Aloha Systems

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Ram Verma
Senior Mechanical Engineer
California Energy Commission
1516 Ninth Street, MS 25
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RE: 2008 Building Energy Efficiency Standards
Support of Robert Mowris's Recommendations

Dear Ram:

Aloha Systems has served as the CPUC's evaluation contractor for the Refrigerant Charge and Airflow Verification Program (RCAVP) implemented by Robert Mowris and Associations (RMA) during the 2004-05 program year. As such we have become very familiar with the program, its implementation, the theories underlying it, the means by which it achieves substantial energy savings for the state (it exceeded its goals), and the attitudes and opinions of contractors and technicians involved with the program.

My personal background includes former employment by Southern California Edison in its research and development programs for alternative energy as well as conservation and load management. My Ph.D. is in electric power systems from the University of California. I am a registered professional engineer in California, Texas, and New York, and a license contractor in California. In the course of evaluating RMA's program, I have gained a deep respect for Robert Mowris and interest and trust in his comprehensive understanding of issues regarding the efficiency and proper installation of HVAC systems.

I have read Robert's "Suggestions for HVAC Efficiency Improvements for the 2008 California Building Energy Standards" that he presented at the March 28, 2006, workshop and fully concur with them.

Furthermore, I offer some information gleaned from the RCAVP during our evaluation process. During the two year program 13,512 HVAC systems had their refrigerant charge and airflow verified and, if necessary, adjusted. A comprehensive database included full details on 12,453 of these units, which were located throughout the service territories of PG&E, SCE, and SDG&E and 14 of the 16 climate zones. We estimate that the verification and adjustment of these units saved 6,021,115 kWh/year, or an average of 446 kWh per unit.

The RCAVP verified and adjusted the charge and airflow of both newly installed and previously existing units, as well as those with and without TXVs. Nearly two-thirds (65%) of the older units needed refrigerant charge adjustments, and 45% of newly installed units required adjustment. This appears to indicate that (a) technicians do not finely tune the charge when installing new units and (b) that proper charge degrades over time.

While interviewing contractors and technicians, we confirmed the general hypothesis that most people working in the industry do not understand the importance of *precise* refrigerant charge. They understand "proper charge" in the sense that very low charge will cause a unit to not work effectively, and that very high charges can damage compressors. Most do not understand the relationship between small discrepancies in charge and decreases in operating efficiency. This lack of understanding often produced a lack of care for calibration of equipment and/or the use of rules of thumb or simple slide-card calculators to determine the amount of charge required. Nearly all technicians given pre- and post-training surveys showed significant increases in their personal understanding of these measures after being trained by the RMA staff.

Our interviews also showed that contractors and technicians like the locking Schrader caps. Almost all (96%) agreed with the statement, *"I am confident the locking Schrader caps will identify and maintain proper refrigerant charge,"* and 52% "strongly agreed" with it. Many commented that the color-coded caps serve a dual purpose – they indicate the type of refrigerant to use, eliminating possible errors from adding the wrong type, and they serve as a flag that this unit has had special treatment. The technicians also like the idea of the "Verified" stickers being placed prominently on the unit.

We also found that units with TXVs were just as likely to require refrigerant charge adjustments as those without. For units without TXVs (combined commercial and residential, old and new), 51% required a charge adjustment; for units with TXVs, 49% required a charge adjustment. Thus statistics from this large sample of over 12,000 verified HVAC units demonstrate that the presence of a TXV is not a good substitute for RCA verification and adjustment.

Based upon these observations, we fully support amending the 2008 building standards to require proper RCA verification for *all* new split system and packaged unit air conditioners, including those with thermostatic expansion valves (TXVs) and those in both commercial and residential applications. We also believe that locking Schrader caps should be installed once the refrigerant charge has been verified and (if needed) adjusted. This adds only a very minor cost, but will decrease refrigerant leakage and tend to prevent future devolution of the charge by unauthorized or unqualified personnel.

Please feel free to contact me at (949) 851-2221 or by email at MarkS@alohasys.com if you have any further questions.

Sincerely,

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