are optional. Five copies of written comments are recommended and should be submitted to the committee chair at the meeting.

Request for Written Comments: We invite the public to submit written comments relevant to the focus of the Advisory Committee. We would like to receive written comments from members of the public no later than April 30, 2007.

SUPPLEMENTARY INFORMATION: Submit all comments to the Advisory Committee using one of the following methods: 1. Internet. We encourage the public to submit comments through the Internet to the following address: *Peirce.Hammond@ed.gov* 2. Mail. The public may also submit comments via mail to Peirce Hammond, Office of Indian Education, U.S. Department of Education, 400 Maryland Avenue, SW., Room 5C132, Washington, DC 20202. Due to delays in mail delivery caused by heightened security, please allow adequate time for the mail to be received.

Records are kept of all Council proceedings and are available for public inspection at the Office of Indian Education, United States Department of Education, Room 5C141, 400 Maryland Avenue, SW., Washington, DC 20202, Monday through Friday from 9 a.m. to 5 p.m.

Electronic Access to This Document: You may view this document, as well as all other documents of this Department published in the **Federal Register**, in text or Adobe Portable Document Format (PDF) on the Internet at the following site: *http://www.ed.gov/news/federegister.*

To use PDF you must have Adobe Acrobat Reader, which is available free at this site. If you have questions about using PDF, call the U.S. Government Printing Office (GPO), toll free at 1–888–293–6498; or in the Washington, DC, area at (202) 512–1530.

Note: The official version of this document is the document published in the **Federal Register**. Free Internet access to the official edition of the **Federal Register** and the Code of Federal Regulations is available on GPO Access at: *http://www.gpoaccess.gov/nara/index.html.*

Kerri L. Briggs,

Acting Assistant Secretary for Elementary and Secondary Education.

[FR Doc. E7–7522 Filed 4–19–07; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

[Case No. CAC–013]

Energy Conservation Program for Consumer Products: Publication of the Petition for Waiver and Denial of the Application for Interim Waiver of Cascade Group, LLC From the DOE Commercial Package Air Conditioner and Heat Pump Test Procedures

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of Petition for Waiver, denial of Application for Interim Waiver, and request for comments.

SUMMARY: Today's notice publishes the Petition for Waiver from Cascade Group, LLC (hereafter ''Cascade''). This Petition for Waiver (hereafter ''Cascade Petition'') requests a waiver from the Department of Energy (hereafter ''DOE'') test procedure for commercial package air conditioners and heat pumps. In addition, today's notice denies Cascade's Application for Interim Waiver from the DOE test procedure applicable to commercial package air conditioners and heat pumps. Today's notice also includes an alternate test procedure DOE is considering. DOE is soliciting comments, data, and information with respect to the Cascade Petition, Cascade's Application for Interim Waiver, and the proposed alternate test procedure.

DATES: DOE will accept comments, data, and information until, but no later than May 21, 2007.

ADDRESSES: Please submit comments, identified by case number CAC–013, by any of the following methods:

- *Mail:* Ms. Brenda Edwards-Jones, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–2945. Please submit one signed original paper copy.
- *Hand Delivery/Courier:* Ms. Brenda Edwards-Jones, U.S. Department of Energy, Building Technologies Program, Room 1J–018, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585.
- *E-mail: Michael.Raymond@ee.doe.gov*. Include either the case number [CAC–013], and/or ''Cascade Petition'' in the subject line of the message.
- *Federal eRulemaking Portal: http://www.regulations.gov*. Follow the instructions for submitting comments.

Instructions: All submissions received must include the agency name and case number for this proceeding. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format and avoid the use of special characters or any form of encryption. Wherever possible, include the electronic signature of the author. Absent an electronic signature, comments submitted electronically must be followed and authenticated by submitting the signed original paper document. DOE does not accept telefacsimiles (faxes). Any person submitting written comments must also send a copy of such comments to the petitioner. (10 CFR 431.401(d)(2)) The contact information for the Petitioner of today's notice is: Gary R. Scoggins, P.E., Special Projects Engineer, United Mechanical, Inc., P.O. Box 551206, Dallas, Texas 75355–1206.

According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit two copies: One copy of the document including all the information believed to be confidential, and one copy of the document with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to that determination.

Docket: For access to the docket to read the background documents relevant to this matter, go to the U.S. Department of Energy, Forrestal Building, Room 1J–018 (Resource Room of the Building Technologies Program), 1000 Independence Avenue, SW., Washington, DC, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Available documents include the following: (1) This notice; (2) public comments received; (3) the Cascade Petition for Waiver and Application for Interim Waiver; and (4) prior DOE rulemakings regarding commercial central air conditioners and heat pumps. Please call Ms. Brenda Edwards-Jones at the above telephone number for additional information regarding visiting the Resource Room. Please note that DOE's Freedom of Information Reading Room (formerly Room 1E–190 at the Forrestal Building) is no longer housing rulemaking materials.

FOR FURTHER INFORMATION CONTACT: Dr. Michael G. Raymond, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Mail Stop EE–2J, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585–

0121, (202) 586–9611; e-mail: *Michael.Raymond.ee.doe.gov;* or Francine Pinto, Esq., U.S. Department of Energy, Office of General Counsel, Mail Stop GC–72, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585–0103, (202) 586–9507; e-mail: *Francine.Pinto@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

I. Background and Authority

Title III of the Energy Policy and Conservation Act (EPCA) sets forth a variety of provisions concerning energy efficiency. Part C of Title III (42 U.S.C. 6311–6317) provides for an energy efficiency program entitled ''Certain Industrial Equipment,'' and includes commercial air conditioning equipment, packaged boilers, water heaters, and other types of commercial equipment.

Today's notice involves commercial equipment under Part C, which specifically provides for definitions, test procedures, labeling provisions, energy conservation standards, and the authority to require information and reports from manufacturers. With respect to test procedures, Part C generally authorizes the Secretary of Energy to prescribe test procedures that are reasonably designed to produce results which reflect energy efficiency, energy use and estimated operating costs, and that are not unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)).

For commercial package air conditioning and heating equipment, EPCA provides that the test procedures shall be those generally accepted industry testing procedures or rating procedures developed or recognized by the Air-Conditioning and Refrigeration Institute (ARI) or by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), as referenced in ASHRAE/IES Standard 90.1 and in effect on June 30, 1992. (42 U.S.C. 6314(a)(4)(A)) This section also provides for the Secretary of Energy to amend the test procedure for a product if the industry test procedure is amended, unless the Secretary determines that such a modified test procedure does not meet the statutory criteria. (42 U.S.C. 6314(a)(4)(B)) On October 21, 2004, DOE published a direct final rule, effective December 20, 2004, adopting ARI Standard 210/240–2003 for small commercial package air conditioning and heating equipment with capacities < 65,000 Btu/h and ARI Standard 340/360–2000 for large commercial package air conditioning and heating equipment with capacities ≥ 135,000 Btu/h and < 240,000 Btu/h and small commercial package air conditioning and heating equipment with capacities ≥ 65,000 Btu/h and < 135,000 Btu/h. 69 FR 61962, October 21, 2004. According to Cascade, both ARI Standard 340/360–2000 and ARI Standard 210/240–2003 are applicable to Cascade's Cascade Energy Saver (CES) products. However, Cascade only seeks a waiver from ARI Standard 210/240–2003.

DOE's regulations set forth under 10 CFR 431.401 contain provisions allowing a person to seek a waiver from the test procedure requirements for commercial equipment. The waiver provisions allow the Assistant Secretary for Energy Efficiency and Renewable Energy (hereafter ''Assistant Secretary'') to temporarily waive test procedures for a particular basic model when a petitioner shows that the basic model contains one or more design characteristics which either prevent testing according to the prescribed test procedures, or when the prescribed test procedures may evaluate the basic model in a manner so unrepresentative of its true energy consumption as to provide materially inaccurate comparative data. 10 CFR 431.401(a)(1). The Assistant Secretary may grant the waiver subject to conditions, including adherence to alternate test procedures. 10 CFR 431.401(f)(4). Petitioners are to include in their petition any alternate test procedures known to evaluate the basic model in a manner representative of its energy consumption. 10 CFR 431.401(b)(1)(iii). Waivers generally remain in effect until final test procedure amendments become effective, thereby resolving the problem that is the subject of the waiver. 10 CFR 431.401(g).

The waiver process also allows the Assistant Secretary to grant an interim waiver from test procedure requirements to manufacturers who have petitioned DOE for a waiver of such prescribed test procedures. 10 CFR 431.401(a)(2). An interim waiver remains in effect for a period of 180 days or until DOE issues its determination on the petition for waiver, whichever is sooner, and may be extended for an additional 180 days, if necessary. 10 CFR 431.401(e)(4).

II. Petition for Waiver

On July 22, 2005, Cascade filed the Cascade Petition for Waiver and its Application for an Interim Waiver from the test procedures applicable to commercial package air conditioning and heating equipment. On May 26, 2006, Cascade filed an amended Petition for Waiver listing all the basic models for which Cascade seeks a waiver. In particular, Cascade requested a waiver from the commercial test procedures contained in ARI Standard 210/240–2003 for the system combinations listed in Table 1, attached to its amended Petition.

Cascade seeks a waiver from the test procedures in ARI Standard 210/240–2003 and asserts that the design characteristics of the CES systems prevent testing according to these prescribed test procedures. In particular, Cascade states that the CES indoor-coil blower models have more than one blower per coil and up to and as many as eight blowers that operate independently. Cascade claims that its products do not conform to the test procedures in ARI Standard 210/240–2003, because these test procedures are based on a system with only one indoor-coil blower.

Cascade asserts that with slight modifications to ARI 210/240 procedures, CES units can be tested and that such testing can provide measurements to satisfactorily determine the Seasonal Energy Efficiency Ratio (SEER) and the Heating Seasonal Performance Factor (HSPF). Cascade included in its petition sample SEER calculations, sample test procedures used to derive the SEER calculations, and sample test data. The testing, contracted by Cascade to Texas A&M University Energy Services Laboratory (hereafter ''TAMU–ESL''), provides data on a system with two 2.5-ton Amana RHF 030 heat pump units of SEER 12 connected to a dual-circuit evaporator coil, followed by a plenum housing 8 blowers operated by a control system. Using a test procedure based on ARI 210/240, TAMU–ESL calculated a SEER value of 18.1 and an HSPF of 9.5. Details of the testing are provided in the Cascade Petition, published in full, below.

III. Application for Interim Waiver

Cascade also requested immediate relief through its Application for Interim Waiver to avert undue economic hardship. According to DOE regulations, an interim waiver may be granted if it is determined that the applicant will experience economic hardship if the application for interim waiver is denied, if it appears likely that the petition for waiver will be granted, and/or the Assistant Secretary determines that it would be desirable for public policy reasons to grant immediate relief pending a determination of the petition for waiver. 10 CFR 431.401(e)(3).

Cascade's Application for Interim Waiver does not provide sufficient information to evaluate what, if any, economic impact or competitive disadvantage Cascade will likely experience absent a favorable determination on its application. It also does not provide sufficient information to determine if there are public policy reasons to grant immediate relief. Furthermore, DOE has never granted a previous waiver for a similar product design. Thus, the likelihood of granting the waiver is unclear until further information and comment is provided.

Therefore, Cascade's Application for an Interim Waiver from the DOE test procedure for its CES products is denied. Hence, it is ordered that: The Application for Interim Waiver filed by Cascade is hereby denied for Cascade's CES air conditioners and central air conditioning heat pumps.

This denial of Cascade's Application for Interim Waiver is based upon the presumed validity of statements and allegations submitted by the company. This denial of Interim Waiver may be modified if DOE receives information that justifies granting an Interim Waiver.

IV. Alternate Test Procedure

DOE will make its judgment on the Cascade Petition after the period for public comment ends. However, should DOE grant Cascade a waiver from the applicable test procedures, DOE would likely prescribe an alternate test procedure. Manufacturers face restrictions with respect to making representations about the energy consumption and energy consumption costs of products covered by EPCA. (42 U.S.C. 6314(d)) Consistent representations are important for manufacturers to make claims about the energy efficiency of their products. For example, they are necessary to determine compliance with state and local energy codes and regulatory requirements, and can provide valuable consumer purchasing information. Therefore, DOE is considering an alternate test procedure for Cascade. DOE is publishing the proposed alternate test procedure in this notice to account for the potential need for an alternate test procedure and to allow the public to comment on a proposed alternate test procedure.

Cascade included a description of an alternate test procedure and test data for a sample system in its Petition. DOE is considering prescribing an alternate test procedure that takes into account the information Cascade provided in the petition. In particular, the proposed alternate test procedure would require Cascade to test units according to ARI Standard 210/240–2003, but permit Cascade to use alternate requirements when testing systems that have multiple fans per indoor coil.[1] Cascade may test systems with multiple indoor fans that jointly provide the total indoor-coil airflow rate required for the capacity being tested, however, Cascade would be required to adhere to the airflow requirement of section 6.1.3.3 of ARI Standard 210/240–2003, which sets an upper limit on indoor-coil airflow according to system capacity.[2] During testing, the individual indoor fans would each deliver an equal portion of the total required airflow.

DOE generally agrees with TAMU–ESL's testing and analysis of a system with a CES 5-ton, 8-zone unit connected to an Amana RHF030 heat pump with a SEER of 12–14. As each Amana RHF030 heat pump uses a single-speed compressor, DOE agrees with TAMU–ESL's choice to treat the system as a two-speed blower with a two-stage compressor and test the system according to A2.2.2 and A2.1.3. Furthermore, DOE agrees with TAMU–ESL's decision to ensure a total indoor-coil airflow rate of around 2,000 cfm with eight blowers providing 250 cfm each, when operating the system at a full capacity. For low-speed conditions, TAMU–ESL operated the system at a 2.5-ton capacity and ensured a total indoor-coil airflow rate of around 1,000 cfm, with four blowers providing 250 cfm each.

However, it is not clear why TAMU–ESL conducted Test C for full load operation only, though section A3.1.3 indicates that if one chooses to perform Test C, the system must be tested at low-speed. Furthermore, for certification, testing conditions must fall within the applicable tolerances provided in ARI 210/240–2003. Finally, while DOE generally approves of the TAMU–ESL method to test a CES multi-blower unit paired with two Amana RHF030 heat pumps, DOE would expect Cascade to test its units according to those appropriate tests, procedures and conditions generally stated in ARI 210/240–2003. For example, testing of a CES unit paired to a variable-speed compressor should follow the procedures and requirements described for a system with a variable-speed compressor in A2.1.6.

Given consideration of the information provided to DOE in the Cascade Petition, DOE is considering the following alternate test procedure:

Alternate test procedure. Cascade shall be required to test the products covered under this Waiver according to the prescribed tests, conditions, and procedures referenced in ARI Standard 210/240–2003, except that Cascade shall be permitted to test systems with indoor units that have multiple fans. As such, Cascade shall be required to meet the usual indoor-coil airflow rate requirements of ARI Standard 210/240–2003, section 6.1.3.3. However, tested units may run multiple indoor-coil fans which collectively meet the required indoor-coil airflow rates per capacity. To determine the level at which to operate the indoor fans during testing, Cascade may divide the total indoor-coil airflow rate at full load, by the number of indoor fans in the tested system. During testing, Cascade shall run the indoor fans at this level, and may decide how many indoor fans to operate by dividing the total indoor-coil airflow required at the capacity being tested by the indoor fan level, as determined above. Cascade may make representations of the CES products covered in this Waiver, consistent with the provisions outlined in this alternate test procedure.

V. Summary and Request for Comments

Today's notice announces the Cascade Petition for Waiver and denies Cascade's Application for Interim Waiver from the test procedures applicable to Cascade's CES air conditioner and heat pump units. DOE is publishing the Cascade Petition for Waiver in its entirety. The Cascade Petition contains no confidential information. Furthermore, today's notice includes an alternate test procedure that the DOE is considering including in the subsequent Decision and Order, should DOE decide to grant Cascade a Waiver.

DOE is interested in receiving comments on all aspects of this notice. DOE is particularly interested in receiving comments and views of interested parties concerning whether to grant the Cascade Petition and regarding the proposed alternate test procedure. Specifically, DOE would like to receive comment on the following questions:

• Does this alternate test procedure adequately specify how to handle

[1] For example, according to a 450 cfm/ton requirement, a 5 ton unit would be permitted to have an airflow rate of 2,250 cfm or lower. If that system were to operate at 2,000 cfm and have 8 fans, each fan would blow 250 cfm. In addition, if that same system were to operate at partial load with 2.5 tons of capacity, the tester could operate 4 fans with each fan blowing 250 cfm.

[2] For example, section 6.1.3.3 requires equipment with indoor fans intended for use with field installed duct systems to be rated at the indoor-coil airflow rate of equal to or less than 37.5 SCFM per 1,000 Btu/h of rated capacity.

airflows when testing a system with multiple blowers?

- In the proposed alternate test procedure, fans are to run at a set cfm per fan throughout a test. Is this appropriate or should DOE allow fans to run at different cfm's throughout a test while still meeting the required overall indoor-coil airflow rate according to capacity?
- Cascade states that the current test procedure is not specific about the method of configuring a dual-circuited evaporator coil to blowers. However, Cascade does not propose specific language. Does the alternate test procedure proposed in this notice need to specifically address configurations of dual-evaporator coils and coil-blowers?
- DOE is interested in receiving general comments on possible modifications to any test procedures or alternative rating methods that DOE could use to fairly represent the energy efficiency of Cascade's CES products.

Any person submitting written comments must also send a copy of such comments to the Petitioner, whose contact information is cited above. 10 CFR 431.201(d)(2).

Issued in Washington, DC, on April 9, 2007.

Alexander A. Karsner,

Assistant Secretary, Energy Efficiency and Renewable Energy.

Petition of Waiver Submitted by: Cascade Group, LLC, General partner for Cascade Manufacturing, LP; 11540 Plano Road, Dallas, Texas 75243, 1–214–341–9300, Patents 5,701,750 and 6,792,768, 05/26/06, Amended 04/16/07

Identification of Basic Sizes and Models of CES

The CES is sold in the following sizes and models:

Example 1: Model CES 1–2–2-H–5kw is a size 2 Ton evaporative coil matched with a single 2 ton heat pump, with 2 blowers, horizontal configuration with 5 kW auxiliary heat.

Example 2: Model CES 2–2.5–8-V–10kw is a size 6 ton 50/50 split evaporative coil matched with two 2.5 ton heat pumps, with 8 blowers, vertical upflow configuration with 10 kW auxiliary heat.

Note: Table 1 below only shows horizontal configurations. There is not a difference in performance. A vertical unit could have been easily represented.

TABLE 1

Tons	Qty of heat pump units	Number of blowers						
2	1–2 Ton	2	3	4				
		CES 1–2–2–H–5KW	CES 1–2–3–H–5KW	CES 1–2–4–H–5KW.				
2.5	1–2.5 T	2	3	4				
		CES 1–2.5–2–H–5KW	CES 1–2.5–3–H–5KW	CES 1–2.5–4–H–5KW.				
3	2–1.5 T	2	3	4				
		CES 1–3–2–H–5KW	CES 1–3–3–H–5KW	CES 1–3–4–H–5KW.				
4	2–2 T	2	3	4	5	6	7	8
		CES 2–2–2–H–10KW	CES 2–2–3–H–10KW	CES 2–2–4–H–10KW	CES 2–2–5–H–10KW	CES 2–2–6–H–10KW	CES 2–2–7–H–10KW	CES 2–2–8–H–10KW.
5	2–2.5 T	2	3	4	5	6	7	8
		CES 2–2.5–2–H–10KW	CES 2–2.5–3–H–10KW	CES 2–2.5–4–H–10KW	CES 2–2.5–5–H–10KW	CES2–2.5–6–H–10KW	CES 2–2.5–7–H–10KW	CES 2–2.5–8–H–10KW.

Table 1–1 below shows the system combinations of Cascade Indoor Units with the respective outdoor heat units sorted by manufacturer with the associated model number.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade Manufacturing, L.P. (Cascade)	CES 1–2–2	2	Amana	1	ASH130241A.
Cascade	CES 1–2–2	2	Aire-Flo	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–2	2	AirPro	1	FRHS0241CD.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES 1–2–2	2	American Standard	1	2A6B3024A1.
Cascade	CES 1–2–2	2	Bryant	1	213ANA024–A.
Cascade	CES 1–2–2	2	Carrier	1	25HBA324A30.
Cascade	CES 1–2–2	2	Coleman	1	DRHS0241BD.
Cascade	CES 1–2–2	2	Ducane	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–2	2	Fedders	1	CH24ABD1VF.
Cascade	CES 1–2–2	2	Frigidaire	1	FT3BD–024K.
Cascade	CES 1–2–2	2	Gibson	1	GT3BD–024K.
Cascade	CES 1–2–2	2	Goodman	1	GSH130241A.
Cascade	CES 1–2–2	2	Lennox	1	12HPB24–P.
Cascade	CES 1–2–2	2	Luxaire	1	EABC–F024S.
Cascade	CES 1–2–2	2	Maytag	1	PSH1BC024K.
Cascade	CES 1–2–2	2	Rheem	1	13PJA24.
Cascade	CES 1–2–2	2	Ruud	1	13PJA24.
Cascade	CES 1–2–2	2	Tappan	1	FT3BD–024K.
Cascade	CES 1–2–2	2	Trane	1	2TWB3024A1.
Cascade	CES 1–2–2	2	York	1	E1RC024S06.
Cascade	CES 1–2–2	2	Westinghouse	1	FT3BD–024K.
Cascade	CES 1–2–2	2	Whirlpool	1	W2H324A–1A.
Cascade	CES 1–2–3	2	Amana	1	ASH130241A.
Cascade	CES 1–2–3	2	Aire-Flo	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–3	2	AirPro	1	FRHS0241CD.
Cascade	CES 1–2–3	2	American Standard	1	2A6B3024A1.
Cascade	CES 1–2–3	2	Bryant	1	213ANA024–A.
Cascade	CES 1–2–3	2	Carrier	1	25HBA324A30.
Cascade	CES 1–2–3	2	Coleman	1	DRHS0241BD.
Cascade	CES 1–2–3	2	Ducane	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–3	2	Fedders	1	CH24ABD1VF.
Cascade	CES 1–2–3	2	Frigidaire	1	FT3BD–024K.
Cascade	CES 1–2–3	2	Gibson	1	GT3BD–024K.
Cascade	CES 1–2–3	2	Goodman	1	GSH130241A.
Cascade	CES 1–2–3	2	Lennox	1	12HPB24–P.
Cascade	CES 1–2–3	2	Luxaire	1	EABC–F024S.
Cascade	CES 1–2–3	2	Maytag	1	PSH1BC024K.
Cascade	CES 1–2–3	2	Rheem	1	13PJA24.
Cascade	CES 1–2–3	2	Ruud	1	13PJA24.
Cascade	CES 1–2–3	2	Tappan	1	FT3BD–024K.
Cascade	CES 1–2–3	2	Trane	1	2TWB3024A1.
Cascade	CES 1–2–3	2	York	1	E1RC024S06.
Cascade	CES 1–2–3	2	Westinghouse	1	FT3BD–024K.
Cascade	CES 1–2–3	2	Whirlpool	1	W2H324A–1A.
Cascade	CES 1–2–4	2	Amana	1	ASH130241A.
Cascade	CES 1–2–4	2	Aire-Flo	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–4	2	AirPro	1	FRHS0241CD.
Cascade	CES 1–2–4	2	American Standard	1	2A6B3024A1.
Cascade	CES 1–2–4	2	Bryant	1	213ANA024–A.
Cascade	CES 1–2–4	2	Carrier	1	25HBA324A30.
Cascade	CES 1–2–4	2	Coleman	1	DRHS0241BD.
Cascade	CES 1–2–4	2	Ducane	1	2HP13(B,L)24P–1.
Cascade	CES 1–2–4	2	Fedders	1	CH24ABD1VF.
Cascade	CES 1–2–4	2	Frigidaire	1	FT3BD–024K.
Cascade	CES 1–2–4	2	Gibson	1	GT3BD–024K.
Cascade	CES 1–2–4	2	Goodman	1	GSH130241A.
Cascade	CES 1–2–4	2	Lennox	1	12HPB24–P.
Cascade	CES 1–2–4	2	Luxaire	1	EABC–F024S.
Cascade	CES 1–2–4	2	Maytag	1	PSH1BC024K.
Cascade	CES 1–2–4	2	Rheem	1	13PJA24.
Cascade	CES 1–2–4	2	Ruud	1	13PJA24.
Cascade	CES 1–2–4	2	Tappan	1	FT3BD–024K.
Cascade	CES 1–2–4	2	Trane	1	2TWB3024A1.
Cascade	CES 1–2–4	2	York	1	E1RC024S06.
Cascade	CES 1–2–4	2	Westinghouse	1	FT3BD–024K.
Cascade	CES 1–2–4	2	Whirlpool	1	W2H324A–1A.
Cascade	CES 1–2.5–2	2.5	Amana	1	ASH130301A.
Cascade	CES 1–2.5–2	2.5	Aire-Flo	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–2	2.5	AirPro	1	FRHS0301CD.
Cascade	CES 1–2.5–2	2.5	American Standard	1	2A6B3030A1.
Cascade	CES 1–2.5–2	2.5	Bryant	1	213ANA030–A.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES 1–2.5–2	2.5	Carrier	1	25HBA330A30.
Cascade	CES 1–2.5–2	2.5	Coleman	1	DRHS0301BD.
Cascade	CES 1–2.5–2	2.5	Ducane	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–2	2.5	Fedders	1	CH30ABD1VF.
Cascade	CES 1–2.5–2	2.5	Frigidaire	1	FT3BD–030K.
Cascade	CES 1–2.5–2	2.5	Gibson	1	GT3BD–030K.
Cascade	CES 1–2.5–2	2.5	Goodman	1	CPLT30–1.
Cascade	CES 1–2.5–2	2.5	Lennox	1	12HPB30–P.
Cascade	CES 1–2.5–2	2.5	Luxaire	1	EABC–F030S.
Cascade	CES 1–2.5–2	2.5	Maytag	1	DT3BD–030K.
Cascade	CES 1–2.5–2	2.5	Rheem	1	13PJA30.
Cascade	CES 1–2.5–2	2.5	Ruud	1	13PJA30.
Cascade	CES 1–2.5–2	2.5	Tappan	1	FT3BD–030K.
Cascade	CES 1–2.5–2	2.5	Trane	1	2TWB3030A1.
Cascade	CES 1–2.5–2	2.5	York	1	E1RC030S06.
Cascade	CES 1–2.5–2	2.5	Westinghouse	1	FT3BD–030K.
Cascade	CES 1–2.5–2	2.5	Whirlpool	1	WGH430A.
Cascade	CES 1–2.5–3	2.5	Amana	1	ASH130301A.
Cascade	CES 1–2.5–3	2.5	Aire-Flo	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–3	2.5	AirPro	1	FRHS0301CD.
Cascade	CES 1–2.5–3	2.5	American Standard	1	2A6B3030A1.
Cascade	CES 1–2.5–3	2.5	Bryant	1	213ANA030–A.
Cascade	CES 1–2.5–3	2.5	Carrier	1	25HBA330A30.
Cascade	CES 1–2.5–3	2.5	Coleman	1	DRHS0301BD.
Cascade	CES 1–2.5–3	2.5	Ducane	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–3	2.5	Fedders	1	CH30ABD1VF.
Cascade	CES 1–2.5–3	2.5	Frigidaire	1	FT3BD–030K.
Cascade	CES 1–2.5–3	2.5	Gibson	1	GT3BD–030K.
Cascade	CES 1–2.5–3	2.5	Goodman	1	CPLT30–1.
Cascade	CES 1–2.5–3	2.5	Lennox	1	12HPB30–P.
Cascade	CES 1–2.5–3	2.5	Luxaire	1	EABC–F030S.
Cascade	CES 1–2.5–3	2.5	Maytag	1	DT3BD–030K.
Cascade	CES 1–2.5–3	2.5	Rheem	1	13PJA30.
Cascade	CES 1–2.5–3	2.5	Ruud	1	13PJA30.
Cascade	CES 1–2.5–3	2.5	Tappan	1	FT3BD–030K.
Cascade	CES 1–2.5–3	2.5	Trane	1	2TWB3030A1.
Cascade	CES 1–2.5–3	2.5	York	1	E1RC030S06.
Cascade	CES 1–2.5–3	2.5	Westinghouse	1	FT3BD–030K.
Cascade	CES 1–2.5–3	2.5	Whirlpool	1	WGH430A.
Cascade	CES 1–2.5–4	2.5	Amana	1	ASH130301A.
Cascade	CES 1–2.5–4	2.5	Aire-Flo	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–4	2.5	AirPro	1	FRHS0301CD.
Cascade	CES 1–2.5–4	2.5	American Standard	1	2A6B3030A1.
Cascade	CES 1–2.5–4	2.5	Bryant	1	213ANA030–A.
Cascade	CES 1–2.5–4	2.5	Carrier	1	25HBA330A30.
Cascade	CES 1–2.5–4	2.5	Coleman	1	DRHS0301BD.
Cascade	CES 1–2.5–4	2.5	Ducane	1	2HP13(B,L)30P–1.
Cascade	CES 1–2.5–4	2.5	Fedders	1	CH30ABD1VF.
Cascade	CES 1–2.5–4	2.5	Frigidaire	1	FT3BD–030K.
Cascade	CES 1–2.5–4	2.5	Gibson	1	GT3BD–030K.
Cascade	CES 1–2.5–4	2.5	Goodman	1	CPLT30–1.
Cascade	CES 1–2.5–4	2.5	Lennox	1	12HPB30–P.
Cascade	CES 1–2.5–4	2.5	Luxaire	1	EABC–F030S.
Cascade	CES 1–2.5–4	2.5	Maytag	1	DT3BD–030K.
Cascade	CES 1–2.5–4	2.5	Rheem	1	13PJA30.
Cascade	CES 1–2.5–4	2.5	Ruud	1	13PJA30.
Cascade	CES 1–2.5–4	2.5	Tappan	1	FT3BD–030K.
Cascade	CES 1–2.5–4	2.5	Trane	1	2TWB3030A1.
Cascade	CES 1–2.5–4	2.5	York	1	E1RC030S06.
Cascade	CES 1–2.5–4	2.5	Westinghouse	1	FT3BD–030K.
Cascade	CES 1–2.5–4	2.5	Whirlpool	1	WGH430A.
Cascade	CES–2–1.5–2	3	Amana	2	ASH130181A.
Cascade	CES–2–1.5–2	3	Aire-Flo	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–2	3	AirPro	2	DRHS0181BD.
Cascade	CES–2–1.5–2	3	American Standard	2	2A6B3018A1.
Cascade	CES–2–1.5–2	3	Bryant	2	213ANA018–A.
Cascade	CES–2–1.5–2	3	Carrier	2	25HBA318A30.
Cascade	CES–2–1.5–2	3	Coleman	2	DRHS0181BD.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES–2–1.5–2	3	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–2	3	Fedders	2	CH18ABD1VF.
Cascade	CES–2–1.5–2	3	Frigidaire	2	FT3BD–018K.
Cascade	CES–2–1.5–2	3	Gibson	2	GT3BD–018K.
Cascade	CES–2–1.5–2	3	Goodman	2	GSH130181A.
Cascade	CES–2–1.5–2	3	Lennox	2	12HPB18–P.
Cascade	CES–2–1.5–2	3	Luxaire	2	EABC–F018S.
Cascade	CES–2–1.5–2	3	Maytag	2	DT5BD–018K.
Cascade	CES–2–1.5–2	3	Rheem	2	13PJA18.
Cascade	CES–2–1.5–2	3	Ruud	2	UPNE–018JZ.
Cascade	CES–2–1.5–2	3	Tappan	2	FT3BD–018K.
Cascade	CES–2–1.5–2	3	Trane	2	2TWB3018A1.
Cascade	CES–2–1.5–2	3	York	2	E1RC018S06.
Cascade	CES–2–1.5–2	3	Westinghouse	2	W2H318A–1A.
Cascade	CES–2–1.5–2	3	Whirlpool	2	W2H318A–1A.
Cascade	CES–2–1.5–3	3	Amana	2	ASH130181A.
Cascade	CES–2–1.5–3	3	Aire-Flo	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–3	3	AirPro	2	DRHS0181BD.
Cascade	CES–2–1.5–3	3	American Standard	2	2A6B3018A1.
Cascade	CES–2–1.5–3	3	Bryant	2	213ANA018–A.
Cascade	CES–2–1.5–3	3	Carrier	2	25HBA318A30.
Cascade	CES–2–1.5–3	3	Coleman	2	DRHS0181BD.
Cascade	CES–2–1.5–3	3	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–3	3	Fedders	2	CH18ABD1VF.
Cascade	CES–2–1.5–3	3	Frigidaire	2	FT3BD–018K.
Cascade	CES–2–1.5–3	3	Gibson	2	GT3BD–018K.
Cascade	CES–2–1.5–3	3	Goodman	2	GSH130181A.
Cascade	CES–2–1.5–3	3	Lennox	2	12HPB18–P.
Cascade	CES–2–1.5–3	3	Luxaire	2	EABC–F018S.
Cascade	CES–2–1.5–3	3	Maytag	2	DT5BD–018K.
Cascade	CES–2–1.5–3	3	Rheem	2	13PJA18.
Cascade	CES–2–1.5–3	3	Ruud	2	UPNE–018JZ.
Cascade	CES–2–1.5–3	3	Tappan	2	FT3BD–018K.
Cascade	CES–2–1.5–3	3	Trane	2	2TWB3018A1.
Cascade	CES–2–1.5–3	3	York	2	E1RC018S06.
Cascade	CES–2–1.5–3	3	Westinghouse	2	W2H318A–1A.
Cascade	CES–2–1.5–3	3	Whirlpool	2	W2H318A–1A.
Cascade	CES–2–1.5–4	3	Amana	2	ASH130181A.
Cascade	CES–2–1.5–4	3	Aire-Flo	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–4	3	AirPro	2	DRHS0181BD.
Cascade	CES–2–1.5–4	3	American Standard	2	2A6B3018A1.
Cascade	CES–2–1.5–4	3	Bryant	2	213ANA018–A.
Cascade	CES–2–1.5–4	3	Carrier	2	25HBA318A30.
Cascade	CES–2–1.5–4	3	Coleman	2	DRHS0181BD.
Cascade	CES–2–1.5–4	3	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–1.5–4	3	Fedders	2	CH18ABD1VF.
Cascade	CES–2–1.5–4	3	Frigidaire	2	FT3BD–018K.
Cascade	CES–2–1.5–4	3	Gibson	2	GT3BD–018K.
Cascade	CES–2–1.5–4	3	Goodman	2	GSH130181A.
Cascade	CES–2–1.5–4	3	Lennox	2	12HPB18–P.
Cascade	CES–2–1.5–4	3	Luxaire	2	EABC–F018S.
Cascade	CES–2–1.5–4	3	Maytag	2	DT5BD–018K.
Cascade	CES–2–1.5–4	3	Rheem	2	13PJA18.
Cascade	CES–2–1.5–4	3	Ruud	2	UPNE–018JZ.
Cascade	CES–2–1.5–4	3	Tappan	2	FT3BD–018K.
Cascade	CES–2–1.5–4	3	Trane	2	2TWB3018A1.
Cascade	CES–2–1.5–4	3	York	2	E1RC018S06.
Cascade	CES–2–1.5–4	3	Westinghouse	2	W2H318A–1A.
Cascade	CES–2–1.5–4	3	Whirlpool	2	W2H318A–1A.
Cascade	CES–2–2–2	4	Amana	2	ASH130241A.
Cascade	CES–2–2–2	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–2	4	AirPro	2	DRHS0241BD.
Cascade	CES–2–2–2	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–2	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–2	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–2	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–2	4	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–2–2	4	Fedders	2	CH24ABD1VF.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES–2–2–2	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–2	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–2	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–2	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–2	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–2	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–2	4	Rheem	2	13PJA24.
Cascade	CES–2–2–2	4	Ruud	2	13PJA24.
Cascade	CES–2–2–2	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–2	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–2	4	York	2	E1RC024S06.
Cascade	CES–2–2–2	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–2	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–3	4	Amana	2	ASH130241A.
Cascade	CES–2–2–3	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–3	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–3	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–3	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–3	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–3	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–3	4	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–2–3	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–3	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–3	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–3	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–3	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–3	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–3	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–3	4	Rheem	2	13PJA24.
Cascade	CES–2–2–3	4	Ruud	2	13PJA24.
Cascade	CES–2–2–3	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–3	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–3	4	York	2	E1RC024S06.
Cascade	CES–2–2–3	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–3	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–4	4	Amana	2	ASH130241A.
Cascade	CES–2–2–4	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–4	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–4	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–4	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–4	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–4	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–4	4	Ducane	2	2HP13(B,L)18P–1.
Cascade	CES–2–2–4	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–4	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–4	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–4	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–4	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–4	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–4	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–4	4	Rheem	2	13PJA24.
Cascade	CES–2–2–4	4	Ruud	2	13PJA24.
Cascade	CES–2–2–4	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–4	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–4	4	York	2	E1RC024S06.
Cascade	CES–2–2–4	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–4	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–5	4	Amana	2	ASH130241A.
Cascade	CES–2–2–5	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–5	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–5	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–5	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–5	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–5	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–5	4	Ducane	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–5	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–5	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–5	4	Gibson	2	GT3BD–024K.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES–2–2–5	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–5	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–5	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–5	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–5	4	Rheem	2	13PJA24.
Cascade	CES–2–2–5	4	Ruud	2	13PJA24.
Cascade	CES–2–2–5	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–5	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–5	4	York	2	E1RC024S06.
Cascade	CES–2–2–5	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–5	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–6	4	Amana	2	ASH130241A.
Cascade	CES–2–2–6	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–6	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–6	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–6	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–6	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–6	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–6	4	Ducane	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–6	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–6	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–6	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–6	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–6	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–6	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–6	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–6	4	Rheem	2	13PJA24.
Cascade	CES–2–2–6	4	Ruud	2	13PJA24.
Cascade	CES–2–2–6	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–6	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–6	4	York	2	E1RC024S06.
Cascade	CES–2–2–6	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–6	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–7	4	Amana	2	ASH130241A.
Cascade	CES–2–2–7	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–7	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–7	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–7	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–7	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–7	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–7	4	Ducane	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–7	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–7	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–7	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–7	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–7	4	Lennox	2	12HPB24–P.
Cascade	CES–2–2–7	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–7	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–7	4	Rheem	2	13PJA24.
Cascade	CES–2–2–7	4	Ruud	2	13PJA24.
Cascade	CES–2–2–7	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–7	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–7	4	York	2	E1RC024S06.
Cascade	CES–2–2–7	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–7	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2–8	4	Amana	2	ASH130241A.
Cascade	CES–2–2–8	4	Aire-Flo	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–8	4	AirPro	2	FRHS0241CD.
Cascade	CES–2–2–8	4	American Standard	2	2A6B3024A1.
Cascade	CES–2–2–8	4	Bryant	2	213ANA024–A.
Cascade	CES–2–2–8	4	Carrier	2	25HBA324A30.
Cascade	CES–2–2–8	4	Coleman	2	DRHS0241BD.
Cascade	CES–2–2–8	4	Ducane	2	2HP13(B,L)24P–1.
Cascade	CES–2–2–8	4	Fedders	2	CH24ABD1VF.
Cascade	CES–2–2–8	4	Frigidaire	2	FT3BD–024K.
Cascade	CES–2–2–8	4	Gibson	2	GT3BD–024K.
Cascade	CES–2–2–8	4	Goodman	2	GSH130241A.
Cascade	CES–2–2–8	4	Lennox	2	12HPB24–P.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES–2–2–8	4	Luxaire	2	EABC–F024S.
Cascade	CES–2–2–8	4	Maytag	2	DT3BD–024K.
Cascade	CES–2–2–8	4	Rheem	2	13PJA24.
Cascade	CES–2–2–8	4	Ruud	2	13PJA24.
Cascade	CES–2–2–8	4	Tappan	2	FT3BD–024K.
Cascade	CES–2–2–8	4	Trane	2	2TWB3024A1.
Cascade	CES–2–2–8	4	York	2	E1RC024S06.
Cascade	CES–2–2–8	4	Westinghouse	2	FT3BD–024K.
Cascade	CES–2–2–8	4	Whirlpool	2	W2H324A–1A.
Cascade	CES–2–2.5–4	5	Amana	2	ASH130301A.
Cascade	CES–2–2.5–4	5	Aire-Flo	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–4	5	AirPro	2	FRHS0301CD.
Cascade	CES–2–2.5–4	5	American Standard	2	2A6B3030A1.
Cascade	CES–2–2.5–4	5	Bryant	2	213ANA030–A.
Cascade	CES–2–2.5–4	5	Carrier	2	25HBA330A30.
Cascade	CES–2–2.5–4	5	Coleman	2	DRHS0301BD.
Cascade	CES–2–2.5–4	5	Ducane	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–4	5	Fedders	2	CH30ABD1VF.
Cascade	CES–2–2.5–4	5	Frigidaire	2	FT3BD–030K.
Cascade	CES–2–2.5–4	5	Gibson	2	GT3BD–030K.
Cascade	CES–2–2.5–4	5	Goodman	2	CPLT30–1.
Cascade	CES–2–2.5–4	5	Lennox	2	12HPB30–P.
Cascade	CES–2–2.5–4	5	Luxaire	2	EABC–F030S.
Cascade	CES–2–2.5–4	5	Maytag	2	DT3BD–030K.
Cascade	CES–2–2.5–4	5	Rheem	2	13PJA30.
Cascade	CES–2–2.5–4	5	Ruud	2	13PJA30.
Cascade	CES–2–2.5–4	5	Tappan	2	FT3BD–030K.
Cascade	CES–2–2.5–4	5	Trane	2	2TWB3030A1.
Cascade	CES–2–2.5–4	5	York	2	E1RC030S06.
Cascade	CES–2–2.5–4	5	Westinghouse	2	FT3BD–030K.
Cascade	CES–2–2.5–4	5	Whirlpool	2	WGH430A.
Cascade	CES–2–2.5–5	5	Amana	2	ASH130301A.
Cascade	CES–2–2.5–5	5	Aire-Flo	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–5	5	AirPro	2	FRHS0301CD.
Cascade	CES–2–2.5–5	5	American Standard	2	2A6B3030A1.
Cascade	CES–2–2.5–5	5	Bryant	2	213ANA030–A.
Cascade	CES–2–2.5–5	5	Carrier	2	25HBA330A30.
Cascade	CES–2–2.5–5	5	Coleman	2	DRHS0301BD.
Cascade	CES–2–2.5–5	5	Ducane	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–5	5	Fedders	2	CH30ABD1VF.
Cascade	CES–2–2.5–5	5	Frigidaire	2	FT3BD–030K.
Cascade	CES–2–2.5–5	5	Gibson	2	GT3BD–030K.
Cascade	CES–2–2.5–5	5	Goodman	2	CPLT30–1.
Cascade	CES–2–2.5–5	5	Lennox	2	12HPB30–P.
Cascade	CES–2–2.5–5	5	Luxaire	2	EABC–F030S.
Cascade	CES–2–2.5–5	5	Maytag	2	DT3BD–030K.
Cascade	CES–2–2.5–5	5	Rheem	2	13PJA30.
Cascade	CES–2–2.5–5	5	Ruud	2	13PJA30.
Cascade	CES–2–2.5–5	5	Tappan	2	FT3BD–030K.
Cascade	CES–2–2.5–5	5	Trane	2	2TWB3030A1.
Cascade	CES–2–2.5–5	5	York	2	E1RC030S06.
Cascade	CES–2–2.5–5	5	Westinghouse	2	FT3BD–030K.
Cascade	CES–2–2.5–5	5	Whirlpool	2	WGH430A.
Cascade	CES–2–2.5–6	5	Amana	2	ASH130301A.
Cascade	CES–2–2.5–6	5	Aire-Flo	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–6	5	AirPro	2	FRHS0301CD.
Cascade	CES–2–2.5–6	5	American Standard	2	2A6B3030A1.
Cascade	CES–2–2.5–6	5	Bryant	2	213ANA030–A.
Cascade	CES–2–2.5–6	5	Carrier	2	25HBA330A30.
Cascade	CES–2–2.5–6	5	Coleman	2	DRHS0301BD.
Cascade	CES–2–2.5–6	5	Ducane	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–6	5	Fedders	2	CH30ABD1VF.
Cascade	CES–2–2.5–6	5	Frigidaire	2	FT3BD–030K.
Cascade	CES–2–2.5–6	5	Gibson	2	GT3BD–030K.
Cascade	CES–2–2.5–6	5	Goodman	2	CPLT30–1.
Cascade	CES–2–2.5–6	5	Lennox	2	12HPB30–P.
Cascade	CES–2–2.5–6	5	Luxaire	2	EABC–F030S.
Cascade	CES–2–2.5–6	5	Maytag	2	DT3BD–030K.

TABLE 1–1.—COMBINATIONS OF INDOOR-OUTDOOR UNITS THAT ARE SUBJECT TO THE WAIVER—Continued

Indoor unit			Outdoor unit		
Manufacturer	Cascade model	Tons	System heat pump manufacturer	Qty of outside units per cascade unit	Model No.
Cascade	CES–2–2.5–6	5	Rheem	2	13PJA30.
Cascade	CES–2–2.5–6	5	Ruud	2	13PJA30.
Cascade	CES–2–2.5–6	5	Tappan	2	FT3BD–030K.
Cascade	CES–2–2.5–6	5	Trane	2	2TWB3030A1.
Cascade	CES–2–2.5–6	5	York	2	E1RC030S06.
Cascade	CES–2–2.5–6	5	Westinghouse	2	FT3BD–030K.
Cascade	CES–2–2.5–6	5	Whirlpool	2	WGH430A.
Cascade	CES–2–2.5–7	5	Amana	2	ASH130301A.
Cascade	CES–2–2.5–7	5	Aire-Flo	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–7	5	AirPro	2	FRHS0301CD.
Cascade	CES–2–2.5–7	5	American Standard	2	2A6B3030A1.
Cascade	CES–2–2.5–7	5	Bryant	2	213ANA030–A.
Cascade	CES–2–2.5–7	5	Carrier	2	25HBA330A30.
Cascade	CES–2–2.5–7	5	Coleman	2	DRHS0301BD.
Cascade	CES–2–2.5–7	5	Ducane	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–7	5	Fedders	2	CH30ABD1VF.
Cascade	CES–2–2.5–7	5	Frigidaire	2	FT3BD–030K.
Cascade	CES–2–2.5–7	5	Gibson	2	GT3BD–030K.
Cascade	CES–2–2.5–7	5	Goodman	2	CPLT30–1.
Cascade	CES–2–2.5–7	5	Lennox	2	12HPB30–P.
Cascade	CES–2–2.5–7	5	Luxaire	2	EABC–F030S.
Cascade	CES–2–2.5–7	5	Maytag	2	DT3BD–030K.
Cascade	CES–2–2.5–7	5	Rheem	2	13PJA30.
Cascade	CES–2–2.5–7	5	Ruud	2	13PJA30.
Cascade	CES–2–2.5–7	5	Tappan	2	FT3BD–030K.
Cascade	CES–2–2.5–7	5	Trane	2	2TWB3030A1.
Cascade	CES–2–2.5–7	5	York	2	E1RC030S06.
Cascade	CES–2–2.5–7	5	Westinghouse	2	FT3BD–030K.
Cascade	CES–2–2.5–7	5	Whirlpool	2	WGH430A.
Cascade	CES–2–2.5–8	5	Amana	2	ASH130301A.
Cascade	CES–2–2.5–8	5	Aire-Flo	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–8	5	AirPro	2	FRHS0301CD.
Cascade	CES–2–2.5–8	5	American Standard	2	2A6B3030A1.
Cascade	CES–2–2.5–8	5	Bryant	2	213ANA030–A.
Cascade	CES–2–2.5–8	5	Carrier	2	25HBA330A30.
Cascade	CES–2–2.5–8	5	Coleman	2	DRHS0301BD.
Cascade	CES–2–2.5–8	5	Ducane	2	2HP13(B,L)30P–1.
Cascade	CES–2–2.5–8	5	Fedders	2	CH30ABD1VF.
Cascade	CES–2–2.5–8	5	Frigidaire	2	FT3BD–030K.
Cascade	CES–2–2.5–8	5	Gibson	2	GT3BD–030K.
Cascade	CES–2–2.5–8	5	Goodman	2	CPLT30–1.
Cascade	CES–2–2.5–8	5	Lennox	2	12HPB30–P.
Cascade	CES–2–2.5–8	5	Luxaire	2	EABC–F030S.
Cascade	CES–2–2.5–8	5	Maytag	2	DT3BD–030K.
Cascade	CES–2–2.5–8	5	Rheem	2	13PJA30.
Cascade	CES–2–2.5–8	5	Ruud	2	13PJA30.
Cascade	CES–2–2.5–8	5	Tappan	2	FT3BD–030K.
Cascade	CES–2–2.5–8	5	Trane	2	2TWB3030A1.
Cascade	CES–2–2.5–8	5	York	2	E1RC030S06.
Cascade	CES–2–2.5–8	5	Westinghouse	2	FT3BD–030K.
Cascade	CES–2–2.5–8	5	Whirlpool	2	WGH430A.

Design Characteristics Constituting the Grounds for Petition

The United States Department of Energy has designated the American Refrigeration Institute (ARI) as the body of air conditioning industry partners to develop and maintain standards for compliance to the National Appliance Energy Conservation Act of 1987 (NAECA). (10 CFR 430). The two standards that were developed by ARI that are applicable to the CES are the ARI 210/240 and ARI 340/360.

ARI 210/240 is the standard that certifies the performance of units that are 65,000 Btu/hr or less. Currently, this standard requires that a split system heat pump meet a minimum SEER of 10. The standard also stipulates that it meet the maximum standard airflow rate of 37.5 CFM/1000Btu/hr. This CFM is assumed to be applicable to the indoor unit that has only one blower-motor. The CES unit does not fit this model in that the indoor blower-motor combinations can range from 2 to 8 indoor blower-motors that are independently operating. Thus a waiver is sought since the current procedures for testing do not apply.

This request for a waiver will include SEER calculations that are the result of live data for a multi-indoor blower-motor configuration, those specific procedures followed during the test, the data in the test were conducted by the Texas A&M University Energy Services

Laboratory (TAMU–ESL) by Michael Davis under the supervision of Dr. Dennis O'Neal, Dean of Mechanical Engineering, Texas A&M University.

The following results show that under ARI 210/240 conditions, connecting the CES 5ton-8 zone unit to an Amana RHF030 heat pump with an SEER of 12–14 (dependant on the indoor blower-coil for the rating) produced an SEER value based on the calculations of 18.1 and an HSPF of 9.5. This is a 29% savings on cooling Seasonal energy efficiency Ratio and a 19% increase over the heating seasonal efficiency ratio.

The ''Results of Heating and Cooling Performance Testing of Cascade Energy Saver™'' report from Texas A&M is attached in the Appendix A.

Specific Requirements Sought To Be Waived

Cascade requests a waiver by this petition from the procedures of ARI210/240 for models that are 65000Btu/h and smaller because the Cascade Manufacturing indoor blower coil models have more than one blower per coil and up to and as many as eight blowers. Thus, it does not conform to the test procedures of ARI 210/240, which are based solely on one single indoor-coil blower. We have proven with laboratory tests that an enhanced multi-blower fan coil is efficient and that by slight modifications to the current ARI 210/240 procedures, Cascade Energy Saver units can be tested and the results will show that the SEER and HSPF are easily measurable.

Pursuant to the purchase of the CES, Cascade seeks to be a viable and profitable business concern and therefor desires to implement its business plan for manufacturing and distribution of mass quantities of the CES units in the various models and sizes to the general public within the United States. To effectuate the manufacturing and distribution, Cascade has entered into certain agreements with United Chester Industries, Inc. dba United Mechanical, Inc., an existing mechanical contractor with manufacturing and distribution capabilities.

Cascade seeks immediate relief through this waiver to avert undo economic hardship.

Discussion in Details for the Requested Waiver

Concerning ARI 210/240

1. The ARI 210/240 test procedure does not take into account indoor blower coils with more than one indoor blower and motor. The Cascade Energy Saver indoor coil-blower is thus a deviation from the ARI 210/240 model. This design is what Cascade believes will be product to fill a market niche and that the consumer with find huge energy saving benefits.

Cascade contracted with TAMU–ESL to perform the ARI 210/240 testing comprised of two operating conditions, namely with 2 variations/combinations of indoor blowers and outdoor heat pumps, in order to demonstrate that the efficiencies are within the acceptable values of the NAECA, namely, SEER, COP, HSPF.

2. In addition to the data, the assumptions, the test conditions, the procedures followed by TAMU–ESL are all included in the report from TAMU–ESL.

3. These procedures are the means by which the Cascade CES units will meet the standards as set forth by the NEACA of 1987. Once reviewed by DOE or its assigns, we assert that the test procedures presented herein can be incorporated into the ARI 210/240 as an approved manner to test multi-blower coil assemblies like the Cascade Energy Saver.

4. It is Cascade's intention to cooperate with DOE or its assigns, in rigorously supporting the data presented herein, the procedure as detailed by TAMU–ESL, our laboratory, the efficiencies reported and the conclusions.

5. Cascade Manufacturing believes that the benefits to the consumer in the future usage of this CES unit will be dramatic in terms of reducing energy consumption which is the intent of the NAECA.

Identification of Manufacturers With Similar Design Characteristics

There are no other known manufacturers or products that are like the CES. This is the patented feature of the CES. The fact that the CES using multiple blowers is what creates the problem with the standards as noted previously in this Petition.

Alternative Test Procedures To Evaluate Energy Consumption Characteristics

- Cascade Manufacturing entered into a testing contract with Texas A&M University's Energy Services Laboratory. The procedure that TAMU–ESL followed was the ARI 210/240 procedure. TAMU–ESL ''modeled'' the Cascade system as a 2 speed blower and the compressors with 2 stages.
- Thus, TAMU–ESL's procedure was to collect data under the Tests A,B,C and D with all 8 blowers running (modeled as a single blower) and both compressors running (modeled as a single 2 speed compressor) and this is a full load case. Then, part load conditions were 4 blowers operating (modeled as a low speed single fan) and one compressor operating (modeled as a single compressor in low speed).
- The CES unit had a 5 ton evaporator coil, split 50%/50% in the sense that it has a 4 row slab coil with 2 of the rows being connected to one 2.5 ton heat pump and the other two rows connected to the other 2.5 ton heat pump. The slab coil is patented in its design. It is a face split. Rows 1 and 3 are connected to one heat pump and rows 2 and 4 are connected to the other heat pump. The coil surface stays wet with one or both of the heat pumps operating.
- When the full load test was conducted, all 8 fans were on. The 8 fans are powered by individual ⅓hp GE ECM motors which use 50 watts of power each, thus 400 watts total for all 8 fans. Each fan was set to blow only 250 cfm at 0.5″ ESP, for a total of 2000 cfm (i.e., 5 tons of air). The outlet from each of the 8 zones was ducted with flex into a single 16″ header. The 16″ header was then ducted into the wind tunnel.
- During the part load test, only four zone blowers were operating. Each of these four blowers was delivering 250 cfm at 0.5″; ESP, for a total of 1000 cfm which is the 400 cfm per ton for 2.5 tons. The ducting was the same as in full load.
- Tests A,B and C were run in accordance with the ARI210/240 procedure and pursuant to the notes summarized above. Test D was not run since we chose to use the default coefficient of degradation of 0.25.
- Finally, it is evident to me from these results that the ARI 210/240 procedures worked for the Cascade unit. Further, the procedure can and should be evaluated by the industry bodies that are responsible for code enforcement to implement changes accordingly to allow for testing of Cascade units.

Petitioner

Gary R. Scoggins, P.E.,

Special Projects Engineer.

Representative for Cascade Group, LLC general partner for Cascade Manufacturing LP.
2183 Buckingham Road #301,
Richardson, Texas 75081–5499
1–214–341–9300
Patents 5,701,750 and 6,792,768

Appendix A—The Test Report From Texas A&M University, College Station, Texas, Dated August 27, 2004

Results of Heating and Cooling Performance Testing of Cascade Energy Saver™

Final Report

Submitted to

Cascade Manufacturing, LP, c/o United Mechanical, Inc., 11540 Plano Road, Dallas, Texas 75243.

Submitted by
Michael A. Davis, Assistant Research Engineer;
Carlos Ortiz, P.E., Assistant Research Engineer;
August 27, 2004.
Energy Systems Laboratory, Texas Engineering Experiment Station, College Station, Texas 77843.

Executive Summary

Cascade Manufacturing, LP (CM) contracted with the Energy Systems Laboratory (ESL) to conduct heating and cooling rating and performance tests on their multizoned coil blower unit called, ''Cascade Energy Saver'' (CES) in accordance with the ARI Standard for Air Source Split system heat pumps. The equipment tested consisted of one CES unit with 8 blowers, one Aspen 5 ton Coil model # BHA40 60+x3 50/50SP (a two circuit slab coil with TXVs, 2.5 tons per circuit), and two Amana 2.5 ton Heat pump model RHF 030—12 SEER.

At the time that this report was written and the tests were conducted, the ARI 210/240 (Standard) was not clear with a procedure for the proper rating and performance tests for an HRCU–A–CB with multiple-zone blowers as manufactured by CM. In order to obtain laboratory data that would support an SEER, HSPF, COP and EER determination, ESL determined to follow and apply the Standard's HRCU–A–CB as closely as possible (exceptions, deviations and assumptions to follow in this document). It appeared to ESL engineers that the Standard could be applied to the performance ratings of a CES unit when fixed indoor blower fan speeds were used in combination with (1.) traditional 400 cfm per ton and (2.) various compressor combinations. Before describing the application of the Standard, a description of the CES unit will be given in order for the reader to understand the logic behind the application of the Standard.

The CES unit consists of two heat pump units connected to an evaporator that has two refrigerant circuits. The evaporator is followed by a plenum which houses multiple blowers that are independently operated by a control system developed specifically for the blower/evaporator/heat pump system. When in normal operation, the control system manages the operation of the compressors and fans in order to meet the system load as dictated by the multiple thermostats connected to the controller. The blower motors are variable speed motors manufactured by GE, model 2.3 ECM that can be operated at full capacity during peak operation or scaled back to lower rotational speeds at part load conditions. With the lower rotational speeds, lower cfm rates can be delivered independently to each zone connected to the system.

The heat pump condenser units are off-the-shelf units and are not manufactured by Cascade Manufacturing, rather their design permits the use of any manufactured unit from companies such as Amana Trane, Carrier, Lennox, or others. For our tests, we were supplied with Amana Heat Pumps. The heat pumps were operated in either an on or off mode and each one had single speed compressors and single speed fans. The fact that there are two heat pumps of equal size providing the two stages of cooling and heating with up to 8 indoor fans in a draw thru configuration to the dual circuit evaporator coil was the primary reason for selecting the specific guidelines from the Standard. The Standard gives detailed instructions for a variety of compressor operation combinations but it does not adequately describe various combinations of indoor fan(s) and two evaporator/compressor combinations possible with this unit. It was decided that the standard descriptions where the title included ''units with two-speed compressors, two compressors, or cylinder unloading'' most closely matched the operation of the CES unit. Typically units with two compressors also have separate refrigerant circuits on both the indoor and outdoor coils which match the configuration of the CES unit.

The two major differences with this system in light of the Standard was how to apply the Standard to (1.) a coil blower unit with a 4 row, dual circuited evaporator coil which is circuited with full face of the 1st and 3rd rows on one heat pump and rows 2 and 4 on the second heat pump, (2.) more than one evaporator blower. The coil blower unit tested had 8 blowers. The Standard does not describe how to handle the various air flows that can be produced with eight blowers. It was determined that the best way to test the unit was to apply full-load air flows as determined by nominal 400 cfm per ton (compressor) operation. For example, if both 2.5 ton heat pumps were operating, the rated air flow that was tested was 2,000 cfm. With one heat pump running, the coil blower unit would have half the heating/cooling capacity therefore the full load air flow would be 1,000 cfm which is half of the two heat pump supply side air flow. This interpretation of the Standard was used for both heating and cooling tests.

For cooling, testing was done following the guidelines in ARI 210/240 section A2.1.3. Tests A, B, and C were conducted for both single heat pump and two heat pump operation. Test D was not done and the default C_D of 0.25 was used for SEER calculations. The indoor air-enthalpy method was used during the tests. A description of the test facilities and the energy balance method is included below. Proper energy balances were achieved for all tests as were within the specifications of the standard. The results of the cooling tests are included in the table below.

For heating, testing was done following the guidelines in ARI 210/240 section A2.2.2. Tests were conducted at 62F (one heat pump), 47F (one and two heat pumps), 35F (one and two heat pumps), and 17F (two heat pumps). The indoor air-enthalpy method was used during the tests. Proper energy balances were achieved on all test except the 17F test. Due to the cycling of the heat pumps between heating and defrost, two phase transients in the refrigerant circuit prevented a good measurement of the refrigerant flow until the unit reached steady state. The period of time where the refrigerant was in two phases was sufficient to prevent a proper energy balance from being achieved. The air-side measurements were taken with the same instrumentation during the 17F tests as were used during all other testing. It is reasonable to assume the air side measurements were accurate during the 17F tests since proper energy balances were achieved during all other tests. The results of the heating tests are included in the table below.

	Total capacity (btuh)	Total power (kW)	EER
Cooling			
A	65,201	4.4	14.8
B	63,766	3.8	16.6
C	58,393	3.9	15.0
SEER	18.1		
	Total capacity (btuh)	**Total power (kW)**	**COP**
Heating			
62F	37,979 (1 comp)	3.1	3.6
47F	67,827	5.7	3.5
35F	56,561	5.2	3.2
17F	37,645	4.5	2.5
HSPF	9.5		

Facilities and Procedure

All of the tests were conducted in the psychrometric rooms at the Energy Systems Laboratory which is part of the Texas Engineering Experiment Station a division within the Texas A&M University System. These rooms were completed in 1986 and have been used for research projects and industry testing. The rooms were designed for testing of systems with cooling capacities up to 10 tons. Chilled water is provided to the rooms by a 75 ton Trane screw chiller. Reheat is provided by 40 kW of electrical strip heaters in the conditioning ductwork. In addition, a desiccant system is used to provide low humidity conditions in either room. The psychrometric rooms allow indoor and outdoor dry-bulb and wet-bulb temperatures to be maintained within approximately ± 0.3 °C (0.5 °F) during steady state operations. Temperatures from 17 °F to 120 °F have been maintained for tests in the rooms for previous tests. The rooms are capable of running all standard ARI 210/240 (ARI 2003) and ASHRAE 37/116 (ASHRAE 1988 and 1983) unitary heat pump and air conditioners tests, which include both heating and cooling mode.

Electric resistance heaters and chilled water coils are used to maintain room temperature. Reheat in each room is provided by four banks of 9.9 kW electrical strip heaters in the conditioning ductwork. The cooling coil is supplied with a water ethylene glycol solution from the chiller. A 1000 gallon water storage tank is mounted in the system to stabilize the chilled water temperature and reduce the cycling of the chiller. Steam from an electric-fired boiler and dehumidification coils control the humidity in the rooms. The dehumidification coils are fed from the same cool storage tank as the cooling coils. The boiler supplies steam directly into the supply air duct. Room temperature is maintained by adjusting the chilled water flow to coils with VSD driven pumps in combination with the operation of the reheat coils.

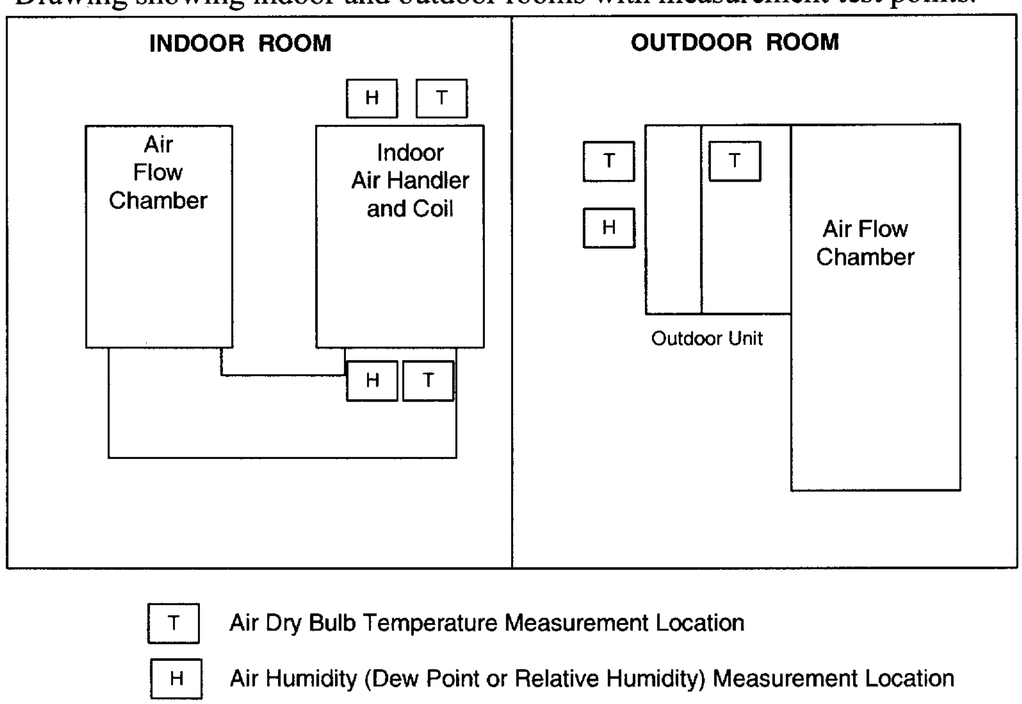
The indoor test section includes the indoor air flow chamber and the indoor fan coil section. The air flow chamber fan draws conditioned air from the indoor room through the indoor test section. An adjustable damper is used to maintain the amount of air flow specified for each unit. After leaving the air flow chamber, conditioned air is routed back into the indoor room. Figure 1 shows a sketch of the indoor and outdoor rooms as used for these tests.

The outdoor room section is the condensing sections for the heat pump units (compressors and outdoor coils) plus the outdoor airflow chamber. Conditioned outdoor air enters the outdoor coil and is exhausted to the outdoor room. Outdoor airflow rates were not measured for these units. Air is drawn in through all sides of the outdoor unit and discharged through the top of the unit. A sampler mounted around the outdoor coils measured dry-bulb temperature and relative humidity as it entered the condensers.

The instrumentation for all tests is divided into air-side and refrigerant-side measurements. The air-side temperature measurements for both the inlet and outlet of the indoor coil unit are made using type-T thermocouple grids. A combination of dew point and relative humidity sensors were used for the inlet and outlet of indoor coil unit. For the outdoor unit, both temperature and humidity were measured on the inlet side of the condenser. Because the indoor enthalpy method was used for all tests, condenser outlet RH was not measured. Both inlet and outlet temperatures were be measured with type-T thermocouples.

BILLING CODE 6450–01–P

Figure 1. – Drawing showing indoor and outdoor rooms with measurement test points.



Refrigerant-side temperatures and pressures were measured throughout the system. Refrigerant-side test points are shown on Figure 2. With the exception of the refrigerant flow rate, the outdoor unit power, and the air flow differential pressure, the rest of the measurements are temperatures (dry-bulb, wet-bulb, dew point) and pressures. Refrigerant mass flow was measured with a Coriolis-type flow meter placed on the liquid line after the condensing section of the heat pump unit (Figure A.2) for both heat pumps units. Separate mass flow meters were used for each heat pump unit.

The data acquisition system converted signals coming from all the sensors in the indoor and outdoor rooms into temperatures, pressures, flow rates, or power. A data logger was used to collect data from the testing apparatus. The logger is linked to a computer where the data was visually displayed during testing. Once a test was complete, the data was transferred to another computer for processing. Each channel was scanned by the logger at regular intervals and the data was stored every thirty seconds. A minimum of one hour of steady state data was collected as per the standard's specifications for cooling and 30 minutes for heating. For cooling tests A and B, steady state was maintained for one hour before the start of data collection in order to ensure that steady state dehumidification had been achieved. A description of the data acquisition test points is listed in Table 1.

Figure 2 – Data acquisition points in the refrigerant side of the system.

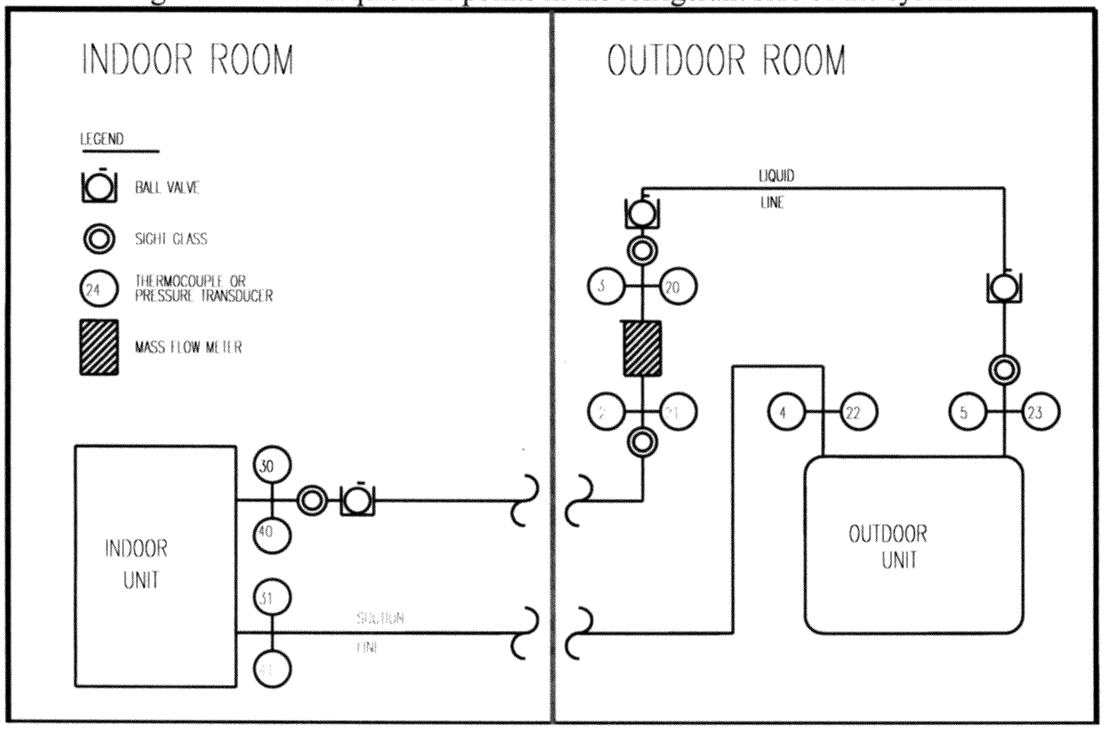


Table 1 – Data acquisition format for these tests.

Channel	Sensor Type	Channel Description
0	Mass Flow meter	Refrigerant Flow rate
1	Watt Transducer	Condenser Power
2	Pressure Transducer	Mass flow exit pressure
3	Pressure Transducer	Mass flow inlet pressure
4	Pressure Transducer	Condenser suction line pres.
5	Pressure Transducer	Condenser liquid line pres.
20	Thermocouple	Mass flow inlet temperature
21	Thermocouple	Mass flow exit temperature
22	Thermocouple	Condenser suction line temp.
23	Thermocouple	Condenser liquid line temp.
24	Thermocouple	Condenser inlet air temp.
30	Thermocouple	Evaporator liquid line temp.
31	Thermocouple	Evaporator suction line temp.
32	Thermocouple	Air flow chamber temp.
33	Wet Bulb sensor	Evaporator inlet wet-bulb temp.
35	Wet Bulb sensor	Evaporator exit wet bulb temp.
36	Thermocouple Grid	Evaporator exit dry bulb temp.
38	Thermocouple Grid	Evaporator inlet dry bulb temp.
40	Pressure transducer	Evaporator liquid line pressure
41	Pressure Transducer	Evaporator suction line pressure
43	Dew point Sensor	Dew point Sensor (temp)
44	Differential Pressure	Air Flow differential pressure

BILLING CODE 6450–01–C

The test procedure consisted of setting up the CES unit as per manufacturer's recommendations, charging the system(s), installing the appropriate instrumentation, and running the selected tests. The tests conducted were selected by following the Standard, HRCU–A–CB. The Standard did not describe how to test a unit with eight indoor blowers, dual circuited evaporator coil and two heat pump units. Since the Standard did describe how to test a unit with two compressors which closely models the heat pumps, it was decided to follow the two compressor model of the Standard for all tests. Because of the way the CES proprietary control system operated the eight indoor blowers, it was decided to use 400 cfm per ton air flow for each compressor (2.5 ton heat pump).

When test points were selected from the guidelines, tests were conducted at the appropriate indoor and outdoor temperatures for single heat pump operation and when both heat pump units were operating. There were three exceptions. When in cooling mode, Test C was conducted for full load operation only. When in heating mode the 62F test was conducted with only single heat pump in operation while the 17F test was conducted for dual condenser operation only. The test point room conditions were as specified by the Standard 210/240 guidelines.

When cooling tests were conducted the moisture measurements were made using chilled mirror hygrometers in combination with relative humidity sensors as a backup. In addition to the two sensors, condensate was collected during all A and B tests. The energy balances were based on the amount of condensate collected. During the last few cooling tests, the hygrometer used to measure moisture at the evaporator exit failed. For these tests, the sensible capacity was calculated using the formula btuh = $1.1^{*}\text{cfm}^{*}(T_{air\_entering} - T_{air\_exiting})$. The latent capacity was calculated from the measured condensate for all A and B tests. For heating tests, the chilled mirror hygrometers were replaced with relative humidity sensors.

Results

A summary of the results of the tests for the full load operation of the Cascade Energy Saver (two heat pumps and eight indoor blowers at a total of 2000 cfm) (hereinafter referred to as ''Full Capacity'') are included in Table 3 below. A detailed summary of each test is included in the pages that follow.

TABLE 3.—SUMMARY OF THE RESULTS OF THE TESTS FOR THE CASCADE ENERGY SAVER

[The test results are for the unit running at full capacity]

	Total capacity (btuh)	Total power (kW)	EER
Cooling			
A	65,201	4.4	14.8
B	63,766	3.8	16.6
C	58,393	3.9	15.0
SEER	18.1		
	Total capacity (btuh)	Total power (kW)	COP
Heating			
62F	37,979 (1 comp)	3.1	3.6
47F	67,827	5.7	3.5
35F	56,561	5.2	3.2
17F	37,645	4.5	2.5
HSPF	9.5		

RESULTS COOLING

Test A. Single Heat Pump, Four Blowers

System Average Performance Data		
System EER	14.2	Btu/hr-W.
Sensible heat factor	0.8	%.
System Capacity	29576.6	Btu/hr.
Total System Power	2.1	KW.
NRG Bal (refside, cond)	5.2	% Diff.
NRG Bal (refside, dps)	7.5	% Diff.
Indoor Coil Conditions		
Air Entering Dry Bulb	80.0 +/−	0.08 Deg F.
Air Entering Wet Bulb	66.7 +/−	0.15 Deg F.
Air Entering Enthalpy	31.2 +/−	0.12 Btu/lb.
Air Exiting Dry Bulb	58.5 +/−	0.18 Deg F.
Air Exiting Enthalpy	25.1 +/−	0.32 Btu/lb.
Air Flow Rate	1033.5 +/−	7.89 CFM.
Measured Fan Power	0.2 +/−	0 KW.
Refrig Entering pressure	212.5 +/−	0.65 Psia.
Refrig Entering temp	99.1 +/−	0.22 Deg F.
Refrig Exiting pressure	82.9 +/−	0.22 Psia.
Refrig Exiting Temp	72.5 +/−	1.08 Deg F.
Air Side SensCap	24464.7	Btu/hr.
AS CondLatentCap	5111.9	Btu/hr.
AS EstLatentCap	4396.2	Btu/hr.
AS Cap Cond	29576.6	Btu/hr.
AS Cap Est	28860.8	Btu/hr.

RESULTS COOLING—Continued

Refrigerant Side Capacity	31206.7 +/−	131.26 Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb	94.5 +/−	0.22 Deg F.
Suction Pressure	83.4 +/−	0.23 Psia.
Suction Temperature	63.1 +/−	0.74 Deg F.
Liquid Line pressure	217.6	0.66 Psia.
Liquid Line Temperature	105.5 +/−	0.25 Deg F.
Mass Flow Meter Conditions		
Refrigerant flow rate	7.0 +/−	0.02 Lb/min.
Entering pressure	217.2 +/−	0.66 Psia.
Entering temperature	104.6 +/−	0.25 Deg F.
Exiting pressure	214.2 +/−	0.65 Psia.
Exiting temperature	103.7 +/−	0.24 Psia.
Test A. Two Heat Pump, Eight Blowers		
Test Description	ARI 210–240 Test A.	
Start of Test	5/22/04	5:21:59 PM.
End of Test	5/22/04	6:21:59 PM.
Number of Data Scans	3289.	
System Average Performance Data		
System EER	14.8	Btu/hr-W.
Sensible heat factor	0.8	%.
System Capacity	65201.2	Btu/hr.
Total System Power	4.4	KW.
NRG Bal (refside, cond)	−2.6	% Diff.
Indoor Coil Conditions		
Air Entering Dry Bulb	79.8 +/−	0.42 Deg F.
Air Entering Wet Bulb	67.0 +/−	0.31 Deg F.
Air Exiting Dry Bulb	58.1 +/−	0.27 Deg F.
Air Flow Rate	2070.9 +/−	0.35 CFM.
Measured Fan Power	0.4 +/−	0.26 KW.
Air Side SensCap	49637.4	Btu/hr.
AS CondLatentCap	13849.3	Btu/hr.
AS Cap Cond	63486.8	Btu/hr.
Refrigerant Side Capacity	65201.2	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	95.0 +/−	0.3 Deg F.
Air Entering Dry Bulb 2	94.5 +/−	0.3 Deg F.
Measured Power	4.0 +/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	7.9 +/−	0.0 Lb/min.
Refrigerant flow rate 2	7.2 +/−	0.0 Lb/min.
Total Mass Flow Rate	15.0	0.0 Lb/min.
Test B. Single Heat Pump, Four Blowers		
System Average Performance Data		
System EER	17.8	Btu/hr-W.
Sensible heat factor	0.8	%.
System Capacity	31891.5	Btu/hr.
Total System Power	1.8	KW.
NRG Bal (refside, cond)	0.5	% Diff.
NRG Bal (refside, dps)	−1.2	% Diff.
Indoor Coil Conditions		
Air Entering Dry Bulb	80.0 +/−	0.06 Deg F.
Air Entering Wet Bulb	67.1 +/−	0.05 Deg F.
Air Entering Enthalpy	31.5 +/−	0.04 Btu/lb.
Air Exiting Dry Bulb	58.6 +/−	0.1 Deg F.
Air Exiting Enthalpy	24.9 +/−	0.41 Btu/lb.

RESULTS COOLING—Continued

Air Flow Rate	1084.5 +/−	3.99 CFM.
Measured Fan Power	0.2 +/−	0 KW.
Refrig Entering pressure	175.6 +/−	0.31 Psia.
Refrig Entering temp	87.7 +/−	0.12 Deg F.
Refrig Exiting pressure	79.3 +/−	0.16 Psia.
Refrig Exiting Temp	81.4 +/−	0.47 Deg F.
Air Side SensCap	26042.4	Btu/hr.
AS CondLatentCap	5849.1	Btu/hr.
AS EstLatentCap	6384.3	Btu/hr.
AS Cap Cond	31891.5	Btu/hr.
AS Cap Est	32426.7	Btu/hr.
Refrigerant Side Capacity	32048.9 +/−	93.46 Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb	81.7 +/−	0.12 Deg F.
Suction Pressure	79.5 +/−	0.15 Psia.
Suction Temperature	68.6 +/−	0.26 Deg F.
Liquid Line pressure	180.1 +/−	0.32 Psia.
Liquid Line Temperature	91.4 +/−	0.14 Deg F.
Mass Flow Meter Conditions		
Refrigerant flow rate	6.7 +/−	0.02 Lb/min.
Entering pressure	180.2 +/−	0.32 Psia.
Entering temperature	90.5 +/−	0.14 Deg F.
Exiting pressure	177.3 +/−	0.31 Psia.
Exiting temperature	89.7 +/−	0.14 Psia.
Test B. Two Heat Pumps, Eight Blowers		
Test Description	ARI 210–240 Test B	
Start of Test	5/24/04	5:00:00 PM.
End of Test	5/24/04	6:00:00 PM.
Number of Data Scans	3332.	
System Average Performance Data		
System EER	16.6	Btu/hr-W.
Sensible heat factor	0.7	%.
System Capacity	63765.7	Btu/hr.
Total System Power	3.8	KW.
NRG Bal (refside, cond)	4.6	% Diff.
Indoor Coil Conditions		
Air Entering Dry Bulb	80.4 +/−	0.14 Deg F.
Air Entering Wet Bulb	67.4 +/−	0.17 Deg F.
Air Exiting Dry Bulb	58.4 +/−	0.15 Deg F.
Air Flow Rate	2071.6 +/−	0.28 CFM.
Measured Fan Power	0.4 +/−	0.21 KW.
Air Side SensCap	49974.3	Btu/hr.
AS CondLatentCap	16706.2	Btu/hr.
AS Cap Cond	66680.5	Btu/hr.
Refrigerant Side Capacity	63765.7	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	82.4 +/−	0.2 Deg F.
Air Entering Dry Bulb 2	81.9 +/−	0.2 Deg F.
Measured Power	3.4 +/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	7.1 +/−	0.0 Lb/min.
Refrigerant flow rate 2	7.0 +/−	0.0 Lb/min.
Total Mass Flow Rate	14.1	0.0 Lb/min.
Test C. Two Heat Pumps, Eight Blowers		
Test Description	ARI 210–240 Test C..	
Start of Test	2/05/2004	1:08:04 PM.
End of Test	2/05/2004	2:09:25 PM.
Number of Data Scans	3438.	

RESULTS COOLING—Continued

System Average Performance Data		
System EER	15.0	Btu/hr-W.
Sensible heat factor	1.0	%.
System Capacity	58392.9	Btu/hr.
Total System Power	3.9	KW.
NRG Bal (refside, cond)	2.0	% Diff.
Indoor Coil Conditions		
Air Entering Dry Bulb	80.4 +/−	0.13 Deg F.
Air Entering Wet Bulb	41.2 +/−	0.00 Deg F.
Air Exiting Dry Bulb	53.5 +/−	0.15 Deg F.
Air Flow Rate	2010.4 +/−	0.24 CFM.
Measured Fan Power	0.4 +/−	0.00 KW.
Air Side SensCap	59532.7	Btu/hr.
AS CondLatentCap	0	Btu/hr.
AS Cap Cond	59532.7	Btu/hr.
Refrigerant Side Capacity	58392.9	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	82.6 +/−	0.1 Deg F.
Air Entering Dry Bulb 2	83.5 +/−	0.3 Deg F.
Measured Power	3.5 +/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	12.9 +/−	0.0 Lb/min.
Total Mass Flow Rate	12.9	0.0 Lb/min.

SEER CALCULATIONS

	One comp	Two comp	One comp	Two comp
OAT	Q1	Q2	E1	E2
95	29576.58	65201	2.08	4.4
82	31891.51	66680	1.79	3.8

Step	j	Nj/N	BL(Tj)	X(k=1)	X(k=2)	PLF	Q(T)?N	E(T)/N
1	67	0.214	3951.576	0.124	0.000	0.781	845.6	0.1
2	72	0.231	13830.515	0.434	0.000	0.858	3194.8	0.2
3	77	0.216	23709.455	0.743	0.000	0.936	5121.2	0.3
4	82	0.161	33588.394	1.053	0.000	1.013	5407.7	0.3
5	87	0.104	43467.333	0.652	0.348	0.913	4520.6	0.1
6	92	0.052	53346.273	0.356	0.644		2774.0	0.2
7	97	0.018	63225.212	0.059	0.941		1173.6	0.1
8	102	0.004	73104.152	−0.237	1.237		260.8	0.0
Sum Q(T)	23298.5						23298.5	1.3
Sum E (T)	1.3							
SEER	18.1							

RESULTS HEATING

Test 62F Outdoor, Single Heat Pump, Four Blowers		
Test Description	ARI 210–240 Heating 62 F OAT.	
Start of Test	8/08/2004	2:30:00 PM.
End of Test	2/05/2004	3:06:33 PM.
Number of Data Scans	2182.	
System Average Performance Data		
System COP	3.6.	
System Capacity	37048.4	Btu/hr.
Total System Power	3.1	KW.
NRG Bal (refside)	−2.5	%.

RESULTS HEATING—Continued

Indoor Coil Conditions		
Air Entering Dry Bulb	69.61 +/−	0.26 Deg F.
Air Entering RH	46.27 +/−	0.07%.
Air exiting Wet Bulb	57.16 +/−	0.22 Deg F.
Air Exiting Dry Bulb	111.2 +/−	0.37 Deg F.
Air Flow Rate	945.4	CFM.
Measured Fan Power	0.2 +/−	0.00 KW.
Air Side SensCap	37979.1	Btu/hr.
Refrigerant Side Capacity	37048.4	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	61.8 +/−	0.3 Deg F.
Air Entering Dry Bulb 2	62.5 +/−	0.3 Deg F.
Measured Power	2.9+/−	0.2 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	7.5 +/−	0.1 Lb/min
Total Mass Flow Rate	7.5	0.0 Lb/min.
47F Outdoor, Single Heat Pump, Four Blowers		
Test Description	ARI 210–240 Heating 47 F OAT.	
Start of Test	7/18/2004	7:24:11 PM.
End of Test	7/18/2004	7:54:49 PM.
Number of Data Scans	1601.	
System Average Performance Data		
System COP	3.3.	
System Capacity	3058303	Btu/hr.
Total System Power	2.8	KW.
NRG Bal (refside)	−4.9	%.
Indoor Coil Conditions		
Air Entering Dry Bulb	69.2 +/−	0.43 Deg F.
Air Entering RH	57.2 +/−	3.11%.
Air exiting Wet Bulb	59.6 +/−	1.14 Deg F.
Air Exiting Dry Bulb	102.6 +/−	0.43 Deg F.
Air Flow Rate	969.3	CFM.
Measured Fan Power	0.2 +/−	0.00 KW.
Air Side SensCap	32093.2	Btu/hr.
Refrigerant Side Capacity	30583.3	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	46.4 +/−	0.4 Deg F.
Air Entering Dry Bulb 2	47.6 +/−	0.6 Deg F.
Measured Power	2.6+/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	6.1 +/−	0.1 Lb/min.
Total Mass Flow Rate	6.1	0.0 Lb/min.
47F Outdoor, Two Heat Pumps, Eight Blowers		
Test Description	ARI 210–240 Heating 47 F OAT.	
Start of Test	7/8/2004	11:12:00 PM.
End of Test	7/8/2004	12:00:00 PM.
Number of Data Scans	1042.	
System Average Performance Data		
System COP	3.5.	
System Capacity	70140.0	Btu/hr.
Total System Power	5.7	KW.
NRG Bal (refside)	3.3	%.

RESULTS HEATING—Continued

Indoor Coil Conditions		
Air Entering Dry Bulb	70.2 +/−	0.25 Deg F.
Air Entering RH	51.8 +/−	0.33%.
Air exiting Wet Bulb	59.1 +/−	0.29 Deg F.
Air Exiting Dry Bulb	104.5 +/−	0.22 Deg F.
Air Flow Rate	969.3	CFM.
Measured Fan Power	0.4 +/−	0.01 KW.
Air Side SensCap	67826.8	Btu/hr.
Refrigerant Side Capacity	70140.0	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	46.8 +/−	0.3 Deg F.
Air Entering Dry Bulb 2	47.6 +/−	0.3 Deg F.
Measured Power	5.2+/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	5.9 +/−	0.0 Lb/min.
Refrigerant flow rate 1	5.7 +/−	0.0 Lb/min.
Total Mass Flow Rate	11.7.	
35F Outdoor, Single Heat Pump, Four Blowers		
Test Description	ARI 210–240 Heating 35 F OAT.	
Start of Test	7/13/2004	12:30:30 PM.
End of Test	7/13/2004	12:00:00 AM.
Number of Data Scans	1562.	
System Average Performance Data		
System COP	3.1.	
System Capacity	25654.6	Btu/hr.
Total System Power	2.6	KW.
NRG Bal (refside)	−5.7	%.
Indoor Coil Conditions		
Air Entering Dry Bulb	70.5 +/−	0.41 Deg F.
Air Entering RH	60.8 +/−	0.44%.
Air exiting Wet Bulb	61.6 +/−	0.46 Deg F.
Air Exiting Dry Bulb	98.0 +/−	3.79 Deg F.
Air Flow Rate	1013.0	CFM.
Measured Fan Power	0.2 +/−	0.00 KW.
Air Side SensCap	27123.9	Btu/hr.
Refrigerant Side Capacity	25654.6	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	34.9 +/−	0.2 Deg F.
Air Entering Dry Bulb 2	35.4 +/−	0.3 Deg F.
Measured Power	2.4+/−	0.1 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	5.1 +/−	0.8 Lb/min.
Total Mass Flow Rate	5.1.	
35F Outdoor, Two Heat Pump, Eight Blowers		
Test Description	ARI 210–240 Heating 35 F OAT.	
Start of Test	7/13/2004	9:56:30 AM.
End of Test	7/13/2004	12:00:00 AM.
Number of Data Scans	1591.	
System Average Performance Data		
System COP	3.5.	
System Capacity	58219.2	Btu/hr.
Total System Power	4.8	KW.
NRG Bal (refside)	2.8	%.

RESULTS HEATING—Continued

Indoor Coil Conditions		
Air Entering Dry Bulb	70.1 +/−	0.23 Deg F.
Air Entering RH	61.9 +/−	0.29%.
Air exiting Wet Bulb	61.5 +/−	0.27 Deg F.
Air Exiting Dry Bulb	99.2 +/−	0.19 Deg F.
Air Flow Rate	1978.7	CFM.
Measured Fan Power	0.4 +/−	0.00 KW.
Air Side SensCap	56561.2	Btu/hr.
Refrigerant Side Capacity	58219.2	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	34.5 +/−	0.5 Deg F.
Air Entering Dry Bulb 2	34.7 +/−	0.6 Deg F.
Measured Power	4.4+/−	0.2 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	5.1 +/−	0.1 Lb/min.
Refrigerant flow rate 1	4.7 +/−	0.1 Lb/min.
Total Mass Flow Rate	9.8.	
17F Outdoor, Two Heat Pumps, Eight Blowers		
Test Description	ARI 210–240 Heating 17 F OAT.	
Start of Test	8/5/2004	3:54:45 PM.
End of Test	8/5/2004	4:19:38 PM.
Number of Data Scans	1485.	
System Average Performance Data		
System COP	2.4.	
System Capacity	37645.5	Btu/hr.
Total System Power	4.5	KW.
NRG Bal (refside)	−88.3	%.
Indoor Coil Conditions		
Air Entering Dry Bulb	70.1 +/−	0.67 Deg F.
Air Entering RH	53.0 +/−	0.53%.
Air exiting Wet Bulb	59.2 +/−	0.65 Deg F.
Air Exiting Dry Bulb	90.3 +/−	0.68 Deg F.
Air Flow Rate	1911.5	CFM.
Measured Fan Power	0.4 +/−	0.00 KW.
Air Side SensCap	37645.5	Btu/hr.
Refrigerant Side Capacity	19993.6	Btu/hr.
Outdoor Coil Conditions		
Air Entering Dry Bulb 1	16.6 +/−	0.3 Deg F.
Air Entering Dry Bulb 2	16.0 +/−	0.3 Deg F.
Measured Power	4.1+/−	0.0 KW.
Mass Flow Meter Conditions		
Refrigerant flow rate 1	3.8 +/−	0.0 Lb/min.
Refrigerant flow rate 1	3.3 +/−	0.1 Lb/min.
Total Mass Flow Rate	7.1.	

BILLING CODE 6450–01–P

HSPF Calculations

							First Comp		Two Comp							
							Q	E	Q	E						
		DHR		60000		62	67979	3130	82917	6205						
				60		47	32093	2810	67827	5660						
				1000		35	27124	2580	56561	4810						
						17	19887	2213	37645	4530						
				C X D												
				Annual	Capacity	Capacity	Load Factor	Load Factor	Part Load	Part Load	Watts	Watts	Watts	Total		Watt
	Frac			Building	1 comp	2 comp	1 comp	2 comp	Factor	Factor	1 comp	comp	Resist	Hourly	Btu/	Hour
Bin	T	Hours	BL(Ti)	Load	Qi(k=1)	Qi(k=2)	X(Ti)k=1	X(Ti)k=2	1 comp	2 comp	E(Tj)k=1	E(Tj)k=2	Heat	Input	watt	Input
			BTUH													
1	62	0.132	2,310	2,671,099	37,979	82,917	0.060823	0.027859	0.756		3,130			190	12.1	220,136
2	57	0.111	6,160	5,989,738	36,017	77,887	0.171030	0.079089	0.793		3,023			517	11.9	502,790
3	52	0.103	10,010	9,031,823	34,055	72,857	0.293936	0.137392	0.823		2,197			857	11.7	773,537
4	47	0.093	13,860	11,291,465	32,093	67,827	0.431870	0.204343	0.858		2,810			1,214	11.4	988,658
5	42	0.100	17,710	15,513,960	30,131	62,797	0.587767	0.282020	0.897		2,703			1,589	11.1	1,391,902
6	37	0.109	21,560	20,586,350	27,928	58,663	0.771982	0.367524	0.943		2,597			2,005	10.8	1,914,053
7	32	0.126	25,410	28,046,542	25,918	53,408	0.980406	0.475768	0.995		2,490			2,441	10.4	2,694,511
8	27	0.087	29,260	22,299,631	23,908	48,154	1.223881	0.607635		0.902		4,933		2,998	9.8	2,284,582
9	22	0.055	33,110	15,952,398	21,897	42,899	1.512060	0.771805		0.943		4,752		3,667	9.0	1,766,934
10	17	0.036	36,960	11,655,706	19,887	37,645	1.858501	0.981804		0.995		4,570		4,487	8.2	1,414,971
11	12	0.026	40,810	9,294,886	17,853	32,615	2.285933	1.251278		1.000		4,388		4,388	9.3	999,487
12	7	0.013	44,660	5,085,881	15,818	27,584	2.823306	1.619035		1.000		4,207	5,008	9,214	4.8	1,049,312
13	2	0.006	48,510	2,549,686	13,784	22,554	3.519298	2.150838		1.000		4,025	7,612	11,637	4.2	611,627
14	-3	0.002	52,360	917,347	11,750	17,524	4.456297	2.987959		1.000		3,843	10,216	14,059	3.7	246,318
15	-8	0.001	56,210	492,400	9,715	12,493	5.785700	4.499200		1.000		3,662	12,820	16,482	3.4	144,381
															Total	17,003,099
				161,378,910												
											HSPF =	9.5				

52

[FR Doc. 07–1887 Filed 4–19–07; 8:45 am]

BILLING CODE 6450–01–C