified to alert the contractor to special work area problems.

c. Construction Cost Estimates and Schedules: Evaluation of the bid market should be made. The impact of remodel work, crowded working and access spaces, equipment delivery time, and possible premium overtime hours should all be factored into the project cost estimate and schedule, and clearly stated in the construction contract.

10. Demolition and Remodel

a. Phasing of work to allow shutdowns to occur may extend construction time.

b. Disposal of materials can be a problem with limited on-site areas for temporary storage. Define reuse of equipment where appropriate.

c. Correcting existing panel schedules, removing conductors and raceways of abandoned circuits, and maintaining existing circuits being modified all need addressing in the contract documents.

d. In general, the abandonment of equipment and raceways in place is not acceptable. Space shall be conserved as much as possible.

C. Interdisciplinary Coordination

The Engineer shall coordinate the electrical work with other specification sections to completely define the work and responsibilities of the electrical contractor. Indicate control wiring interfaces between systems.

1. Hardware.

2. Kitchen equipment.

3. Mechanical equipment.

4. Architectural specialties.

5. Elevator/escalator: Include machine room, hoistway, and pit lighting, receptacles, and communication outlets.

6. Shop equipment.

D. Important Areas of Coordination with Plant Engineering and Electricians.

1. Service conductor taps and service classifications.

2. Electrical room locations, sizes, and equipment arrangements within these rooms (for all service equipment and floor distribution electrical rooms.)

3. Distribution concepts including grounding, calculated fault duties and protective relay coordination methods.

4. Connected and demand load calculations for power system.

5. Connecting to existing distribution systems including capacity and location.

6. Situations where spare parts inventories and operational reliability are a concern such that Equipment specifications which limit the number of vendors and assure quality must be written.

7. Special considerations for operations and maintenance to reduce the impact of noise, outages, and testing.

8. All shutdowns must be coordinated with Seattle Center staff, and can take several weeks of planning so all affected departments can plan operations around them. The Contractor's construction schedule should take this into consideration when setting major milestones.

END OF SECTION 26 00 00

A. Scope

Following are requirements for electrical rooms and spaces. Coordinate with architect, mechanical, civil and other consultants for complete work definition.

B. General

1. Provide concrete bases and housekeeping pads for all transformers and equipment, seismically designed with structural connections to floor slab, and channel or angle iron frames for welded equipment fastening.

2. Design for future removal or replacement of transformers and provide ventilation for removal of heat generated by the transformers.

3. Provide supports and restraints for Seismic Zone III requirements for all equipment and raceways.

4. Provide separate rooms or closets for communications equipment.

C. Building Electrical Service Rooms

1. Install all medium voltage services for buildings in rooms or spaces with concrete or solid masonry walls and ceilings.

2. In general, allocate floor space for future switchgear.

3. The building service room shall contain the primary interrupter switch, the service transformer, and the service switchboard. The preferred configuration of this equipment is in the form of a unit or packaged substation. Allow clearances in excess of NEC for safety and maintenance convenience.

4. The building service room may also house other related secondary distribution equipment.

5. The room design shall take into consideration the possibility of flooding when below grade.

6. Equipment and transformer rooms must be designed with consideration for the following features:

   a. Convenient conduit and cable entrance.

   b. Walk-in access for personnel from within the building.

   c. Adequate doors, hatchways, etc., to permit ready installation or removal of major equipment items such as transformers, motors, controls, switchboards, etc. Provide exit paths per NEC.

   d. Standard Physical Plant Department keying to limit access to authorized personnel.

e. Adequate ventilation completely separate from the building ventilating systems. A gravity type system is preferred when sufficient exterior wall area is available.

f. An areaway may serve the function for both equipment removal and ventilation.

g. Mechanical piping and ductwork must not be installed in electrical equipment and transformer rooms except where required for operation of the electrical equipment.

h. Piping and ductwork must never be installed directly over any transformer or switchgear. Sprinklers are the only exception, if installed to protect electrical equipment.

i. Adequate lighting, ventilation, and sound control must be provided, including emergency lighting and receptacles, if emergency system is available.

D. Electrical Rooms and Closets

1. Electrical rooms and closets must be provided for installation of panels and equipment and for vertical wiring. In multi-story buildings, they must be located on each floor with risers in direct vertical alignment.

2. Distribution switchboards and panelboards, and dry transformers over 30 KVA, shall be in electrical rooms. Rooms shall stack for riser efficiency, and be centrally located to keep feeder lengths minimum. Several rooms may be necessary to accommodate the building configuration and system design.

3. As a general guide, provide one floor electrical distribution room to serve each 15,000 to 20,000 square feet.

4. Mechanical ventilation is required for spaces containing transformers as are equipment replacement clearances and removal routes.

5. Branch panels may be located in closets located throughout the floor or wing.

   a. Closets should be a minimum size 2 feet deep by 6 feet wide, equipped with full width double doors opening into a building corridor.

   b. Closet doors must be equipped with standard Physical Plant Department keying to limit access to authorized personnel. Doors will normally not be keyed to the building master system.

6. In shops or similar areas, branch panels may be mounted on or in walls.

7. Special attention must be given to the design of the floor structure to permit future openings in the slab without weakening the structure. Provide capped sleeves, knockouts and floor space for future conduit.

E. Corridors

Corridors should have accessible type ceilings constructed of readily removable "lift-out" panels to permit access to electrical and communications services.

F. Offices and Miscellaneous Rooms

Offices and miscellaneous rooms shall have accessible type suspended ceilings whenever possible.

END OF SECTION 28 00 01

A. Scope

1. This section applies to the design of building secondary power service and distribution at 480Y/277 and 208Y/120 volts, from the secondary of the service transformer to the branch circuit outlets or utilization equipment. Note that in the Armory, no 240 volt power is available.

B. Short Circuit Study

1. The Consultant shall prepare a short circuit study during design development and evaluate potential coordination and interrupting capacity problems. The purpose of this study is to verify coordination of the proposed electrical equipment. It is possible that not all of the purchased protection equipment will be from the same manufacturer with the end result being unacceptable overlapping time current curves.

2. The initial study shall contain the fault and load current values listed at key points on the distribution system one-line diagram to illustrate the necessary equipment fault duty.

3. The consultant shall propose solutions to any problems, and demonstrate that coordination can be achieved with the proposed devices. Specify the electrical equipment with enough flexibility to allow field solutions on the installed system.

C. General Building Services and Distribution

1. Service and Distribution Methods

a. The design must provide building service reliability commensurate with the needs of the facility's designed usage. Facility designed usage has been categorized into three (3) general normal power classes and three (3) general emergency power classes:

b. Seattle Center Redevelopment and Electrical Crew Chief will participate in the selection of the building service configuration.

c. Normal Power

Provide main power and lighting distribution in new buildings and renovations at 480Y/277 volts, 3 phase, 4 wire solidly grounded. Serve convenience receptacles, special equipment and special lighting from a 208Y/120 volt, 3 phase, 4 wire solidly grounded system established by means of one or more dry-type transformers throughout the building.

In general, smaller (maximum 800A) conduit and cable risers are preferred over busway risers for convenience in maintenance shut downs and to limit disruptions during faults and repair.

d. Emergency Power

Emergency lighting and power shall connect to existing emergency power systems whenever possible.

System requirements will be decided on an individual building basis. Seattle Center Redevelopment and electricians shall be included in the decision making process for each project.

2. Equipment Specifications

a. All building services should be designed to limit the maximum available fault current to 50,000 amps or less.

b. Select all equipment with full consideration for overcurrent protection, phase and ground fault selectivity (use zone-selective interlocking where beneficial), fault current interrupting, and fault closing capabilities, as well as current carrying capacity.

c. Determine the requirements from the ultimate installed transformer capacity programmed for the building.

d. Breakers and current limiting circuit breakers are preferred in lieu of fused switches and fused breakers.

e. Each building shall have a main service switchboard(s) with main disconnect(s), tie breakers (where required), necessary feeder breakers, and metering. Unless otherwise directed, the application will be a 480/277 volt, 3 phase, 4 wire distribution system.

3. Electrical Rooms and Closets

a. See Section 26 00 01 ***Electrical Rooms and Spaces*** for requirements for electrical rooms and closets Size rooms with future panel and riser space accounted for in space provided.

b. Distribution switchboards, panel boards, and dry transformers over 30kVA, shall be in electrical rooms.

c. Electrical closets may be used for floor branch panels and transformers 30kVA and smaller, and riser panels not serving over three floors, to supplement electrical rooms. There shall be no storage in panel rooms.

4. Additional Considerations

Secondary system design must give full consideration to future expansion, maintenance, and alterations by use of the following features:

a. Switchboards and motor control centers located and arranged to permit installation of additional sections or cubicles.

b. Spare full size breaker or space with hardware for maintenance backfeed operations.

c. Panels with spare breakers, or space for additional breakers.

d. Spare conduits or sleeves to minimize core drilling in the future.

e. Surface raceways for multiple outlet areas.

D. Switchboards

1. General

All switchgear shall be reviewed and approved by Seattle Center or its designated representative before ordering. Price lists of breakers and a physical sample should be available for inspection. The physical sample can be an existing panel on site.

Square D® is Seattle Center's preferred manufacturer because of readily available parts and a large inventory of spare breakers used for temporary panels.

a. The switchboard shall have an adequate number of spare feeder breakers, spaces for hardware for future feeder breakers, and provisions for adding vertical sections onto one end.

b. Each of the circuit breakers shall be provided with overcurrent and, as required, ground fault relay protection. A breaker tripping scheme should be specified that will not require an alternate source of control power. The settings for overcurrent and ground fault protective devices should be chosen to provide a completely selectively coordinated system.

c. Provide Ground Fault Protection as Follows:

(1) All services (unless programmed otherwise) shall be provided with GFP per NEC.

(2) When ground fault protection is used on the main, there should also be ground fault protection on the sub-feeders.

d. Provide status monitoring dry contacts on the following breakers for open, closed, and trip conditions for mains, ties and feeders for building services.

e. When viewing the switchboard from the front:

(1) Phase relationship (A-B-C) shall be left-right, top-bottom, front-back.

(2) Low voltage switchgear connected to building power service transformers have their buses identified 1-2-3.

(3) Connections between the transformer low voltage terminals and the switchgear shall be as follows:

"X1" to "1" (Bus)
"X2" to "2" (Bus)
"X3" to "3" (Bus)

Note that transformer connections as indicated above will result in a rotation sequence at the low voltage switchgear of 1-2-3.)

g. Aluminum bus is allowed if insulated.

2. Switchboard Designations

The Seattle Center has designated switchboards (400 amps and larger) into the three following types:

a. Type A:

(1) Bus 1600A and above, and all service switchboards.

(2) Similar to GE AKD-8, Siemens type R, or Square D® Powerzone II; with hinged rear and front access panels for breaker and metering compartments.

(3) Insulated and isolated bus, with fully rated horizontal phase and neutral buses. Aluminum bus is acceptable.

(4) Isolated compartments for all breakers.

(5) Draw-out air circuit breakers, 100% rated, stored energy opening and closing, with electronic static overcurrent, ground fault, current limiting fuses, and zone selective interlock protection. Integral current limiting fuses on tie and feeder breakers.

(6) Bus and connecting stubs for individual breakers sized for the full capacity of the breaker frame size and not for the trip setting of the overcurrent devices.

(7) 800 amp minimum breaker frame size.

b. Type B:

(1) Bus 801 through 1600A.

(2) Use GE "AV-3", Square D® or Siemens.

(3) Insulated and isolated continuous main bus and full neutral bus, also with hinged rear and front access panels for breaker and metering compartments in feeder compartments. Aluminum bus is acceptable.

(4) Main and tie breakers draw-out air circuit breaker type, with stored energy opening and closing.

(5) Feeder breakers may be stationary mounted molded case type, with interchangeable thermo-magnetic trip units.

(6) Minimum size breaker 100A.

c. Type C:

(1) 401A through 800A.

(2) Use GE "AV-2" Square D® or Siemens, with group mounted feeders and individually mounted main. Provide copper busing and hinged wiring compartment doors with captive screws.

(3) Molded case mains and feeders, except when serving service entrance.

(4) Wall mount panelboard construction with group mounted main permissible when not a service entrance. Provide copper busing.

(5) Provide door over circuit breaker handles.

3. Service Equipment

a. Service entrance label required for all building service switchboards, and all side load switchboards or panelboards of derived sources.

- See other electrical Sections

b. On services from a utility company, provide metering to suit their requirements. Provide space for clamp-on type metering where service is subfed from other campus structure.

4. Additional Switchboard Requirements

a. Accessories such as breaker racking devices, integral extension rails, breaker lifting devices, and maintenance closing handles.

b. Shop drawings, wiring diagrams, maintenance manuals, and overcurrent device time-current characteristic curves.

c. Additional ground bus for 208Y/120 volt equipment.

E. Distribution Feeders

1. Equipment grounding conductors shall be included in all raceways. Isolated ground conductors on 208 volt systems shall be included in raceways when required and allowed by NEC 250-74 Exception 4. Indicate on feeder schedules and circuiting.

2. Provide panel and feeder identification.

3. For wiring continuity, phase identify all feeder cables.

4. Consider the neutral as a current carrying conductor.

5. Specify circuit breaker lugs to match feeder size. Splitting single conductor to two smaller taps to accommodate parallel lugs on a breaker is not acceptable.

6. Switching mode power supplies can generate harmonic currents The harmful effect of these currents on distribution feeders and equipment must be considered in the design process.

F. Distribution Panels

1. Construct as non-service type B or C switchboards depending on size.

2. Copper busing only.

3. Provide additional isolated ground bar for 208Y/120 volt systems.

4. Derived source distribution panels shall have service entrance label.

5. Panel must have a main breaker.

G. Dry Type Transformers

1. Utilize as required to provide 208/120v, 3 phase, 4 wire service from the building 480 volt distribution system. Connect delta-wye.

2. Air cooled dry-type with steel housing enclosing all wiring and connections. Provide built-in vibration isolators.

3. Insulated/isolating type with class H insulation with an average temperature rise not to exceed 150 °C. based on a 40 °C ambient temperature. Shielded type may be advisable for certain applications.

4. Six fully rated taps on the primary winding for each transformer: three 2-1/2 percent taps below normal and three 2-1/2 percent taps above normal.

5. Transformers shall be located to assure adequate ventilation. Provide heat gain calculations for space involved to verify adequate ventilation. Mechanical ventilation is probably necessary. Set transfers away from walls at least as far as the width of the ventilation opening, or per U.L. listing.

6. Do not locate heat sensitive equipment or equipment requiring working clearance above transformers.

7. Dry transformers may be a source of noise, heat, and vibration problems. High quality equipment, special mounting arrangements, sound isolation, etc., may all need detailing in the specifications and on drawings. Suspended platform mountings for transformers must be coordinated with the structural engineer, as well as floor loadings. Wall mounted transformers shall be limited to 30 KVA and below.

8. A local primary side disconnect is not required if the transformer has a local secondary disconnecting means.

H. Branch Circuit Panelboards

1. Locate panels in electrical rooms, electrical closets, or utility hallways on each floor. Special rooms with highly concentrated loads should have separate panels. Do not locate panels in janitor closets or toilet room entries. As much as possible, locate panels near columns, on permanent corridor walls, or other permanent features, to reduce the chance of having to relocate panels on remodel projects.

2. Surface mounted panels are preferred to flush panels. Surface mount panels in utility spaces. In finished areas provide flush mount with full height access to ceiling for future raceways. All flush panelboards shall have a minimum of (3) 3/4" conduits stubbed out above panel into accessible ceiling space.

3. Provide door-in-door construction with lockable metal latch fasteners on all doors. When more than one fastener is required on a door, provide single operator handle with multi-point fasteners. Locks shall be keyed alike and to match the existing standard keying system. Opening outer door should expose terminals and circuit breakers in a single operation.

4. Provide all 208Y/120 volt panels located in office areas with a dedicated, isolated, full size ground bus to serve future computer equipment, and a separate equipment grounding conductor bus. Provide terminals for a minimum of 50% of panel circuits on each bus. Connect to derived system ground. See "grounding" section.

5. Panels served by oversized feeders may require larger enclosures for bending space.

6. Circuit breaker type, equipped with "bolted-in" breaker units. Equipment must be provided with adequate interrupting capacity. Minimum interruption capacity for each panel shall be 10,000 AIC or as calculated, whichever is higher.

7. Panelboard designations shall be labeled on the front of the panel and on the directory to agree with as-built drawings.

8. Number panel circuits to correspond with the panel schedule. Each panel shall be provided with clear plastic covered typewritten circuit directory.

9. Provide copper busing.

I. Branch Circuit Wiring

1. Definitions

a. Dedicated Circuit: A branch circuit with phase, neutral and ground conductor serving only designated loads. No other outlets to share neutral or phase conductors.

b. Dedicated Outlet: A single outlet on dedicated branch circuit.

c. Isolated Ground Circuit: An electrical branch circuit which includes a ground wire which is electrically insulated from all other electrically conductive items except at the point of origination of the circuit. It achieves a degree of freedom from interference. The ground is terminated at an isolated ground bus.

d. Isolated Ground Bus: A ground bus which is electrically insulated from adjacent conductive surfaces and which is electrically connected to a selected reference point.

2. General

a. Minimum conductor size shall be #12. Home runs greater than 75 feet to the first receptacle outlet shall be #10. Evaluate necessary longer runs and size to suit voltage drop limitations. As a rule keep 120 volt circuits to less than 75 feet, 277 volt circuits to less than 125 feet. Maximum branch circuit voltage drop to be 3%.

b. Original circuit loading shall not exceed 1,600 watts on 20 ampere, 120 volt circuits; 3,800 watts on 20 ampere, 277 volt circuits.

c. Common neutrals are permitted in a single conduit for two or three single phase circuits served from different phases when objectionable harmonic currents from fluorescent fixtures, electric discharge lighting, computers, etc. do not exist. The Contractor should be cautioned not to reconnect common neutral circuits to the same phase when balancing panel loading.

d. Office electrified or wired furniture partitions to have neutrals sized at 200%, or separate neutrals per circuit.

e. Microwave ovens, refrigerators, hot plates, water heaters shall be on dedicated circuits on normal power.

f. Each branch circuit raceway shall contain a green equipment grounding conductor in addition to the phase and neutral conductors. Indicate on branch circuits on plans, and size if other than #12.

g. Isolated ground circuits shall contain an additional grounding conductor.

3. Harmonic Currents: Switchmode power supplies, dimmers, variable frequency drives, etc., may create harmonic distortion and neutral current in excess of phase currents, provide properly sized lugs as required for larger conductors. As a guide, in lieu of specific data on equipment, use:

a. Oversized (#10) neutral on 120 volt receptacle circuits sharing a neutral is the preferred design as this provides the least voltage drop; however, separate neutrals are required for dedicated circuits

b. Double size neutral for 3 phase branch circuits.

c. Disconnect panelboard and neutrals sized at 200% of phase conductor.

d. If total panel load includes over 30% switchmode power supplies, derating of transformers, generators, and power supplies may be required, and other circuit adjustments necessary.

J. Raceways - See other electrical Sections.

K. Wiring Devices and Plates

1. Use specification grade self-grounding devices in general; 20 amps for dedicated outlets. Fifteen amps for multiple outlets on 20 amps circuits is acceptable. Hard ground pigtails are to be connected at all times. Do not rely on self-grounding feature.

2. Use AC only "quiet" type switches, 20 ampere rating, self grounding. Use white color for normal power. Interchangeable type devices may be used only for special applications when approved by the Engineer. Use Leulton 1201-2Lfor locking switches..

3. Use neon or low voltage transformer-base type pilot lights for long life and ruggedness.

4. Provide 120 volt convenience receptacles in janitor closets, toilet rooms, corridors, pipe tunnel and other special purposes spaces for maintenance department use. Receptacle locations in offices, classrooms, etc., shall be determined by the occupancy of the room. In corridors, receptacles for cleaning shall be provided at spacing not to exceed 50 feet near hallway intersection and rear entry vestibules on circuits separate from office circuits. Provide janitorial receptacles in stairs at each floor landing. In general, each circuit's overcurrent device should be on the same floor as the outlets.

5. If an emergency system exists in a particular building, provide at least one 120 volt convenience receptacle in each mechanical, electrical and communications room connected to the building standby emergency panel for emergency maintenance use, in addition to normal power receptacles.

6. Receptacle configuration shall conform to NEMA Standards.

7. Locate GFCI exterior weatherproof convenience receptacles adjacent to each entry.

8. Provide ground fault circuit interrupter (GFCI) receptacles as dictated by good engineering practice. Use master/slave arrangement. Reset must be accessible by users.

a. Follow NEC rules for residential use to determine need for GFCI in all areas.

9. Device Plates

a. Use stainless steel for devices in finished areas unless otherwise specified.

b. Use galvanized or cast to suit box when exposed wiring is permitted.

L. Grounding

1. Proper grounding is a very important aspect of all electrical installation. The Specifications shall state, "all electric systems, components, and devices shall be properly grounded per National Electrical Code"..

2. A maximum resistance to ground of the grounding electrode system of two ohms is allowed.

3. In the following areas, comprehensive engineering design is required. For these installations, it is expected that the consultant will provide documents completely detailing all of the grounding requirements. Typical installations include, but are not limited to the following:

   a. Building services and grounding risers.

   b. Electrical vaults and substations.

      (1) Ground rod and mechanical system bonding details.

      (2) Adequacy of existing grounding in building remodels or renovations.

   c. Secondary distribution systems.

   d. Separately derived systems.

   e. Computer and communications rooms.

   f. Hazardous locations.

   g. Shop air and gas systems.

   h. Lightning protection per NFPA 78.

4. Details

   a. Diagrams covering several standard conditions are included as Standard Drawings SD-E-133 through 139 in the Volume 4 Appendix to be used as guides in developing the grounding systems. The consultant shall include the proposed grounding scheme and details with the design development submittal.

   b. Specify that paint between grounding lugs and enclosures is to be completely removed.

   c. Use multi-terminal lugs and ground bars to accommodate the number of ground conductors.

   d. Bond structural steel column anchor bolts in footings to footing rebar for added lightning protection.

   e. Equipment grounding conductors shall be provided for all raceways and should be so indicated in feeder schedules and branch circuiting representations. Bond to intermediate pull and junction boxes.

   f. Specify exothermic welds for inaccessible connections, and for splices in grounding conductors.

M. Equipment and Conductor Load Calculations

1. Normal Power

a. Lighting

1) NEC Table 220-3(b). Any VA excess over Energy code allowed VA may be considered spare capacity.

2) Demands in Table 220-11 not applicable.

b. Other Loads: Use NEC 220-3(c).

2. Emergency Power Systems

a. Lighting at 100% load.

b. Receptacles and other loads per NEC.

c. 100% coincident operating equipment.

3. Load Schedules

Indicate panel demand loads on a drawing schedule.

4. Show Power

100 amps or 60 amp. Use Hubbell pin and sleeve three-phase, 5-wire plugs. Disconnects for 200-400 amp show power should be rated at 240 volts, fused and have multiple load lugs if backstage.

H. Equipment and Conductor Sizing

1. Service Transformer
See other electrical sections.

2. Service Switchboards

Size switchboards to handle full forced air cooled capacity of the service transformer. Provide one spare breaker of each frame size with each draw out switchgear lineup, with multiple tap C.T.'s. Where space only is indicated, provide all bussing and mounting hardware.

3. Distribution Feeders

Distribution feeders serving several floors shall be sized with 25% spare capacity based on the calculated demand load for the feeder. The feeder capacity shall be based on the code allowable capacity of the cable and overcurrent protective device. 800A maximum riser feeder size. Multiple riser feeders shall be provided where additional capacity is needed.

Additional capacity, disconnects and plugs for show power may be required. Provide Hubbell pin and sleeve plugs.

4. Distribution Switchboards and Panels

Size equipment and source feeders to carry the calculated demand load plus 25% spare ampacity. The switchboards and panels shall have 25% spare breaker space. Additional larger load capacity may be needed for show power.

5. Transformers

   Transformers shall be sized to carry the calculated demand load, with at least 25 percent of their capacity reserved or spare. The use of special transformers, or additional space capacity allowances may be necessary to compensate for excessive harmonic currents.

6. Branch Panels

   Size panels and their source feeders serving mainly lighting and receptacle loads for their calculated demand load plus a minimum of 30 percent spare capacity for lighting and 40% for equipment and outlets. All lighting branch panels shall have 20% spare breaker space, and all receptacle and equipment branch panels shall have 25%. (See also 16A05.) May need more for show power, with disconnect and plugs.

7. Branch Circuits

   See other electrical Sections for required loading calculations for branch circuits.

8. Remote Power Accommodations

   Supply (2) disconnects with plugs in the main electrical room of the building to accommodate remote power needs for show power. Provide one 200 amp 208V-3~~0~~ disconnect and plug in each location.

   Buildings used by the public shall have at least one 60 amp three-phase, 5-wire Hubbel pen and sleeve plug at each entrance or side of building.

END OF SECTION 26 10 00

A. Scope

1. These standards and procedures apply to the selection and installation of motors and controls whether furnished under the electrical, mechanical, architectural, or other divisions of contract. Coordinate all requirements and references with other Divisions.

2. Packaged equipment with prewired central panels shall have the same type of indicating lights, identification of wiring and components necessary to comply with this Section.

B. Design Criteria

1. Design Review and Submittal

a. The type of control for every motor must be identified in the specifications or on the drawings.

b. Controls in motor control centers shown on electrical drawings must be verified by the mechanical engineer for compatibility with the control requirements.

2. Codes, Regulations, and Standards

a. Motors and controls shall conform to NEMA standards for each specific purpose and application. Specify Square D®, GE, or Siemens. Where applicable they should be installed following systems capability analysis, including consideration of harmonic distortion.

b. Conform to Seattle Energy Code, latest edition.

3. General Requirements

a. Provide identification on each motor and disconnect. Provide phenolic tags (black w/ white letters) indicating power source and location. (Gear, MCC, panel, circuit and room, etc.)

b. “Caution” labels warning against frequent starting of motors may be necessary, or lockout controls with thermal sensor in motor windings.

c. As part of the as-built drawings, each motor shall have a control diagram indicating what devices are controlling it, where they are located, their identification name or number, and what they are supposed to do. Note relationships between devices (priorities) and timed functions. The engineer shall provide specification wording and coordination with the work of other Divisions to make certain the electrical contractor performs the work. Show typical diagrams on the drawings.

C. Specific Requirements

1. Motors

a. Motors shall be high efficiency energy conservative models, meeting the ASHRAE 90.1 requirements.

b. Voltage ratings for motors shall be as follows:

(1) Less than 1/2 horse power (hp): 120 volt, single phase if readily available.

(2) 1/2 hp and larger: continuous operation 460, 460/208, 3 phase. Connect to 480 volt source when available, 208 volt is acceptable for smaller motors where 480 volt is not available. For 1/2 HP sizes for intermittent light duty where energy consumption is minimal, such as sump pumps, door operators, unit heaters, etc., 120 volt operation may be used for first cost savings.

(3) Over 150 hp: coordinate with Seattle Center plant engineers and electricians.

c. Motor speeds shall be matched to the driven equipment. Heavy fan drive motors should be 1,200 rpm or less.

d. Motors must be rated for "continuous duty," and shall be oversized to avoid tripping.

e. Motors shall be open drip-proof construction. Totally enclosed or explosion-proof types shall be provided where conditions dictate. Aluminum components are not acceptable.

f. Motor bearings shall be sealed. Sleeve bearings will be permitted for fractional horse power motors and where specifically recommended by the equipment manufacturer as the better type of bearing for the application.

g. Vertical shaft motors for special application shall be equipped with suitable thrust bearings.

h. Fractional horse power motors for unit ventilators and similar applications should be carefully selected with respect to speed, load, and starting torque characteristics. Shaded pole-type motors are not acceptable.

i. Avoid exposing motors to the weather; install in penthouses or other suitable enclosures. Motors installed in equipment exposed to the weather shall be totally enclosed type, even though a weatherproof enclosure is provided.

j. Motors used in communication with variable frequency drives shall be matched for full operating range of that drive. Provide necessary isolation or conditioning such that harmonic distortion is addressed and will not be an issue for the power system associated.

2. Power Factor Correction

a. Induction motors rated 15 hp and over shall be equipped with capacitors for power factor correction to 0.95 minimum. Capacitors should have blown fuse indicator lights. Capacitors shall not be used with variable frequency drive applications.

b. Capacitors shall be connected downstream of motor overloads. A location near the motor and fed from the load side of the local disconnect is preferred. May be fed from starter "T" leads if no disconnect. Motor overload devices must be properly coordinated.

c. Capacitors shall be connected to correct power factor to 0.95 for motor control center buses serving more than 15 total horse power of small induction motors.

d. Verify and record power factor after building systems are operational and HVAC system balanced. Verify transform load and supply harmonic load analyses.

e. Capacitors are not required for motors controlled by variable frequency drives.

3. Motor Controls

   a. All motors must be provided with proper motor starting and overload protection devices. Overload protections shall be provided in all three phases for three phase motors, and in all "hot" legs for single phase motors.

   b. Combination circuit breaker starters are preferred over separate components. Fusible switch types are generally not allowed. Motor control centers shall be used in lieu of distribution panels and separate starters in mechanical rooms and other multi-motor installations.

   c. Determine short circuit rating by calculations, with consideration given to future system changes.

   d. Motor controls shall be provided as follows:

      1) Manual starters (non-magnetic type): for single phase motors which do not require remote or automatic control.

      2) Magnetic Starters

         a) All motor starters shall have selector switch "Hands-Off-Automatic" controls with magnetic starters: for all three phase and single phase motors.

         b) Automatic control requirements shall be coordinated with other equipment operations, automatic control by the temperature regulation system, float controls, central supervisory controls, etc.

         c) Leave the automatic position open for motors without an automatic control.

      3) The manual position shall never have any automatic controls except for safety and equipment overload protection. The automatic position shall be used for any automatic control including freeze stats, load shed, smoke control, remote manual control, and process control. The automatic and manual positions shall have status contacts wired to the starter control terminal strip for smoke control fans and other critical motors.

      4) Only intermittent, task oriented motor starters shall have locally mounted "start-stop" push-button control (in addition to the starter HOA). If safety is a concern, local emergency stop buttons shall be provided.

   e. Full voltage starters shall normally be used. Reduced voltage starters must be used in case of motors over 60 hp, limited power supply, or unusual load characteristics.

   f. Large compressor-type equipment must have automatic controls to "unload" the machine during start-up.

      (1) Utilize autotransformer type unless variable speed required by process or energy code.

   g. Variable frequency drive (VFD)

      GENERIC AC MOTOR SPECIFICATIONS

      NEMA B
      Class B or better insulation; F preferred

1.15 Service Factor
1,750 rpm preferred for inverter service
Winding thermostat for best protection
Enclosure, oversized 120-150 % - Nema 4 enclosure
Designate an acceptable efficiency range

GENERIC AC DRIVE SPECIFICATIONS

Constant voltage dc bus with mov on input rectifier

Voltage Rated +10%, -6% (or 10%)
Min. power factor 95%
Harmonic content 95%
Allowable temperature rise Not less than 40 degrees C
Altitude, standard 3300 ft.
Humidity 5 to 95%, non condensing
Vibration 1.0 G
Output power Pulse width modulated
Enclosure To suit ambient
Ride through on power drop 3 Hz minimum
Readouts Frequency, Current, Fault

h. Controls exposed to weather or severe moisture conditions shall have NEMA type 4 enclosures. This includes area where storm water or chemical pipes are located. Type 3 enclosures are not acceptable.

i. Pushbuttons, selector switches, pilot lights, etc., shall be heavy duty "oil-tight" devices.

   1) Control and pilot light circuits shall operate at 120 volts. 480-volt starters shall have internal control transformers. Motor control centers may utilize a common control transformer if each unit is separately protected by a control circuit fuse or breaker.

   2) Every control and remote push-button shall have an "on" pilot light.

      a) Red "on" pilot light and "off" push button.
      b) Green "off" pilot light and "on" push button.

j. Coordinate locations of remote and central control and annunciation panels with Seattle Center engineers.

k. Lockout safety disconnect switches shall be provided in sight of motors. Disconnects shall be horsepower rated, number of poles required and shall have lock-open features.

l. Motor controls not located in motor control centers shall be located adjacent to the motor served; either wall mounted or mounted on an angle iron frame or framing channel supported from the structure.

m. Motor shall have sealed bearings.

n. All variable frequency drives must have bypasses and be oversized by 120-150%. All drives shall have harmonic distortion conditioning. Provide Allen Bradley or Graham. VFDs shall shut off at 50 Hz to prevent problems.

4. Motor Control Centers

   a. Provide motor control centers in mechanical rooms and other "multi-motor" locations.

   b. Foregoing requirements for motor controls shall apply to controls in motor control centers.

   c. Motor control centers shall be standard manufacturer design and construction to permit ready installation, removal, or replacement of standard components.

   d. Construction shall be NEMA Class I or II, Type B with unit terminal strips only.

   e. Vertical wiring spaces shall be accessible from the front without opening individual control units, with hinged cover and captive screws.

   f. Units shall be located so as not to be subjected to high ambient temperatures, and not be in close proximity to radiant heat source.

   g. Starter units shall be minimum NEMA size 1 for uniformity and maximum interchangeability and shall be the circuit breaker combination type.

5. Motor Starter Stations

   a. Locally mounted motor starters shall be NEMA 1 enclosures for general use and NEMA 4 for damp and wet areas.

   b. The foregoing requirements for motor controls shall apply to controls in motor starter stations.

   c. Starters shall be minimum NEMA size required for service.

END OF SECTION 26 18 39

A. Scope

1. Provide an engine-generator set together with all required operating accessories properly assembled to give a complete and fully operational power generation system. The engine and alternator shall be the product of one manufacturer or a combination of two manufacturer's equipment regularly assembled by the supplier as a complete package in this size and configuration. The equipment manufacturer(s) and the authorized supplier shall have complete responsibility for the performance of the engine-generator set and its accessories. Set shall be new, latest production model factory assembled and tested prior to delivery to jobsite.

2. Provide all necessary controls and accessories which, used with the engine-generator set, will make a complete operating package for installation up to 3,000 feet above sea level in an ambient temperature of 40 °C. maximum, -10 °C. minimum.

3. The power generation equipment supplies emergency power to legally required standby and optional standby loads. Automatic selective load pickup and load shedding is provided to assure adequate power to (1) emergency circuits, (2) legally required standby circuits, (3) optional standby circuits, in that order of priority.

B. Requirements to Qualify as an Acceptable Manufacturer and/or Supplier

1. Manufacturer and/or supplier shall have been in the business of distributing and/or installing and maintaining the specific type of engine-generation equipment under the present firm name for at least five years.

2. Manufacturer and/or supplier shall have the capability of dispatching a maintenance or repair truck with a qualified factory trained repairman and spare parts to the job site within four (4) hours of a request for service on the equipment.

3. Equipment shall be the product of a firm which has regularly assembled and/or manufactured such equipment for at least five years.

4. Bidders will not be considered unless there is a local office (within 100 miles of project site), with factory-trained representatives who have been under their direct employment for a period of at least one year. All bidders shall maintain a stock of spare parts to minimize system down time in case of a component failure.

C. Applicable Codes and Standards

The engine-generator set and accessories shall comply with the requirements of the National Electrical Code and NFPA 37 Combustion Engines and Gas Turbines. Set shall comply with NEMA Standards for all other requirements, not specified herein.

D. Rating

1. The engine-generator set rating shall be based on operation of the set when equipped with all the necessary operating accessories (radiator fan, exhaust silencer, air cleaners, lubricating oil pump, lubricating oil filters, fuel priming pump, fuel injection pump, jacket water pump, governor, alternating current generator and exciter regulator).

2. The engine-generator set shall be capable of producing not less than rated (with a 0.8 power factor load) continuously for standby power applications at the altitude and ambient temperature conditions as noted above.

3. On closing of the starting contact, each engine generator shall be capable of accepting

full rated load and stabilizing at rated voltage plus or minus (+/-) 5 percent of rated frequency, within 7 seconds.

4. The engine-generator set shall be capable of accepting full rated load and stabilizing at rated voltage, within plus or minus(+/-) 5 percent of rated frequency, within 6 seconds, and shall be capable of accepting the following loads with no more than 10% voltage dip: Base Load 100 @ 0.8 PF.

E. Service Equipment Sign

Provide a sign at the service entrance main disconnect(s) to identify type and location of on-site emergency power source per NEC® 700.7.

F. Shop Drawings and Submittal Data

1. Submit prior to manufacture dimensioned clearance drawings of the engine generator set including bolting template, earthquake restraints, and location of all stub ups for fuel and electrical connections.

2. Submit prior to manufacture literature describing the engine-generator set including the following data in tabulated form:

   a. Engine make and type
   b. Number of cylinders
   c. Make and type of generator
   d. Generator electrical rating 't0/A, power factor and winding arrangement.
   e. Number and type of bearings (for generator and for engine)
   f. Type of exciter and voltage regulator
   g. Type and manufacturer of engine governor
   h. Certification of factory vibration test report and torsional analysis
   i. Certified engine horsepower curves
   j. Engine generator control and monitoring panel

3. Submit prior to manufacture drawings and/or literature describing the accessories including:

   a. Batteries and rack
   b. Battery charger and wiring diagrams
   c. Jacket water heater
   d. Silencer, exhaust adapter and other exhaust system components
   e. Remote annunciator descriptions and wiring diagrams
   f. Control wiring diagrams

G. Warranty

The complete emergency power system (generator set, controls, and associated switchgear and accessories), as provided by the single source manufacturer shall be warranted by said manufacture against defects and workmanship for a period of five years or 1500 hours, whichever occurs first from the date of system, start up. Such coverage shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment, per the manufacturer’s standard published limited warranty. There shall be no deductibles applied to said warranty.

H. Manufacturer

Engine-generator set and accessories shall be one of the following:

MANUFACTURER	SUPPLIER
Onan	Cummins Northwest, Inc.
Caterpillar	NC Machinery Company
Kohler	Pacific Detroit Diesel Allison, Inc.
FG Wilson/Energy Dynamics	Signal Equipment, Inc.
Mitsubishi/Detroit Diesel	Aptech, Inc.
Simpower/Mitsubishi	Emergency Power Consultants
Katolite	EC Power Systems

I. Engine Specifications

1. Type: The engine shall be a water-cooled, two or four cycle, compression ignition engine of either vertical in-line or Vee-type. The engine shall be provided with an integrally mounted instrument panel including a water temperature gauge, lubricating oil pressure gauge, and engine running hourmeter.

2. Horsepower: Certified engine horsepower curves shall be submitted showing the manufacturer's approval of the engine rating for standby application. The horsepower rating shown shall be a minimum of 1.5 HP/KW when corrected to the altitude and temperature conditions noted in DESCRIPTION above.

3. Speed: The engine speed shall be based on 1800 RPM for 60 Hertz output.

4. Governor: The engine speed shall be controlled by a hydraulic droop type governor with +/- .5% stability at any constant load from no load to full load, 3% droop from no load to full load, maximum transient of 5%, and recovery time of 1.5 seconds upon application or removal of full load.

5. Fuel System

   a. Fuel: The engine shall perform satisfactorily and meet all specification parameters when operating on a commercial grade of distilled fuel oil such as No. 2 heating oil. Diesel engines requiring premium fuels (higher than 40 cetane) are not permitted.
   b. Consumption: Fuel consumption of the engine-generator set with all engine driven accessories shall not exceed 0.09 gallons of fuel per kilowatt-hour at any load between 50 and 100 percent rated load.
   c. The fuel system shall be the normal fuel system used by the engine manufacturer. An engine fuel priming pump, an engine mounted fuel filter and an electric solenoid shutoff valve in the supply line shall be provided. Flexible fuel connections shall be provided at the engine. A manual fuel shutoff shall be included, located upstream of the fuel filters.

6. Lubrication: The engine shall incorporate a gear driven lubricating oil pump for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, cam shaft bearings and injection rocker mechanism. Provide full flow oil filters, conveniently located for servicing. The filters shall be equipped with a spring loaded bypass valve to insure oil circulation if the filters are clogged. A lubricating oil pressure gauge shall be provided.

7. Air Filters: The engine shall be provided with one or more heavy duty, dry type air filters.

8. Exhaust System

   a. Furnish with the engine a critical silencing type muffler and a stainless steel flexible exhaust adapter (at least 18 inches long) for each engine exhaust outlet to the

muffler. The muffler shall be arranged for horizontal mounting above the engine and shall have provisions for supports separate from the engine. The muffler shall be Riley Beaird, Inc., Maxim, or Kittel protected by a high temperature corrosion resistant coating, and suitable for mounting as specified. The muffler shall be fitted with a drain. The muffler shall have a minimum sound attenuation of 35 db at a frequency of 300 Hz.

b. Exhaust manifold, flex and muffler connections shall be bolted flange type.

9. Cooling System

a. The engine shall be furnished with a cooling system having a sufficient capacity for cooling the engine when the engine-generator set is delivering full rated load, with all auxiliaries, in the ambient temperature conditions as noted in DESCRIPTION above. The engine shall be equipped with an engine driven pusher fan, water circulating pump and a thermostatic valve to maintain the engine at the proper temperature level. A water temperature gauge calibrated in °F (or °C) with range adequate to monitor jacket water heater operation shall be provided. The cooling system shall be filled with a commercial grade of Ethylene Glycol containing anti-corrosives and water to 0 °F.
b. The radiator shall be provided with an expansion tank with sight glass, filler cap, and vacuum relief valve.
c. The radiator shall be provided with core guard, belt guard, fan guard, duct flange and mounting hardware with flexible pipe connections between the engine and the radiator.

10. Safety Devices. The engine shall be provided with safety devices to provide automatic shutdown and remote alarm for any of the following conditions:

a. Engine over crank (failed to start)
b. Over speed
c. Low lubricating oil-pressure
d. Excessive engine temperature

11. Starting System

a. Starting Motor: A direct current electric starting system with a positive engagement drive shall be furnished with the engine. The motor voltage shall be as recommended by the engine manufacturer.
b. Jacket Water Heater: A water heater with integral thermostatic switch shall be provided to maintain engine jacket water at a temperature which will allow the engine-generator set to meet the 6 second acceptance of full rated load as specified above in an ambient temperature of 0 °F. The heater shall operate on 277 volts, single phase, 60 Hertz, AC.
c. Batteries: Provide a lead-acid storage battery set of the heavy duty truck engine starting type. The battery voltage shall be compatible with the starting motor. The battery set shall have sufficient capacity to provide one (1) minute total cranking time at 0 °F. without recharging.
d. Battery Box: Provide a high density white or gray polyethylene seamless box (1/4" thick minimum) with removable polyethylene cover. Provide with seismic restraint battery hold down clamps or straps.
e. Battery Cables: Extra flexible, multi-strand copper insulated conductors, #4/0 minimum, with copper ring tongue type terminals for engine, battery type cable clamps for battery.
f. Battery Charger: A current limiting voltage compensated battery charger shall be furnished to automatically recharge the batteries. The charger shall include overload

protection, silicon diode full wave rectifiers, voltage surge suppressors, D.C. ammeter and fused AC. input. The charger shall operate on 120 volts, single phase, 60 Hertz, AC. with an ampere output not less than 5 amperes. The charger shall be disconnected from the battery set during the cranking cycle or shall be capable of withstanding starting current voltage drop. Include a timer switch to provide an equalizing charge to the batteries. Provide an alarm contact for remote annunciation of battery charger loss of output. When located on set mount via vibration isolators.

g. Alternator: Provide a battery charger alternator with voltage regulator.

12. Generator Control and Monitoring Panel

a. The engine mounted control and monitoring panel shall contain, but is not limited to, the following items:
   1) Engine Controls. Engine mode selector switch labeled stop-off- auto-run.
   2) When the selector switch is in the "stop" position, the generating plant shall be locked out. Whenever the selector switch is placed in the "stop" position while the engine is running it shall be immediately shut down.
   3) An "off' position shall be provided to allow a normal shutdown with a time delay to allow the engine to cool down after operating under load.
   4) When the selector switch is placed in the "auto" position the engine generator shall be on standby and shall start whenever a power failure signal is received. When the commercial power returns and the transfer system signals the engine generator to shutdown, the engine shall continue to operate for the time delay period before shutting down in readiness for the next power failure.
   5) When the engine selector switch is placed in the "Run" position, the engine shall start and come up to speed. It shall continue to run until the selector switch is returned to "off' or "auto" position. This position is to be used for testing or for manual operation.

b. Engine Monitoring Devices.
   1) Water temperature gauge Lubricating oil pressure gauge
   2) Engine running hourmeter

c. Generator Monitoring Devices
   1) Voltmeter with seven position selector switch
   2) AC ammeter, 0-300 amp scale with four position selector switch
   3) Frequency meter: (A single selector switch for both the voltmeter and ammeter is acceptable.)

d. Meters shall be dial type with 2% accuracy. At suppliers option digital back-lit LCD displays may be utilized for individual voltage, frequency and ampere meters. A common back-lit LCD display with selector switches may be utilized to display engine jacket water temperature, lubricating oil pressure and engine running hourmeter.

e. Automatic starting control and failure system to control the starting, stopping and monitoring of the engine generator. The engine cranking system shall permit at least four cranking attempts of ten seconds (adjustable) duration with rest periods of ten seconds (adjustable). Over crank lockout shall occur after four unsuccessful cranking attempts. A means shall be provided to allow for continuous cranking cycle if required.

   The failure system shall be provided with amber and red running lights or LED indicators to indicate the nature of the failure. All alarms shall be of the "ring back" type, i.e. anytime the alarm horn is silenced for a failure, the next failure or alarm shall re-energize the alarm horn. The following fail circuitry and alarms shall be provided.

Low water temperature	Amber	alarm only
Battery charger failure	Amber	alarm only
Low fuel level	Amber	alarm only (1)

High fuel/rupture Day tank	Amber	alarm only (2)
Low coolant level	Amber	alarm only
Over speed	Red	immediate shutdown & alarm
Overdrank	Red	immediate shutdown & alarm
Overcurrent (circuit breaker trip)	Red	immediate shutdown & alarm
Low lube oil pressure	Red	immediate shutdown & alarm
High water temperature	Red	immediate shutdown & alarm
Control not in automatic	Red	immediate shutdown & alarm

(1) Combine low fuel main tank and low fuel day tank alarms
(2) Alarms on day tank

f. The alarm horn shall sound upon occurrence of any of the alarms described above. To reset the engine generator after a failure while in automatic operation the engine mode selector switch shall be rotated to the "stop" position then back to the "auto" position. Control panel shall be provided with horn silence button and lamp test switch (or push to test indicator lights). Terminal strip connections shall be provided for the remote annunciator panel and other remote alarm connections.
g. If the generator set is equipped with an emergency off pushbutton it shall be wired to illuminate the "Control not in automatic" alarm when it is activated.
h. Voltage level adjustment rheostat. (Recessed screw driver adjustable).
i. A control wiring diagram shall be permanently fixed (glued) to the inside of the panel showing wire numbers and device names. All wiring shall be number coded at all terminations. Devices shall be labeled with engraved plastic nameplates correspondingly. Wiring shall be neatly bundled or contained within wire ways.
j. A main line molded case circuit breaker with auxiliary alarm contact shall operate both manually for normal switching function and automatically for overload and short circuit protection. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection.

12. Crankcase ventilation filter: Provide Nelson EcoVent recirculation with replaceable filter element.

13. Day Tank shall be provided by Division 23.

J. Generator Specifications

1. The generator shall be 480 volts, 3 phase, 4 wire, 60 Hertz, rated not less than the KW size and voltage noted or as determined under RATING above at 0.8 power factor. The generator rating shall be applicable for continuous service in standby power applications. The temperature rise of the generator shall not exceed 105 °C based on operation at 40 °C ambient when producing its full rated output continuously per NEMA MG1.

2. The generator shall be a single bearing, rotating field, synchronous type built to NEMA standards with class F insulation rating. The exciter shall be brushless rotating full wave rectification exciter with solid state components. The generator shall be coupled directly to the engine flywheel through a flexible driving disc to assure positive alignment.

3. Voltage Regulator. The voltage regulator shall control the exciter field to maintain the generator output voltage to within +/- 1% for all steady state load conditions from no load to full load, and for +/- 5% frequency variation and provide volts per hertz performance in transient conditions exceeding 5% engine speed variation. The regulator shall be a solid state device with three phase voltage sensing and built in electromagnetic interference

suppression. Readily accessible voltage droop, voltage level and voltage gain controls shall be provided. Voltage adjustment rheostat shall be located in the generator control and monitoring panel. Provide fuse protection against overvoltage and overcurrent and protection for the regulator from under voltage and under frequency. Provide protection for the load and generator against loss of voltage sensing.

K. Mounting and Balance

1. The complete unit shall be mounted on a structural steel sub-base with sufficient rigidity to maintain alignment of the generator set. The emergency generator set shall be statically and dynamically balanced at the factory. The peak to peak amplitude of vibration velocity in the horizontal, vertical and axial directions shall not exceed 0.65 inch per second at the main structural components.

2. Provide vibration isolators between the structural steel base and the floor consisting of steel or cast iron top and bottom housings incorporating one or more steel springs with built-in leveling bolts and built-in resilient chocks to control oscillation and withstand lateral forces in all directions. CalDyn RJSD Series, Mason Industries type FEQ, or equivalent by Korfund. Model shall be selected and installed in accordance with the manufacturer's recommendations. Vibration isolators shall incorporate earthquake restraints to meet the seismic zone requirements of the area in which the generator will be installed.

L Remote Annunciator Panel

1. A remote derangement signal panel shall be provided at security office 223 to indicate via a common alarm any of the abnormal conditions described in 2.2L above.

2. The remote annunciator and derangement signal panel shall be mounted in a 4" deep surface mounted enclosures. Provide engraved or silk screen legends for each indicator light and generator. The panels shall be provided with an alarm horn or buzzer, alarm silencing switch and a lamp test switch to test all the lamp filaments simultaneously. Annunciator wiring shall be number coded at all termination (color coding not acceptable.)

M. Fuel, Piping, Exhaust and Ventilation

1. Refer to Division 23. The coordination of the mechanical systems with the generator set installation shall be the responsibility of the generator set supplier.

N. Manufacturer's Instructions

1. Comply implicitly with manufacturer's installation instructions and do not "turn over" engine or energize control system until specifically authorized by engine-generator supplier.

O. Installation

1. Verify access space and routing through the building structure. Remove and reinstall accessories as required.

2. Provide a concrete housekeeping pad under generator. Pad shall be 6" greater in dimension {horizontal minimum) than base of equipment mounted thereon. Pad shall be 18" deep with top 3" above final finished grade. The pad shall be rebar reinforced with #4, 12" o.c., both ways. Mount set via vibration isolators with 1/2" drilled in concrete anchors with 4 1/2" minimum embedment. Mounting system shall be of sufficient strength to

prevent walking or overturning during an earthquake.

3. Bolt the battery box to the floor.

4. Extend the crankcase ventilation discharge tube to the downstream side of the engine radiator.

P. Connections

1. Stub up connecting services to generator set immediately adjacent to base such that exposed systems on floor are not required. Final connections to set shall utilize flexible pipe. (Electrical in Sealtite flex).

2. Provide circuits to battery charger, each heater and day tank(s).

Q. Exhaust Installation

1. Install the muffler and adapter when the Contractor performing the Division 23 work is not required to make this installation.

2. Provide exhaust piping with a water trap and drain cock between engine and muffler. Coordinate work with other trades.

3. Provide calcium silicate insulation with glass fiber cloth fagging wired in place over all interior exposed surfaces of the exhaust system piping and silencer. Provide tie on blanket insulation over flexible connection.

4. Provide wall or roof thimble per manufacturer’s recommendation and flash weather tight.

R. Start Up and Testing

1. Coordinate with supplier representative in performing startup, testing and instruction on systems.

2. Install oil filters and air filters.

3. Fill crank case with engine manufacturer’s recommended lubricating oil.

4. Fill cooling system with specified antifreeze.

5. Fill fuel tank full for testing and instruction periods.

6. Prior to full load test, the set shall be operated at reduced load for a time period as recommended by the manufacturer.

7. Prior to acceptance of the permanent installation, the engine- generator set shall be subjected to a full load (KW) test by the Contractor using a portable load bank (provided by supplier) to fully load the set for a period of two hours. The engine-generator supplier shall have a representative in attendance to conduct the test, make measurements, advice and assure that his equipment is properly operating and protected. Any defects in the equipment which surface from this test shall be corrected. Subsequent to test, the manufacturer's representative shall submit a test report indicating (at 15 minute intervals during test):
   a. Generator load.
   b. Voltage (permanent and calibrated test voltmeter).
   c. Amperage output (permanent and calibrated test ammeter).

d. Ambient air temperature.
e. Coolant temperature.

8. Additional testing shall demonstrate the following:
   a. A simulated power outage shall demonstrate the automatic starting of the generator, transfer of transfer switch (es) and energizing of emergency loads.
   b. Simulated fault or alarm conditions of each item noted to be monitored.
   c. Engine cool down cycle is set as noted.

9. A typed certified copy of the test record shall be forwarded to the engineer and copies shall be included in the 0 & M manual.

10. Corrective measures required shall be made at the expense of the Contractor and the test(s) repeated until all systems are complete and fully operational. Check filters and re-fill all fluids after tests are complete.

11. Notify Architect and Owner prior to scheduling tests.

S. Operation and Maintenance Manuals

1. O & M manuals shall be submitted to the engineer for review sixty days prior to acceptance of the unit. They shall contain step by step instructions for startup and shutdown. The first page shall contain the name, address and phone number of the local representative to be called for service or parts. This shall be followed by complete parts lists by actual ordering catalog numbers. Also shall contain four copies each of test record forms and service record forms for Owner use. These forms shall show the proper interval for test, servicing and replacement of all components, lubrication, filters, anti-freeze, etc., including recommended specifications for all lubricants.

2. The final reviewed manuals shall be turned over to the Owner prior to conducting the instruction and demonstration session. Obtain a receipt for the manuals and forward a copy of the receipt to the Engineer.

3. A single copy of the service record forms, recommended operation and service practices for the unit shall be sealed in plastic and wall mounted in the generator room.

T Instruction and Demonstration

1. The Contractor shall (after one week (minimum) written notification to Architect) conduct a 4 hour instruction and demonstration session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system and the supplier’s representative. This instruction session shall also include step by step instruction on the sequence of startup and shutdown of the unit, following the written operating instructions listed in the O & M manual, and shall include procedures to be followed in the event of audible/visual fault conditions occurring on generator annunciators.

2. Instruction on maintenance procedures shall include proper interval for system tests and duration, replacement interval for fuel, oil and air filters; lube oil and coolant change; interval for fluid level checks (i.e. fuels, oil, lube oil, coolant and battery levels) as contained in the O & M manual test and service record forms.

3. Upon completion of the instruction period, the Owner's representative shall complete the Owner’s portion of the Job Completion Form, copies of which shall be included with the O & M manual and forwarded to the Engineer.

4. Instructions shall be coordinated with those furnished under Division 26 36 23 ***Automatic Transfer Switches***.

U. Fuel

1. After testing and instruction period, refill fuel tank with a full supply of fuel.

END OF SECTION 26 32 00

A. Scope

These standards and procedures apply to purchase and complete installation of automatic transfer switches, fully operation and fully tested. Confirm with UL Standard 1008.

B. Automatic Transfer Switch Type, Rating and Operation

1. All transfer switches shall be of the same manufacturer. Acceptable manufacturers are Automatic Switch Company, Resselectric, Caterpillar, Onan, Kohler, Cutler Hammer, and Zenith. Transfer and retransfer to normal source shall be automatic. Automatic transfer switches shall be electrically operated, mechanically held and supplied with positive mechanical interlocking. The main contacts shall be equipped with a safe manual override capability. The transfer switch shall be UL 1008 listed, and meet the requirements of Tables 21.1, 23.1, 23.2. Wiring and grounding shall conform to all applicable Codes and other Sections of the ***Site Standards***.

2. Sensing and control logic may utilize solid state components mounted on printed circuit boards. Construction shall allow individual function replacement in the field without requiring replacement of the complete solid state package. The control panel shall meet or exceed the voltage surge withstand voltage test in accordance with IEEE/ANSI C37.90.1-2012.

3. Transfer switches serving fire pumps shall be U.L. listed for fire pump service and comply with the requirements of NFPA 20.

4. Transfer switches shall have voltage, amperage and ampere withstand ratings as shown on the drawings.

5. Transfer switches used to transfer from normal to emergency power shall be approved for emergency service, full continuous ampere rated (no derating) with make rating at 20 times and break rating at 6 times full load current rating.

6. Provide fully rated 4th pole for switching of neutral in addition to phase conductors when generator neutral is grounded at the generator, or as shown on the drawings.

C. Accessories

The following accessories shall be provided as a minimum in addition to those normally required for proper operation:

1. Full three phase voltage failure with adjustable drop out and pick up. Set at 80% dropout, 90% pick up.

2. Signals. Two pilot lights for indicating transfer position. Green - normal, red - emergency at transfer switch. Auxiliary contacts for remote pilot lights.

3. Test switch. For simulating power failure.

4. Time Delay Before Engine Starting: Adjustable ride through feature of approximately 0- 10 seconds for start of engine generator and transfer on momentary loss of normal source. Set at 1 second. Include two auxiliary contacts, 1 N.O. and 1 N.C. for use for engine start signal.

5. Retransfer. Adjustable time delay (with emergency failure by-pass) of 0 to 30 minutes for re-transfers to normal. Set at 15 minutes.

6. Generator Condition. Voltage and frequency sensitive lockout relay. Prevents transfer until voltage and frequency of generator have reached preset rating. Set at 95%.

7. Time Delay Neutral - Provide time delay with transfer switch in neutral position and load disconnected from either source, adjustable .2 to 50 seconds, to prevent transfer between sources when sources are significantly out of phase. Set at 50 seconds.

8. Exerciser Clock. Shall set the day, time and duration of the generator exercise period and shall include a selector switch for choosing exercise with load transfer, without load transfer, or for bypassing the exercise period.

D. Enclosure

Each transfer switch shall be enclosed in an enclosure suitable for the environment in which it is located, with front opening lockable door. Provide enclosure suitable for front and side access only.

E. Shop Drawings

Prepare and submit detailed shop drawings for review prior to manufacture. Include the following information: wiring diagrams, dimensions, front view and catalog information indicating complete electrical and mechanical characteristics.

F. Nameplates

Provide engraved phenolic nameplates per 26 00 00. Include name, voltage, phase, source (switchboard fed from) and load served.

G. Mounting

Wall mounted or free standing assembly with housekeeping pad as noted. Bolt to wall and/or floor in a manner similar to that for switchboards and/or panel boards. Verify space available with equipment sizes and code required working clearances prior to submittal of shop drawings.

H. Operation and Sequence Tests

Provide testing of transfer system coordinated with generator set(s) and start control panel to insure proper operation of transfer devices under actual operating conditions. Any automatic transfer switch sensing loss of power shall start the emergency generator set and the set shall continue to run until after all transfer switches have returned to

normal power (engine cool-down timer part of emergency generator set). Monitor and verify correct operation and timing of the following applicable items:

1. Normal voltage sensing relays.
2. Emergency voltage sensing relays.
3. Test switch.
4. Time delay neutral.
5. Engine start sequence.
6. Time delay upon transfer.
7. Interlocks and limit switch function.
8. Timing delay and re-transfer upon normal power restoration.
9. Engine cool-down time delay and shutdown.

I. Operation and Maintenance Manuals

Provide in quantities and format specified in General Requirements. Manuals shall include the following information:

1. Recommended test intervals.
2. Recommended service intervals.
3. Test and service record forms showing proper intervals for tests.
4. Recommended maintenance.
5. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and parts.

J. Instruction

The Contractor shall after one week (minimum) written notification to Architect conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner in conjunction with instruction period for Generator System Equipment, Section 26 32 00. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M manual information regarding the system shall be turned over to the Owner prior to scheduling the instruction session.

K. Warranty

The manufacturer shall warranty the transfer switches against failures which result, under normal use and service, from defects in workmanship and materials. Warranty shall be for parts and labor for two years from date of "Notice of Completion" and for parts for an additional three years after the expiration of the first two year period.

END OF SECTION 26 36 23

A. Scope

These standards and procedures apply to the design and installation of illuminating systems including fixtures, switching and specialized control requirements. Compliance with the Seattle Energy Code, latest edition, is required. Also see Seattle Center ***Exterior Lighting Master Plan (Latest version, 10/8/21)***

B. General Design Criteria

1. Lighting systems shall be designed in accordance with the latest engineering practices and standards, including energy conservation. (LED preferred)

2. Installations shall meet high standards of quality, comfort, and maintainability.

3. Standard circuit breakers must not be utilized for general switching applications. Low voltage switching systems with master lighting controls are required for larger buildings.

4. Lighting layouts must be coordinated with the architectural design so as to control interior and exterior brightness. Non-glare surface finishes with maximum reflection factors and minimum deterioration are encouraged for fixture finishes.

5. Energy Code requirements change frequently and must be the basis of design. Higher lighting levels may be required where specified in the building program or to meet a special visual task. For further details concerning lighting levels, refer to the latest edition of the IES Lighting Handbook.

6. Average maintained foot-candle levels at work surface shall be calculated using an 80% maintenance factor. Refer to the latest edition of the Seattle Energy Code to determine the maximum allowable wattage in each space. Special considerations apply to entertainment venues or sports arenas where the foot-candle reading shall be 150 to 250 foot-candles (average 200 foot-candles).

7. Ease of maintenance shall be a primary consideration in selection and location of fixtures. Access for service by ladders or standard lifts, point load rated and accessible to locations.

8. In the interest of energy conservation, the lowest reasonable ambient illumination level will be encouraged with the balance of the volt-amp allowance used for task lighting. Multiple switching and split circuiting are preferred instead of constant higher light levels. Task lighting should be maximized.

9. Use energy efficient LED light bulbs unless otherwise approved by Seattle Center electricians.

10. Provide ground fault protection on exterior lighting circuits. (Only as required by the NEC)

11. Convenient means must be provided for relamping, cleaning, repairing, or replacing lighting fixtures. Special consideration must be given to fixtures mounted in high or other inaccessible or hazardous locations by providing catwalks or overhead access. During design, consider the ability to drive lifts on the floor to access fixtures for maintenance.

12. Use only astronomical-clocks provided by Seattle Center electricians for outside lighting.

C. Emergency Lighting

1. Provide exit signs in accordance with the Seattle Building Code. Sufficient stairway and corridor pathway lights shall be on emergency lighting circuits to permit safe passage through the building and so a person does not have to pass through an unlighted space to reach an exit. For example, an interior reception area without windows that occupants of perimeter offices must travel through in order to exit a building must have emergency lighting.

2. Provide emergency lighting in mechanical and electrical rooms. Position fixtures over equipment control stations and pathways.

3. All daylightied spaces shall be separately switched.

4. Consider use of spaces and frequency of occupancy when circuiting fixtures and determining which fixtures should be on emergency circuits. Particularly in 277 volt systems, do not put so many fixtures on a single circuit that most of the lights need to remain on in order to maintain emergency lighting circuits.

5. Mount light fixtures in stairways on the wall or on pendants at a height of 8'-0" (not at the ceiling).

D. Roadway and Pathway Lighting (LED preferred)

1. Street lights shall be accessible for maintenance from the street or sidewalk. No lights shall hang over the streets on the Seattle Center campus.

2. Pole-mounted fixtures shall be served from existing street light circuits wherever possible. New services shall be controlled from existing master circuits where feasible. Outside lights shall be controlled by astronomical time clocks or building lighting control systems. Do not use photoelectric controls.

3. All street and walkway lighting fixtures shall be individually protected by an in-line waterproof fuse holder with quick disconnect on the line side of circuit. Configure to break all conductors at first access point. The fuse shall be on the line side of the ballast.

4. Provide grounding terminals in each pole base or fixture.

E. Products

1. Ballasts and LED Drivers

Ballasts shall be a standard product of the manufacturer and shall have been in production for at least three years. Ballasts and LED Drivers shall be acceptable under the Seattle City Light rebate program.

2. Fixtures

Minimize number of fixtures in a building: Minimize amount of lamp parts. Fixtures in bid documents shall not be replaced with substitute unless pre-approved with a sample of the future. Fixtures shall be available locally or available in a reasonable period of time. If from another country, all parts shall be stocked locally. Parts and fixtures must be available within one to two months. All colors shall be standard stock.

a. All lighting fixtures shall be of high quality construction, designed for long life and easy maintenance. The use of high efficiency metallized reflectors is encouraged for energy conservation and maintenance.

b. Fixtures should be designed with simple contours for minimum dust collection.

c. Replacement parts should be readily available and easily secured from the manufacturer/supplier.

d. Glass or plastic diffusers shall be designed with standard dimensions for ready replacement. Enclosing globes, louvers, or diffusing panels shall be of sturdy rigid construction, designed for ease in opening, closing, or removing. Diffusing lens shall be of framed, hinged construction. Do not specify frameless lenses.

3. Exterior Lighting Fixtures

Building entrance, landscape and courtyard fixtures shall be suitable for the location, shall be metal halide and shall be controlled with astronomical time clock. Fixtures shall be heavy duty cast metal construction designed to withstand normal weather conditions. "Sheet metal" type fixtures are not permitted. The primary exterior pole fixture shall be Louis Poulsen Nyhaven Series.

Light Fixture: Albertslund Mini Post (ALB-MIN-PT-42W LED-3000K)
Mounting: Post top: Mounted on 12’ dual round aluminum (DRA-5”-3”)
(See Appendix A for product specification)

4. Controls

a. All lighting controls shall be pre-approved by Seattle Center electricians and, in cases of show and house lighting, the Seattle Center Stage Department also. Any sophisticated controls shall be demonstrated before purchase. All control programming shall be demonstrated and programming literature and detailed programming instructions shall be made available before approval.

b. Do not use systems utilizing a carrier frequency for control.

END OF SECTION 26 50 00

Seattle Center Site Standards

Division 28

Electronic Safety & Security

A. Scope

The following is intended to be modified for particular installations in consultation with the Project Manager and Seattle Center plumbing and fire protection staff. It establishes the requirements for the design and installation of a fire detection and alarm system to include smoke detectors, heat detectors, manual alarm stations, speakers or horns, and strobes. It also establishes the requirements to make network connections between the fire alarm system and Seattle Center's Simplex Fire Alarm Network. Refer also to Section 21 00 00 ***Fire Suppression.*** Also refer to Sections covering electromagnetic door holders, closers, and door controls; fan and damper controls; and elevator recall.

Generally, fire protection systems at Seattle Center are design-build installations by a Contractor with a valid Washington State Contractor's license. Some items in this Section are optional, or require special attention by the designer and review and approval by Seattle Center.

B. General Requirements

Contractor is expected to provide all miscellaneous parts and labor required to install a complete workable system. This includes providing and installing all devices and all necessary conduit and wiring associated with the fire detection and alarm system and providing all necessary modules to make network connections between the fire alarm system and the Simplex system. These connections shall be fire optic or standard telephone wire, only if no fiber is available. The Work includes providing electromagnetic door holders, auxiliary controls and switches (including interposing control and monitor relays), and wiring and raceway to door holders and closers, remote annunciator panels, and one-way voice communication as part of an audio evacuation system.

Provide permanent signs, labels, operational instructions, testing and training.

C. Codes and Standards

Perform all work in accordance with the requirements of the latest issue of the following codes and standards, unless specifically directed otherwise in order to allow designs in excess of the code requirements:

1. International Fire Code with Local Amendments (Including SFD Administrative Rulings)
2. International Building Code with Local Amendments Including DPD Director's Rules)
3. NFPA 71 - Central Station Signaling Systems
4. National Fire Alarm Code (NFPA 72)
5. Washington Administrative Code 296-46B
6. National Electric Code (NFPA 70)
7. Safety Code for Elevators and Escalators (ANSI A17.1) as Amended by DPD Director's Rule 7-2014
8. Americans with Disabilities Act (ADA)
9. Local rules and interpretations required by the Authority Having Jurisdiction, including Seattle Building and Fire Codes.

D. Approval Authorities

The approval authority shall be the Seattle Fire Department and the Seattle Center Project Manager or designated representative.

E. Fire Alarm Vendor Qualifications

The entire Fire Alarm System shall be installed by skilled electricians and mechanics, all of whom are properly trained and qualified for this work and possess the Seattle Fire Department NICET Fire Alarm Level 1 license. The vendor shall design, supervise, program and commission the installed system and shall provide warranty service. The vendor shall be the local authorized representative of the manufacturer. The vendor shall have the ability to provide any replacement part on site within 48 hours, and shall be able to provide a fully equipped and qualified, factory trained repair technician at the job site within four (4) hours of a request for emergency service. This service shall be available 24 hours per day during the term of the warranty.

F. Fire Watch and Fire Suppression System Shutdowns

Where it is necessary to shut down existing fire alarm systems outside of normal working hours (7:00 AM to 5:00 PM) or for longer than eight hours or more, the Contractor shall:

1. Provide 14 days written notification to the Seattle Center Project Manager requesting approval for fire protection system shutdown or functional impairment. Approval from the SC Project Manager is required before any system shutdown or functional impairment.

2. Notify the Seattle Fire Department by
   a. emailing the new Report of Impaired Systems to SFD_Impairments@seattle.gov. Available in Appendix D of these Site Standards or from the SFD website at http://www.seattle.gov/fire/FMO/firecode/firecode.htm
   b. calling the impairment hotline any time day or night at (206) 233-7219

3. Provide a continuous approved fire watch during such a shutdown. The fire watch shall be performed by licensed security personnel, trained in the use and operation of portable fire extinguishers and instructed in how to contact the Seattle Center SC Emergency Services Unit by either radio or telephone. Continuous rounds to cover all areas of the building are required every 30 minutes. A log of the rounds and copious notes shall be maintained. See the sample at the end of this Section.

   If a fire watch longer than a single shift is anticipated, the Contractor shall confer with the Seattle Center Project Manager and develop a plan to ensure that the fire watch period is as short as possible.

   When shutting down the sprinkler system for work, follow these procedures and Seattle Fire Department Administrative Rule 9.06.14:

1. The Contractor shall notify Seattle Center Unit 19 (206) 255-7669 when the Contractor is ready to drain the sprinkler system.

2. Unit 19 will put the building on Hold and put in all bypasses.

3. Unit 19 will contact the Contractor and tell the Contractor that he has permission to drain the system.

4. The Contractor shall notify Unit 19 when the system is drained.

5. Unit 19 will contact Simplex to tell them to ignore supervisory alarms only and to take the building off Hold. Unit 19 will release the bypasses.

6. The Contractor shall notify Unit 19 when the Contractor is ready to re-fill the sprinkler system.

7. Unit 19 will again put the system on Hold and put in the bypasses.

8. Unit 19 will contact the Contractor and give him permission to re-fill the system.

9. The Contractor shall notify Unit 19 when the system is full, at which time Unit 19 will take the system off Hold and release the bypasses.

   With these procedures, the fire alarm and smoke detectors, including those in restaurant hoods, remain operational. Only the sprinkler system itself is affected.

G. Submittals and As-built Drawings

1. Submit complete shop drawings, product date and samples to the Project Manager within 20 days of Notice to Proceed. Once they have been reviewed by the Seattle Center Project Manager or designated representative, forward to the Seattle Fire Department for its approval. Do not start any construction or order any materials prior to acceptance of all submittals by the Owner and the SFD.

2. Submittals, as a minimum, shall include the following:

   Floor plans shall show device layout, raceway routing, riser diagrams, conduit and wire size, wire identification numbers, room and floor identification numbers. More specifically, these documents shall include:

   a. Typical point-to-point wiring diagrams of the control panels, including but not limited to, all control and annunciator panel components, field devices, relays, fans, elevators, and other auxiliary control(s), and terminal cabinets showing all installed wiring (not factory wiring harnesses) and wiring connections. All variances from typical shall be illustrated in separate diagrams. All components shall be labeled.

   b. Detailed mounting installation diagrams of the control panel(s), remote annunciator(s) and keyed signal silencing switch.

   c. Provide battery calculations, speaker, and strobe circuit power drop and power consumption.

   d. Riser diagrams with circuit identification labels, conduit and wire size, and device locations (with room numbers).

   e. Functional response matrix identifying all system responses.

   f. Front view of the control panel(s) and all annunciator panels.

   g. FACP, labels and labeling schemes for circuits, and field devices. Nameplates and messages on the control panel(s) and annunciators shall be provided in actual size.

   h. Wire/circuit legend with circuit identification, color, gauge, wire type and number of conductors.

   i. Raceway size calculations showing % fill in accordance with this specification.

   j. Circuit schedules for speakers, strobes, auxiliary controls, and software/advisory code zones.

   k. Schedule of addressable circuits and corresponding circuit lengths.

l. A Materials Submittal cover sheet identifying all FACP equipment, model number, and quantities.

m. A written acceptance test procedure.

n. A complete fire alarm point list for all addressable devices and circuits to identify the device address (initiating only), manufacturer fixed labels (device type), custom labels and software zone. This list shall also include signaling and all other auxiliary circuits

3. Provide as-built drawings at the end of the project. Refer to other Sections.

H. Products and System Operation Description

1. Activation of a pull station, sprinkler water flow or activation of an automatic sensing device for fire, temperature, flame, or smoke shall cause an audible evacuation alarm signal to continuously sound a SLOW WHOOP signal until the system is reset or the voice override is utilized, cause the visual evacuation alarm devices to flash rapidly until the system is reset, and cause an alarm condition to be transmitted, through a peer-to-peer network connection, to the Simplex or existing Cerberus Fire Alarm Control Panel.

2. The fire alarm system shall, during certain alarm conditions, control doors, fans, dampers, and elevators. It is the responsibility of this specification to provide raceway wire from the FAP to all equipment specified to respond to an alarm. Direct control from detector output contacts is not permissible. As a minimum, the controls shall automatically restore the controlled systems to normal operation after FACP is reset from alarm posture.

3. If there are two or more fans of 20 HP or greater controlled directly from the FACP, then the fans shall "stagger start" with an appropriate delay between each start. The time delay shall be incorporated into the fire alarm system programming. A 10 second delay between fan restart is recommended.

4. The fire alarm system shall cause elevator Phase I operation.

5. The designer shall provide a list of building fans that hall shut down upon activation of any fire alarm device via direct control from the FACP. FACP control shall have priority over all other interlocks and controls. Include all environmental fans that supply and return air and are 10,000 cfm, or 2000 cfm for multi-floor systems. An exception to automatic shut down on general alarm may be necessary where fan shutdown would adversely affect the space. In such case only an alarm initiated from within the zone would shut down the fans in the zone.

Fans that solely exhaust air from a building may in some cases shut down with the supply and/or return fan, and in other cases remain running. An alarm contact is often necessary at the FACP for the building ventilation control system so it may respond appropriately during an alarm. Coordinate design with other Divisions.

Pressurization and other dedicated fire safety fans shall start and be controlled directly from the FACP manual override: Provide on-off-auto manual override switches with priority over local HOA, and other automatic control for all dedicated fire safety fans as identified above. Provide positive feedback fan status at the FACP using a voltage sensor relay located at the load side of the disconnect switch. Confirm that the voltage sensor is specified in the appropriate Division. Provide a red LED for stop and a green LED for run.

6. Supervisory Functions shall be as described below:

   a. Supervise the 120 VAC circuits supplying the FACP.

   b. Supervise the alarm initiating circuits, building signaling circuits, and auxiliary control circuits, except the door circuits, against grounds, opens, and shorts.

   c. Any equipment trouble or malfunction shall sound a local buzzer, turn on an externally visible amber light (LED) in the FACP and cause a trouble condition to be transmitted, through a peer-to-peer network connection, to the Fire Alarm Control Panel.

   d. Any activation of a sprinkler system supervisory switch, shall sound a local buzzer, turn on an externally visible amber light (LED) in the FACP and cause a supervisory condition to be transmitted, through a peer-to-peer network connection, to the Fire Alarm Control Panel.

   e. Upon application or reapplication of 120 VAC power, the fire alarm system shall automatically, without any operator intervention, initialize all circuitry and shall be in a normal operating condition. Systems which require operator intervention to reset manual controls following a 120 VAC restoration are not acceptable.

   f. Each initiating device shall annunciate at the FACP and remote annunciator as a discrete point on an alphanumeric display. In addition, the appropriate software zone LED shall light at the FACP.

   g. Provide descriptive alphanumeric program labels for each system initiating device. For example, for each floor zone device type (if not included in standard manufacturer LCD labels), indicate location and special access notes, such as fourth floor, smoke, corridor by building name, floor level, and room number. , duct detector SF-2, in mechanical room 111,

   h. Provide manual switches and status LEDs at the FACP for fans at the remote annunciator if required. Confer with Seattle Center and the Seattle Fire Department.

   i. The fire alarm speaker system shall incorporate a "one way" fire commander's voice communication or paging system. A microphone shall be placed at the main control panel and at the remote annunciator if requested by the Seattle Fire Department.

7. Locks for cabinets, enclosures, and manual pull stations shall be keyed alike, Simplex “B” unless otherwise approved.

8. Fire Alarm Control Panels (FACP)

   a. The FACP shall be a Simplex microprocessor operated modular in design and equipped with a nonvolatile memory that requires no battery backup. A single FACP shall be able to utilize, in combination, addressable, analog, and 2/4 wire NO/NC detectors. (Plug-in "mix and match" modules or similar architecture is acceptable.)

   b. Seattle Center personnel shall be able to create and modify control software with an IBM compatible PC utilizing MS-DOS based, menu driven, user friendly programming and shall be able to store the programming on a removable computer disk and pre-program a nonvolatile, transportable memory storage device which can be used for replacement in a FACP as the programming backup. All software including

proprietary software shall be provided to Seattle Center as necessary to meet the above requirements.

c. Fire Alarm System shall be wired for "Class B" operation on alarm initiating and signaling (notification) circuits. All end-of-line devices shall be located in the terminal cabinet or the end of the corridor for the zone served. Tee tapping is not allowed on conventional systems.

d. FACP shall incorporate power supplies and all controls for systems except as described elsewhere within the specification. Field control modules are not allowed. Alarm output and auxiliary controls shall not be integrated with detection circuits. All amplifiers shall be located at the head-end (FACP) of the system. All components shall be mounted within a steel enclosure with locked door(s). Door(s) shall incorporate a transparent window for viewing indicator lights, and other pertinent components. Cabinet(s) shall be mounted as indicated on the drawings. Provisions shall be made in or near the FACP for storing connection and schematic wiring diagrams, and emergency operating plans. Transponders for auxiliary control will be approved only for exceptionally large projects.

e. The FACP shall support independent addressable circuits (initiating circuits) originating from FACP mounted hardware, for each floor and zone. No circuit shall exceed 2000 feet in length.

f. The FACP shall support independent speaker circuits (signaling circuits) originating from FACP mounted hardware, for each floor and zone of the building.

Provide a schedule by performing circuit load calculations considering wire length, gauge, number of devices, and FACP specifications. A single circuit shall not be used for multiple floors or zones; however, a number of circuits may be required for a single zone.

The FACP shall support independent strobe circuits, originating from FACP mounted hardware, for each floor and zone of the building.

Provide a schedule by performing circuit load calculations considering wire length, 14 gauge THHN wire, number of devices, and FACP specifications. A single circuit shall not be used for multiple floors or zones; however, a number of circuits may be required for a single zone.

g. The FACP shall support independent door and {corridor damper} control circuits originating from FACP mounted hardware for each floor and zone of the building.

h. Provide FACP spare equipment for 5% (at least two each) spare fully operational speaker, strobe and auxiliary control circuits.

i. The FACP 24 VDC power supply shall be powered by 120 volt AC power. A battery backup system shall be required regardless of the building's primary or alternate source of power, except emergency power is not required for door holders, which may close upon loss of building power. The system shall also have the following requirements:

1) Sealed gelled cell type batteries.

2) 24 hour system backup capability plus 5 minutes of full alarm operation at the end of the 24 hour period. Systems serving as a preaction releasing system require additional backup capability.

3) Charger shall be able to restore batteries to full charge within 48 hours after a complete discharge.

4) Battery and charging system shall be supervised by the FACP, including trouble annunciation of high/low voltage, shorted cell and open circuits.

j. Other FACP features shall include the following:

1) Walk Test: A test mode that causes the systems signal to sound, and a report printed, when a device is activated, or a trouble or supervisory condition identified, followed by a prompt automatic reset of the FACP. The signal sounding shall be capable of being turned off independent of the printing function. This feature shall be available for system acceptance testing/commissioning.

2) Alarm Verification: An activated smoke detector shall automatically reset and then recheck the atmosphere following a 60 second waiting period. The fire alarm system shall not be activated until detection is confirmed following the waiting period. Activation of a second detector during the waiting period shall activate the alarm system immediately. All area and duct smoke detectors shall be enabled with this feature. Provide a disabling feature at the system keypad for system commissioning and Owner confidence testing. Disabling this feature shall be accomplished via the keypad on a zone, or group of zones, basis. Enable the feature following Owner and SFD approval of the system.

3) History Log: The FACP shall log a history of alarm and trouble events for the system in the normal and walk test mode.

k. Other FACP components shall include the following:

1) Alarm and trouble lights located to be visible with the door closed.

2) System reset switch.

3) Trouble buzzer with silencing switch inside locked cabinet.

4) Control relays as required.

5) Supervised switches (one for each listed function) installed to allow a complete test of the system without evacuating the building, recalling elevators, releasing doors and/or posturing for smoke control (i.e. bypass switches).

6) Supervised control switches or relays for use in interfacing with other devices as required.

7) Permanent printed labels for all interactive equipment, zones, switches, controls, and instruction.

9. Voice Communication System

a. Audio amplifiers shall be sized to provide one-half (1/2) watt minimum. Each audio amplifier shall have 50% minimum spare capacity when attached to the speakers necessary to meet audio requirements.

b. FACP shall incorporate a spare automatic backup audio amplifier equal in size to the largest individual amplifier.

10. Manual pull stations shall be addressable double action with breakable element. Reset shall be accomplished with a lock and key. The station housing shall be fire red factory finish. Exposed back boxes shall be provided by the manual station manufacturer and be designed specifically for the application.

11. Smoke Detectors and Sensors

a. Ceiling or area type smoke detectors shall be photoelectric addressable analog with separate base. The detectors, complete with terminating equipment shall be fully supervised and shall not activate alarm due to rapid changes in humidity, or a fan maintenance shutdown, etc. The detector shall be equipped with LED alarm condition indicator light. When exposed back boxes are needed, use round "wire mold" boxes of the appropriate size.

b. Duct type smoke detectors shall be addressable analog photoelectric, in an enclosure with remote indicator and reset. The devices shall include necessary sampling tube extensions. The device shall function uniformly in air velocities of 500 FPM through 3000 FPM. Heat sensor feature is not required. Remote indicating light shall be installed where shown on the drawings, and where detector indicating lights are not readily visible. Remote indicator lights shall be mounted in the hallways or lobby, preferable above the door to the area protected. Device shall be flush or semi-flush mounted with identifying nameplate.

12. Heat detectors shall be combination of fixed temperature and rate-of-rise low profile addressable type and shall be "ordinary" temperature range in all areas except where located in a high ambient temperature area, where they shall be "intermediate" temperature as defined in NFPA 72. Conventional heat detectors with an addressable monitor module may be used where intermediate temperature detectors are required. An indicator on the exposed surface of the detector shall display the actuated condition of the detector. Analog detectors may be used as part of an addressable system.

13. Provide addressable interface modules to interface with non-addressable initiating devices, i.e. water flow and tamper switches. Field control modules are not allowed.

14. Module Alarm Devices

a. Speakers shall be 75/15 Candela (with strobe) re-entrant type with die-cast housing. They shall have multiple wattage taps including 1/8, 1/4, 1/2, 1 watt, and 2 watts. They shall not be used at wattage greater than two (2). All speakers shall be installed at the 1/2 watt setting unless indicated otherwise on the drawings. The grill shall be designed to prevent damage by pointed objects. Speakers shall be suitable for flush mounting in accessible ceilings. For surface mounting use a finished enclosure painted red provided by the manufacturer for use with the speaker. Cone type speakers are not permitted. Speakers located in restrooms and other remote locations where the intent is to alarm only the room where placed should be tapped at 1/8 to 1/4 watt.

b. For outdoor and Environmental Rooms with high humidity and controlled temperature, including coolers and freezers, provide weatherproof back box with weep hole oriented down, and seal conduit penetration with mastic and orient weep holes down.

c. Horn systems shall be multi-tone with 15/75 Candela strobe with slow whoop tone option. Set horns for a slow whoop tone.

d An open circuit in any speaker or horn coil shall not prevent the rest of the audio devices connected to that circuit from operating. If a short circuit occurs, the faulted circuit shall not prevent any other circuit from operating and trouble shall be indicated. If the shorted circuit clears, signaling operation shall be automatically restored.

e. The speaker cable shield or drain wire shall remain intact and be spliced through all terminal cabinets, junction boxes and speakers. The drain wire shall not be grounded for terminated except at the main FACP. Wherever the drain wire is exposed, it shall be wrapped with UL approved electrical tape, in order to avoid shorts or grounds.

15. Visual alarm signal shall operate at 24 volts DC and be equipped with a Xenon strobe flashing light which meet the ADA requirement (75/15 candela minimum). The thermoplastic lens shall be white with red letters. Strobes shall be combined into one unit with speakers (or horns) where appropriate.

16. Provide, furnish, and install Rixon Style (Simplex series 2088) wall mount and floor mount or approved equal door holders. Where it is physically impractical to use the Simplex series 2088 style door holders, LCN series 4040 door closers may be used with owner approval. Coordinate door closers with Section 08 70 00 ***Door Hardware***. Power for door holders shall be 24 VDC and originate from the FACP but shall not transfer to battery power upon loss of 120 VAC

17. Provide relays and wiring from FACP to the elevator machine room as identified on the plans for activation of the elevator phase I recall system. Interposing relays shall be UL cross listed with the FACP.

18. Sprinkler system alarm and supervisory switches shall be provided by and installed in coordination with other Divisions. Wiring and raceway and final connection to the fire alarm system shall be provided and installed in coordination with other Divisions.

19. Fire alarm terminal cabinets and auxiliary cabinets shall be NEMA Type 1 or Type 12 and sized for 20% spare capacity. All panels shall be surface or flush mounted, as determined in consultation with Seattle Center Project Manager, with hinged door and latch with lock. Box and front shall be steel, painted to match wall in finished areas. Backboards in the terminal cabinets shall be construction of fire retardant treated ¾” exterior grade plywood, painted white.

Fire alarm terminal cabinet shall be labeled with a riveted or screwed laminated plastic nameplate indicating "FIRE ALARM TERMINAL CABINET" in 1/4" white letters on a red background.

Provide a wire scheme similar that specified herein inside of the cabinet door. Also, provide a schedule identifying all end-of-line resistors for the zone and their respective locations.

Provide terminal blocks in all terminal cabinets and auxiliary control cabinets. These blocks shall be sized to accommodate wire from 19 to 10 gage.

20. Provide an alphanumeric type remote annunciator with 80 character LCD display, and system acknowledge switch(s). Do not provide zone LEDs. Provide manual override switches for fans, microphone and other options as required for the project. Specify surface, flush or semi-recessed mounting.

21. In addition to spare capacities and equipment listed in other portions of Section 28 31 00, prove and install spare auxiliary relays and control/bypass switches in the FACP cabinet.

22. Smoke/fire dampers shall be provided as indicated in other Divisions. Interface relays shall be provided to operate 120VAC AC smoke dampers from the 24VDC fire alarm system. Fire alarm relay contacts shall be rated at 10 amps. Interface relay to be provided in NEMA 1 enclosure in the proximity of the each terminal cabinet. The interposing relay is to be normally closed and the damper(s) powered open. Upon alarm, or AC power failure, the damper(s) shall close. The relay must be UL cross listed with the FACP._It is the intent to control multiple corridor fire/smoke dampers with a single interposing relay. Show a NEMA 1 enclosure on plan sheets for each zone as appropriate.

I. Execution and Installation

1. Speakers, horns, and strobes shall be mounted on the walls, 80 inches above finish floor to bottom of device. Ceiling mounted speakers are also acceptable and occasionally necessary in open areas where audibility cannot be reached otherwise. In such case, separate wall mount strobes must be shown.

2. Mount pull stations four feet from floor to center of device.

3. Placement of duct detectors must conform to NFPA standards. Coordinate location with mechanical engineer and contractor and Seattle Center Project Manager or designated representative.

4. Conduit, panels, devices and boxes shall be secured by means of expansion shields in concrete, machine screws on metal surfaces and wood screws on wood construction. Attachment with devices driven in by power charge or nail type nylon anchors are not acceptable in lieu of machine screws.

5. Provide all wire ways, wiring, interposing relays, terminal boxes, and relay cabinets for FACP controlled equipment including fans, dampers, doors, elevators, etc. Each type of equipment shall be controlled by dedicated double throw relay(s) located in or adjacent to the FACP or elsewhere in the building

6. General Wiring and Raceway System:

   a. The manufacturer's recommendations shall only be used as a minimum requirement.

   b. All wire shall be new, UL approved and marked, and brought to the job site in original packages. Wire insulation shall be one of the types required by NEC. All wires shall be sized per the NEC for the load serviced. Field wiring for initiation, supervision and signal circuits shall be solid conductor. All wire shall be approved for fire alarm installations.

c. Fire alarm system shall be wired "Class B", device to device, with no splicing unless approve by the Owner. End of line resistors shall be located in the terminal cabinet or the end of the corridor or other unassigned (public) space for the zone served.

d. Colors shall match when possible and the conductors shall be mechanically secured to each other such that no stress shall be applied to the splice.

e. Aluminum wire is prohibited. Stranded wire is prohibited. Wire pulls by powered mechanical means is prohibited. Conduit shall be thoroughly cleaned of all foreign material just prior to pulling the wire or cable. Lubricants shall be compounds specifically prepared for cable pulling and shall not contain petroleum or other products which will affect cable insulation.

f. Low voltage energy limited wiring shall not be run in the same wire ways with or closely parallel to high voltage and/or switched power wiring.

g. Interposing relays shall be used for all switched power loads and shall be located such that the switched power conductors do not run in the same raceway as the interposing relay coil power or any other energy limited low voltage conductors.

h. All wiring shall be contained in metal conduit or raceways dedicated to fire alarm service.

i. Conduit size shall be 3/4" minimum unless approved in writing. Wire mold shall be #700 minimum.

j. No raceway shall be filled such that the maximum filled in excess of 60%. The contractor shall demonstrate by performing fill calculations that the designs complies with this criteria. Exceptions are only allowed when use of existing wire ways is approved.

k. Provide 6x6 inch or larger junction boxes at all junctions where more than three conduits are combined, and for all junctions on the main lateral conduit run for the floor/zone. Use of extension rings to achieve adequate space for a device or junction is not allowed.

l. The raceway system shall resemble a branch and tree configuration where the main run has limited offsets, and branch line run perpendicular to the main run. Each device shall be connected from a junction box on the main FA raceway so that main raceway does not pass through a device back box. Branches shall be provided with sufficient junction boxes so that not more than three unassociated circuits pass through a device back box.

m. Main lateral runs in a zone shall be sized at one (1) inch minimum. All raceways shall run parallel or perpendicular to walls, floors, and ceilings. It is preferred to route the main raceway in the corridor and branch off perpendicular to pick up the devices. Raceway(s) between FACP and terminal cabinets shall not be larger that 2 1/2 inch diameter. Where additional capacity is needed, provided a second, third, or more raceways. As a minimum, provided a single 1 1/2 inch diameter raceway between the FACP and terminal cabinets, regardless of the wire fill.

n. Do not encase raceway in concrete unless specifically called for.

n. No wire run or circuit shall be longer than 80% of the maximum allowable length and power consumption for the wire size and application. No output circuit shall exceed 80% of the maximum load capacity specified by the manufacturer.

o. All wiring for each zone or floor shall be terminated in a terminal cabinet as indicated on the contract drawings prior to running the wires to the fire alarm panel. Provide at least one terminal cabinet for each floor.

p. All solid wire terminations shall be made bare to screw terminals specifically designed for bare wire connection. Cable shield terminations shall be made with T&B "Sta-Kon" (or equivalent) self-insulated, spade lugs where connected to screw type terminals.

q. Wiring in all cabinets and terminal boxes shall be neatly arranged and bundled with tie wraps or equivalent.

r. All junction boxes and covers for the fire alarm system shall be painted red inside and outside except that J-Box covers in finished areas shall be painted to match the wall or ceiling and have a 1/2 inch minimum red dot on the cover.

s. All conduit and raceways shall be color coded by a 3/4 inch red tape band at 10 ft. intervals. Tape shall be Scotch Brand #35 or approved equal.

t. All circuits and conduits shall be identified with labels to include circuit type, zone, floor, wing, and conduit number. Labels must be provided at the FACP, annunciator, terminal cabinets, and auxiliary cabinets. Labels shall be produced using an electronic labeler.

u. All initiating and signaling circuit devices shall be externally labeled with a printed adhesive label approximately 1/2 by 1 inch is size. Identify the circuit and zone, consistent with wire labeling scheme, using a 12 to 14 point font, black ink on white.

J. Record and As-built Documents

Provide operations and maintenance manuals including as-built drawings, catalog cuts, and manufacturer wiring diagrams of all FACP components. Also provide electronic copies. Refer to other Divisions for additional close-out requirements

K. Testing

The completed system shall be subjected to two required tests. The initial test shall be a preliminary test which will be conducted by the contractor and witnessed by the SC Project Manager and the A/E. This test shall be completed after the system has been on line for a minimum of seven days. Should the results not be satisfactory to the SC representatives, then corrections will be made and a re-test will be required at the contractor's expense. The Installer and a factory trained technician for the FACP shall be present for all testing.

The preliminary test shall be in accordance with a written Functional Test Procedure (FTP) to demonstrate and certify proper system operation. The FTP shall be prepared by the contractor and submitted to the Owner for approval prior to the performance of the FTP. As a minimum, the FTP shall provide a detailed method of testing and documenting the following to demonstrate to the Owner that the systems function as intended by the design. The document shall include written test procedure and customized check off sheets for the following as a minimum:

1. All detectors shall be removed from their mounting boxes. A wire shall be lifted from each detector, one at a time to verify proper supervision of the devices.

2. All audible alarm devices shall be removed from their mounting boxes. A wire shall be lifted from each device, one at a time to verify proper supervision of the devices.

3. All bypass and control switches shall be operated to indicate proper supervision of the switch.

4. All valve and sprinkler supervision switches shall be operated to verify proper response.

5. All valve and sprinkler supervision switches shall have one wire removed to verify proper supervision.

6. Each alarm output, detection or supervision zone may be tested for proper response to ground conditions.

7. AC power shall be interrupted for 24 hours by a 5 minute alarm test.

8. All critical fuses shall be removed to check for proper supervision.

9. Test all detectors for alarm operation.

10. Test all strobe units for wiring supervision by removing a wire from the device. Test device for proper alarm operation.

11. Test all alarm sounding devices for proper operation.

12. Conduct audibility tests to determine compliance with the dBA requirements. For replacement systems in occupied buildings, the audibility test shall be conducted after normal working hours.

13. Test all elevator, fan, door holder, damper etc. control functions and circuits shall be tested for proper supervision and operation.

14. Test for proper operation of the All Call portion of the FACP.

15. Test fan and damper control, including manual override and priorities. Coordinate with other trades.

16. Test magnetic door closers, holders, locking mechanisms. Verify appropriate priority with security and access control systems.

17. Test elevator recall, Phase I and II.

18. Test transfer to emergency power, where provided.

19. Test alarm verification function. Confirm no delay occurs if two detectors are activated.

20. Confirm analog sensor adjustable sensitivity function is operable and properly set.

21. Test interface with the Fire Alarm Control Panel.

After satisfactory completion of the preliminary testing, the Contractor shall arrange for the SFD to witness a final contractor executed acceptance test of the system. Final

acceptance will be granted jointly by the SFD and the SC Project Manager or the SC's designated representative. Approval of the Authority Having Jurisdiction shall be evidenced in writing and a copy forwarded to the Seattle Center Project Manager.

The requirements for final testing shall be as requested by the Seattle Fire Department at the preliminary test.

L. Training

The vendor shall conduct a training session with Seattle Center during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Seattle Center Project manager. The session(s) shall be conducted by a manufacturer's representative thoroughly familiar with the characteristics of the installed system.

M. Final Letter and Permit

At the completion of the installation when the as-built drawings have been submitted and accepted, the contractor shall submit a letter to the SC certifying that the fire alarm system is completely functional and conforms to all applicable codes, ordinances, and requirements of the contract.

Submit installation permit from the Authority Having Jurisdiction to the Seattle Center Project Manager.

FIRE WATCH LOG

Name of Fire Watch Person: _____

Area (Basement Storage, Room 111, Etc.	Date	Time	AM/PM	Comments

END OF SECTION 28 31 00

Seattle Center Site Standards

Division 32

Exterior Improvements

A. Scope

These standards and procedures apply to pavements constructed of asphalt concrete to include base courses, leveling courses, and wearing surfaces.

B. Codes, Regulations and Standards

1. All work shall conform to the latest edition of the City of Seattle ***Standard Specifications for Road, Bridge and Municipal Construction and Standard Plans for Municipal Construction.***

C. Design Review and Submittals

1. Preliminary meetings shall cover anticipated vehicular and pedestrian routings, and emergency and maintenance access requirements.

2. The number of courses in the pavement cross section shall be shown on the plans or designated in the special provisions.

D. General Requirements

The finished surface of all asphalt concrete paving shall be dense, uniform in texture, smooth and free of hollows, depressions, roller marks, and surface cracks.

Anyone cutting into and removing an area of the roadway surface s responsible for permanent pavement restoration.

1. All asphalt sidewalks and walkways shall be constructed of 2" of asphalt concrete paving over a 2" compacted crushed rock base.

2. Some walkways that will double as service access ways for maintenance trucks, etc. shall be constructed of 3" of asphalt concrete paving over a 4" compacted crushed rock base.

3. All asphalt roads, streets and driveways shall be constructed of 3" of asphalt concrete paving over a 6" compacted mineral aggregate Type 2 with 6” compacted subgrade(Ref. STD Spec Sec 2-09, 4-04, 5-04, 5-05 & 8-04).

4. All asphalt parking areas shall be constructed of 3” of hot mix asphalt paving over 12” compacted mineral aggregate Type 2 (for top and base course)(Ref. STD Spec Sec 2-09, 4-04, 5-04, 5-05 & 8-04 and STD Plan No 404a).

5. All patching of existing asphalt paved surfaces shall be to match the existing pavement thickness (depth).

6. All overlays of existing asphalt paved surfaces shall be particularly specified for thickness (depth) and class of asphalt.

7. All asphalt to asphalt cold joints that are sealed must be sanded to prevent excess tracking.

8. Temporary cold mix patches must be installed within 3 days.

9. Final pavement restoration must be completed within 30 days of trench closure.

10. Concrete Pavement
    a. Concrete roadways shall be restored to the nearest full panel.
    b. Concrete shall be replaced or patched with concrete per City of Seattle Standard Specifications Section 5-05 and Section 6-02.3.
    c. Any concrete pavement traffic lane affected by the trenching shall have all affected panels replaced.
    d. Concrete pavement shall be connected to existing concrete pavement with dowels and epoxy and restored with a WSDOT approved mix.
    e. Concrete pavement shall be restored consistent with City of Seattle Standard Plan 405A-D.

11. Asphalt Pavement
    a. Refer to City of Seattle Standard Plan for Trench-Pavement Restoration.
    b. Asphalt pavement removal shall be by full depth saw cut or drum grinder.
    c. Asphalt pavement cut widths, based on the final trench width, however, the SC PM shall extend cut limits to competent roadway pavement.
    d. Seattle Center PM shall approve the restoration limits before restoration begins.

Pavement Cut Dimensions

TRENCH DEPTH (FT)	MINMUM CUT BEYOND TRENCH (FT) ALL FOUR SIDES
Up to 4	1.0
More than 4 up to 6	1.5
More than 6 up to 8	2.0
10	2.5
12	3.0
14	3.5
16	4.5
20	5.0

Resource: Utility Cuts in Paved Roads, FHWA-SA-97-049

    e. Cuts in asphalt must be wide enough to accommodate compaction equipment.
    f. Cuts shall be expanded to include joints, panel edges, existing patches, or cracks within four feet of the opening.
    g. Cuts shall be expanded to ensure that new longitudinal joints are not located in a wheel path.
    h. The cut face shall be neat, straight, and vertical. The corners shall be square.
    i. When an existing asphalt paved street is to be widened, the edge of pavement shall be saw-cut to provide a clean, vertical edge for joining to the new asphalt at the time of the placement of the new asphalt. After placement of the new asphalt section, the joint shall be sealed.
    j. When a pavement cut extends beyond half the travel lane's width, the pavement repair shall be extended to include the full width of the travel lane.
    k. Tack coat shall be used on all vertical edges between concrete and asphalt or asphalt to asphalt and on all horizontal surfaces between asphalt layers.

E. Products

The material from which Asphalt and Mineral Aggregate for Asphalt Concrete is composed shall comply to these standards.

1. Pavement, HMA Class ½ Inch shall be specified in the special provisions or designated on the plans.

2. Performance Grade Pinder shall be PG 64-22.

3. Mineral aggregate for Asphalt Concrete shall be manufactured from material meeting the following test requirements: Los Angeles Wear (ASTM Designation C 131) 500 Rev. 30% 35 Max.

F. Execution

These standards shall be complied with in the installation and placement of Asphalt Concrete Paving.

1. The Asphalt Concrete mixture shall leave the Mixing Plant at a temperature between 250 °F and 350 °F and when deposited shall not be less than 250 °F. The mixture shall be transported in suitable dump trucks of sufficient size and shape to easily accommodate the load. When required by the engineer, each load shall be covered with a suitable tarpaulin while in transit to prevent unnecessary heat loss.

2. Preparation of Existing Surfaced Roads/Streets

   a. Before construction of an asphalt concrete pavement on an existing surface, all fatty asphalt patches, grease drippings and other objectionable matter shall be entirely removed from the existing pavement. The existing pavement shall be thoroughly cleaned by sweeping to remove dust and other foreign matter.

   b. A Tack Coat of emulsified asphalt applied at the rate of .02 to .08 gallon per square yard of retained asphalt shall be applied uniformly to all existing surfaces on which any course of asphalt concrete is to be placed, unless its omission is specified.

   c. The existing pavement shall be removed when it has been determined that such pavement is in poor condition, and the crushed rock base shall be reconstructed. This shall be shown on the plans or designated in the special provisions.

3. Preparation of Asphalt Patches

   a. Where existing asphalt concrete pavement upon a granular base is required to be removed due to deterioration and/or settlement, the area shall be uniformly defined in size and shape. The existing asphalt shall be removed by cutting pavement vertically at a sufficient distance of at least 6" over the undisturbed base surface, and then the affected pavement shall be broken up and removed.

   b. The granular base under the removed pavement shall be restored so as to correct the condition that caused the deterioration and/or settlement, and this shall be shown on the plans or designated in special provisions.

   c. Overlay

      i. A street shall be overlaid as indicated when any of the following conditions exist:

         a. Utility installation parallel to the pavement centerline requires half-street overlay from the centerline to the curb line (or edge of pavement) for the

entire length of the utility extension. If the utility trenching encroaches on both sides of the centerline, a full width street overlay will be required;

b. Utility installation consisting of three or more perpendicular (transverse) trenches within 150 feet, measured along the pavement centerline, requires overlay from the curb line to the centerline for the full length plus 5 feet on each end. If a trench extends beyond the centerline, a full width street overlay will be required;

c. Utility installation at an angle to the pavement centerline: requires an overlay from the centerline to the curb line for the entire length plus 5 feet on each end of the utility installation. If the utility trenching encroaches on both sides of the centerline, a full width street overlay will be required;

d. Road cuts are made in a street that has been resurfaced or constructed within the last 5-years

e. Plane existing road at ends of the overlay perpendicular to the roadway for at least 15 feet to provide a flush transition. For half-street or full-street overlays, planing (grinding) of the entire paving area is required (centerline to edge of pavement or edge (gutter or curb) to edge (gutter or curb). All asphalt joints and tapered transitions shall be sealed with AR4000 or equivalent. The joints shall then be sanded while the surface of the AR4000 is still wet to prevent track off from pedestrian or vehicular traffic.

4. Preparation of Asphalt Pavement on Existing or Constructed Unsurfaced Subgrades.

Prior to the first application of asphalt, the entire area to be paved shall be constructed of specified granular base material (crushed rock) which shall be stable and unyielding, be of medium damp condition, be free from irregularities and material segregation, and be true to line grade and cross section. All castings shall be covered and weighted for protection.

Where concrete curb or curb and gutter exist, they shall be protected with a splash board so as to prevent spraying thereon.

5. Miscellaneous Details of Construction

a. Unless otherwise specified, construction of one course or lift upon another shall not proceed until the underlying course is completely cooled and set.

b. Asphalt Concrete Mixture shall not be deposited on a road if the rolling cannot be completed before dark. The placing of asphalt concrete mixture at night shall not be permitted.

c. Where the Asphalt Concrete is to be placed against a concrete or stone curb or gutter, or against a cold pavement joint or any metal surface, a thin tack coat of asphalt shall be applied in advance of the placing. The application shall be thin and uniform. Avoid accumulation of asphalt in depressions.

6. Asphalt for "prime coat" shall not be applied when the ground temperature is lower than 50 °F. or unless otherwise specified. Paving shall not commence unless the subsurface subrade temperature is 50 degrees and rising.

   Paving shall not be done if it is raining.

7. Asphalt walkways, including vacated streets, shall be paved with a 2% cross slope in the direction of travel with no surface to surface changes in level greater than 1/4” in height to meet 2010 ADA Standards to the maximum extend feasible.

8. Testing

   a. Testing and inspection of paving shall be conducted in the presence of the contractor (or representative), and Seattle Center representatives.

   b. The finished surface, when tested with a 10-foot straight edge, shall reveal no deviations in excess of 1/4".

   c. Core samples, 4" in diameter, shall be taken at the owner's discretion to verify total asphalt thickness. When the results are approved, the contractor shall patch all the test holes to the satisfaction of the inspector.

   d. Prior to placing any asphalt surface materials on the roadway, the Inspector shall review and approve density test reports, certified by a professional engineer, for the crushed surfacing base course and the crushed surfacing top course.

   e. Testing shall be performed by a certified independent testing laboratory. The cost of testing is the responsibility of the franchise utility or contractor. The testing and approval by the SC PM does relieve the contractor from any liability for the trench restoration.

   f. Material testing shall be required for trench backfill (native or imported), asphalt, and concrete.

   g. All densities shall be determined by testing specified in City of Seattle Standard Specifications.

   h. Compaction of all lifts of asphalt shall be 91 percent of maximum density as determined by City of Seattle Standard Specifications.

   i. Testing of CDF shall be in accordance with City of Seattle Standard Specifications.

   j. The compaction tests in back filled trenches shall be performed in maximum increments of two feet. The number of tests required shall be determined per square feet of compaction area as follows:
      i. One test for less than 50 square feet;
      ii. Two tests for 50 to 100 square feet;
      iii. Three tests for 100-plus to 300 square feet;
      iv. One test for every 200 square feet over 300 square feet or every 100 lineal feet of crushed rock.
      v. Proof rolling shall be required by the inspector prior to asphalt installation.

END OF SECTION 32 10 00

A. Scope of Work

These standards and procedures apply to the design and installation of a complete underground irrigation system for landscaped areas, lawns, and planting beds.

B. General Requirements

1. All trenches must be deep enough to allow eighteen (18) inches cover for lateral lines, twenty-four (24) inches cover for sprinkler main and quick coupling line, and twenty-four (24) inches minimum on main water line to backflow prevention device.

2. Pipe shall lie side by side in trench and shall be separated by two (2) inches of clean fill. No stacking of pipe in trench is allowed.

3. All sprinkler systems shall have a quick coupler backup system. The quick coupler line shall have full line pressure and not pass through sprinkler PRV (Rainbird 33K) every 50'.

4. Generally, piping under existing concrete or asphalt shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of sidewalks, concrete work and/or asphalt is necessary, it shall be removed and replaced by the contractor. Permission to cut or break sidewalks, concrete and/or asphalt shall be obtained from the Project Manager or the appropriate City of Seattle Department. All pipe and control wires shall be installed inside sleeves under all pavements. Each sleeve shall be 2-1/2 times the diameter of the pipe that passes through it. No bunching of pipes in sleeve is allowed. No fitting on pipe inside of sleeves less than eighteen (18) feet long is allowed. Plug upper end of sleeve that is installed on a slope with duct tape.

5. Only double check valve assemblies (DCVAs) shall be used in low hazard situations and reduced pressure backflow assemblies (RPBAs) in high hazard situations, no other backflow devices are allowed. RPBAs shall be installed above ground in a “Hot Box” and protected from freezing. DCVAs shall not be installed where they are subject to flooding or freezing. RPBAs shall be WATTS 009 or 909.

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6. All mains on upstream side of backflow prevention device shall be Type L copper pipe. All pipe inside or under building shall be Type "L" copper.

7. Design the system for water velocities not to exceed five (5) feet per second.

8. Automatic System

   a. Permanent sprinkler installations shall be designed for full automatic operation and connected to the existing Rainbird Maxicom Central Control System. System design shall take into account time, length and frequencies of sprinkling as well as the local nature of the soil and plantings; and shall be zoned accordingly.

   b. Install a manual shutoff valve to isolate the system from the supply main. Use copper pipe & fittings. All connections between PVC and copper or brass shall be made with a Spears 835 BRA adapter.

   c. Design all sprinkler systems for complete drainage by air pressure.

   d. Piping connections to sprinkler heads shall include triple swing joints, defined as three ½” martex 90 fittings with ½” spiral male adapter connected to Rainbird SPX-Flex pipe, or approved alternate.

e. Sprinkler heads shall be staggered in location. Laterals shall be laid across prevailing slopes as nearly level as possible. Static pressures within any one system shall not vary more than10 percent. Lateral sprinkler lines shall be sized for pressure drops not in excess of 20 percent of the average sprinkler operating pressure.

9. Quick Coupler System

a. Quick coupler systems shall consist of Rainbird 33 DRG quick coupling valves set at maximum spacing of 50'. Installation shall be such that hoses will not cross walkways and roads. Quick couplers shall be located so that they are easily accessible and should be no more than 18" from the outer edge of a lawn or planter.

b. Install quick couplers on ¾" brass triple-swing joints, with brass riser. Connect to PVC with Spears 835 BRA fitting

c. Install all quick couplers in turf boxes with the top of the quick coupler no more than 2" from bottom of turf box lid.

d. Provide Owner with three Rainbird 33 DK quick coupling keys.

10. Plastic Pipe and Joints

a. All plastic to plastic joints shall be solvent-weld joints utilizing appropriate primer and glue for the material. Use only the solvent recommended by the pipe manufacturer. Install all plastic pipe and fittings per manufacturer's recommendations and field direction. Keep all solvent in original can with expiration date legible.

b. All plastic to metal joints shall use Spears 835-BRA adapters. All connections from plastic to metal shall be made with Spears 835-BRA fittings.

c. Allow joints to set at least 24 hours before pressure is applied to the system on PVC pipe.

11. Valves

a. Gate Valves - All zone shutoff valves or other valves not indicated as manual angle control valves, sizes two (2) inches and smaller shall be all bronze model, disc wedge type with integral taper seats and with rising stem. All gate valves 2-1/2 inches or larger and not indicated as manual angle control valves shall be iron body, brass trimmed, double disc sedge type with integral taper seats and with non-rising stems. Gate valves shall be Hammond, with brass cross handles.

b. Automatic Valves - Electric control valves shall be Rainbird GB Series (brass) only.

c. Automatic valves shall be assembled with Spears 835-BRA Sch. 80 adapter connected to a 6" brass nipple on the upstream side, and a Schedule 40 PVC male adapter followed with a PVC Slip-fix on the downstream side. A gate valve shall be installed on the upstream side of zone valve between the 835 BRA adapter and the zone valve.

All threads shall be Teflon taped. No "pipe dope" is permitted.

Automatic valves shall rest on minimum six (6) inches of pea gravel inside the valve box.

12. Backflow Prevention

a. Double check valve assemblies (DCVAs) shall be used where quick coupler, hose bibs, electrical or manual valves are installed downstream or when sprinkler main comes from the basement of a building. Use only Watts 007,707 or Febco 850 double check valves. Refer to City of Seattle ***Standard Plans for Municipal Construction,*** latest edition for vault installation.

Install manual shutoff valves on each side of the double check valve. The device shutoff valves are not to be used as shutoff valves, additional gate valves need to be installed both upstream and downstream of device, before going into irrigation main.

Test cocks shall face away from the wall. The double check valve shall be installed in an accessible area to facilitate maintenance and testing. The double check valve must be protected from freezing.

b. Use only DCVAs or RPBAs for backflow protection.

13. Automatic Controllers

a. All systems shall be integrated with Seattle Center's existing Rainbiard Maxicom Central Control system installed to manufacturer's requirements. Solenoid master valves and flow sensors shall be installed on the mainline downstream of double check valves. Field/Satellite controllers shall be located to facilitate service to this system.

b. All wall mounted controllers shall be mounted with bottom of the controller case a minimum of four (4) feet from the floor or ground level and with top of controller a maximum of six (6) feet from the floor or grounded level. Controllers shall be mounted inside a lockable, weatherproof, vandal proof stainless steel box.

c. All controllers shall be Rainbird ESP- MC Series.

d. Maxicom wire shall be PE-89, 19AWG, direct burial, twisted pair, multiconductor telecommunication wire. Connection shall be made to nearest Maxicom 2 wire run and wire provided to Rainbird Satellite controller. All splices shall be protected by electrical junction boxes.

e. All local and applicable codes shall take precedence in the furnishing and/or connecting of the 110 volt electrical service to the controller. All controllers shall be UL approved and have a resettable circuit breaker to protect valves and transformers against damage due to shorted circuits.

f. Provide metal conduit protection for the 24 volt service wires leading from the controllers and extend at least 24 inches below ground level or six (6) inches below floor level.

g. Wire the controller so that the zones are in chronological order starting with the zone next to the controller.

14. Control Wire

a. Tape wires together at ten (10) foot intervals and lay under to supply line. A minimum three (3) foot coil of wire shall be provided at each valve box.

b. No splices of lead wire between valve and controller. Separate lead or "hot" wire to each automatic valve. Common ground wire is acceptable. All splices shall be in

valve boxes. Splice with Dri-Splice wire connector or equal. An extra control wire must be run to the remote valves of the system but not connected (for future repairs).

c. Minimum size of wire as follows:

Number of Valves Maximum Length & Size of Common Wire

	500	1000	2000	3000
1	14	14	14	12
2	14	14	12	10
3	14	14	10	8

d. Color Code as follows:

Extra Control Wire Orange
Ground Wire White
Lead-in Wire Red

15. Sprinkler Heads

a. Install Rainbird 1800 Series sprinkler heads using three ½" Martex 90 fittings with a ½" spiral adapter connected to Rainbird SPX Flex pipe. Use Rainbird 1800 SAM-PRS Series. Use 6" for all shrubs and garden applications, 4" for small lawn areas and tree pits or another suitable Rainbird product may be substituted in tree pits.

b. Install Rainbird Falcons and Rainbird 5000 Series sprinkler heads with Schedule 80 PVC triple swing joints. All threads shall be Teflon taped. No "pipe dope" permitted. Use Rainbird Falcon for lawns 45' and farther. Use Rainbird 5000 Plus Series for lawns 15' to 45'.

16. Valve Boxes

a. Caron and NDS products are acceptable.

b. All valve access boxes shall be installed on a suitable base of gravel for proper foundation of box and easy leveling of box to proper grade and also to provide proper drainage of the access box. Install a minimum of 2 cubic feet of washed gravel at valve boxes with valves less than two (2) inches. Install a minimum of 3 cubic feet at valve boxes with two (2) inches or larger valves.

c. All valve access boxes shall be provided with proper length and size extensions, wherever required, to bring the valve boxes level with the finish grade.

d. Gate valves and quick coupler valves shall be installed in a Carson 910 or approved equivalent size box.

e. Install remote control valves, manual control valves, and zone shutoff valves in a Carson 1419 or approved equivalent.

f. Install double check valve assemblies of 1 inch or smaller in Carson1220 or approved equivalent.

g. Install double check valve assemblies larger than 1 inch n a Carson1324 or approved equivalent.

C. Products

1. No substitutions will be permitted which have not been submitted for prior approval by Seattle Center's authorized representative. All materials shall be new without flaws or defects and shall be the best of their class and kind. Sufficient descriptive literature and/or samples must be furnished for any materials submitted as "equal" substitutes. All materials shall be guaranteed for a period of one (1) year against material defects and workmanship.

2. Steel Pipe and Fittings:

   Steel pipe or fittings are not allowed.

3. PVC Pipe and Fittings:

   a. PVC pipe shall be virgin, high impact polyvinyl chloride pipe, Type I only conforming to commercial standards CS 207-60, CS 256-63. Type II is not acceptable. Main and laterals shall be schedule 40 PVC pipe and fittings with solvent weld type joints except where risers, valves, etc., require threaded joints. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name, kind of pipe, size, NSF approval and Schedule Number. Install all pipes with fittings of the same schedule and manufacturer.

D. Execution

1. Pipe shall be laid in straight lines, without bends and curves. Use the proper fitting or combination of fittings to change direction.

2. Trenches for sprinkler lines shall be excavated of sufficient depth and width to permit proper handling and installation of the pipe and fittings. Backfill shall be thoroughly compacted and evened off with the adjacent soil level. Selected fill dirt or sand shall be used if soil conditions are rocky. In rocky areas the trenching depth shall be two (2) inches below normal trench depth to allow for this bedding. The fill dirt or sand shall be used in filling four (4) inches above the pipe. The remainder of the backfill shall contain no lumps or rocks larger than three (3) inches. The top six (6) inches of backfill shall be free of rocks over one (1) inch, subsoil or trash. In turf areas the top 12” of backfill must be sand based soil consisting of 85% sand and 15” compost, mixed to a uniform consistency.

3. Testing:

   a. Flush system with all control valves opened with a full head of water.

   b. Hydraulically test main lines to control valves at 200 pounds for 15 minutes. Hydraulically test lines from control valves to sprinkler head at100 pounds for 15 minutes before backfilling and in the presence of the A/E and a Seattle Center Plumbers and Seattle Center Gardeners. The line shall be acceptable with pressure drop of no more than 6 psi in 15 minutes on main and 5 psi on line from control valve to sprinkler head.

4. Record Drawings:

   a. Immediately upon installation of any piping, valves, wiring, sprinkler heads, etc., in locations other than shown on the original drawings, or of sizes other than indicated, the contractor shall clearly indicate such changes on a record set of drawings to be provided to the owner. The Contractor shall also provide the owner with a computer disk (CADD) which shows the as-built condition of the irrigation system.

b. The contractor shall provide a zone control map encased in plastic and mounted next to the controllers. The map shall show main and zone valves and the locations they cover.

c. Before final acceptance the contractor shall set a date for a walk-through and operation orientation.

d. After final acceptance of the completed installation, the contractor shall be responsible for having complete drawings prepared showing all such changes and these shall be turned over to Seattle Center Redevelopment.

END OF SECTION 32 80 00

A. Scope

The work includes furnishing and installation of soil mixes for lawn are as, plantings and tree pits.

B. Submittals

1. Refer to latest edition of ***City of Seattle Standard Specifications for Road, Bridge and Municipal Construction***, Section 9-14.1(A) for required accredited laboratory certified analyses and product sample submittals. **SAMPLES MUST BE OF ACTUAL SOILS TO BE DELIVERED, NOT FROM SOME "TYPICAL" PILES OF SOIL.**

C. Products – Refer to latest edition of City of Seattle Standard Specifications for Road, Bridge and Municipal Construction.

D. Execution

1. Prior to installing soil mix for lawn areas, remove from site, all general debris, woody material, roots, concrete, and stones larger than one and one-half (1-1/2) inch diameter within two (2) inches of the surface. For soil depths, refer to plans and details. Place soil mix in 2 equal lifts and roll to 80% maximum density between lifts.

2. Prior to installing soil mix for planting beds, remove from site, all general debris, woody material, roots, concrete, and stones larger than one and one-half (1-1/2) inch diameter within two (2) inches of the surface. Soil mix for shrubs and groundcovers shall be thoroughly tilled into the top 6 inches of the pre-tilled base of existing soil, except within tree root zones. Tree root zones shall not receive rototilling. Verify tree root zone area with Seattle Center Landscape Crew Chief. Soil depths shall be a minimum of 12".

3. For trees in tree pits and isolated conditions, backfill planting pits with native soil adding no additional soil amendments. For trees in planting areas, amend planting pit soil around trees to match amended soil in planting areas. Remove from site all general debris, woody material, roots, concrete, and stones larger than 1-1/2" diameter within 2" of the surface that is generated from the tree planting process.

4. Finish grading and compaction shall meet the following requirements:

   a. Grade all areas to be planted with a tolerance of plus or minus 0.1 foot.

   b. Grade to uniform levels or slopes between points of elevation. Round surfaces at abrupt changes in levels.

   c. Compact to a maximum dry density of 85% as per the standard Proctor Method, ASTM D-698.

   d. The Landscape Architect or Seattle Center Landscape Supervisor shall have final approval of finish grading before planting.

END OF SECTION 32 91 13

Seattle Center Site Standards

Division 33

Utilities

A. Scope

These standards and procedures apply to the design and installation of water service and distribution mains owned and maintained by the Seattle Center.

B. Design Criteria

All work shall conform to the following codes, regulations and standards:

1. The Uniform Plumbing Code with City of Seattle Amendments, latest edition

2. The International Association of Plumbing and Mechanical Officials (IAPMO) Standards

3. American Water Works Association (AWWA) Standards

4. City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction, latest edition

5. City of Seattle Standard Plans for Municipal Construction, latest edition.

C. General Requirements

1. Service mains will, in general be routed along pre-established utility corridors. Seattle Center Redevelopment or its designated representative will furnish the general line routings and sizes, as well as the location of connection points to the existing system.

D. Specific Requirements

1. Size service mains to meet the larger demands of either the maximum hourly domestic or the combination of maximum day domestic plus fire flow.

2. Determine fire flows according to City of Seattle Fire Department requirements.

3. Yearly average domestic demands shall be the product of a 60 gallon per capita day usage and projected population densities. Maximum day rates shall be taken at 150 percent of this yearly average and the maximum hourly rate shall be set at 250 percent. System losses and unaccounted for usages shall be taken at 25 percent of the domestic demand.

4. Line velocities shall, in general, average 5 feet per second up to a maximum of 10 feet per second.

5. Bury mains 36 inches below finished grade; no more or no less, unless approved by the Project Manager.

6. Gate valves eight (8) inch size and larger shall be fitted with an auxiliary bypass line and valve; four (4) inch size.

7. Gate valves eight (8) inch size and larger shall be installed in a standard valve chamber per City of Seattle ***Standard Plans for Municipal Construction***, latest edition.

8. Maximum hydrant spacing shall be 300 feet. No hydrant shall be located closer than 40 feet to any building wall, subject to City of Seattle Fire Department review and approval.

9. Pipe bedding shall be installed in accordance with City of Seattle ***Standard Specifications for Road, Bridge and Municipal Construction***, latest edition, and ***Standard Plans for Municipal Construction***, latest edition.

E. Products

1. Distribution main shall be Ductile iron AWWA C 151 Class 52 and shall be cement mortar lined per AWWA C 104.

2. Fittings shall be cast iron, AWWA C110 and C111 or AWWA C153 and cement mortar lined.

3. Valves shall be flanged, iron body, bronze mounted double disc gate; over eight (8) inches, valves to have non-rising stems. Maximum operating pressure shall be not less than 175 psi for valves up to twelve (12) inch size.

4. Valves shall be installed vertically in level lines and shall meet AWWA C500 specifications. Flanges shall be faced and drilled, ASA Class 235, for use with full face gaskets.

5. Fire hydrants shall conform to AWWA C 502, shall be manufactured and pattern approved by the City of Seattle and shall be UL/FM approved. Hydrants shall have two (2) 2-1/2 inch and one (1) 4 inch connections, 6 inch riser barrel, 5 inch bottom valve and 6 inch connection to the main and shall be suitable for a working pressure of 150 psi. Hydrants shall be flanged and installed complete with auxiliary valve and box.

6. Post Indicator valve shall be Kenny #641 or equal.

F. Execution

1. All water mains will be installed per City of Seattle ***Standard Specifications for Road, Bridge and Municipal Construction***, latest edition, except that connections to existing water mains owned and maintained by the Seattle Center can be made by the Contractor or other designated Seattle Center representative.

2. Do not make connections to existing water mains without making necessary arrangements with the Seattle Center Plumbing Department in advance.

3. Install new gate valve or connect to existing line - per requirements of City of Seattle ***Standard Plans for Municipal Construction***, latest edition.

4. Install new fire hydrants per requirement of City of Seattle Standard Plans 310.1a or 310.1b.

5. At the entry to buildings and at other locations where a water main crosses backfill, provide a concrete grade beam to support the pipe. Support off the building and/or firm soil.

6. Provide flexibility in piping on unstable earth and provide a flex joint at building entry.

7. Testing shall be conducted in accordance with the City of Seattle Standard ***Specifications for Road, Bridge and Municipal Construction***, latest edition.

   a. All lines and fire hydrants shall be subject to hydrostatic pressure testing after laying and blocking and prior to joint backfilling.

b. Test pressure shall not be less than 50 psi above static, but no less than 200 psi or more than 200% of the working pressure for the class and size of pipe tested.

c The line shall be filled between valves with all air expelled at high points. Test pressure shall then be applied and maintained, for at least 2 hours. Test pressure must be maintained without pumping for 15 minutes with a pressure drop of less than 15 psi.

d. Seattle Center Plumbing department staff shall witness and approve tests.

e. The Construction Coordinator will make all necessary test arrangements with the contractor and notify the following as to date and time of hydrostatic and bacteriological testing.

(1) Seattle Center Redevelopment

(2) Environmental Health & Safety Department

(3) Seattle Fire Department

END OF SECTION 33 10 00

A. Scope

These standards and procedures apply to the design and installation of sanitary sewer systems. Seattle Center's has a combined sanitary sewer-storm water system.

B. Design Criteria

All work shall conform to the latest edition of following codes, regulations and standards.

1. The Uniform Plumbing Code with City of Seattle Amendments

2. The International Association of Plumbing & Mechanical Officials (IAPMO) Standards

3. City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

C. General Requirements

1. Trunk and sub-trunk sanitary sewers will, in general, be routed along pre-established utility corridors. Seattle Center Redevelopment will furnish the general line routings and sizes, as well as the location of connection points to the existing system.

2. Whenever possible, recorded or projected required water use shall be used to determine the quantity of "used water" to be found in the sanitary sewer connection system. Where such data is not available, loadings shall be based on ultimate growth potentials of 140 persons per acre and per capita usage values of 60 gallons per day and shall be added to the domestic sewage loading. Infiltration and inflow shall be taken at 1500 gallons per acre per day and added to the domestic loading.

3. The consultants will verify that the existing system is adequately sized to accommodate the new line.

D. Specific Requirements

1. All lateral and trunk sanitary sewers shall be sized to flow full under maximum anticipated flow while maintaining minimum velocities under average flow conditions. In general, design flow velocities shall be kept within the range of 3 - 8 feet per second.

2. Do not use pipes smaller than 6 inches.

3. Manholes shall be located at all changes in grade, alignment or pipe size; with a maximum spacing of 400 feet. Invert elevations of all pipes entering and leaving manholes shall be identified on design drawings.

4. Allowances for hydraulic losses through abrupt change of direction manholes shall be directly proportioned to velocity head.

5. All connections of one sewer line to another shall be made so as to provide a smooth hydraulic gradient, one to the other under full flow conditions, match spring line of the pipes.

6. Size laterals to carry four times the estimated average flow.

7. Main trunk sewers and sub-trunk collectors shall be sized two times the annual flow.

8. Manholes and safety rungs shall be designed in accordance with City of Seattle ***Standard Plans for Municipal Construction***, latest edition.

9. Generally, use outside drops at manholes. When connecting to drawing(s) holes, inside drops will be considered if the manhole is at least 54" in diameter and the piping will not affect maintainability. Obtain City of Seattle Engineering approval for any inside drops.

E. Products, Materials

1. PVC pipe shall conform to City of Seattle Standard Specifications for Road, Bridge and Municipal Construction, latest edition and shall have rubber gasket joints. . Connections to manholes shall be by a C or GPK manhole adaptor.

2. Do not use corrugated steel or aluminum pipe.

3. Unreinforced concrete pipe (ASTM C14) may be used only with specific approval of the Project Manager.

4. Use reinforced concrete (ASTM C76) and ductile iron pipes (ANSI A21.51) under all roads and installations 5'-0" below grade.

5. Ductile iron pipe shall be used under all buildings and extended a minimum of 2' beyond all concrete covered areas next to the building, including raised planter beds.

6. Transition to other types or sizes of pipe will be made with molded rubber couplings and bushings manufactured by Calder.

7. Pipe and fitting shall be joined by flexible compression rings conforming to ASTM C443

8. Pipe to pipe connections shall be made by gaskets furnished by the manufacturer and installed according to manufacturers' instructions.

9. Portland cement joints are prohibited.

10. Provide clean outs where piping changes direction, at buildings (interior and exterior) and elsewhere where required to maintain the system. Clean outs shall be full line size per SD-C38.

F. Execution

1. Testing

All new lines shall be tested after installation. In general, such tests shall be exfiltration tests or the low pressure air method tests according to the Seattle Standard Specifications. per APWA and WSDOT Air pressure test. Tests shall be conducted in the presence of a City of Seattle Inspector, the civil site engineer, and a Seattle Center representative.

END OF SECTION 33 30 00

A. Scope

These standards and procedures apply to the design and installation of storm detention and retention systems.

B. Design Criteria

The City of Seattle's Storm Detention Design Program is based upon the Soils Conservation Services Hydrologic Technical Manuals for Urban Watersheds. The following are the design parameters needed to design the volume of a storm water detention system with the City of Seattle.

1. Area of the site which is impervious (i.e., paved or buildings -- the more landscaped areas will help reduce the overall storm water detention system volume).

2. Area of the site which is pervious (i.e., landscaped -- larger landscaped areas will help reduce the overall storm water detention system volume.)

3. The time of collection, which is the sum of the time of concentration and the overland flow times to the detention pond/tank (the longer the overall time of collection, the smaller the detention volume will be).

The City of Seattle's design methodology is based upon a storm water release rate of 0.2 cfs per acre (100-year storm) and is not based upon the existing storm water runoff from the undeveloped site conditions. Further, the allowable storm water runoff collected from the site and discharged to the City of Seattle's combined sewer system is reduced if there is uncontrolled storm water runoff. Uncontrolled storm water runoff is defined as storm water that, due to the site grading, is not collected on-site and flows off-site to the City of Seattle's combined sewer system within the adjacent streets.

C. Storm Water Collection

1. Site Storage: The entire site storm water is collected and controlled on site with no storm water leaving the site without being routed through the storm water detention system.

2. Substitution storage: If the site grading or existing storm drainage systems are such that some of the site are drains from the site without being routed through the storm detention system, an equal area adjacent to the site can be collected and detained along with the on-site areas to account for the site areas which have been bypassed. This substitution storage system is used for example, at KeyArena. KeyArena's storm detention system was part of the International Fountain project, with substitution storage used due to the existing grades along the western portion of the International Fountain site

3. Compensatory storage: If a portion of the storm water drainage leaves the site uncontrolled and no substitution storage area is available, the outlet rate of the storm water detention pond is reduced to compensate for this uncontrolled storm water discharge. For example, a representative 12-acre site with just 5% of the area uncontrolled results in the storm water detention volume increasing approximately 45%. The impact of the uncontrolled storm water release is tremendous and should be avoided whenever possible. For public safety reasons, the City of Seattle does not allow uncontrolled storm water traveling over sidewalks, etc. Other site grading alternatives must be considered.

4. Consider additional storm water detention options such as:

a. Reducing the size of the site that is being developed of phase the project. This could require additional permits for the future work but could mitigate the costs in the interim.
b. Providing storm water detention ponds in lieu of below-grade structures.
c. Optimizing use of precast below-grade storm water detention structures.
d. Providing storm water retention (i.e. infiltration of the storm water into the existing ground) if existing site conditions allow.

END OF SECTION 33 40 10

A. Scope

These standards and procedures apply to the design and installation of gas service lines.

B. Design Criteria

All work shall conform to the following codes, regulations and standards of latest edition:

1. The Uniform Plumbing Code
2. International Fuel Gas Code, including Seattle Amendments
3. IAMPO Standards
4. APWA Specifications
5. Washington Natural Gas Company

C. Specific Requirements

1. Gas service lines will, in general, be routed along pre-established utility corridors. Seattle Center Redevelopment or Engineers will furnish the general line routings and sizes as well as the location of connection points to the existing system.
2. Gas piping shall be buried 30 inches below finished grade; no more or no less.
3. The consultant shall specify the type number that will meet the field condition. All pipe bedding shall be Type IV.

D. Products

1. Pipe shall be black steel, schedule 40, welded or seamless, API-5L.
2. Fittings shall be black steel, schedule 40, seamless, ASTM A234.
3. Valves shall be lubricated plug type, semi-steel, 175 pounds WOG.
4. Shop protective wrapping shall consist of coal tar enamel, AWWA C203-62.
5. Field protective wrapping shall consist of coal tar tape, glass reinforced, hot application.

E. Execution

1. Connections to existing and activation of all new lines will be under the supervision of the Washington Natural Gas Co.
2. Welders must have certification from ASME, Section 9, or WABO certification.
3. All natural gas piping shall be install or repair by person with the City of Seattle Gas Piping Mechanic licenses.
4. Testing
   a. In addition to inspection requirements of the Uniform Plumbing Code, all welds shall be inspected. Protective wrapping shall be holiday tested.

b. Piping shall be subjected to a pneumatic line test at 200 psi for 24 hours.

c. Tests shall be conducted in the presence of a King County inspector, and a designated Seattle Center representative.

END OF SECTION 33 90 00

APPENDIX A

Seattle Center Design Guidelines

Architectural Design Guidelines

Landscape Design Guidelines

Public Art Design Guidelines

Signage Guidelines

Lighting Design Guidelines

Exterior Lighting Master Plan

Construction Signage Examples

seattlecenter

Century 21

Architectural Design Guidelines

Century 21 Architectural Guidelines

Table of Contents

INTRODUCTION

Purpose

The Architectural Design Guidelines offer recommendations for elements of continuity and cohesion campus-wide as well as specific recommendations based on the zones of redevelopment identified in the Master Plan.

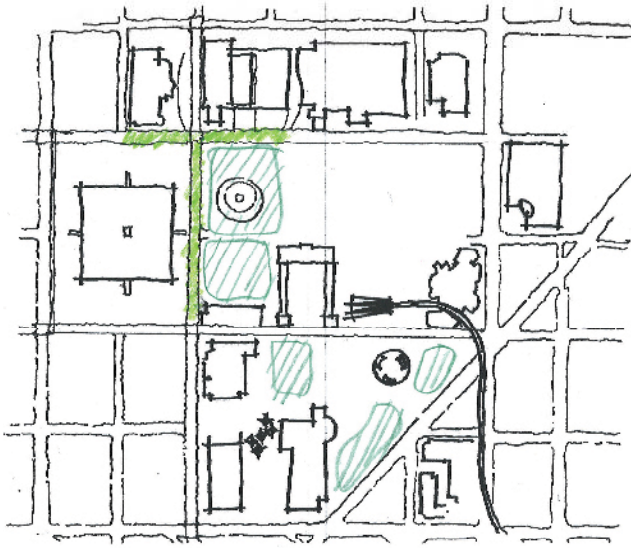
Overview

Seattle Center is home to an eclectic collection of high profile buildings scattered across a 74-acre urban campus. The distinctiveness of its iconic buildings and attractions – the Space Needle, KeyArena, International Fountain and EMP|SFM – is fundamental to the architectural character of the campus. These stand out as elements of uniqueness.

Bold architectural expression on the campus has produced buildings recognized world wide, and there may be occasions for such bold expression in new structures. Simple, straightforward architectural expression also has clear precedent at Seattle Center, such as the World's Fair era colonnades that form the walls of the Intiman Playhouse, Exhibition Hall and elegant connecting canopies. These design guidelines encourage design excellence in architectural concepts and execution of both foreground and background buildings, as the mix is what makes the Seattle Center campus interesting.

There is also great cohesion across the campus with a network of landscaped plazas and open spaces. The diverse collection of buildings is held together by what the Century 21 Master Plan refers to as the "Green Canvas," the connective tissue of green spaces and plazas that serve as the ground plane for the campus. The elements of continuity on the campus begin with the interior streets with mature tree canopies and extend to the open spaces. As major pedestrian routes through the campus, the streets help orient visitors. Large open spaces are also characteristic of the campus. Site furnishings along these signature streets and open spaces are typically part of a language of consistency that helps to define Seattle Center. The campus is the "sum of its parts" and is both eclectic and cohesive as a result of its ongoing evolution from a World's Fair site to a modern, multi-use urban park and cultural destination.

Iconic Buildings and Attractions



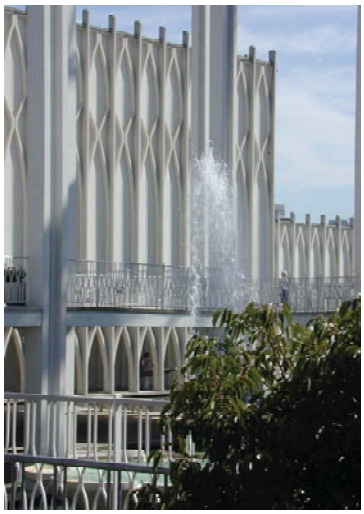
Open spaces and signature streets

ELEMENTS OF UNIQUENESS

Architectural guidelines for future construction at Seattle Center must begin with an understanding of the legacy of its buildings and the spirit that inspired them.

The city's original Civic Center served as the site of the 1962 World's Fair. The underlying street network is still legible on the campus and continues to link Seattle Center and its surroundings. The Civic Auditorium, built in 1927, was remodeled to create the Opera House, and remains today as Marion Oliver McCaw Hall, completed in 2003. The 1939 Armory is today's Center House. The architectural legacy of these buildings and their enduring physical fabric is still visible through subsequent renovations and upgrades. One example is the layering of architectural styles atop a partially obscured art deco façade on Center House.

More legible and visible on the campus today is the architecture of the 1962 World's Fair. Even with the renovations and additions, the architecture of that time sets the tone for the campus with the Space Needle, Monorail, KeyArena, International Fountain, Pacific Science Center, Northwest Rooms, Exhibition Hall and Intiman Playhouse. Other elements, such as the colonnades, were used to elegantly link together buildings at the Fair. This collective architecture represents a clean, light aesthetic from an optimistic and ambitious time with unique forms and a distinct spirit.



Elegant
Optimistic
Vertical

White
Clean
Green

Seattle Center -- A Landmark of Optimism
Gustafson Guthrie Nichol Ltd

Redevelopment efforts since the 1980's have produced a new generation of buildings. The earliest of these include new venues for performance, including the Seattle Repertory Theatre's Bagley Wright Theatre (1983) and Leo Kreielsheimer Theatre (1995), and Seattle Children's Theater (1992) followed by Fisher Pavilion (2001), the EMP|SFM (2000), and Marion Oliver McCaw Hall (2003). The EMP|SFM added a unique contemporary and organic form to the existing architectural icons. Fisher Pavilion was an urban design move as well as an architectural move, opening up views to the International Fountain and connecting outdoor and indoor space with large operable doors. Marion Oliver McCaw Hall transformed the old Civic Auditorium/Opera House with expansive glazing along a new pedestrian entry to the campus, Kreielsheimer Promenade.

Existing structures such as the Exhibition Hall, Playhouse and Snoqualmie Room have remained unchanged on their exteriors, but have been repurposed for resident organizations such as Pacific Northwest Ballet, Intiman Theatre and VERA. The reuse and revitalization that most reflects and celebrates the vision and mission of Seattle Center was the renovation of the International Fountain. Decades of visitors loved to view the elegant water feature in the heart of the campus, but at a distance, as the fountain was a series of individual water shooters surrounded by sharp, slippery rock. Using innovative, sustainable technology and universal design concepts, in 1995 the International Fountain was transformed into a welcoming and barrier-free interactive water experience for all visitors, not just to watch, but to participate in.

The architectural legacy of the early Civic Center buildings is "solidity," which makes the "bones" of these buildings suitable for major remodels.

The most recent generation of buildings on campus connects outside and inside, as shown here at Fisher Pavilion.

The architectural legacy of the Worlds Fair is a body of unique forms from an optimistic era. These structures are expressive, bold and elegant.

McCaw Hall is another example of the most recent generation of campus architecture.

ELEMENTS OF CONTINUITY

Many functional elements exist on campus and work together to provide consistent amenities for Seattle Center visitors. The quality, arrangement and relationship of these elements contribute significantly to the appearance and comfort of the campus. These elements deserve appropriate care and maintenance over time.

Site furnishings present an opportunity to help unify the campus and establish a design vocabulary for the public realm with a similar look and feel, especially on primary pedestrian routes and open spaces.

Seattle Center has Campus Site Standards and Specifications, which provide greater detail to ensure consistency in the design, construction and maintenance of site features on campus. The Seattle Center Redevelopment staff oversees the Site Standards and coordinates with other Seattle Center work divisions on maintenance and upkeep of site features. The Site Standards address the preferred dimensions, type, model and color for a range of common site features including:

- Paving material
- Light fixtures
- Pedestrian streetlights
- Benches
- Trash receptacles
- Bollards
- Bicycle racks

Elements of continuity on 2nd Ave N

CAMPUS-WIDE DESIGN GUIDELINES

A GREAT GATHERING PLACE

Campus character and legibility

New buildings and elements should be sited and conceived to reinforce the cohesion of Seattle Center as a campus.

Consider new construction in relation to the overall campus, as part of an ensemble of buildings and spaces. Some structures should be background elements, especially in light of the many strong building forms already on the campus.

Treat existing architectural icons respectfully, because simplicity and structural expression are halllmarks of the 1962 World's Fair architectural style. Any additions to these buildings should be carefully considered.

Consider views and patterns of movement when siting new buildings and structures, with clear entries and sight lines.

Be clear about which building and site elements are specific to a particular project, versus elements of continuity that are common to the language of the campus.

The crosswalk at the Broad Street campus entry leads to the Center House, but the view is partially blocked by the Fun Forest building.

A synergy of uses

Locate active uses along public edges of buildings, with maximum transparency and generous entries.

Building program should be developed to best support the Center's mission, with uses located to foster and increase interaction between functions.

Consider the ability to open or subdivide spaces, with multiple entry points.

Fisher Pavilion's fully operable overhead doors allow flexibility and the ability to connect outdoor and indoor activities.

Flexibility

Design buildings and spaces to accommodate the wide range of uses and users, that are comfortable and attractive during day and evening hours, across the seasons, during festivals and during quiet periods.

The architecture should allow for diverse uses over the life of the building.

Locate power and other utilities to allow multiple uses.

BUILDING DESIGN

Design Concept

New buildings and architectural elements should have a clear, cohesive concept that is reflected in building form, siting, facade, details, and related site elements.

Even with the very diverse range of buildings and structures on campus, all the successful architecture has a strong and legible concept and an integral consistency. This is true for the quiet or connective structures as well as the iconic structures.

This Victor Steinbrueck sketch of the Space Needle illustrates the powerful simplicity of a design concept. Its elegance comes from the proportion and striking verticality.

Relationship of building and open space

Provide physical and visual connections between ground level interior uses and adjacent exterior routes and spaces where appropriate.

Consider adjacent open spaces and circulation in formulating buildings on campus. Buildings contribute activity to adjacent spaces, and may include integrated weather protection or sheltered spaces, as well as views from grade level and upper level windows.

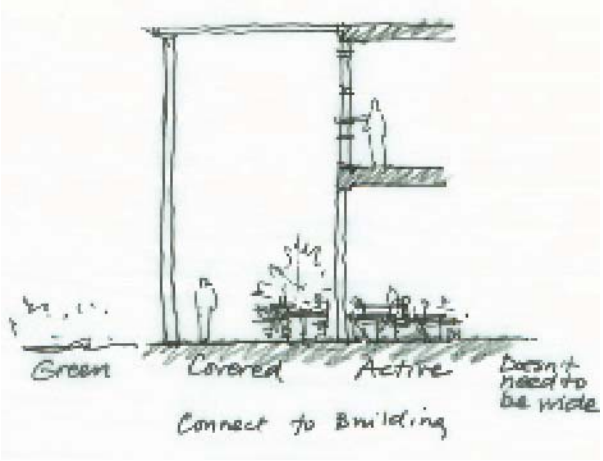
Massing

Consider proportion and scale, shading and shadowing, adjacent users, relationships to other buildings on the campus, and the way buildings meet the ground and sky.

Massing should be appropriate to the typology and function of the building.

Any new building should be a good neighbor to nearby open space and existing buildings.

Respect significant view corridors.



Buildings adjacent to open spaces can provide weather-protected transitions with related activities and multiple layers of overlooks.

Facade treatment

Create a well-proportioned façade with quality materials, highlighting areas of internal activity on the façade with ample glazing.

Facades at Seattle Center will vary with the uses but where possible, should offer transparency and interest to passers-by, revealing the activities inside.

Where blank walls are unavoidable, consider treatments such as green screen or art. In other cases, high quality materials, proportions, and detailing are critical.

Recent architectural vocabulary tends to use large amounts of glazing and steel. The transparency helps activate the campus and blur the distinctions between outside and inside.

A green screen with lush vegetation is used to enliven a blank wall at the south end of Kreielsheimer Promenade.

Architectural elements

Handrails, canopies and other architectural elements should be based on the language of the associated building, but can also take cues from other buildings on campus, where appropriate.

Consider the design language for architectural elements already established at Seattle Center as unifying elements, especially where they are part of the broader campus. Such elements include stairs and handrails, concrete edges and partial height walls, drainage treatment, lighting, and canopies.

Handrail leading down Fisher steps is simple and modern.

Materials

Use high quality materials, appropriate to the use and character of the building. Consider the expressive nature of materials in the spirit of existing buildings at Seattle Center.

Glass, steel, and masonry are favored at the Seattle Center for their simplicity and durability.

Pay attention to the quality of the ground plane, with good paving material, textures, and patterning where appropriate.

Many materials are used at Seattle Center, including metal, concrete, glass and brick. The selection of material is often fundamental to the building design. The Space Needle and EMP are two examples of buildings that highlight the properties of structural and architectural materials.

Materials on campus - metal, concrete, glass - express their structural and sculptural properties

World's Fair architectural columns

Detailing

Thoughtfully detail materials, considering the expression of joints and edges and a high level of care and craftsmanship.

Consider the spirit of World's Fair architecture for detailing that reveals structural forces and the nature of materials. The cruciform columns, pictured below, illustrate an expression of the structure in the shape of the columns and in the way that they meet the ground.

Expressive drain covers are elements that give interest to the ground plane.

Use quality materials on the ground plane as well as the building

ENTRIES AND EDGES

Campus entries

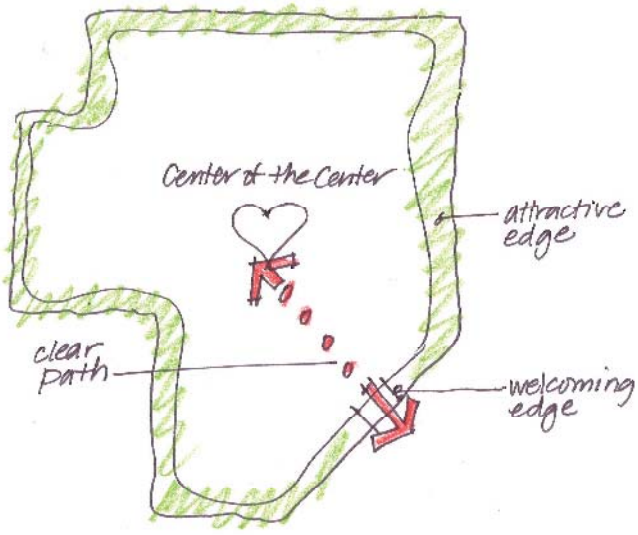
Arrange and design buildings, open spaces and site elements to create welcoming entries to Seattle Center.

Respond to the context and site specific conditions to make a clear and welcoming entry. The entry conditions vary, but should be treated with quality materials that denote arrival at the campus.

Consider the needs for site elements, and arrange them thoughtfully (Bolllards, guard booth, security cameras, paving, ATM machines, etc.)

Consider the ability to limit access to the entry area during festivals and the flow of high pedestrian volumes through the entries during festivals.

Prioritize pedestrian safety, especially where vehicles share entries.



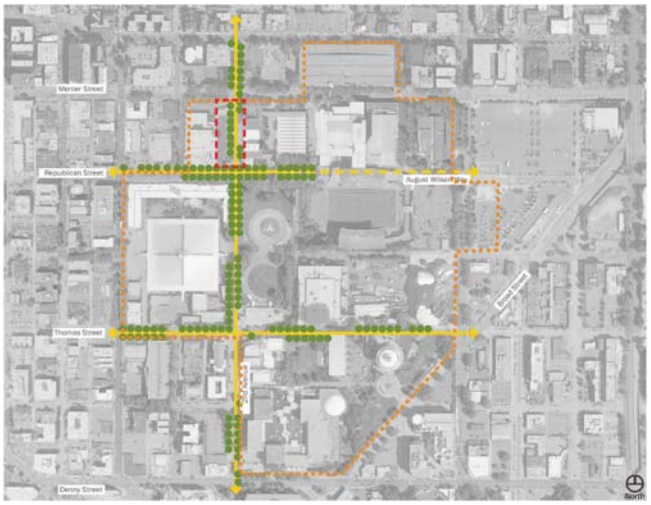
The Century 21 plan reinvigorates the "center of the center". Successful implementation of this approach requires enticing movement to the center via attractive, permeable edges and clear routes into the heart of the campus.

Streetscape and edges

Create a comfortable and welcoming pedestrian environment along the perimeter streets as an attractive edge that strengthens the identity of Seattle Center and celebrates "crossing the threshold" into a distinct place.

Streetscape design should provide a distinct edge to the campus, but not feel like a barrier.

The mature London Plane trees from the 1962 World's Fair line much of the campus' perimeter pedestrian pathways and streets and should be maintained and reinforced as recognizable defining elements of Seattle Center.



Studies of trees, pathways and open space connections through the Seattle Center campus and adjacent neighborhoods.

Neighborhood connections

Link the campus and the surrounding neighborhood with visual and physical

Continue the practice of softening the edge conditions by tearing down former walls and gates that line the perimeter and replacing them with more visual and physical openness that emphasize neighborhood conditions. These connections, like the edge conditions, will vary in design character based on the different conditions around the perimeter of the campus.

Major arterials surrounding the campus on all sides ensure connections between Seattle Center and the larger street network.

Weinstein A-U, GGN Ltd

WALKABILITY AND PEDESTRIAN SCALE

Circulation

Provide a variety of pedestrian routes that draw people into and through the Center.

The former street grid forms a network of pedestrian routes through the Center. Establishing a hierarchy of main north-south and east-west routes, including major open space and exterior plaza will create legibility for navigating the campus. The August Wilson Way plan is an example of creating a main east-west axis.

Circulation routes range from wide, formal interior "streets" to intimate pathways.

Use design clues to assist visitors in navigating to and through buildings.

Use clear and legible signage and wayfinding throughout campus grounds to ease circulation.

Connecting to Transit

Encourage use of transit by making connections easy to find and comfortable to use.

Near key transit stops, integrate seating and weather protection canopies in adjacent buildings, where possible.

Provide sufficient lighting and good sightlines for pedestrians, whether commuters or patrons, who use the campus as a through-route. Active uses and lighting along routes in the evening create a sense of safety and security after events and performances .

Seating, integrated into the base of the sculpture, provides a welcome resting spot for visitors waiting for transportation

SUSTAINABILITY

Thinking campus-wide

Look for opportunities to incorporate sustainability on a larger scale, considering drainage and energy use campus wide.

The campus offers potential for bigger-picture thinking regarding stormwater management and carbon footprint reduction that should be considered early in any design process.

Individual projects should make incremental ecological design progress toward these larger scale goals.

Impervious surface

Increase permeable surfaces on the campus, utilizing sustainable approaches to paving and ground plane design.

Consider design strategies including green roofs, planted walls, rain gardens, and permeable pavement.

Permeable hardscape offers additional functionality for large events and major festivals without compromising environmental goals.

Rain gardens incorporated into the Broad Street Green accommodate storm water in a visible, attractive manner

Energy use

Incorporate sustainable design strategies and systems in new buildings that reduce energy use.

Consider energy use reduction in shaping the building form. Use daylighting strategies to reduce the need for artificial lighting where possible.

Meet or exceed the energy code, selecting glazing systems and HVAC systems that reduce energy use.

Building strategies and materials

In selecting materials and systems, consider life-cycle costing, sustainable fabrication and embodied energy.

Look at building envelope systems and incorporate green technology.

LEED™ Silver or better curently is the goal for all projects on campus.

Green walls are becoming a common language on the campus, increasing greenery where large blank walls occur

Education

Recognize opportunities for making sustainable solutions visible as a showcase for design excellence.

Seattle Center's sustainable strategies will be seen by millions of visitors and offer and opportunity to demonstrate environmental leadership. As a campus with resident arts and science organizations, make full use of campus resources to showcase innovative and beautiful sustainable solutions.

UNIVERSAL DESIGN

Embrace accessibility in all design decisions

Incorporate universal access as a fundamental part of building and site design.

Design decisions, ranging from large scale planning to the level of the detail, should incorporate the spirit of accessibility, understanding that a philosophy of inclusiveness makes a better environment for everyone. Accessibility offers access, circulation, full use of buildings, facilities and programs to the public.

Ramps are used by visitors in wheelchairs, families with strollers and young children.

Provide access for all levels of mobility

Integrate ramps and railings with architecture and the landscape in strategic locations.

Accessible routes and entries should coincide with the priimary routes and entries for the general public to the extent possible.

Utilize the full range of sensory experiences

Enrich the environment to engage all of the senses.

Consider ways to expand the range of senses in design, including tactile elements and sound. Textures and sounds may be used to improve wayfinding for those with limited sight, as well as making a better environment for all.

Universal Access creates dynamic opportunities.

Emphasize comfort for all

Be generous with seating and weather protection.

Provide a variety of places to rest in order to make the wide variety of visitors comfortable. Consider the details of seating so that people can sit and stand easily. Comfortable waiting places are especially important where people wait for transit, buses, taxis or pick-up by vehicles.

The sound of water can help people orient themselves.

SITE FURNISHINGS

Seating and benches

Comfort is important to Seattle Center visitors, and a variety of places to sit should be offered throughout the campus. Where part of the signature streets or open spaces, seating should be an element of continuity on campus, with a common attitude toward color, and aiming toward consistency over time.

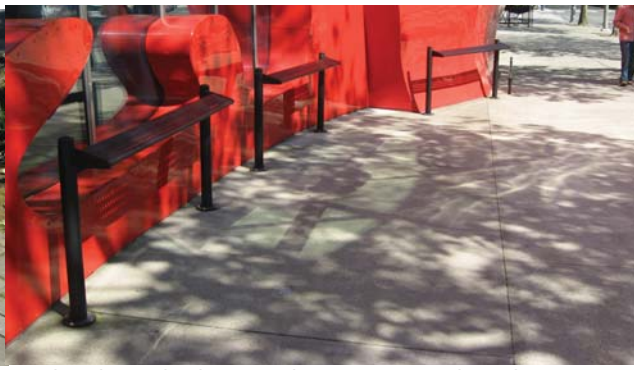
Coordinate the existing free-standing benches by repainting with a consistent color palette and work towards a single standard that can be phased in over multiple purchasing cycles.

Consider integrated seating as part of topographic changes, edges of space or as part of a building edge.

Locate seating where there are opportunities to watch activities.

Consider providing weather-protected seating areas.

Freestanding benches have been acquired over the years; matching the colors would help them serve as elements of continuity.



These lean rails adjacent to the EMP are particular to the expressive nature of the building.

Integrating benches into landscape and building edge conditions is encouraged.

Benches enhance design concepts, emphasizing ground lines or placed as objects in a space.

Other furnishings

The many functional objects and other site furnishings on campus should be thoughtfully selected and located to add to the comfort and attractiveness of the visitor experience.

Trash receptacles: A new standard, which provides recycling as well as trash, has been selected and phased implementation has begun.

Utilities: Continue established practice of inconspicuously supporting "festival utilities" throughout the campus, cleanly integrated into buildings or the landscape.

Bollards at buildings: Security concerns have resulted in bollards added to protect perimeter buildings on campus. Where the bollards are associated with particular buildings, their design should respond to the particular building. KeyArena and the Space Needle bollards have set a language with the spherical bollards that are part of the architectural ensemble.

Bollards at campus entries: Entry bollards, both fixed and hydraulic, should be simple and unobtrusive. Remove temporary concrete bollards as quickly as possible.

Bicycle racks: High volume bicycle racks should be an element of continuity through-out the major entries and streets, with some exceptions, such as the individual bicycle racks shown below that are adjacent to EMP|SFM.

Trash receptacles encourage same style over time.

Electrical equipment is needed for festivals and other outdoor uses.

Bollards can be of a campus language or more specific to particular buildings.

Bicycle racks may be distinctive to adjacent building architecture if appropriate.

Consider other site furnishings to add to the character and function as elements of continuity

ZONE SPECIFIC DESIGN GUIDELINES

In addition to the general guidelines, this section offers specific place-based recommendations to the zones of the campus that were identified as opportunities for redevelopment in the Century 21 Master Plan. The zones are Key Arena, Theater District, Memorial Stadium, and Center of the Center. The remaining areas of the campus, the International Fountain/2nd Ave N zone, and Broad Street Green zone are also discussed.

ZONE SPECIFIC DESIGN GUIDELINES

KEY ARENA ZONE

A new building will hold the corner at 1st and Republican, and its smaller footprint will increase visibility into the campus

1st Ave. N. streetscape is characterized by the tree canopy.

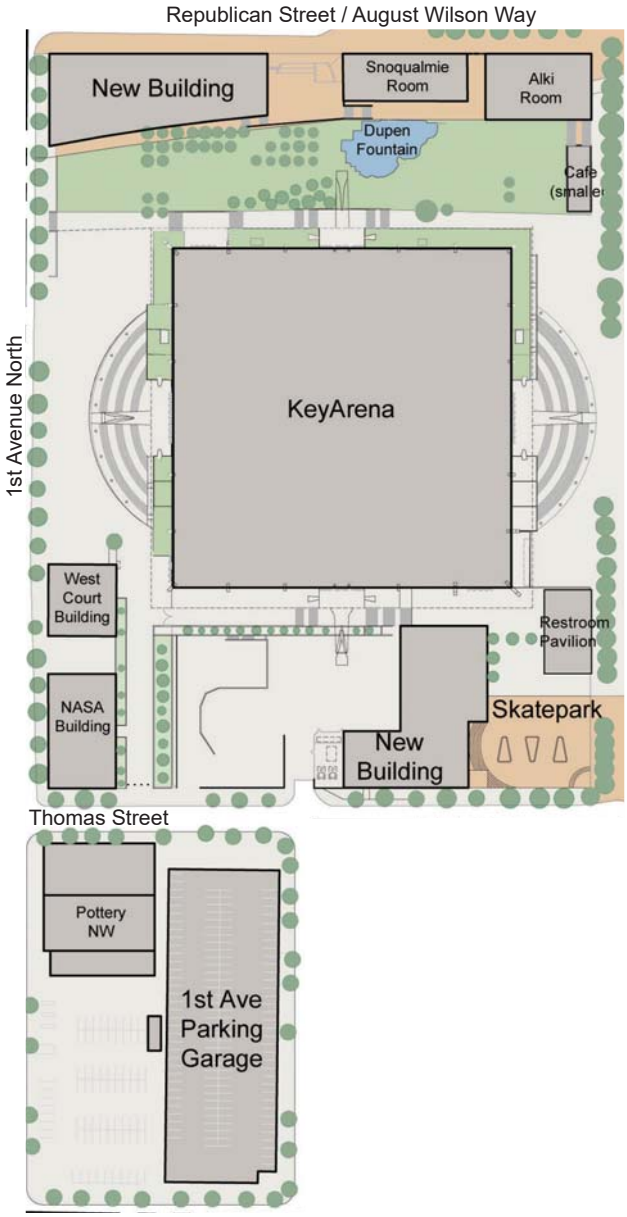
KeyArena Plaza is a primary entry for the venue as well as a major western entry for the campus.

Reinforce 1st Ave. N. as an urban street, with buildings and activities pulled to the sidewalk (this will make the plaza space more distinct in contrast).

Pedestrian access exists around KeyArena, but is challenging at the south edge and not clear at the north end

Entries at far north are an important connection point for the neighborhood

Entry at the Snoqualmie Room is informal and a finer scale that reveals a series of multi-level spaces.



Pull the feel of Seattle Center out to Republican St. between Warren Ave N and 1st Ave N. with streetscape elements and site furnishings.

Transit connections are important at 1st Ave N and Republican St. and will be more so with the new streetcar terminus.

Design to assist visitors in finding their way to transit stops and provide a safe, comfortable environment for waiting.

Placemaking is important at the corner of 1st Ave N and Republican St– it should include recognizable elements of Seattle Center.

Service entry to KeyArena should be discreet.

Hold the edge of Thomas St with a new building and an urban, landscaped edge that blends with the mix of uses in the neighborhood and Skatepark.

Use design clues to help pedestrians know which routes are through routes and which do not lead to the center of the campus.

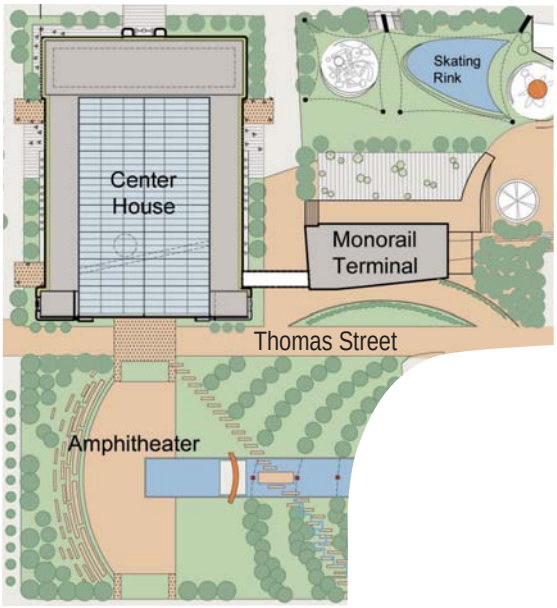
CENTER OF THE CENTER ZONE

Open up the Center House with generous operable glazing, providing associated open spaces on all sides that interconnect with interior uses.

Create the feeling of "front doors" on both the north and the south sides of Center House.

Increase clarity of all pedestrian links to Center House.

Make use of the topographic changes to offer multiple views of active spaces.



Because the monorail terminal is a prime arrival point to the campus, encourage an improved connection of the terminal to the Thomas St. area.

Create a multi-functional activity space north of the monorail terminal that is playful and useful during all seasons of the year. Recognize the relationship of significant open space to the north in the design of this space and its elements

Open up the connection of the Mural Amphitheater space to the east, allowing increased visibility for Center House and a more integrated amphitheater space.

Highlight the Mural as a significant piece of the original World's Fair art program.

THEATER DISTRICT ZONE

Mercer St. over time will have two-way traffic and should become a more pleasant walking environment with generous sidewalks on both sides of the street.

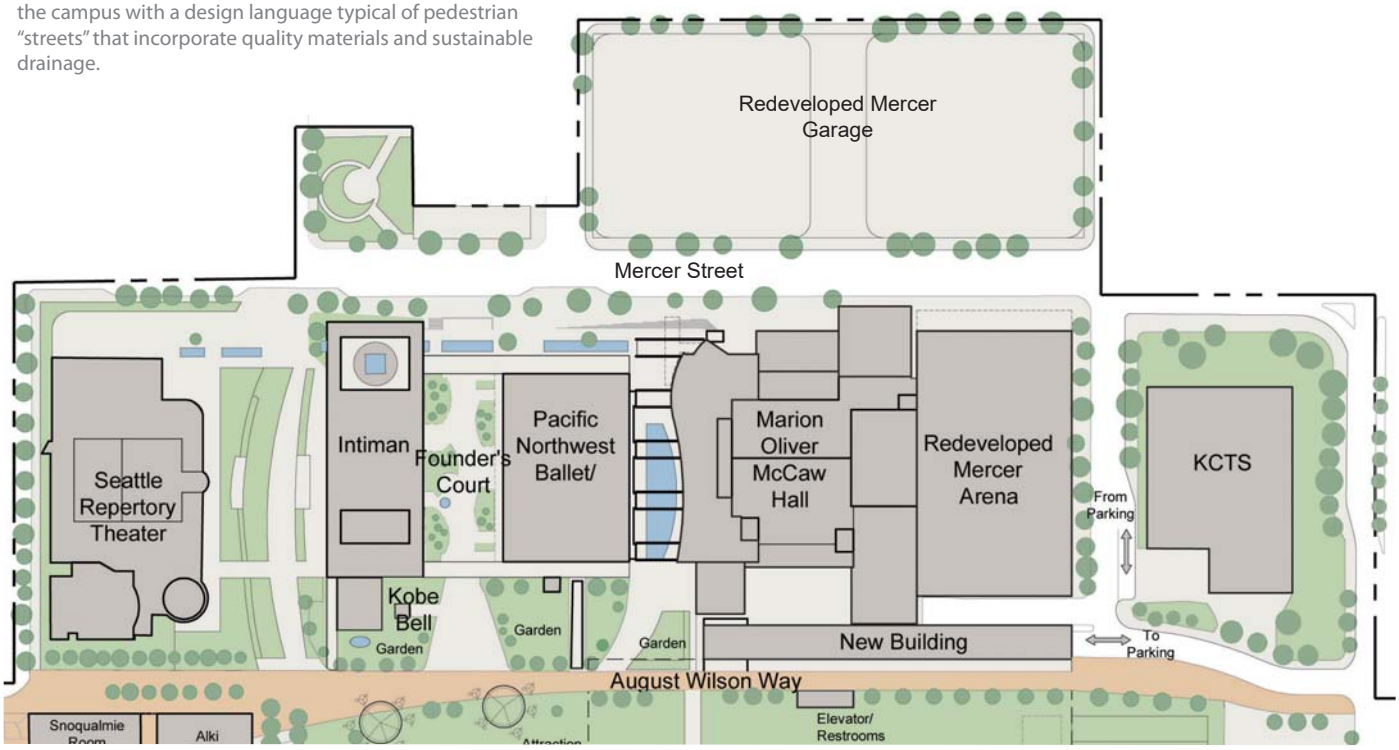
Prioritize quality design and materials for new structures at the Mercer street edge where pedestrian experience matters the most.

Provide adequate space for pick-up and drop-off at venues along Mercer St.

Create a series of intimate scale spaces and buildings along the south edge of the Theater District along August Wilson Way that contribute activity and contrast in scale to the adjoining large open space surrounding the International Fountain.

Entry at August Wilson Way has the tree-canopy linear typology that denotes a through route.

Enhance 2nd Avenue N as a major tree-lined spine through the campus with a design language typical of pedestrian "streets" that incorporate quality materials and sustainable drainage.



MEMORIAL STADIUM ZONE

The new green lid should have an open feel with landscaping at the edges.

Consider overhead weather protection through the large open spaces as an important architectural element.

The headhouses for elevators to the new garage are important architectural elements that should have a distinctive design and be easily recognizable.

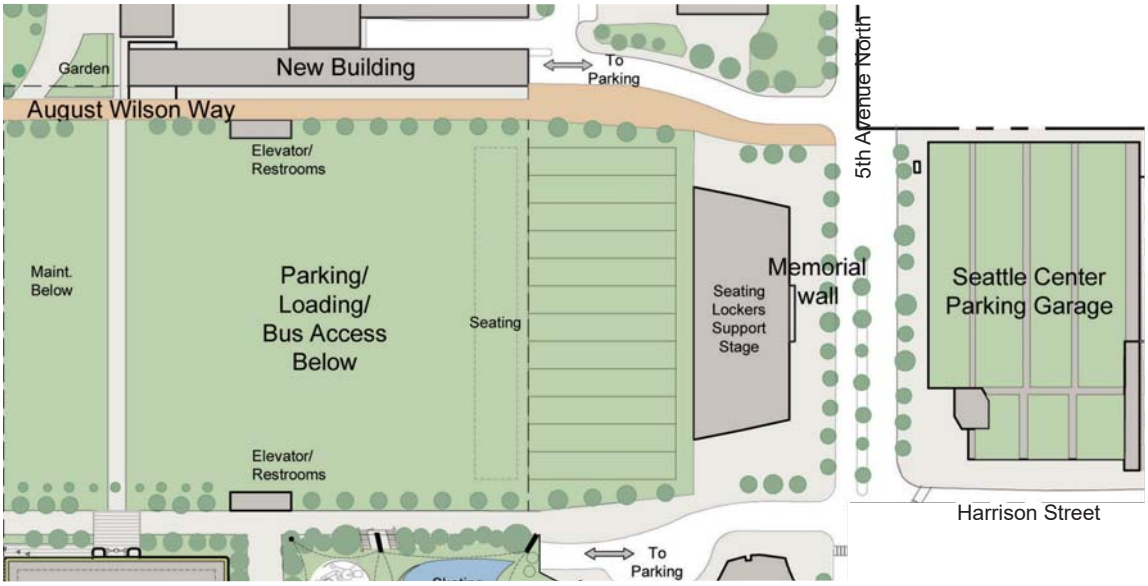
Emphasize the pedestrian character of entries off of 5th Ave. N., understanding that they will also accommodate vehicular traffic entering and exiting the new parking garage below the lid.

The new multi-purpose stage and stadium building should not turn its back to 5th Ave. N. Consider the viewpoint of pedestrians and passing vehicles in creating a high-quality edge to the campus.

5th Ave. N. is the interface between the Gates Foundation and Seattle Center campuses; well designed physical and visual connections at key intersections are a high priority.

In creating the large new green space, make sure that the edges are activated. Look to Fisher Pavilion and the South Fountain Lawn for a model.

Consider the pedestrian routes created by desire lines through the large open spaces, and the character and materials of more informal routes.



FOUNTAIN ZONE

Retain, and where possible, enhance the ability to enjoy the overlook of the campus and its activities from Thomas St. and Fisher Pavilion.

Retain views to the International Fountain as a campus focal point.

Respect the significant green spaces of the Fountain Zone, and support these spaces with well designed edge conditions. The perimeter is defined by London Plane trees around much of the Fountain Zone, and this character should be retained.

2nd Ave. N. and Thomas St. are primary circulation spines through the campus for pedestrians and service vehicles. While retaining the service functions, emphasize the pedestrian nature of these routes and their ability to help visitors with wayfinding on the campus.

Pay special attention to pedestrian safety at the intersection of 2nd Ave. N. and Thomas St.

Continue to improve the intersection of 2nd Ave. N. and Thomas St. as a clear entry point to the campus.

BROAD STREET GREEN ZONE

Consider pedestrian safety at the Thomas St. entry in any improvements to this area.

Use the topography to offer improved visibility for people coming and going and meeting others near the Thomas St. entry.

In selecting plantings in the Broad St. Green area, choose species that will transform through the course of the year, and complement the strong color palette of the EMP|SFM and nearby sculptures.

Take opportunities to highlight the sculptures in this area of the campus, through lighting, landscaped backdrops or the ability of people to interact.

Allow sufficient open space to allow architectural icons to "breathe".

Minimize visual impact of service drives and drop-off areas, emphasizing the quality of the pedestrian experience.

Use design cues to highlight entries to the iconic buildings in this zone, and to assist visitors in finding their way to destinations in the center of the campus.

Create a distinct edge to Seattle Center, protecting pedestrians from traffic on Broad Street.

Consider both the scale of pedestrian experience along Broad St. and the scale of the view from passing vehicles.

Seattle Center

Landscape Management Plan

January . 2009