

## Definition of an Efficient Commercial HVAC Installation

### Summary

Selecting highly-rated efficient equipment installed safely and to-code does not assure the efficient operation of a commercial system installation. This paper suggests use of a ratio representing the field measured system delivered Btu/h into the building compared to the equipment rated Btu/h capacity to rate the efficiency of the installed system.

**Finalized:** December 6th, 2016

---

### Use of this document

*This document provides the Definition of an Efficient Commercial HVAC Installation.*

*It is based on an official [WHPA Work Product](#) of Dec. 6th, 2016 titled “Definition of an Efficient Commercial HVAC Installation.” This Work Product was developed by the WHPA Commercial Quality Installation Committee.*

*This document, and also the WHPA Work Product, may be used in part or whole at no charge. Attribution to the Western HVAC Performance Alliance is requested.*

*We would also ask that you inform the WHPA through [info@performancealliance.org](mailto:info@performancealliance.org) if you have made use of either document, so that we can inform and encourage the hundreds of volunteers who donate their time to providing expert HVAC advice in order to support energy efficiency objectives.*

---

### What is an Efficient Commercial Installation?

The WHPA Commercial Installation Committee published this performance-based definition of an efficient commercial HVAC system installation. This definition was to apply to packaged and split DX cooling systems from 1.5 to 25 tons.

#### Background - Traditional Definition of an Efficient HVAC System

Initial committee discussion focused on traditional HVAC industry definitions of an efficient HVAC System:

- High equipment efficiency ratings.
- Design elements are documented.
- Installed according to manufacturer’s instructions: electrical, wire and pipe sizing, refrigerant charge, combustion adjustment, adequate venting requirements, safety controls assuring safe operation.
- Licensing, technician training and acceptable business operations are assured.
- Installed to meet code requirements

However, while each of these principles apply to an efficient installation, the committee agreed, based on field data received, that these more traditional elements of efficiency may be included but the system installation often operates at a very low efficiency.

If fact, the traditional definition of an efficient installation has little or no documentable evidence quantifying actual installed efficiency at all, except the equipment ratings.

Unfortunately, current industry practices encourage consumers to interpret equipment manufacturer's laboratory efficiency ratings as the installed system efficiency they will be receiving. This inaccuracy must be addressed in the new efficient commercial installation definition.

To summarize: *Highly rated efficient equipment installed safely and to code does not assure an efficient installation.*

### **A New Performance-Based Installation Definition**

The discussion turned to the committee's field data specification currently being completed. The outcome of this test procedure is an installed system efficiency scoring method that will quantify the level of efficiency earned by the installation process.

This test and calculation method:

- Shifts the focus onto the system efficiency and capacity actually delivered into the building, and off of the equipment rated (potential) efficiency and capacity.
- Compares installed system delivered capacity to bench rated equipment capacity
- Can also be expressed as an installed system field EER with the addition of power measurements.

### **Efficient Commercial Installation Definition**

An Efficient Commercial Installation is defined as an HVAC system having the delivered system capacity and efficiency field measured into the building envelope that meets or exceeds a predetermined percent of equipment rated efficiency.

Efficient Commercial Installation refers both to the process of field-measuring and documenting the performance of an installed HVAC system; and to the objective of achieving improvements in measured performance. In the case of existing systems, improvements are relative to measured baseline performance. In the case of new systems, improvements are relative to typical levels of performance.

The process of field-measuring efficiency is an emerging technology, and details of the definition are still being determined. The WHPA Commercial Installation Field Data Collection Specification will, once complete, define the measurement and calculation process necessary to quantify installed efficiency. As this specification is operationalized, efficiency targets may be developed that various types of installations must achieve to be considered an Efficient Commercial Installation

### **For Consumers and Contractors**

For consumer and contractors to define an efficient installation, a ratio representing the field measured system delivered Btu/h into the building compared to the equipment rated Btu/h capacity is to be used.

$$\text{Field Measured Installed System Efficiency Ratio} = \frac{\text{Field Measured Btu/h Delivered into the Building}}{\text{Equipment Rated Btu/h}}$$

*Typical Field Example showing the percent of measured system performance compared to a possible 100% of equipment rated efficiency.*

$$\frac{68,400 \text{ Btu/h System Delivered into Building}}{120,000 \text{ Btu/h Rated Equipment Capacity}} = 57\% \text{ Installed System Efficiency Ratio}$$

### **For Energy Regulators and Utilities**

Utilities and regulators may define an efficient installation by measuring the Installed System Field EER (Energy Efficiency Ratio.) This version requires additional power measurement as required for more stringent reporting requirements.

$$\text{Field Measured System EER} = \frac{\text{Field Measured Btu/h Delivered into the Building}}{\text{Field Measured System Watts}}$$

*Typical Field System EER Example*

$$\frac{120,000 \text{ Btu/h Delivered into the Building}}{20,000 \text{ Watts}} = 6.0 \text{ Field Measured System EER}$$

### **Process or Outcome Driven Definition**

The CI committee decided for the sake of simplicity to define an efficient commercial installation by using *an outcome driven description*. The score of the installed system represents a variable outcome by which the installed efficiency of the system can be judged and compared to pre-and post-measured efficiencies, equipment rated efficiencies and comparison to future averages, codes and standards.

The CI committee discussed *a process driven definition* of installed efficiency. This definition would result in a consistent definition that could be applied and be effectively quality assured in the field. Rather than detail the process here, please refer to the *CI Committee Field Data Collection Specification* to review the processes required to measure the installation efficiency of a commercial HVAC system.