

## **PART 1 – GENERAL**

The Port of Seattle – Sea Tac International Airport has determined that all public spaces in the Terminal(s) should be provided with Smoke Control Systems that will operate to provide safe egress or safe areas to shelter in place in the event of a smoke/fire incident. The systems shall be designed and operated to provide an area for egress or shelter-in-place and shall operate under the pressurization of the area adjacent to/or above and below (in the case of multi-story construction) the smoke exhaust area concept. The building smoke control (HVAC) fire sprinkler, and fire alarm equipment, and controls function together to meet performance requirements, acceptance criteria, and design intent in accordance with the contract documents. The controls function is provided by the direct digital control (DDC) building automation system under an approved sole source agreement to Siemens Building Technologies. (See also DDC Standard)

### **1.01 SMOKE CONTROL SYSTEMS**

General Description – Design Criteria.

All public areas of the Terminals shall be designed so that pressurization or exhaust of each zone may be used to achieve Smoke Control. The area in exhaust (smoke present area) shall be abetted by adjacent pressurization zone(s). This can be accomplished by side-by-side zones as well as floor-by-floor zones.

The concourse level is conditioned by individual air handlers serving the hold rooms, concourse and tenant concession areas. In Smoke Exhaust mode, the air handler or other exhaust fans ramp up to 100% and exhaust the zone through exhaust grilles located no less than twelve feet above the floor (or above Mezzanine if in Atria) and the adjacent smoke zones' supply fans operate in "economizer" mode to deliver a minimum of 1 cubic foot per minute per square foot of floor area per zone of 100% outside air from diffusers located no more than twelve feet above the floor.

Smoke management commands override all other modes of air handling unit control operations except DDC system shutdown (maintenance) or failure of the associated supply fan to operate.

Each area conditioned by an air handler is a smoke management area. For example, A Concourse may be divided into two (2) smoke management areas. A smoke damper in the primary air supply duct serving an area defines the smoke management area. Smoke barriers are installed in the ceiling plenum space at the boundaries between the air handler areas.

The air handlers are located in rooftop mechanical penthouses. All air handlers, associated exhaust and transfer fans, associated heating pumps and all HVAC controls will be served by both normal and emergency electric power. The air handler return-

air and relief- air dampers are listed modulating smoke control dampers. The air handler dampers are electronically controlled by the DDC system and are positioned by UL listed control air actuators. The relief air, exhaust air and outside air dampers are spring opened upon loss of control air or DDC system control signal. The return air dampers are spring closed upon loss of control air or DDC system control signal.

**Air Handler Control Modes:**

Each air handler has 6 modes of operation:

1. Normal DDC HVAC Temperature and Ventilation Control.
2. Normal DDC System Shutdown (maintenance).
3. Smoke Exhaust Mode.
4. Pressurization Mode.
5. Smoke Purge Mode
6. Fire Shutdown Mode.

**1. Normal DDC HVAC Temperature and Ventilation Control**

The Air Handling Unit operates under control of the DDC System executing the normal HVAC temperature/ventilation air volume control.

**2. Normal DDC system Shutdown (maintenance)**

The Air Handling Unit operates under control of the DDC System shutdown logic as needed by maintenance crew.

**3. Smoke Exhaust Mode.**

This Mode will place the Fire/Smoke area (zone) under negative pressure and draw air from adjacent spaces while exhausting smoke to the outside. When a Smoke management zone fire sprinkler flow switch alarms, or if triggered by another type of alarm, or the Fire Commander manually places the Smoke zone in alarm at the Fire Control Center Smoke Management Panel, the alarmed Smoke zone Air Handler supply fan shuts down and the associated smoke control damper(s) close completely. The associated return/exhaust fan ramps up to 100% exhaust capacity. The Air Handler remains in Smoke Exhaust Mode until the Fire Commander manually changes/resets the mode of operation at the Fire Command Center panel.

This mode also may be commanded by the Fire Commander at the Fire Command Center panel if an event occurs where the zone needs to be purged (such as after a smoke event or a release of toxic substance in the zone).

**4. Pressurization Mode.**

The function of the pressurization mode is to place the smoke management zones adjacent to the Fire/Smoke area under a small positive pressure to flow air from the adjacent zones to the alarmed zone. Air Handler smoke exhaust mode of operation shall override pressurization mode of operation. Whenever a smoke management area is placed in pressurization mode either through automatically by alarm or manually by the Fire Commander at the Fire Command Center smoke management panel, the associated air handler shall operate in pressurization mode. The air handler remains in pressurization mode until the Fire Commander manually changes/resets the mode of operation at the Fire Command Center Smoke Management Panel.

- 5. Smoke Purge Mode.** (Note: This mode would be used as an after event for “clean up.”)

When commanded to smoke purge mode by the Fire Commander at the Fire Command Center Smoke Management Panel, the air handler outside air and relief air dampers open fully and the return air damper is fully closed. The Return/Exhaust Fan is ramped up to full speed and the DDC system modulates the unit heating coil temperature control valves and the cooling coil temperature control valve in sequence as required to maintain primary supply air temperature set point. All associated space and tenant exhaust and transfer fans shall be commanded to operate. VIP tenant spaces shall remain positive in relation to the adjacent concourse. The air handler remains in smoke purge mode until the Fire Commander manually changes/resets the mode of operation at the Fire Command Center Smoke Management Panel.

The function of the smoke purge mode is to remove residual smoke after a fire by dilution. A smoke Control Area is manually placed in Smoke Purge Mode at the Fire Command Smoke Control Center. The smoke control area remains in smoke purge mode until the Fire Commander manually changes/resets the mode of operation at the Fire Command Center Panel.

All associated terminal units shall be set to deliver 100% primary air to their associated spaces. The associated terminal unit heating coil temperature control valve shall modulate as required to maintain space temperature set point. Parallel fan terminal unit fans shall shutdown and provide 100% primary air to the space. Series fan terminal unit fans shall operate with 100% primary air flow.

- 6. Fire Shutdown Mode.**

The primary supply air smoke control dampers shut and the fan terminal unit fans shutdown whenever the associated air handler shuts down in fire shutdown mode.

## **1.02 SEQUENCE OF OPERATIONS**

Typical concourse air handling system general description:

The concourse level is conditioned by individual air handlers serving the hold rooms, Concourse and tenant improvement Concession areas.

Each air handling unit system shall be individually controlled by the central DDC system and shall be capable of total stand-alone operation upon failure of the central DDC system or network communications. Each individual air handling system shall have occupancy operation schedules. All fans and pumps associated with an air handling unit shall be controlled by the associated air handler DDC system local panel. All fans and pumps associated with an air handler shall be software interlocked with the unit supply fan operation unless otherwise specifically noted. See each air handling system control diagram for associated fans, pumps and devices. All components shall be served by both normal and emergency electrical power except parallel fan terminal units unless otherwise specifically noted. All control tubing except that associated with parallel fan terminal units shall be metallic. All control wiring except that associated with parallel fan terminal units shall be in metallic conduit or raceways. All functions and controls described below shall be monitored/commanded/ performed by the associated DDC system module.

**A. Tenant Retail Space Description:**

Provide in the associated air handling unit local control panel occupied/unoccupied mode time of day, day of week & holiday schedules and night setback for each retail tenant space - initially set 100%, 24 hours/day, 7 days/week. In unoccupied mode the associated supply and return air smoke control dampers fully close and the fans terminal unit fans are off. Provide night setback temperature control such that if VIP tenant space temperature drops to 60 f, then the supply and return dampers open, the fan terminal unit fans run until the space temperature increases to 70 F. Software interlock with associated air handler operation and smoke management control.

**B. Tenant Food & Beverage Space Description:**

Provide in the associated air handling unit local control panel occupied/unoccupied mode and grease hood exhaust fan on/off time of day, day of week, holiday schedules and night setback for each food & beverage tenant space - initially set 100%, 24 hours/day, 7 days/week. Provide software air handling unit normal operation and occupied mode interlock for each tenant food & beverage space cooking equipment such that if the associated air handler is not in normal DDC mode of operation and the space is not in occupied mode then the grease exhaust fan and the cooking equipment may be locked off.

**C. Air Handler Shutdown and Off Status (Maintenance):**

Upon call for air handling unit shutdown all equipment and devices shall immediately assume off status without time delay. All associated fans and pumps shall be off except tenant grease exhaust fans, tenant grease exhaust fans shall have a software time delay

(0 to 10 minutes) initially set at 3 minutes to allow purging of cooking area. Return air damper shall be positioned open (fails closed), outside air damper shall be positioned closed (fails open), relief /exhaust air damper shall be positioned closed (fails open), heating coil temperature control valve positioned closed (fails open), cooling coil temperature control valve positioned closed (fails closed), all associated smoke control dampers shall be positioned closed unless specifically noted to be positioned open.

**D. Air Handler Normal Startup or Restart:**

1. All start sequence steps shall have software adjustable time delays between steps. The smoke control dampers shall be commanded to normal position or control.
2. The supply fan variable frequency drive shall be commanded to ramp up to control setpoint.
3. The return fan variable frequency drive shall be commanded to ramp up to control setpoint.
4. The heating coil temperature control valve, economizer cycle dampers, cooling coil temperature control valve and heating coil pump have operational mode control.
5. All space terminal units shall operate under normal control. All tenant space terminal units shall operate under normal control if the associated tenant space is scheduled to be occupied.
6. All associated space exhaust fans shall be commanded to run and tenant fans shall operate if the associated tenant space is scheduled to be occupied.

**1.03 COMMISSIONING**

Commissioning shall operate each of the above listed sequences and demonstrate that smoke control is satisfactorily performed and that smoke pressurization/exhaust zones are clearly delineated when in operation.

The commissioning process will incorporate the below listed consecutive commissioning phases and include performance testing:

1. Designate Commissioning Authority
2. Document Owner Project Requirements
3. Conduct Commissioning Design Review
4. Develop and Implement Commissioning Plan. The Plan shall be developed during the design phase of the project.
5. Review Contractor Submittals
6. Installation verification checklist
7. Pre-operational checklist

END OF SECTION