TRANE® TRACKS
TECHNICIAL NEWSLETTER

Spring 2010

Installed Efficiency

There are Four General Categories that are Essential for System Performance:

*Proper System Application to the Home
*Proper Air Flow with Minimal Heat Gains
*Proper Refrigerant Charge & Line Set Design
*Ensuring the System Itself is Working Properly

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It's Hard To Stop A Trane.®

Today's Topic:
Proper Application of the System

You have just received a call from a homeowner that you installed a system for. He is upset with his energy bills and is not seeing the promised savings.

What Could Have Gone Wrong?

In the mid 1990's APS worked with Proctor Engineering to evaluate the performance of newly installed HVAC systems. They tested 28 systems installed by 11 different contractors in the Phoenix area.

They found that the average installation did not perform as advertised and the homeowners were not receiving the system performance they were promised.

This loss of performance was centered around three areas:

--Improper design with oversized systems & undersized ducting
--Improper workmanship with excessive duct leakage
--Incorrect refrigerant charge

Without finding any mechanical problems with the system itself (multiple manufactured brands being tested); APS found that the **average** 5-ton 12 SEER system only delivered 3.5 tons of cooling at 6.7 SEER to the homeowner.

This loss of performance increased the average cooling bill by a whopping 40%!

The systems installed in the mid 90's are being replaced today. Overlooking the installation environment and simply replacing one "box" with another will not deliver the comfort & energy savings the homeowner deserves.

These installation inefficiencies are not confined to the Phoenix area. Similar studies & results have been found throughout the United States.

Proper System Sizing

Never assume the existing system on a home is properly sized. Homeowners are always making upgrades to their homes—adding insulation; upgrading windows, installing sunscreens, etc. Any upgrade that improves the efficiency of the home will require fewer BTU's to maintain comfort.

A heat load calculation based on ACCA Manual J is the first step in any installation process.

Simply replacing an existing system with the same tonnage (or worse yet a larger tonnage) may deprive the homeowner of comfort & energy savings.

Studies have shown that more than 50% of the installed HVAC systems are oversized by a ton or more.

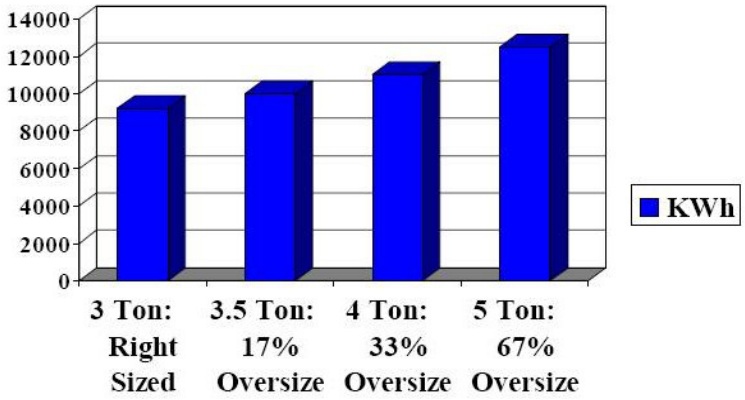
INSTALLING OVERSIZED SYSTEMS CAN:

Require larger electrical circuits
Require larger ducting
Increase chance of air drafts
Increase temperature swings between rooms
Reduce humidity control
Increase noise (especially air noise)

Increase installation costs
Increase energy bills
Generate system short cycling
Cause premature component failures
Reduce indoor air quality

The Effects of Oversizing

➢ Oversized units can cost over 30% more to operate annually than appropriately sized units.



Simply stated, oversizing a system will:

***Increase Energy Usage**
***Reduce Indoor Comfort**
***Generate Premature System Failures**

The chart on the left shows this impact on energy consumption. This example shows a properly sized 3-ton system will consume 9,000 KW annually; "upgrading" to a 5-ton system will increase this energy usage to 12,000 KW. The homeowner will pay 30% more to cool the home and a phone complaint is likely to follow.

INDOOR COMFORT & HUMIDITY CONTROL

The table on the right shows a building heat load for sensible & latent heat on a 95 degree day. A properly sized system with long run cycles will have the ability to absorb & remove both of these loads.

Indoor sensible loads will drop with the outdoor temperature; but the latent load stays fairly constant. You can see this in your own home during the monsoon season. The relative humidity will be the highest in the morning when the AC has the shortest run cycles. As the day progresses, the AC system runs longer and starts to remove more moisture—relative humidity drops.

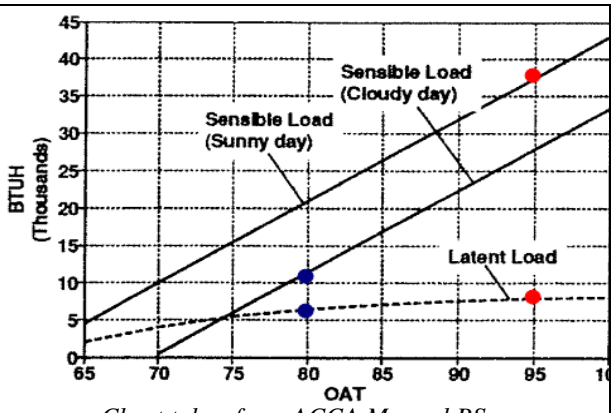
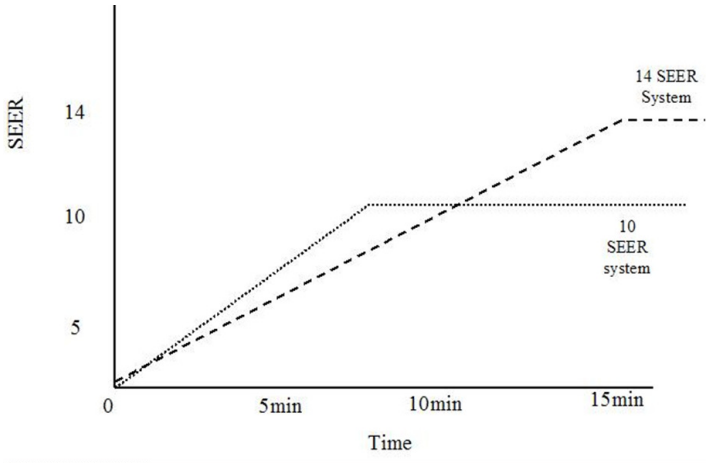


Chart taken from ACCA Manual RS

The red dots on the table at 95 degrees show a sensible load of 40,000 BTU's and a latent load of 8,000 BTU's. A properly sized system will have a run cycle that will absorb both loads. The blue dots represent a cooler 80 degree day (or night conditions) with a sensible load of 10,000 BTU's and a latent load of 6,000 BTU's. The AC that is still delivering 40,000 sensible BTU's and will satisfy the thermostat very quickly; unfortunately it will not run long enough to absorb the latent load. Oversizing a system exacerbates this problem and often generates a humidity complaint.

The chart on the right is not to represent the advantages of an inefficient, oversized, short cycling system.

This chart represents the importance of proper run cycles. A properly sized system that maximizes run cycles will provide the greatest comfort & efficiency savings for the homeowner.



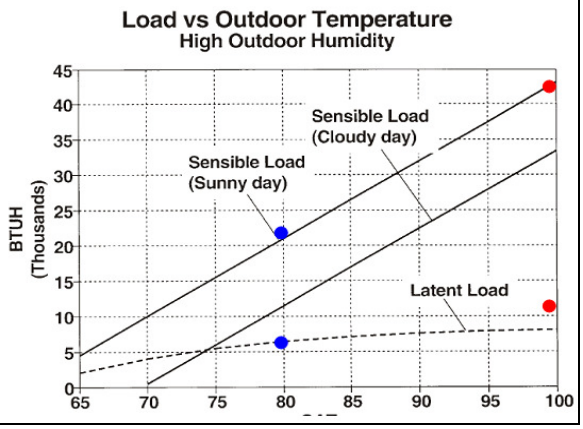
Multi capacity systems (such as our 20i dual compressor or 16i unloading scroll) allow for some cushion in the sizing calculations—but don't get carried away. Manuals J & S recommend that the system size is not more than 15% larger than the heat load calculation.

(or no more than 25% for heat pumps applied in cooler climates such as Prescott or Flagstaff)

A single stage system is only designed around one condition—for Phoenix this is when its 108 degrees outside. The system will cycle and lose its operating efficiency whenever the temperature falls below 108 degrees. Multi stage systems help this situation by reducing capacity output as the outdoor temperature drops. Let's take a look at how our 20i communicating system handles this capacity – comfort issue.

The chart on the right shows our 20i system in action. With 100 degrees outside and 75 indoor with a 63 WB, this system delivers 40,250 sensible & 13,200 latent (represented by the two red dots). This system has a long run cycle on the big compressor & is absorbing both loads.

Once the temperature cools to 80 degrees (with same indoor conditions), the system delivers 21,750 sensible & 6,700 latent (represented by the two blue dots). This system is maintaining long run cycles on the small compressor & continues to absorb both loads.



A properly sized multi stage system has just enough capacity to absorb the heat load in peak conditions, and reduces its capacity with milder outdoor temperatures. This modulating capacity allows for long run cycles throughout the day—maximizing comfort and minimizing the efficiency losses that are inherent in single stage systems.

Advanced Communicating Control Features

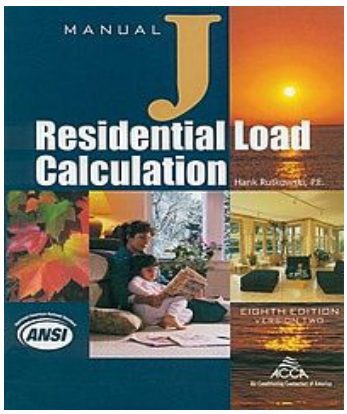
There are several features with the 900 Comfort Control that can enhance indoor comfort.

Compressor Low Stage Airflow	0182	E 2 Stage = 50% 2 Step = 80%	E, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80

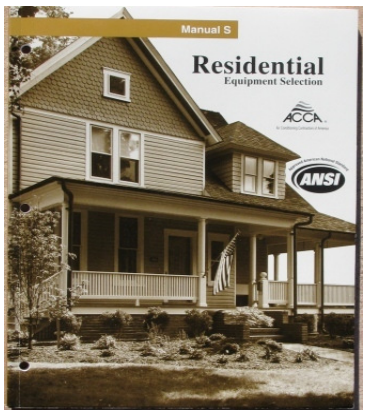
Blower air flow for first & second stage compressor operation can be set individually; you are no longer stuck at 50%. Airflow can be increased for additional capacity or reduced for better humidity control—the option is yours.

Dehumidification Airflow	0387	100	80 - 100	80 - 80% Airflow 85 - 85% Airflow 90 - 90% Airflow 95 - 95% Airflow 100 - 100% Airflow
Trane Proprietary Humidity Control	0388	1	0, 1	0 - Disabled 1 - Enabled

Additional options are available to reduce blower speed & eliminate blower off delays (proprietary control). The blower will respond when humidity levels exceed a desired set point (from 40 – 80%), then revert back to its normal operation once proper humidity levers are obtained.



Applying a Heat Load Calculation Before an Installation is the First Step in Delivering Comfort & Energy Savings to Your Customer!



The focus of this newsletter series is to show the importance of the system environment and how radically this environment can impact system performance & homeowners comfort.

ACCA Manuals J, D, S & RS are recommended for detailed information on this subject, and a software program such as Wrightsoft should be used for the actual design process of the home.