SEQUENCE OF OPERATION FOR ALC CONTROL

AIR SOURCE COOLING
RECIRCULATION AIR WITH ECONOMIZER
The ALC controller is turned on by a switch located on its front upper left corner. Several Occupancy Control options are available for starting the unit. These can be selected from the BACview display pad on the Controls screen (requires user password). The Resident Program has an adjustable scheduler that uses the internal time clock to allow for separate Sequences for Occupied and Unoccupied periods. This can be accessed from the BACview display pad on the Schedules screen (requires user password). NOTE: All temperature-related events have an additional 10 second (fixed) “delay on make” to allow temperatures to settle.

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**OCCUPIED MODE:**

When the BACview Schedule calls for the start of the Occupied Mode, and the ALC controller has verified that there are no fault or shutdown conditions, after a 30 second (fixed) delay the unit goes into Occupied Mode:

1. **Outdoor Air Damper (OD) and Return Air (RA) Damper:**
   - The OA damper is normally closed and the RA damper is normally open.
   - After the unit goes into Occupied Mode, the OA damper will open to the default position of 20% (adjustable, max. 20%) and the RA damper will close 20% (adjustable, open 80%).
   - The OA damper stays open until the system reaches the end of the Occupied Mode period. It will remain open until the supply fan turns off. Then the OA damper closes and the RA damper opens.

2. **Supply Fan (SF):**
   - The SF will run for 60 seconds (fixed) before cooling or dehumidification will be enabled.
   - The SF shall operate continuously while the unit is in the Occupied Mode. When the system reaches the end of the Occupied Mode period, the SF will continue to run for an additional 2 minutes before turning off.
   - **SF-VSC:** Supply Fan with Variable Speed Control.
     - The SF-VSC will modulate its speed based upon the SF Differential Pressure Transmitter (SF-DPT) signal and the supply duct static pressure set point.
   - **Optional:** For constant air volume (CAV), select “Manual Override” in the BACview keypad and input the required speed (%) as determined in the field by Test and Balancing.

3. **Exhaust Fan (EF):**
   - The EF shall be enabled to run while the unit is in the Occupied Mode. When the system reaches the end of the Occupied Mode period, the EF will be enabled to run for an additional 2 minutes before turning off.
   - **EF-VSC:** Exhaust Fan with Variable Speed Control.
     - If the Zone Differential Pressure Transmitter (ZN-DPT) signal is above the building static pressure set point, the EF-VSC will modulate its speed based upon the ZN-DPT and the set point.
   - If the ZN-DPT signal is below the building static pressure set point, the EF will modulate down to 0% (adjustable) speed.
   - **Optional:** For constant air volume (CAV), select “Manual Override” in the BACview keypad and input the required speed (%) as determined in the field by Test and Balancing.

4. **Economizer Mode:**
   - When there is a demand for cooling, if the Outdoor Air Enthalpy (OAE) is below 22 BTU/lb (adjustable) and the Outdoor Air Temperature (OAT) is below 59°F (adjustable), the Economizer will be enabled and act as 1st stage cooling. The compressor will remain off, the OA damper will start to open from the default position, and the RA damper will start to close. The OA and RA dampers will modulate based upon the Supply Air Temperature (SAT) cooling set point of 55°F (adjustable).
   - If the MAT falls below the SAT low limit set point (40°F; adjustable), the EF will turn off and the OA damper shall close.
   - When the OAE goes 2 BTU/lb (adjustable) above the OAE cooling set point 22 BTU/lb (adjustable) or the OAT is equal to or greater than 59°F (adjustable), the OA damper will go back to default position and the unit will return to normal cooling mode.

5. **Cooling Mode:**
   - Cooling Mode is available when the Mixed Air Temperature (MAT) is 1°F (fixed) above the MAT cooling lower limit (55°F, adjustable) and there is a demand for cooling.
   - When the Zone Air Temperature (ZAT) is 1°F (adjustable) or more above the ZAT cooling set point (74°F, adjustable), compressor #1 turns on.
   - When the ZAT is 2°F (adjustable) or more above the ZAT cooling set point (74°F, adjustable), compressor #2 turns on – not less than 30 minutes (adjustable) after compressor #1 turned on.
   - When the ZAT is equal to the ZAT cooling set point (74°F, adjustable), compressor #2 turns off.
   - When the ZAT is 1°F (adjustable) or more below the ZAT cooling set point (74°F, adjustable), compressor #1 turns off.
   - Minimum SF-VSC modulation shall be 50%
6. Dehumidification Mode:

- Dehumidification Mode is available if the MAT is 1°F (fixed) above the dehumidification lower limit of 60°F (adjustable) and there is no call for heating.
- Satisfying the ZAT cooling set point is the priority.
- When the Zone Relative Humidity (Z-RH) is 1% (adjustable) or more above the Z-RH set point (55%rh, adjustable), Dehumidification Mode is enabled. After the minimum time-off delay, compressor #1 turns on.
- When Z-RH is 2% (adjustable) or more above the Z-RH set point (55%rh, adjustable), and after the minimum time-off delay, compressor #2 turns on — not less than 30 minutes (adjustable) after compressor #1 turned on. Both compressors respond in sequence and run at full cooling.
- HGRH is enabled to operate as necessary based upon the SAT dehumidification set point (70°F, adjustable).
- When Z-RH is 1% (adjustable) or more below Z-RH set point (55%rh, adjustable), compressor #2 turns off.
- When the Zone Relative Humidity (Z-RH) is 2% (adjustable) or more below the Z-RH set point (55%rh, adjustable), compressor #1 turns off and Dehumidification Mode is disabled.

- Digital Compressors:
  - The ALC controls the capacity of the digital compressor by rapidly loading and unloading the compressor in 15 second intervals.
  - The digital compressor will modulate based upon the DX LAT sensor and DX LAT set point (53°F, adjustable).

- Optional: When enabled, if there is a call for 1st stage cooling, 2nd stage cooling will be enabled after a 10-minute (adjustable) delay. Both compressors modulate based upon the cooling set point. Default is ‘OFF’.

- Compressor enabling logic includes a 5-minute (fixed) minimum run-time and a 5-minute (fixed) minimum timeoff delay to prevent compressor short cycling.

- Digital Compressors:
  - The ALC controls the capacity of the digital compressor by rapidly loading and unloading the compressor in 15 second intervals.
  - The digital compressor will modulate based upon the SAT sensor and set point (55°F, adjustable).
  - If the DX LAT drops to 38°F or less for 3 minutes, the ALC controller will issue an alarm and the compressor stops. When the DX LAT warms back up to 55°F or more, the compressor turns back on.
  - If there is a current call for 1st stage cooling and compressor #1 is shut down due to an alarm (HPS1, LPS1, or DX LAT1), compressor #2 will be turned on to take its place until it returns.

- When the Zone Relative Humidity (Z-RH) is 55%rh set point (adjustable), compressor #1 is (adjustable) or more below the Z-RH set point. Following a minimum time off delay, compressor #1 will turn on. If the ALC controller records 3 high pressure start/restart failure incidents within 1 hour, compressor #1 is locked out and the ALC controller will issue an alarm. The compressor lock-out can be reset in the BACview display pad or by cycling the power of the ALC controller.

- This sequence is the same for compressor #2, Y2, and HPS2.

- Low Pressure Switch (LPS1): If LPS1 is open after the LPS1 by-pass time, the ALC controller will issue an alarm and compressor #1 turns off. After 30 seconds (fixed), the LPS1 alarm will reset. Following a minimum time off delay, compressor #1 will turn on. If the ALC controller records 3 high pressure start/restart failure incidents within 1 hour, compressor #1 is locked out and the ALC controller will issue an alarm. The compressor lock-out can be reset in the BACview display pad or by cycling the power of the ALC controller.

- This sequence is the same for compressor #2, Y2, and LPS2.

- Safety Shutdown:
  - If a compressor fails to start 3 times in an hour due to high pressure switch lock out.
  - If a compressor fails to start 3 times in an hour due to low pressure switch lock out.
  - If a compressor fails to start 3 times in an hour due to DX leaving air temperature lock out.
  - If the ALC controller detects an SAT sensor failure.

- Standard Alarms: (alarms require reset in the BACview or cycling the power of the ALC controller unless noted)

  1. Supply Fan Alarm: When the SF fails to start and the SF-APS does not confirm air flow to ALC, following 1 minute (adjustable) delay. Unit will automatically shut down.
  2. Supply Fan Hand: When the SF is commanded off and the SF-APS still indicates air flow to ALC,
following 1 minute (adjustable) delay. OA Damper (if existing) will be commanded to remain open.

3. **Supply Fan Run Time:** When the SF run time has exceeded the maximum run time allotted (adjustable).

4. **Exhaust Fan Alarm:** When the EF fails to start and the EF-APS does not confirm air flow to ALC, following 1 minute (adjustable) delay.

5. **Exhaust Fan Hand:** When the EF is commanded off and the EF-APS still indicates air flow to ALC, following 1 minute (adjustable) delay.

6. **Exhaust Fan Run Time:** When the EF run time has exceeded the maximum run time allotted (adjustable).

7. **Compressor #1 Alarm:** Compressor stops due to CC1-CS open; following 60 second (fixed) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (Compressor #1 STOP).

8. **Compressor #1 Hand:** Compressor is commanded off but the CC1-CS still indicates to the ALC it is on; following 60 second (fixed) delay.

9. **Compressor #1 Run Time:** When the C1 run time has exceeded the maximum run time allotted (adjustable).

10. **High Pressure Switch #1 Alarm:** Compressor stops due to HPS1 open; following 30 second (fixed) delay. Requires HPS1 manual reset. Compressor lock out occurs if alarm happens 3 times in 1 hour (High Pressure Switch #1 STOP).

11. **Low Pressure Switch #1 Alarm:** Compressor stops due to LPS1 open; following 90 second (fixed) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (Low Pressure Switch #1 STOP).

12. **Freeze Protection #1 Alarm:** Compressor stops due to DX LAT1 freeze condition; following 3 minute (adjustable) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (FP #1 STOP).

13. **Compressor #2 Alarm:** Compressor stops due to CC2-CS open; following 60 second (fixed) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (Compressor #2 STOP).

14. **Compressor #2 Hand:** Compressor is commanded off but the CC2-CS still indicates to the ALC it is on; following 60 second (fixed) delay.

15. **Compressor #2 Run Time:** When the C2 run time has exceeded the maximum run time allotted (adjustable).

16. **High Pressure Switch #2 Alarm:** Compressor stops due to HPS2 open; following 30 second (fixed) delay. Requires HPS2 manual reset. Compressor lock out occurs if alarm happens 3 times in 1 hour (High Pressure Switch #2 STOP).

17. **Low Pressure Switch #2 Alarm:** Compressor stops due to LPS2 open; following 90 second (fixed) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (Low Pressure Switch #2 STOP).

18. **Freeze Protection #2 Alarm:** Compressor stops due to DX LAT2 freeze condition; following 3 minute (adjustable) delay. Compressor lock out occurs if alarm happens 3 times in 1 hour (FP #2 STOP).

19. **Sensor Failure:** Readings exceed sensor limits, following 2 minute (fixed) delay. Alarms reset automatically.

20. **SAT Sensor Failure:** Open: -60.2°F, Short: 296°F. Unit will automatically shut down.

21. **Low SAT Alarm:** SAT low limit, 40°F (adjustable), following 10 minute (adjustable) delay. Unit will automatically shut down.