**Proposed RTF Measure: Floating Controls on Multiplex Refrigeration System**

1. Proposed measure type: (UES Measure or Standard Protocol)

UES

2. Title:

**Floating controls for multiplex refrigeration system**

3. Proposed category: (Planning, Proven or Small Saver)

\_\_

4. Description:

In this measure, floating head pressure controls are implemented for an existing multiplex system. We proposed two tiers. Tier 1 is “Fixed to Standard FHPC”. Tier 2 is “Standard to Advanced FHPC”.

**Background:** With fixed head pressure control, installers set a fixed pressure-temperature setpoint, typically 90oF (PUC 2014). With floating head pressure control, the saturated condensing temperature (SCT) can change in response to outdoor temperature down to a lower minimum value. The greater the reduction in SCT, the greater the energy savings.

Floating suction pressure controls allow the target saturated suction temperature to float in response to the temperature requirements of the refrigeration loads. Like floating head pressure controls, this measure reduces the differential pressure from suction pressure to head pressure to reduce compressor energy use.

**Variants:** We propose two tiers for this measure:

* Tier 1 - Fixed to standard floating head pressure control for multiplex system: This option requires controls to reduce minimum saturated condensing temperature (SCT) to 70oF or less. We suggest the baseline as fixed FHPC with SCT of 90oF. This measure should include replacing each expansion valve with either balanced-port valve or electronic expansion valve (EEV) sized to meet the load requirement at 70oF condensing temperature.
* Tier 2 - Standard to advanced floating control and electronic expansion valves: We suggest this measure include both floating head and floating suction pressure control. This measure requires minimum SCT of 60oF or less. The baseline is standard FHPC with minimum SCT of 70oF. This measure should include replacing mechanical expansion valves with electronic expansion valves on all evaporator coils served by the impacted suction groups. The system should be commissioned to minimize superheat without impacting system performance. Floating suction setpoints must be optimized to allow suction pressure to rise to the highest pressure possible while still maintaining temperature at the critical case(s).

**Considerations**: This measure is climate dependent with energy savings increasing in cooler climates. UES measures can be calculated by climate zone for the Tier 1 and Tier 2 minimum saturated condensing temperatures using algorithms as laid out in references such as Thornton (1991) or Arias (2005) or using tools such as NREL’s EnergyPlus.

**Preliminary Technical Potential:** Technical potential is estimated to be 4.6 aMW for Tier 1 and 4.2 aMW for Tier 2. This was developed with the assistance of Council staff by estimating savings for three prototypical stores (small, large, big box) based on CEC/PG&E (2011). These were projected regionally using the CBSA (NEEA 2014) and discounted for achievability, applicability, saturation and overlap.

**RTF Background:**

RTF has deemed savings for floating head pressure controls on single compressor systems, but does not include multiplex systems (<https://rtf.nwcouncil.org/measure/floating-head-pressure-controls-single-compressor-systems>).

**Deemed Savings and Incentives by Other Entities:** Standard FHPC for multiplex systems is incentivized by the Energy Trust of Oregon with average estimated savings of 447 kWh per compressor horsepower for air-cooled systems and 222 kWh per compressor horsepower for evaporative systems (ETO 2018).

Chelan County PUD incentivizes both standard FHPC (tier 1) and advanced (Tier 2) floating controls for multiplex systems, which includes both floating head and floating suction pressure controls (Chelan 2019). Avista’s “2018-2019 Biennial Conservation Plan” also includes advanced floating head and suction pressure controls with electronic expansion valves (Avista 2017). Deemed savings are 677 kWh per year per compressor hp. (Note Chelan PUD references the 7th Power Plan and Avista references the RTF as their source.)

**References**

Arias, Jaime, “Energy Usage in Supermarkets – Modelling and Field Measurements”, Division of Applied Thermodynamics and Refrigeration, Department of Energy Technology, Royal Institute of Technology, 2005, [https://www.kth.se/polopoly\_fs/1.301522.1550154794!/Menu/general/column-content/attachment/PhD%20Thesis-Jaime%20Arias.pdf](https://www.kth.se/polopoly_fs/1.301522.1550154794%21/Menu/general/column-content/attachment/PhD%20Thesis-Jaime%20Arias.pdf)

Avista, “2018-2027 TEN-YEAR ACHIEVABLE CONSERVATION POTENTIAL AND 2018-2019 BIENNIAL CONSERVATION TARGET OF AVISTA CORPORATION”, Docket UE-171091, 2017, <https://www.myavista.com/-/media/myavista/content-documents/energy-savings/dsm/wa-2018-2019-biennial-conservation-plan.pdf?la=en>

Chelan County PUD. "Energy Smart, Equipment Terms and Conditions." 2019. <https://www.energysmartonline.org/documents/EnergySmart-Chelan-TCs.pdf>.

PUC. "Technical Reference Manual, State of Pennsylvania, Act 129, Energy Efficiency and Conservation Program, Act 213 Alternative Energy Portfolio Standards." *Pennsylvania Utility Commission.* June 2014. <http://www.puc.pa.gov/pcdocs/1265230.docx>.

Thornton, Jeff. "Supermarket Refrigeration Options." *Masters Thesis, University of Wisconsin, Madison.* 1991, <https://minds.wisconsin.edu/bitstream/handle/1793/45617/Thornton1991.pdf?sequence=1&isAllowed=y>.

ETO. "See What Saving Energy and Money Can Do For Your Business." 2018. <https://insider.energytrust.org/wp-content/uploads/be_pi_incentivebooklet.pdf>