

## **PART 1 – GENERAL**

This section provides guidelines to assist the mechanical engineer and designers during the submittal process by establishing standard practices that achieve uniformity and quality designs.

Note: The Standards are not meant to relieve the Engineer of Record from the responsibility to prepare a complete and comprehensive set of construction documents.

### **1.01 DESIGN SUBMITTAL GUIDELINES**

#### **A. Drawings and Specifications:**

1. Drawings shall be prepared in accordance with Port of Seattle A/E Design Submittal Requirements. Drawings and specifications will be completed in detail to define installation and operation of all systems.
2. Drawings shall comply with Port of Seattle “CAD Standards.”
3. Drawings shall be coordinated with specifications to ensure that all items indicated in the drawings are covered by specification documents and that all specification sections relate to items in the drawings.
4. Mechanical Standard Legend, Symbols, and abbreviations (Appendix A) will be incorporated and modified to indicate all symbols and abbreviations used in the project construction documents. Sheets shall be presented in the following order:
  - a. Mechanical Standard Legend
  - b. Symbols and Abbreviations
  - c. Schedules,
  - d. Floor Plans
  - e. Sections
  - f. Elevations, Details
  - g. Diagrams
  - h. Controls Logic
5. Indicate duct static pressure, required seal, leakages, testing type and pressure on drawings in accordance with SMACNA.
6. Provide schedule indicating indoor and outdoor design conditions for each space.

7. Provide manual volume dampers for each supply, return and exhaust opening, in all branch ducts where three or more openings are associated with branch. All volume dampers shall be shown on drawings.
8. Provide drains at all low points in piping, including any trapped portions of piping. Provide manual air vents at all high points in closed loop mechanical piping system.
9. Indicate ranges for all pressure gauges and thermometers.
10. Mechanical Flow Diagrams (Appendix B) will be incorporated and edited to suit project. Airflow riser, hydronic flow riser, fire sprinkler riser, plumbing riser and steam/condensate flow diagrams shall be provided. Plumbing riser, Air Flow and Hydronic Diagrams are required for all projects and Fire Riser Diagrams for all new fire risers. Plumbing riser diagrams shall consist of separate waste and water diagrams. All diagrams shall indicate flows and sizes for each branch.
11. Design Mechanical systems with future capacity. Primary Air handling units, pumps, convertors, main piping and ductwork distribution systems should be installed with 15 percent extra capacity. (Low velocity ductwork shall use 0.06" wg friction per 100 ft. of duct).
12. Controls and Instrumentation drawings with control diagrams, point list and operating sequences shall be provided. DDC Control Point List (edited or modified to suit Project), (Appendix C) is required.
13. Mechanical Equipment Schedules (Appendix D): Capacity, future capacity, operating parameters, weights, electrical characteristics, efficiencies, equipment ID number, and basis of design (i.e.: make and model) shall be indicated. All equipment and appurtenances intended to be installed in the Mechanical Systems shall be scheduled on the Drawing Sheets. Coordinate all electrical requirements with the project electrical engineer.
14. Mechanical Diagrams and Details (Appendix E) will be incorporated as required and edited to suit project. Note: The Details/Diagrams shown in Appendix E may not be all that are needed. The Engineer shall add Details/Diagrams to show any and all Systems affected by the Mechanical work.
15. Mechanical Equipment will be assigned unique identification numbers obtained (at or before the 30% submittal) from AV Facilities & Infrastructure Mechanical. Refer to Section E, "Mechanical Equipment Identification System."

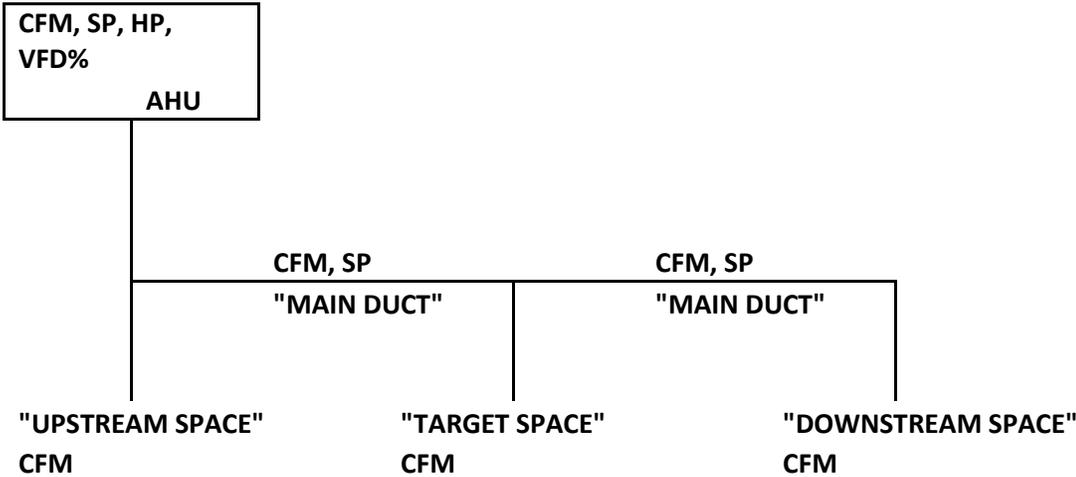
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- 16. Prior to design, designers are required to hire a pre-qualified TAB agency to perform pre-balance measurement of the existing mechanical systems to be re-used and submit the report for review and approval by Facilities and Infrastructure (F&I). Measurements of the source (main air handler) cfm at 70% and 100%, and measurements of the main trunk duct at both of these conditions upstream and downstream of the affected area, and of the space cfm usage in these conditions. Measurements of pumps or other systems may also be necessary.
- 17. These measurements become the system baseline and are submitted with the applications for connection along with the ASHRAE heating and cooling calculations, to show that the new tenant usage will not adversely affect the adjacent spaces by using air capacity previously being supplied to them.
- 18. The pre-balance report shall be also submitted with the application for connection.

Example: get “upstream and downstream” traverses as well as AHU cfm/sp/HP etc  
This is typical for all “pre balance surveys” so that at the end of the project – we can do the same and demonstrate that the “before” and “after” air quantities are being delivered to downstream tenants.

Ex.:



**SUMMARY: AHU CFM XXX, SP XX, HP XX, VFD  
XX%**

**TARGET SPACE CFM,  
UPSTREAM SPACE CFM, SP  
DOWNSTREAM SPACE CFM, SP**

19. Existing utilities that will be used, extended or relocated shall be shown on drawings. Existing equipment, ductwork, piping and components, etc. not being used shall be completely removed (including hangers and supports) and shown on separate demolition drawings. Do not abandon systems or portions of systems in-place. Walls, floor and roof openings shall be patched and repaired to match existing rating and construction.
20. Floor Plans: Provide separate HVAC, Piping, Plumbing and Fire Protection drawings. Multiple Sections or elevations shall be provided to indicate spatial requirements. Coordinate HVAC, Hydronic, Plumbing and fire sprinkler requirements with architectural, structural, electrical, communications, baggage handling and any other special system requirements. Sheet numbering convention is “M” (Mechanical), “MH” (HVAC), “MP” (Piping), “MD” (Mechanical Demolition), “P” (Plumbing) and “F” (Fire).
21. Locate all equipment with associated ductwork and piping to permit service and maintenance requirements to all components. Indicate service area, access doors and panels locations on drawings. Access doors shall be 24”X24” minimum. Pumps, Fans and other large rotating equipment shall have larger access doors and a minimum 36” service space all around.
22. Drawings shall be created at a 1/8-inch per foot scale with enlarged plans at 1/4-inch per foot or greater (with multiple sections) shall be provided for all mechanical rooms, toilet rooms, shafts, and any other areas of complexity.
23. Provide fire protection documents for installation as reviewed by Facilities and Infrastructure and POS Fire Department. Fire Riser Numbers shall be obtained from Fire Department and shown on drawings. Provide code compliance summary sheet and life safety floor plan.
24. Provide Phasing plans as required to maintain Airport’s 24 hours per day operation.
25. Specifications: Port of Seattle Master Specifications shall be edited to incorporate these Standards and to suit project requirements.
26. Smoke Control Drawings, Sequences of Operations, Controls Matrices and Smoke Control Points Lists are required for all projects located within Smoke Control boundaries.
27. Smoke Controls shall be electronic and completely shown and specified on Contract Documents.

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**1.02      APPLICATION FOR CONNECTION**

Prepare and Submit “Application for Connection” document for connections to the existing mechanical, water, sewer, industrial waste, and storm systems. Refer to Section D, “Application for Utility Connection Forms.”

**1.03      BASIS OF DESIGN**

A. Basis of design documents shall address the following at minimum:

1. Include POS project name and project number on all documents.
2. Design criteria: Indicate all codes, design standards and guidelines used for the design. Include the title and date of the edition used for the project.
3. Design conditions: Provide a table indicating the design indoor and outdoor heating and cooling conditions for all the spaces affected by the project. Indicate the estimated number of hours that indoor conditions will not be met during extreme outdoor temperature conditions.
4. Provide a description of heating, cooling and ventilation systems that will be used for the project. Indicate proposed outside air ventilation rates per code-minimum requirements. Indicate outside air ventilation rates in cfm/person and cfm/sf used for all different room types. Indicate air changes per hour for all spaces.
5. Describe all energy and water conservation features, systems, and components implicated in the project with expected energy and water savings.
6. Estimate water demand in gallons per minute (gpm).
7. Indicate the minimum and maximum water pressure in pounds per square inch (psi).
8. Describe water heater type, size and design water temperatures.
9. Describe all systems and fixtures that require backflow preventer and describe type of backflow preventing device.

**1.04      SUBMITTAL REQUIREMENTS**

Submittals shall be in accordance with POS A/E Design Submittal requirements. Design submittal shall include the following Mechanical requirements for each design phase:

A. Conceptual Design (15%)

1. Scope of Work (Basis of Design)

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2. Calculations: ASHRAE Block Load Calculations, “U” Factor Calculations, Building Exhaust Calculations, Outside Air Requirements Calculations, Building Air Balance Calculations, Equipment Sizing Calculations, Domestic Hot Water Heating Calculations, Plumbing Fixture Count/Type Calculations.
  3. Equipment Cut sheets
  4. System Diagrams – Mechanical, HVAC, Plumbing and Fire Risers.
  5. Pre- balance report for relevant systems including HVAC airflow and pump capacities
  6. Application for Connection Forms
  7. Asbestos Assessment
  8. Cost Estimate
  9. Outline Specifications
- B. Schematic Design (30%)
1. Basis of Design
  2. Calculations: “U” Factor Calculations, Building Exhaust Calculations, Outside Air Requirements Calculations, Building Air Balance Calculations, Duct Pressure Drop Calculations, Hydronic System Pressure Drop Calculations, Equipment Sizing Calculations, Pipe Expansion Calculations, Duct Heat Gain Calculations, Duct Leakage Calculations, Heating and Cooling Load Calculations, Domestic Hot Water Heating Calculations, Domestic Water Pressure Calculations, Domestic Hot Water Recirculation Calculations, Domestic Water Pipe Expansion Calculations, ASHRAE 90.1 Compliance Calculations.
  3. Equipment Cut sheets
  4. Port of Seattle assigned equipment ID numbers
  5. System Drawings (Legend, Schedules, System Diagrams, Demolition, HVAC, Piping, Plumbing, Fire Protection, Controls, Mechanical Room enlarged plan showing all major equipment and maintenance access, the enlarged plan shall be created at minimum scale of ¼”=1’-0”).
  6. Mechanical Room Plans & Details
  7. Pre- balance report
  8. Application for Connection Forms
  9. MUST Approvals
  10. Review Comment Responses

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11. Asbestos Assessment
12. Cost Estimate
13. Specifications

C. Design Development (60%)

1. Basis of Design
2. Calculations: “U” Factor Calculations, Building Exhaust Calculations, Outside Air Requirements Calculations, Building Air Balance Calculations, Duct Pressure Drop Calculations, Hydronic System Pressure Drop Calculations, Equipment Sizing Calculations, Pipe Expansion Calculations, Duct Heat Gain Calculations, Duct Leakage Calculations, Heating and Cooling Load Calculations, Domestic Hot Water Heating Calculations, Domestic Water Pressure Calculations, Domestic Hot Water Recirculation Calculations, Domestic Water Pipe Expansion Calculations, ASHRAE 90.1 Compliance Calculations.
3. System Drawings (Legend, Schedules, System Diagrams, Demolition, HVAC, Smoke Control, Piping, Plumbing, Fire Protection, Controls).
4. Floor Plans & Details HVAC, Smoke Control and Plumbing
5. Mechanical Room Plans & Details
6. Show all pertinent seismic details and pipe supports on drawings.
7. Application for Connection Forms
8. MUST Approvals
9. Review Comment Responses
10. Asbestos Assessment
11. Cost Estimate
12. Specifications

D. Construction Documents (90% or 100%)

1. Basis of Design
2. Calculations: “U” Factor Calculations, Building Exhaust Calculations, Outside Air Requirements Calculations, Building Air Balance Calculations, Duct Pressure Drop Calculations, Hydronic System Pressure Drop Calculations, Equipment Sizing Calculations, Pipe Expansion Calculations, Duct Heat Gain Calculations, Duct Leakage Calculations, Heating and Cooling Load Calculations, Domestic Hot Water Heating Calculations, Domestic

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Water Pressure Calculations, Water Fixture Unit Calculations, Waste Drainage Fixture Unit Calculations, Domestic Hot Water Recirculation Calculations, Domestic Water Pipe Expansion Calculations, ASHRAE 90.1 Compliance Calculations, annual energy and water consumption calculations.

3. System Drawings (Legend, Schedules, System Diagrams, Demolition, HVAC, Piping, Plumbing, Fire Protection, Controls, Mechanical Room enlarged plan showing all major equipment and maintenance access, the enlarged plan shall be created at minimum scale of  $\frac{1}{4}''=1'-0''$ ).
4. Floor Ceiling and Roof Plans, Sections & Details HVAC, Smoke Control and Plumbing
5. Mechanical Room Plans & Details
6. Restroom and Kitchen Plans at  $\frac{1}{4}''=1'-0''$
7. Application for Connection Forms
8. MUST Approvals
9. Review Comment Responses
10. Asbestos Assessment
11. Cost Estimate
12. Specifications

END OF SECTION