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Date: December 9, 2013
Via E-Mail

Amanda Stevens
U.S. Environmental Protection Agency
ENERGY STAR Appliance Program
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Dear Ms. Stevens:

Friedrich has been actively involved in the US EPA ENERGY STAR Program and continually seeks design improvements to increase energy efficiency in all of the products we promote in the marketplace.

Friedrich is writing in response to the November 4th US EPA Framework Document which outlined further potential savings for Room Air Conditioner Manufacturers which could possibly be captured by revising the ENERGY STAR Room AC specifications.

Friedrich here wishes to comment on each of the proposed key topics as to their impact on furthering energy efficiency:

1.) Improved Installation Practices : Friedrich applies specific installation instructions for both window mounted and through the wall air conditioner installations where leakage from the outdoors is taken into account by the selected materials used to isolate the inside conditioned space from the higher outdoor temperatures in the summer and cooler outdoor temperatures in the winter. Friedrich uses both pressed fiberboard, cut to the size of the window opening, as well as accordion style plastic curtains which insulate the outdoors from the conditioned space. In addition, Friedrich provides gasket materials to insulate both the double hung windows from outdoor heat infiltration and insulate the outdoor cabinet sleeve from the slide-in window unit.

   Some of the smaller sized Friedrich room air conditioners are equipped with the accordion curtains for seasonal usage for ease of installation and removal. With the nearly infinite window design options this side panel design is well suited to accommodate various widths and height openings which consumers prefer from a portable appliance. It is unreasonable to expect all consumers to break out tools and cut and shape parts when portability is the objective.

   The various sized Friedrich room air conditioner designs also take into account any air leakage points on the bulkhead (the units metal vertical wall), which separates the indoor coil and components from the outdoor coil and components. This bulkhead sealing is in the form of rubber gaskets wrapped around the connecting refrigerant tubing lines which pass through the bulkhead to prevent tube vibration and damage

during transit. The seals further block hot air leakage from entering the indoor conditioned space. Friedrich further stops outdoor air infiltration by using thick thermal blankets adhered to the outdoor bulkhead to minimize outdoor to indoor heat transfer, as well as adding thermomastic (small flexible soft gum pieces) to cover any small air hole leakage points.

Friedrich ensures the above bulkhead treatments meet our design intent through conducting calorimeter performance tests to verify unit efficiency per ANSI/ASHRAE Standard 16. This test also identifies any weaknesses in unit construction since it checks for air infiltration of the unit as part of the test per Section 4.2.3 (of this standard) whereby the room side to outdoor side static pressure difference is not permitted to be greater than 0.005 in $H_2O$.

Friedrich's field data indicates that roughly 70% of room air conditioners are installed in through the wall applications, which provide permanent cabinet sleeves with well caulked perimeter sealing to protect the conditioned space from moisture and heat infiltration. Friedrich thinks it would be a burden to the manufacturers to add parts on all products to accommodate permanent installations. Friedrich would also be concerned about the safety of requiring consumers to perform skilled labor functions. Friedrich would not expect to see a significant increase in energy efficiency by further modifying the bulkhead or installation materials from our current installation instructions.

2.) Component Improvements: Friedrich has kept pace with the technological changes converting components and refrigerants from R22 to R410A. In the area of higher efficiency R410A compressors there has been no step change in energy efficiency to recapture the efficiency lost moving away from R22 compressors. There have been a few new R410A compressor models with incremental efficiency improvements but overall the R410A EER levels lag behind the R22 EER levels by as much as 1.0 EER.

Friedrich notices the compressor industry focuses on inverter technology due to sales volume increases in split systems. This technology is cost prohibitive to the consumer on the order of adding the cost of two compressors to each room air conditioner design.

Friedrich feels the current room air conditioner DOE test procedure would not apply to inverter technology testing since additional indoor and outdoor room temperature conditions would have to be measured to integrate the benefits of an inverter compressor similar to a SEER rating approach. These test procedure changes would add significant test burden on the order of 6x more testing to derive an efficiency rating point. Engineering expenses for expanded testing would be cost

prohibitive to the consumer since this added resource would need to be recovered in the product.

Friedrich has implemented the latest enhancements in coil designs in tube and fin heat transfer technology. Friedrich still reserves judgment regarding application readiness for using micro-channel coils. In seacoast and many urban applications the all-aluminum condenser coil could create catastrophic refrigerant leaks from corrosive salt air whereas copper tubing is generally more durable in these environments.

In addition to the compressor loss of efficiency, R410A refrigerant operates at a 50% increase in pressure versus R22 requiring increased heat exchanger wall thicknesses and in some cases changing to larger chassis sizes to achieve the same energy efficiency once obtained from the R22 system designs. The additional expenses in larger coils, added weight, larger refrigerant amounts, and sound deadening materials were increases passed on to the consumer.

3.) Reduced Evaporator Recirculation: Friedrich designs plastic fronts and sheet metal parts to achieve the level of efficiencies we have today by eliminating recirculation through internal testing in our lab using thermo-imaging and smoke tests to track and prevent unwanted recirculation. Friedrich focuses on larger plenum throat shapes which maximize the cooling air throw into the conditioned space. This plenum shape integrates with the plastic front louver assembly to provide substantial distance between the plenum and the return air going through the evaporator coil to minimize air recirculation.

Friedrich has seen little difference in energy efficiency when testing the same room air conditioner in a room air enthalpy test method per ANSI/ASHRAE Standard 58 versus using the calorimeter method outlined in ANSI/ASHRAE Standard 16. The first method seals the discharge plenum air from the recirculating return air using ductwork attached directly to the plenum into an air flow measurement box. The second method allows the air to flow freely into the indoor conditioned space with any recirculation free to return down and back into the return air through the evaporator coils. Both test methods show minimal differences in energy efficiency. Friedrich does not see a significant change in energy efficiency with redesign for recirculation effects.

4.) New Refrigerants: Friedrich has been following closely the efforts by the AHRI research group in finding acceptable low GWP (global warming potential) refrigerants as alternates to R410A. At present Friedrich is not aware of any drop-in replacements for R410A systems that have completed their chemistry, toxicology, and component life testing that matches the energy efficiency of the current R410A system designs for RAC's. We know of no hydrocarbon refrigerant substitute

for R410A on the current SNAP list that meets the requisite UL safety standards. UL has been evaluating natural refrigerants based on room sizing, unit capacity, charge amounts, and safe fuel-air mixture ratios in the event of a leak from a hydrocarbon refrigerant. Friedrich is concerned when UL defines the safe natural refrigerants maximum charge limits the amounts will fall short of typical charges in use in today's room air conditioners.

5.) "Connected" Functionality: Friedrich is concerned this technology presents added costs for the consumer. The benefits of "connected" functionality certainty can ease utility peak demand periods. However, Friedrich is concerned the current technology is in the early stages of development and requires further utility integration and controls vetting as well as consumer education. Friedrich further wants to understand the comfort benefits of this function in every application to ensure consumer acceptance and satisfaction. Friedrich feels that the EPA shouldn't be dictating design features but rather focus on reducing greenhouse gases.

6.) Portable AC's : Friedrich feels there should be a separate standard from the RAC standard since portable air conditioners have a variety of configurations to consider when setting efficiency ratings. Some portables come with one hose, some with two hoses, some without hoses. A PAC test standard is being developed now through collaboration with AHAM and US, Canadian, and global industry representatives to define the test unit configurations, room conditions and rating methods in anticipation of adoption by the DOE as a PAC test procedure. Once these new standards define a known baseline then applying ENERGY STAR thresholds would naturally follow the process. Adding the Portables to the RAC specification would require substantial test burdens on manufacturers which may also confuse the consumer when making a purchase decision.

Friedrich encourages the US EPA consider "sun setting" the ENERGY STAR PROGRAM for room air conditioners. Friedrich feels the recent change to the RAC DOE specifications for implementation in June, 2014 has increased again the efficiency levels to be at or above recent ENERGY STAR energy level increases of October 2013. Friedrich feels we are at the limit on increased room air conditioner efficiency versus having to increase all chassis sizes significantly. This effect would diminish the portability of the product and place price points out of reach for the consumers who typically purchase Friedrich products.

Sincerely,

Edward P. Wuesthoff
Sustainment Engineering Manager