

ER-110 Saving Energy  
APP- 018

This application note will discuss ways to make your refrigeration system run more efficiently using the ER-110 and electronic expansion valves. **The two main benefits are allowing the evaporator fans to run at a greatly reduced rate and running at the ideal evaporator superheat setting.** Mechanical expansion valves have a very limited range and can not adjust enough to control superheat at significantly reduced air flows (below 70%). Some valves may not be able to even control down to 70%. The electronic valves are driven by a electric stepper motor and provide a much more precise control. We have been able to control superheats using the ER-110 down to a evaporator fan speed of 40%. We have learned a great deal about the ideal superheat settings over the last year. As the ambient temperature varies, the ideal superheat setpoint will also vary. With mechanical valves, it is virtually impossible to change the superheat settings for different operating parameters. JMC and IVI use the Sporlan control board, and are stuck with a fixed setpoint. There are huge energy saving to be had by running the lowest possible evaporator superheat for a given set of parameters. The following data will show exactly what I am talking about. When the ambient temperature is very warm, you can get far more cooling out of your evaporator by lowering the superheat setpoint and at the same time keeping your compressor cooler and raising the suction pressure. When you are in a position of running very low loads, you can increase the superheat on the evaporator making it less efficient and keeping the compressor from short cycling. The following real data shows how significant changing the evaporator superheat can be.

|  |       |     |   |      |     |
|--|-------|-----|---|------|-----|
| <div style="border: 1px solid black; background-color: yellow; padding: 2px;">                 O'Neill 6<br/>07/17/07 3:32 PM             </div> |       |     | <div style="border: 1px solid black; background-color: green; color: white; padding: 2px; text-align: center;">                 REFRIG             </div> |      |     |
| TEMP SP  | 40    | F   | PLENUM T  | 40.6 | F   |
| HUMID SP   | 97    | %   | PLENUM H  | 97.1 | %   |
| CO2 SP   | 2000  | ppm | CO2   | 1169 | ppm |
| OUTSIDE T  | 101.4 | F   | RETURN T  | 42.4 | F   |
| OUTSIDE H  | 30.4  | %   | START T   | 63.9 | F   |
| DOOR OPEN  | 0     | %   | REFRIG LEVEL  | 100  | %   |
| FAN  | 55    | %   | DAILY RUN   | 3.3  | hrs |

Note - the OSA is 101 degrees and the compressor is running at 100% and not able to maintain plenum setpoint. This system has a 120hp screw compressor with 6 evaporators all with electronic expansion valves. Also this system has been running at 55% on the evaporator fans for some time. When this was recorded all the evaporator super heat setpoints were at 10 degrees.

| ONeill 6         |     | REFRIG |     |     |    |      |     |    |
|------------------|-----|--------|-----|-----|----|------|-----|----|
| 07/17/07 3:32 PM |     |        |     |     |    |      |     |    |
| DEVICE           | No. | MODE   | DIS | SUC | SH | AMPS | OUT | SU |
| COMP             | 51  | REFRIG | 293 | 47  | 22 | 126  | 99  | 4  |
| EVAP A           | 61  | REFRIG | 0   | 55  | 6  | 0    | 19  | 3  |
| EVAP B           | 61  | REFRIG | 0   | 55  | 10 | 0    | 14  | 4  |
| EVAP A           | 62  | REFRIG | 0   | 54  | 12 | 0    | 8   | 4  |
| EVAP B           | 62  | REFRIG | 0   | 54  | 12 | 0    | 14  | 4  |
| EVAP A           | 63  | REFRIG | 0   | 54  | 11 | 0    | 16  | 4  |
| EVAP B           | 63  | REFRIG | 0   | 54  | 13 | 0    | 24  | 4  |

Note - Compressor parameters.

Discharge 293  
Suction 47  
Super Heat 22  
Amps 126

Evaporator Super Heat 10 degrees

1 Hour Later Evaporator Superheat Setpoint 6 degrees

|                  |      |        |              |      |     |
|------------------|------|--------|--------------|------|-----|
| ONeill 6         |      | REFRIG |              |      |     |
| 07/17/07 4:41 PM |      |        |              |      |     |
| TEMP SP          | 40   | F      | PLENUM T     | 40   | F   |
| HUMID SP         | 97   | %      | PLENUM H     | 97.3 | %   |
| CO2 SP           | 2000 | ppm    | CO2          | 1117 | ppm |
| OUTSIDE T        | 101  | F      | RETURN T     | 42.2 | F   |
| OUTSIDE H        | 30.5 | %      | START T      | 63.9 | F   |
| DOOR OPEN        | 0    | %      | REFRIG LEVEL | 69   | %   |
| FAN              | 55   | %      | DAILY RUN    | 4.3  | hrs |

One hour later after changing the evaporator superheat setpoint to 6 degrees.

Note - Outside air temperature still 101 degrees, evaporator fans 55%.

Plenum temperature has been reached and the compressor has backed off to 69%.

This shows how dramatic changing the Superheat Setpoint in the evaporator can be. The following page shows the change in operating parameters.

The discharge pressure dropped from 293 to 286 psi.

The suction pressure rose from 47 to 52 psi.

The super heat at the compressor dropped from 22 to 14 degrees.

The amps on the compressor dropped from 126 to 106.

