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Comments on:

- Section 120.6 Mandatory Requirements for Supermarket Refrigeration, California Title 24
- Title 24, Part II Non-residential voluntary "reach" standards
- Joint Appendix JA-1 – Glossary

Subject: October 13th, 2011 Staff Workshop- 2013 Building Energy Efficiency Standards

Target Corporation is submitting the following comments concerning the proposed language for Title 24 Draft Language for supermarket refrigeration.

120.6.b

Retail food stores with ~~8,000 square feet or more of conditioned area or more~~ total refrigeration loads greater then 500,000 Btu/hr, and that utilize either refrigerated display cases, or walk-in coolers or freezers connected to remote compressor units or condensing units, shall meet the requirements of Subsections 1 through 4.

Target comments:

We ask that the exception based on square footage be defined in terms of total refrigeration load. It's possible that a retailer may have a refrigeration system that has an equivalent load of a small supermarket, or less, but have the same net sales floor area of a large supermarket. The Supermarket energy efficiency report released in September 2011 did not take into consideration the efficiencies and scalability of these technologies for this particular situation. We believe that for small refrigeration loads that utilize distributed equipment, the energy consumption will increase with some of these measures which is counterproductive to the goals of Title 24.

120.6.b.1.A-C

1. Condensers. Fan-powered condensers shall conform to the following requirements.

~~A. All condenser fans for air-cooled condensers, evaporative-cooled condensers, air- or water-cooled fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.~~

A. The refrigeration system condenser controls for systems with air-cooled condensers shall use variable-set-point control logic to reset the condensing temperature set-point in response to ambient dry bulb temperature.

B. The refrigeration system condenser controls for systems with evaporative-cooled condensers shall use variable set-point control logic to reset the condensing temperature set-point in response to ambient wet bulb temperature, water sump temperature, refrigerant liquid temperature, ambient dry bulb temperature, or system head pressure.

Target comments:

Item A states "All condenser fans…shall be continuously variable". Industry experience has indicated that the equipment that is utilized to allow continuously variable fan operation is frequently bypassed by service technicians, which in turn increases overall power consumption from a standard staged fan on/off control type system. We propose that this item is removed until serviceability can be better understood and correlated to lifetime energy consumption of the equipment.

Item C states "….in response to ambient wet bulb temperature". The intent of the language is to require condenser control based on a single variable value. We ask that the committee consider expanding the language to include the options of controlling based on sump temperature, refrigerant liquid temperature, dry bulb temperature or head pressure. These devices will allow the same energy reduction and reliability of control as the wet bulb temperature.

120.6.b.4

~~4. Refrigeration Heat Recovery.~~

~~A. HVAC systems shall utilize heat recovery from refrigeration system(s) for space heating, using no less than 25% of the sum of the design Total Heat of Rejection of all refrigeration systems that have individual Total Heat of Rejection values of 150,000 BTU/Hr or greater at design conditions.~~

~~EXCEPTION 1 to Section 120.6(b)4. A: Stores located in Climate Zone CTZ15.~~

~~EXCEPTION 2 to Section 120.6(b)4. A: HVAC systems that are reused for an expansion or remodel.~~

~~B. The increase in HFC refrigerant charge associated with refrigeration heat recovery equipment and piping shall be no greater than 0.35 lbs per 1,000 BTU/Hr of heat recovery heating capacity.~~

Target comments:

Item 1: The inclusion of the term "HVAC" requires that the air conditioning system be designed with hot-gas reheat and is outside of the scope of Title 24, Section 127, Supermarket Refrigeration. The requirement for HVAC would be better placed in a different section.

The phrase "all refrigeration systems" can be interpreted to mean individual spot merchandisers and beverage coolers located in point of sale locations throughout the store. This will require a different system design for those pieces of equipment as well as a unique engineered system to remove heat from the condenser and move it to the heat reclaim coil. The amount of heat recovered from the equipment will likely not be worth the expense of the required piping system.

Item 1 also requires the heat to be used for space heating. In some areas of California during specific seasons there will not be a need for heat nor there a need to use the heat for dehumidification. The intent of the language is to require heat recovery and to put the energy to useful work.

Target has been actively working with the National Renewable Energy Lab (NREL) on a Department of Energy (DOE) grant to design a store that achieves energy savings of 50% over ASHRAE 90.1. Energy modeling for this project has indicated that refrigeration heat recovery is not a reasonable energy savings measure for Target's store design, since Target's reheat requirements are significantly lower than a traditional super market. Specifically, since Target has a small refrigeration load (typically less than 500 mbtu/hr) in a large sales floor area (typically around 80,000 ft^2) the excess cooling effect from refrigeration is used to indirectly cool the balance of the store that does not have refrigeration but does have internal heat gains.

Several of the variables mentioned above are shown in the table below for two Target stores in California. The "total 2010 gas usage" is for the entire store, and includes gas use for water heating and emergency generator. The total store gas usage at a Target Store is less than the predicted gas savings from the Supermarket Refrigeration Energy Efficiency Study. The model assumes a primary supermarket with large refrigeration load in a small footprint which would lead to more need for heating energy in the

space. As can be seen from this table, for Target's store design of a relatively small amount of refrigeration in a large box, the natural gas savings from refrigeration heat reclaim is small and the cost to effectively utilize this heat across the store in several roof top HVAC units would be high. We believe that this situation was not adequately accounted for in the Supermarket Refrigeration Energy Efficiency Study.

Target Store Number	Store Location	California zone location	Sales Floor Square footage	Total 2010 Natural Gas Usage (Therms)	Total Market Area Refrigeration Load (MBtu/hr)	HVAC units	Predicted Natural Gas Savings from NREL model (Therms)
T1421	Eureka, CA	CTZ01 - Arcata	80,000	8,976	357	16 RTUs and 2 unit heaters	421
T1120	Paso Robles, CA	CTZ05 - Santa Maria	71,000	4,702	440	19 RTUs and 3 unit heaters	520

A high efficiency refrigeration system design utilizing floating condensing temperatures will have little available useful heat at low ambient temperatures. Requiring use of the low quality heat in the HVAC system will likely require a heat pump type system. Although packaged heat pump systems are available, they are limited and much more expensive than traditional commercial HVAC systems. From our research, the HVAC systems available with heat pumps have a lower cooling efficiency than the available non heat pump systems so the electrical energy during cooling season will go up with the heat pump requirement and would not likely offset the gas savings from available refrigeration heat recovery particularly in California for a retail format such as Target. Also, there are other heat recovery methods such as energy recovery ventilators on the HVAC system that would provide a more economical means of energy savings in both cooling and heating modes. Forcing refrigeration heat recovery might make addition of energy recovery ventilators not viable for HVAC system. During the dehumidification mode for a HVAC system, heat recovery for reheat is available and more economical from fully utilizing the HVAC system heat of rejection from a DX cooling system or desiccant dehumidification system.

The concept of utilizing heat of rejection is good, but there should be a means of meeting the requirement using a performance based procedure that will verify the economical viability of capturing the rejected heat versus other methods of energy savings.

APPENDIX A5 - NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.2 ENERGY EFFFICIENCY

A. Commercial Refrigeration.
Retail food stores with ~~8,000 square feet or more of conditioned area~~ 500,000 Btu/hr or more of total refrigeration load, and that utilize either refrigerated display cases, or walk-in coolers or freezers connected to remote compressor units or condensing units, shall meet the requirements of Subsection (a).
(a) CO2 Indirect or Cascade Cooling Systems. Cooling for all refrigerated display cases and walk-in coolers and freezers shall be provided using carbon dioxide (CO2), connected to compressors as a direct expansion refrigerant, or as a phase-change indirect cooling fluid.
~~EXCEPTION 1 to Section (a): Stores with less than 20,000 square feet of sales area.~~
EXCEPTION 1 to Section (a): Existing compressor systems that are reused for an expansion or remodel
EXCEPTION 2 to Section (a): For the medium temperature display cases and coolers use of indirect glycol cooling including the following:
i. Stores with a total medium temperature fixtures and walk-in cooling load of 360,000 BTU/Hr or greater shall have at least one glycol chiller designed with a glycol supply temperature no lower than 25°F.

ii. Glycol supply pump(s) equipped with variable speed drives controlled based on glycol loop pressure differential and with two-way (no bypass) type control valves at cooling coils and display cases.
iii. Variable speed control on walk-in cooling coil fans, utilizing speed control as primary temperature control before cycling glycol supply valves, with minimum fan speed no greater than 70%.
EXCEPTION 3 to Section (a): Direct expansion systems using a Low-GWP Refrigerant.
EXCEPTION 4 to Section (a): Self-contained refrigerated display cases.

JOINT APPENDIX JA-1
LOW-GWP REFRIGERANT is a compound used as a heat transfer fluid or gas that is: (A) any compound or blend of compounds, with a GWP Value less than ~~150~~ 1500; and (B) U.S. EPA Significant New Alternatives Policy (SNAP)-approved; and (C) not an ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2009).

Target comments:
Target has tested a liquid CO2 refrigeration system for over a year in a small format grocery market with approximately 9,000 square feet of grocery area. Our results indicate that this system requires 70,000 to 100,000 kW-hr per year in increased electrical demand when compared to a traditional direct expansion type refrigeration system (approximately a 30% increase). We believe that this increased electrical demand is counterproductive to the goals of Title 24. Our testing has also shown that the electrical demand from these CO2 systems increases faster than a traditional direct expansion system as the outside air temperature increases; we expect that these systems would place a disproportionally larger load on the grid when electrical demand is highest.
Even though the "Supermarket Refrigeration Efficiency Report" made an effort to model the energy consumption of these types of systems, we believe that their theoretical models did not capture the multitude of variables associated with such a highly complex system. We request that their models be validated against empirical data as shared with VaCom Technologies Inc., such as the information that we've gathered through extensive third party electrical sub-metering of actual stores.

Also, since we believe that the technologies utilized for these types of systems are not scalable to small market sizes, due to component availability, we ask that the committee redefine the requirement for CO2 based on the connected refrigeration load or required refrigeration horsepower.

Through extensive testing, empirical data shows that using commercially available refrigerants with GWP values of 1500 or less can drastically reduce the overall system carbon footprint without impacting energy consumption such as with these CO2 systems. Therefore, we also ask the committee to change the definition of a low GWP refrigerant (Appendix JA-1) to "any compound or blend of compounds with a GWP value of less than 1500."

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