ADDISON®

SEQUENCE OF OPERATION FOR ALC CONTROL

WATER SOURCE HEATPUMP
RECIRCULATION AIR WITH ECONOMIZER

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SEQUENCE OF OPERATION

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.

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 (OA) Damper 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 openuntil 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, dehumidification, or heating 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:**
   - Reversing Valve is "**ON**" in 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**% (adjustable; 50% min.).
- **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.

6. Dehumidification Mode:
- Reversing Valve is "**ON**" in 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 **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 the **DX LAT** Dehumidification set point (**53°F**, adjustable).
- **Hot Gas Reheat (HGRH) – On/Off:**

7. Heating Mode:
- Heating Mode is available when the **MAT** is **1°F** (fixed) below the **MAT** heating upper limit (**70°F**, adjustable) and there is a demand for heating.
- Reversing Valve is "**OFF**" in Heating Mode.
- When the **ZAT** is **1°F** (adjustable) or more below the **ZAT** heating set point (**68°F**, adjustable), compressor #1 turns on.
- When the **ZAT** is **2°F** (adjustable) or more below the **ZAT** heating set point (**68°F**, adjustable), compressor #2 turns on -- not less than **10** minutes (adjustable) after compressor #1 turned on.
- When the **ZAT** is equal to the **ZAT** heating set point (**68°F**, adjustable), compressor #2 turns off.
- When the **ZAT** is **1°F** (adjustable) or more above the **ZAT** heating set point (**68°F**, adjustable), compressor #1 turns off.
- **Optional**: When enabled, if there is a call for 1st stage heating, 2nd stage heating will be enabled after a **10**-minute (adjustable) delay. Both compressors modulate based upon the heating set point. Default is "**OFF**".
- Compressor enabling logic includes a **5**-minute (fixed) minimum run-time as well as the **5**-minute (fixed) minimum time-off delay to prevent compressor short cycling.
- **Digital Compressor:**
- 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 on the **SAT** sensor and **SAT** heating set point (**90°F**, adjustable).
- If there is a current call for 1st stage heating 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.
- **Auxiliary Heat:**
- After either heat pump has been enabled, when the **SAT** is **2°F** (adjustable) or more below the **SAT** heating set point (**90°F**, adjustable), and after a **10**-minute (adjustable) delay period, auxiliary heating will be enabled. When the **SAT** is equal to the **SAT** heating set point (**90°F**, adjustable), auxiliary heating will be disabled.

- **Modulated Auxiliary Heat:**
- **Modulating Gas Furnace:** On demand for auxiliary heating, the **ALC** controller modulates the gas furnace controller to control the gas flow based upon the **SAT** heating set point (**90°F**, adjustable).

8. Emergency Heating Mode:

- Compressors are "**OFF**" in Emergency Heating Mode.
  - **Modulated Emergency Heat:**
  - **Modulating Gas Furnace:** On demand for emergency heating, the **ALC** controller modulates the gas furnace controller to control the gas flow based upon the **SAT** heating set point (**90°F**, adjustable).

UNOCCUPIED MODE:

- When the **Occupancy Control** indicates the end of the Occupied Mode, the compressor(s) and outdoor fan(s) will turn off (subject to minimum run-time). The **SF** and **EF** will continue to run for **2** minutes before turning off.
- After this, the **OA** damper will close and the **RA** damper will open. The unit is now off.

Safety Switches:

- **High Pressure Switch (HPS1):** If **HPS1** is open, compressor #1 will turn off and the **ALC** controller will issue an alarm. After manually resetting **HPS1**, the **HPS1** 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 **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** low 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. **High SAT Alarm: SAT** high limit, **130°F** (adjustable) with Gas Furnace Heat. Alarm resets automatically.

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

23. **Heat Failure:** In heating mode and the **SAT** falls below **50°F** (adjustable), following **10** minute (adjustable) delay. Alarm resets automatically.

24. **Freeze Stat Alarm:** If Freeze Stat (**FZT**) relay opens indicating a water line freeze condition. Both compressors will automatically shut down. Alarm resets automatically when **FZT** relay closes.

25. **Water Flow Alarm:** If Water Flow Switch (**WFS**) relay opens indicating a no flow or low flow in water line. Both compressors will automatically shut down. Alarm resets automatically when **WFS** relay closes.