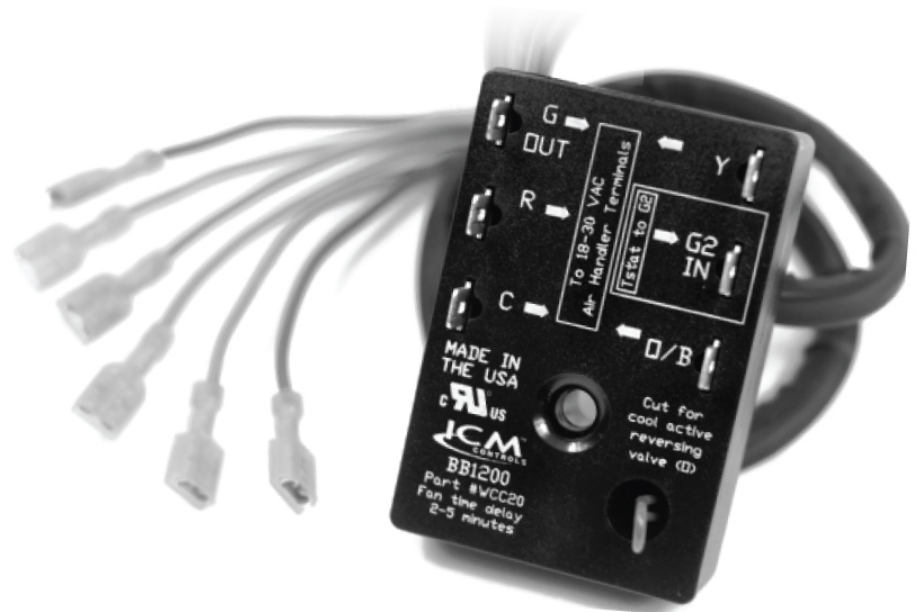


APS Cool Control Program

Western Cooling

Training Manual





WCCTM Contact Information

For Technical Support (Paul Mohoff):
For Sales (Patricia Pintner):
For Engineering Support (Abram Conant):
Email:
Web Site:

415-261-7177
415-451-2485
760-230-6469
mail@proctoreng.com
www.proctoreng.com

Arizona Public Service Cool Control Program Overview (Western Cooling - WCC)

About the program:

- The WCC is eligible for inclusion in the APS Home Performance with Energy Star Programs along with the Solutions for Business Program.
- The WCC is the only control approved for rebates under the new APS Cool Control Program.
- APS provides free contractor training at the FSL Southwest Building Science Training Center.
- Applicable to all single family and multifamily residential and commercial central air conditioners.
- Not applicable to evaporative coolers, mini-splits/multi-splits, PTAC, or window air conditioners.
- Residential customer rebates are processed through the APS Online Application (Energy Savvy) system.
- Proven energy savings, reliability, and sales methods resulting in over 80,000 installations in the Western United States.

The Western Cooling Control™ (WCC1 and WCC20):

- A 24V relay that keeps the indoor fan motor running 2-5 minutes once the compressor shuts off.
- A simple, inexpensive way to maximize sensible cooling for dry climates.
- Based on the same technology manufacturers use to get increased SEER ratings.
- Saves residential and commercial customers 10% - 17% on their cooling energy cost.
- Two different models depending on the application.
 - WCC1 for straight AC applications.
 - WCC20 for heat pump applications.
- APS rebate of \$70.00 per WCC installed under the new Cool Control program, Home Performance with Energy Star Program, and the Solutions for Business Program.
- The WCC1/WCC20 is purchased directly through Proctor Engineering Group in minimum orders of 25.
- Wholesale cost of \$35.00 per WCC1 and \$40.00 per WCC20.
- Volume discounts are available for single order of 200 WCC1 or WCC20 or greater.
- Suggested installed retail price of \$100.00.
- Easy installation process requiring less than 10 minutes to install and test. Four to six basic low voltage connections.

Western Cooling

Frequently Asked Questions

- **Most systems already have a fan delay built in, how is this different?**

Manufacturers have a set blower off delay ranging from 0-90 seconds. However, there is still sensible cooling (moisture) available even after 90 seconds. Our WCC technology will keep the fan operating for 2-5 minutes to maximize all the sensible cooling once the compressor cycles off.

- **Can the WCC be installed on ECMs?**

Absolutely! In fact the WCC is most efficient when installed on ECMs that operate at low speed during a call for fan only.

- **Will this void any manufacturers' warranties?**

No. The WCC is a simple 24V control. Installing the WCC is no different than installing an aftermarket thermostat or any other aftermarket 24V control. The WCC does not have any effect on manufacturers' warranties.

- **Are there systems that are incompatible with the WCC?**

We don't recommend installing the WCC on communicating systems that do not use standard 24V control. Additionally, the Nest thermostat has the AirWave feature that provides a similar function to the WCC so the customer would not realize additional energy savings if they have a Nest thermostat.

- **Where is the WCC made?**

We are proud to say the WCC is made in the USA, is UL listed, and is backed with a one year warranty.

- **Why would my customers be interested in the WCC?**

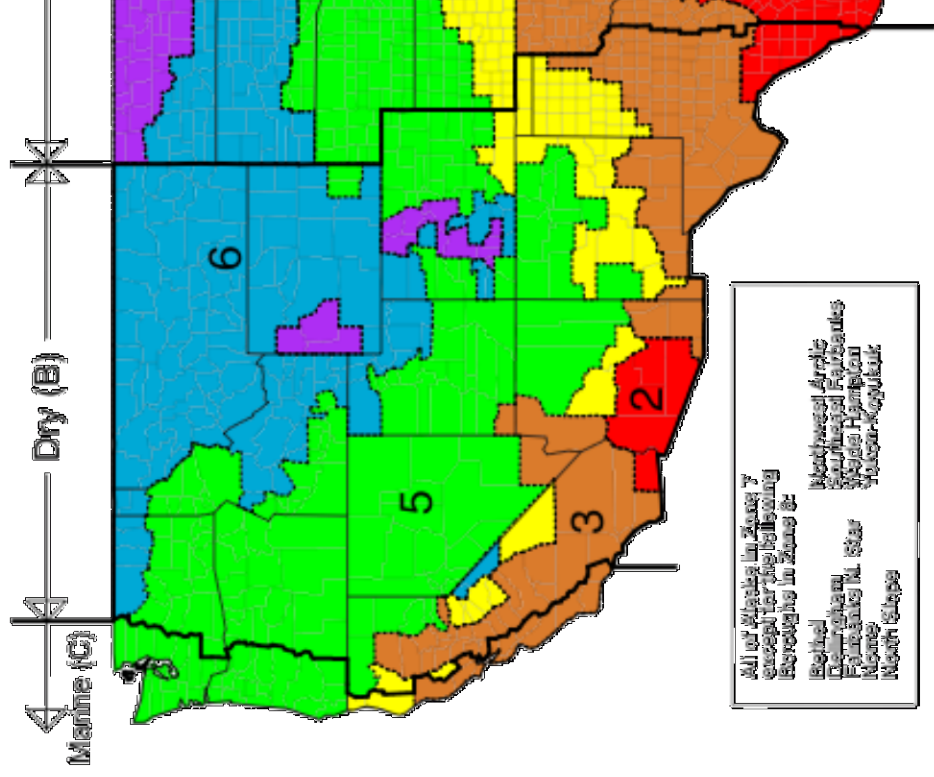
Energy savings! When presented correctly, the WCC should be seen as a simple, inexpensive upgrade to your customer's AC system.



The CheckMe![®] Enhanced Time Delay Relay

**Optimizing the Air Conditioner
for Dry Climates**

Dry Climates



Arizona,
Colorado,
Idaho,
Montana,
Nevada,
New Mexico,
North Dakota,
Utah,
and Parts of:
Oregon,
California,
Texas,
Washington

What Does an Air Conditioner DO?

- Reduces the Temperature – Sensible Capacity
- Removes Moisture – Latent Capacity

Total Capacity =
Sensible Capacity + Latent Capacity

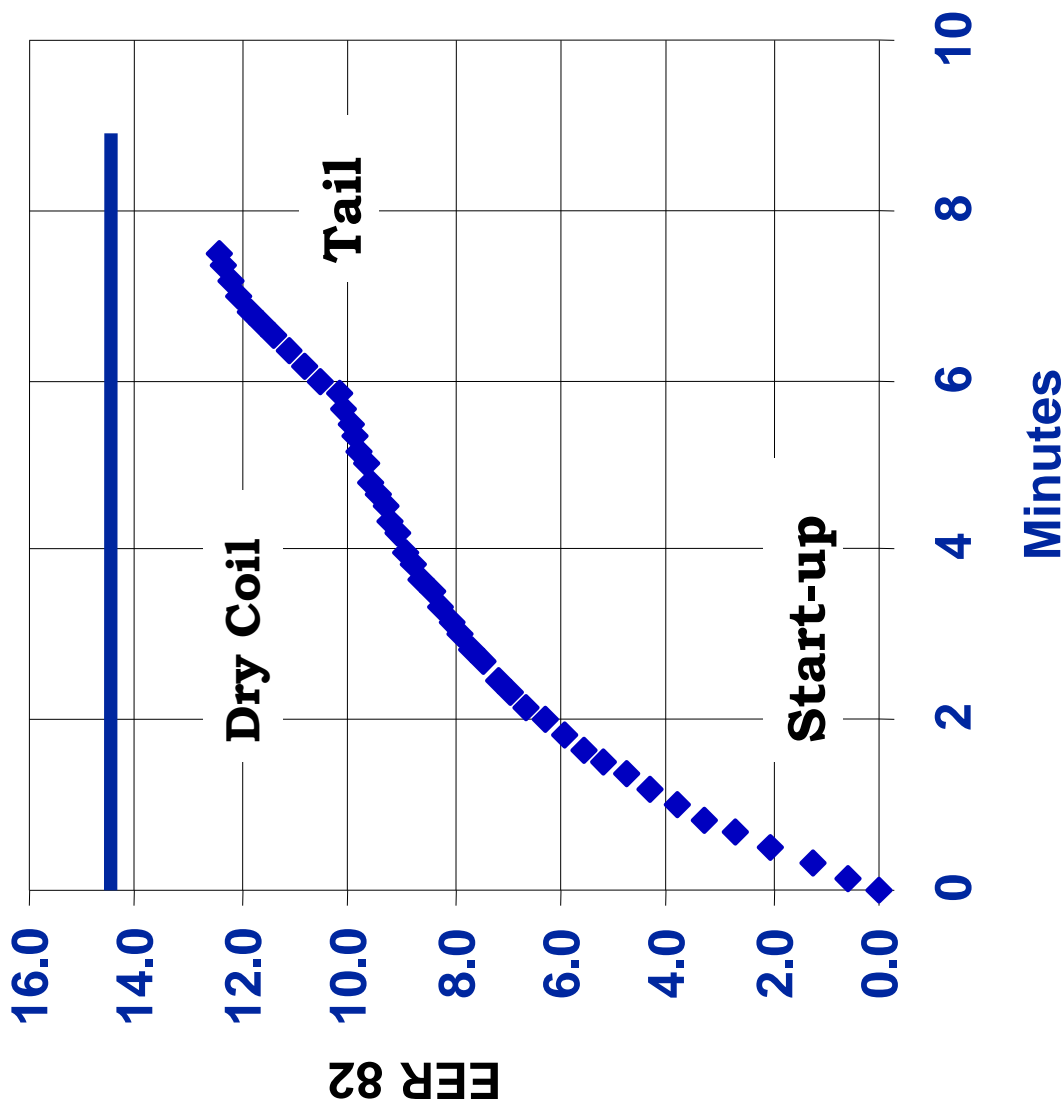
Sensible Heat Ratio =
Sensible Capacity / Total Capacity

Optimizing for Dry Climates

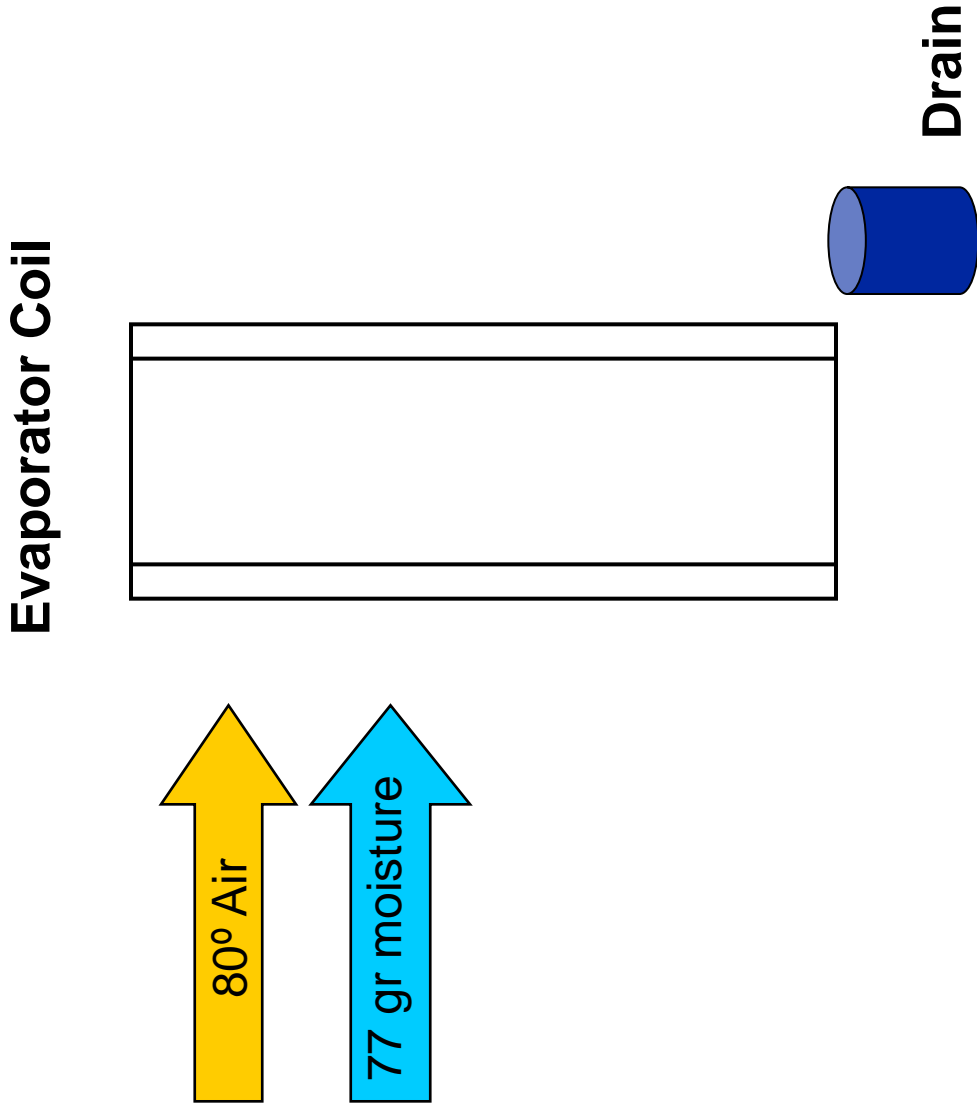
- Typical Sensible Heat Ratios are 75% to 80%. 20% of the capacity is wasted in dry climates
- In dry climates we want to maximize sensible capacity
- There is cooling stored on the coil as water when the compressor turns off.
- Evaporating the water off the coil at the end of the cycle improves sensible efficiency 10 to 20%

**Manufacturers
use short Time
Delay Relays
to boost SEER**

SEER Tests

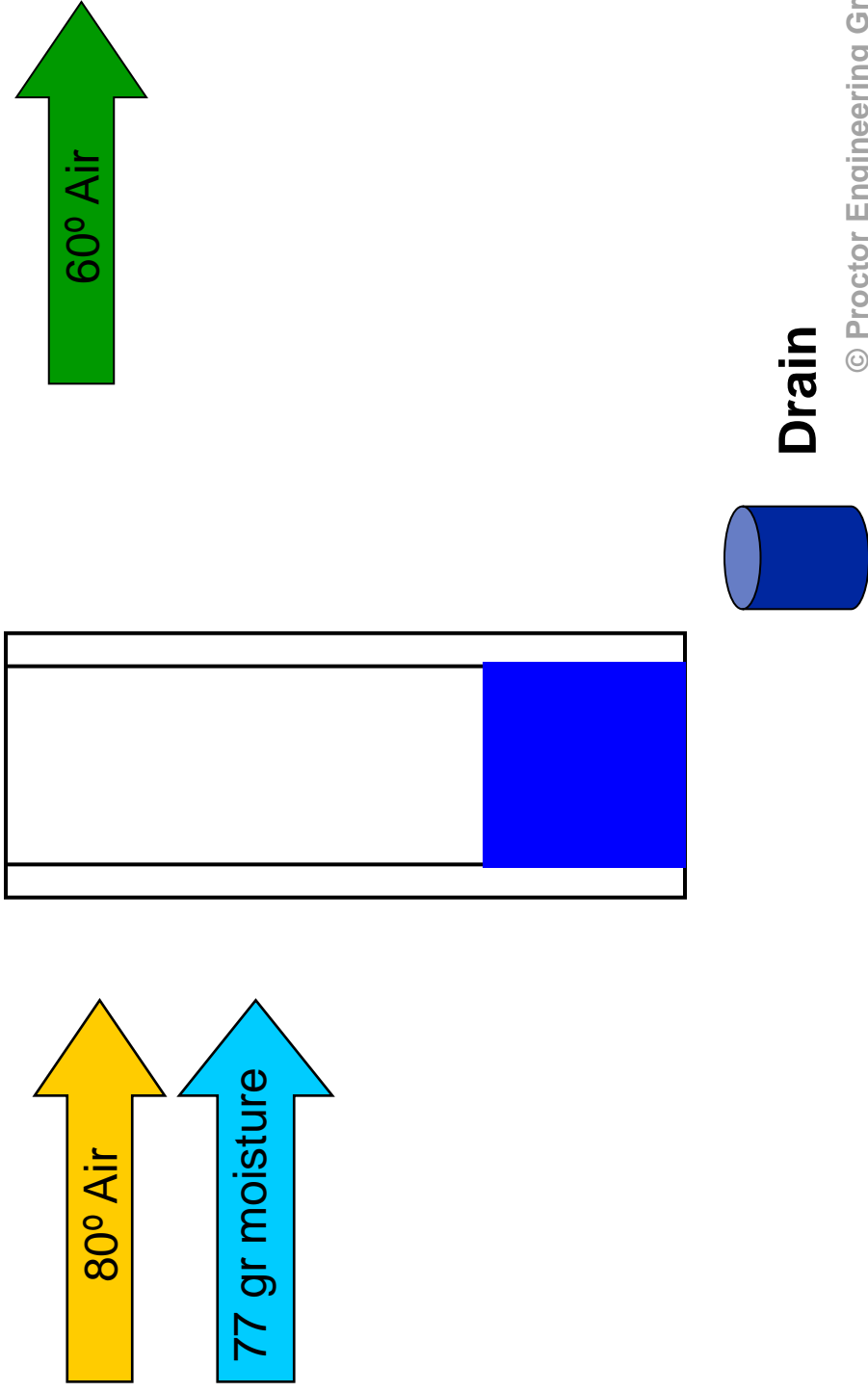


Latent Storage and Capacity



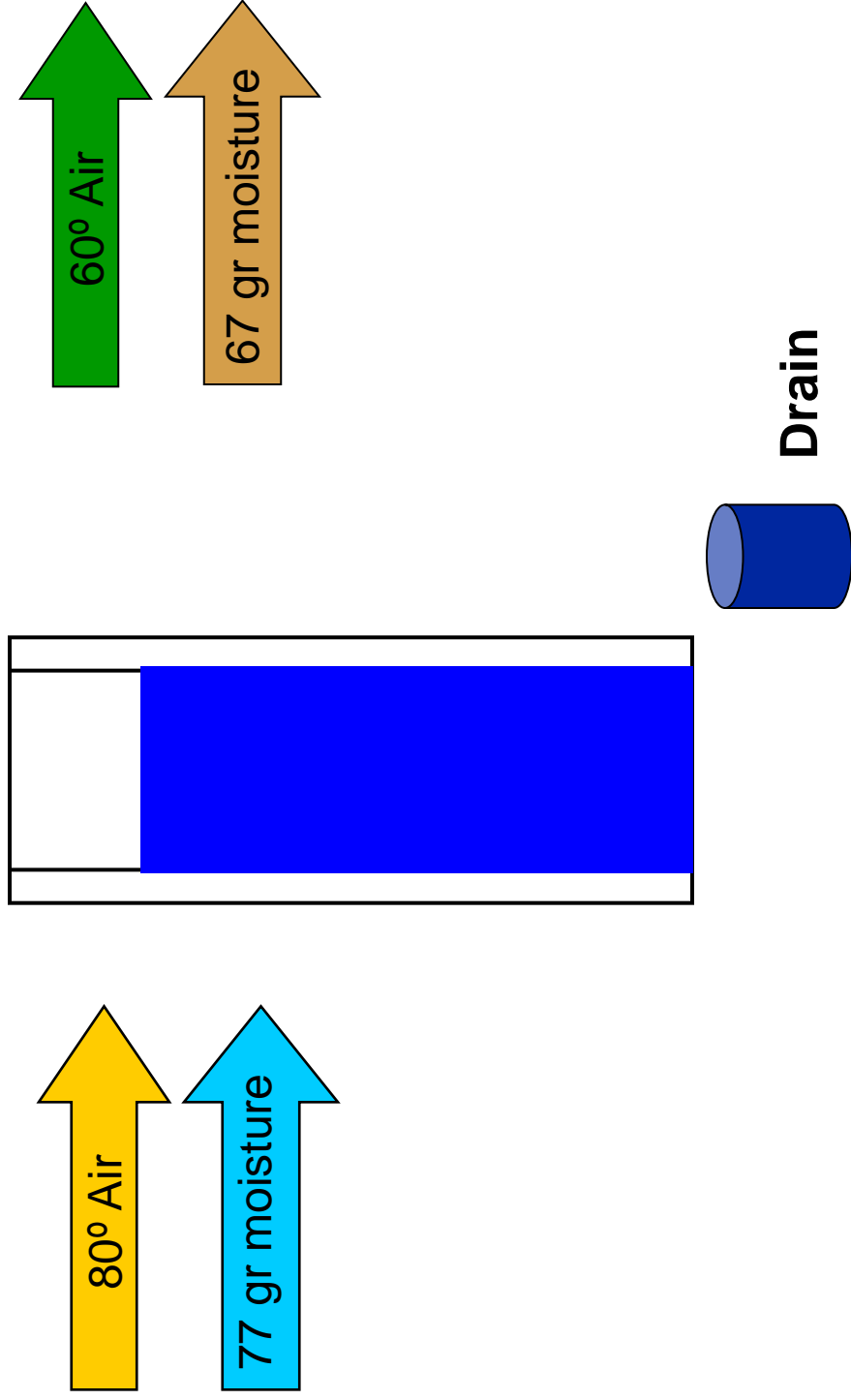
Latent Storage and Capacity

Evaporator Coil

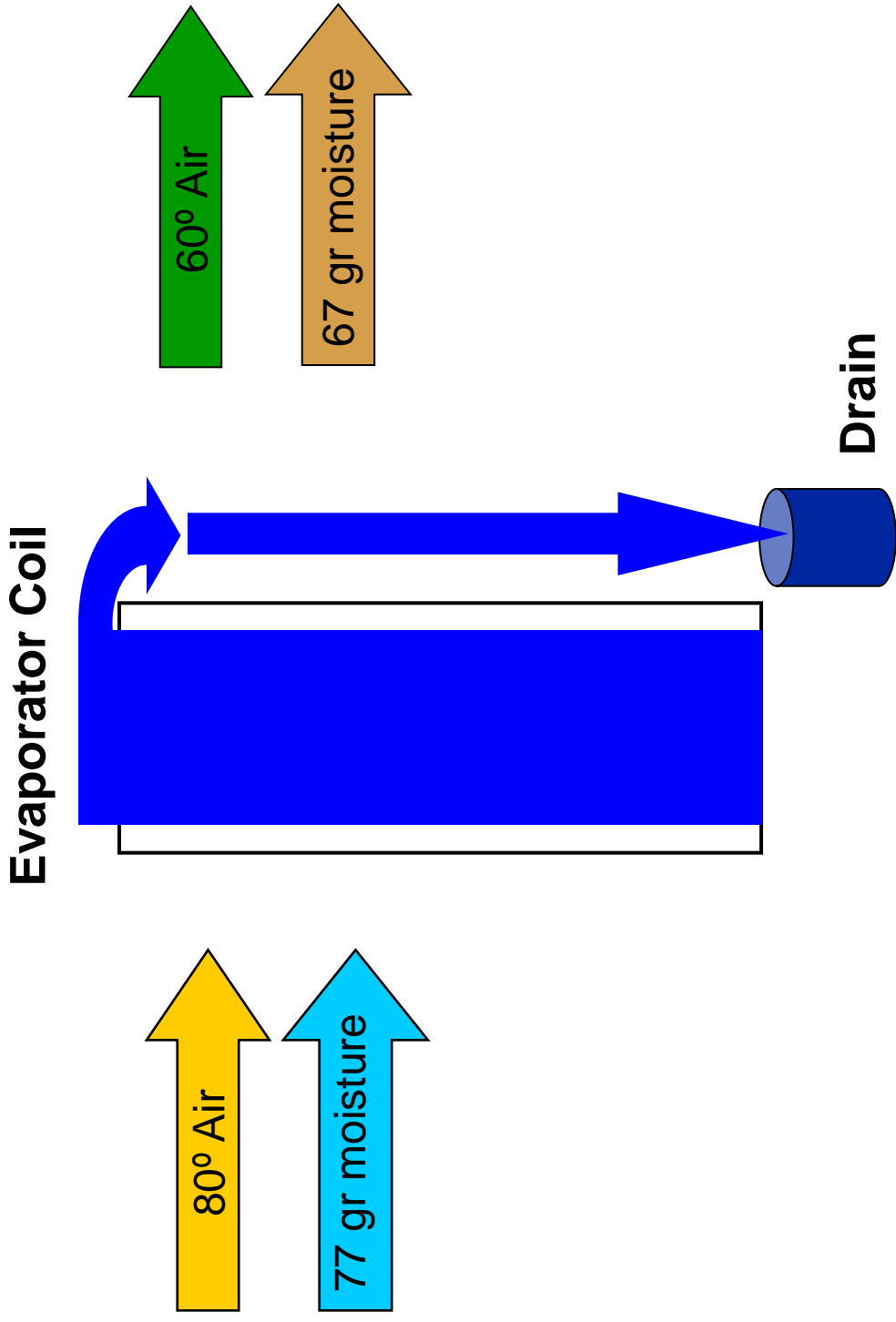


Latent Storage and Capacity

Evaporator Coil

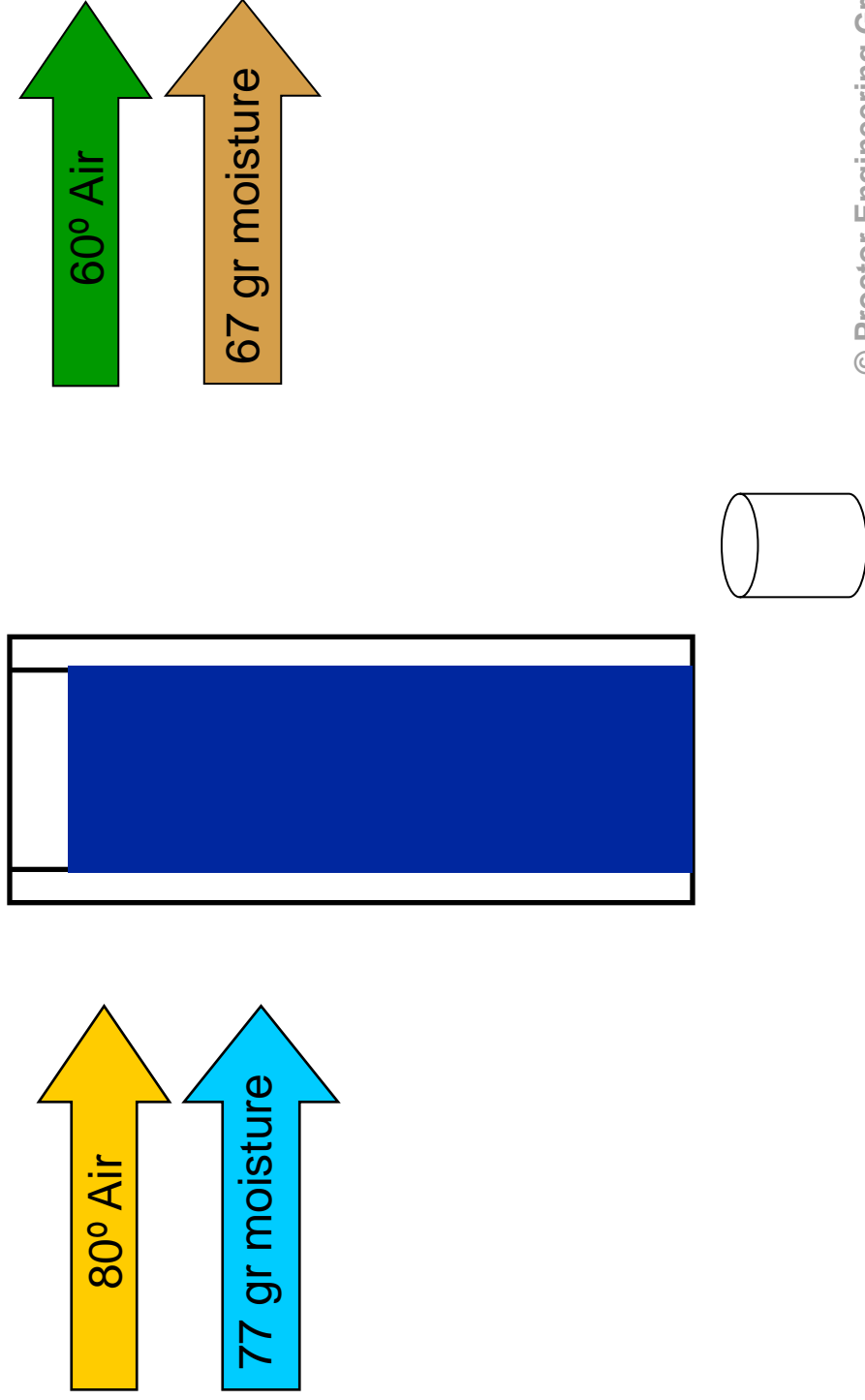


Latent Storage and Capacity



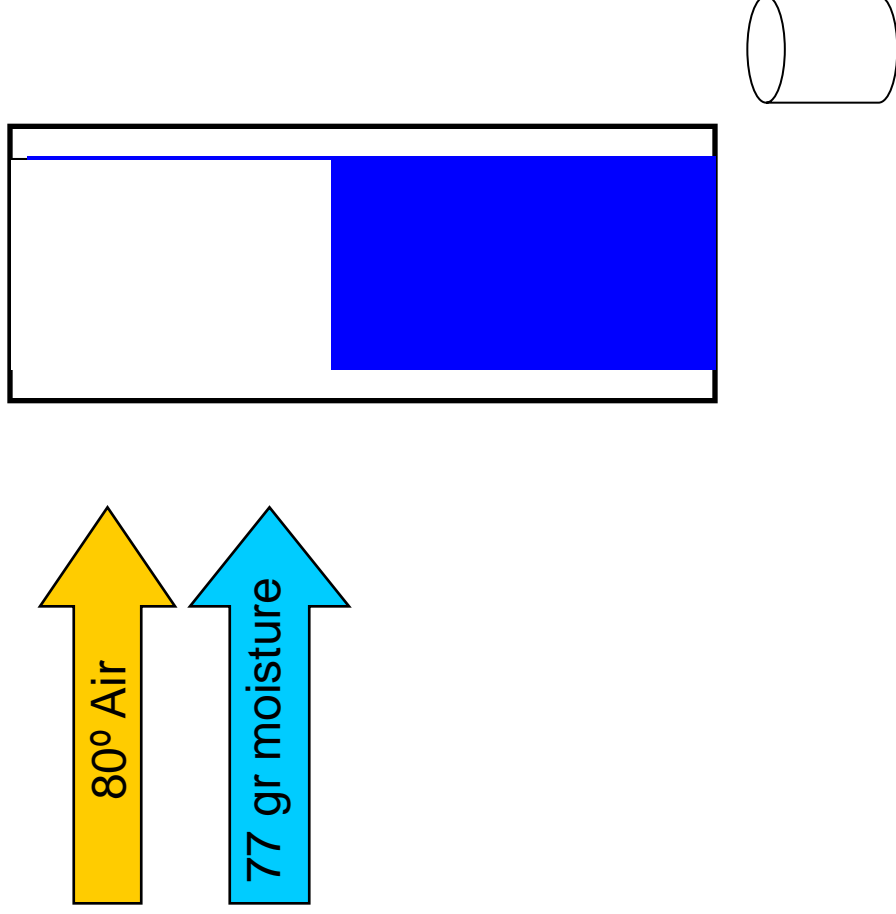
Lost Latent Capacity Recovered as Sensible Capacity

When Compressor turns off



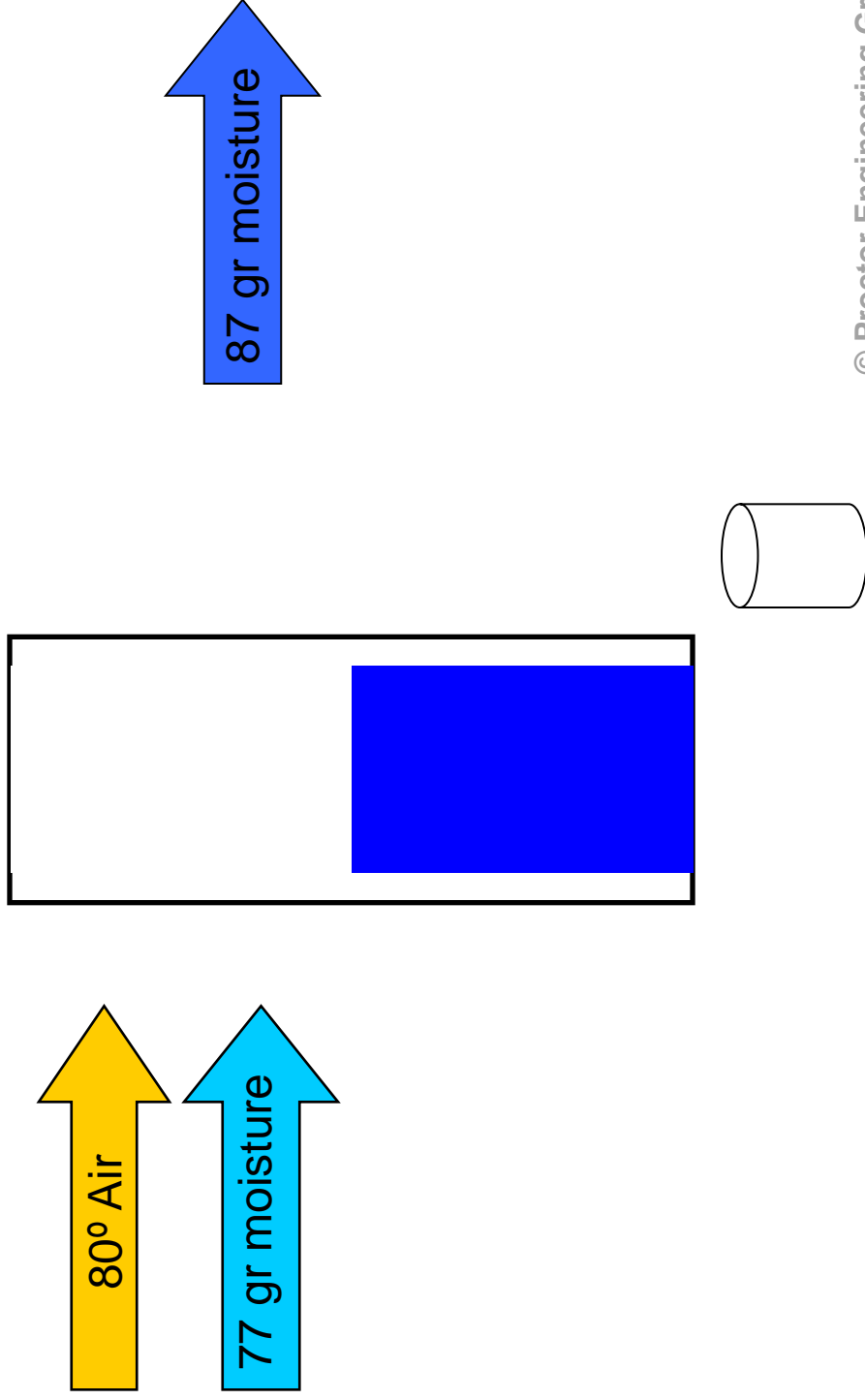
Lost Latent Capacity Recovered as Sensible Capacity

and the fan stays on, water evaporates off the coil



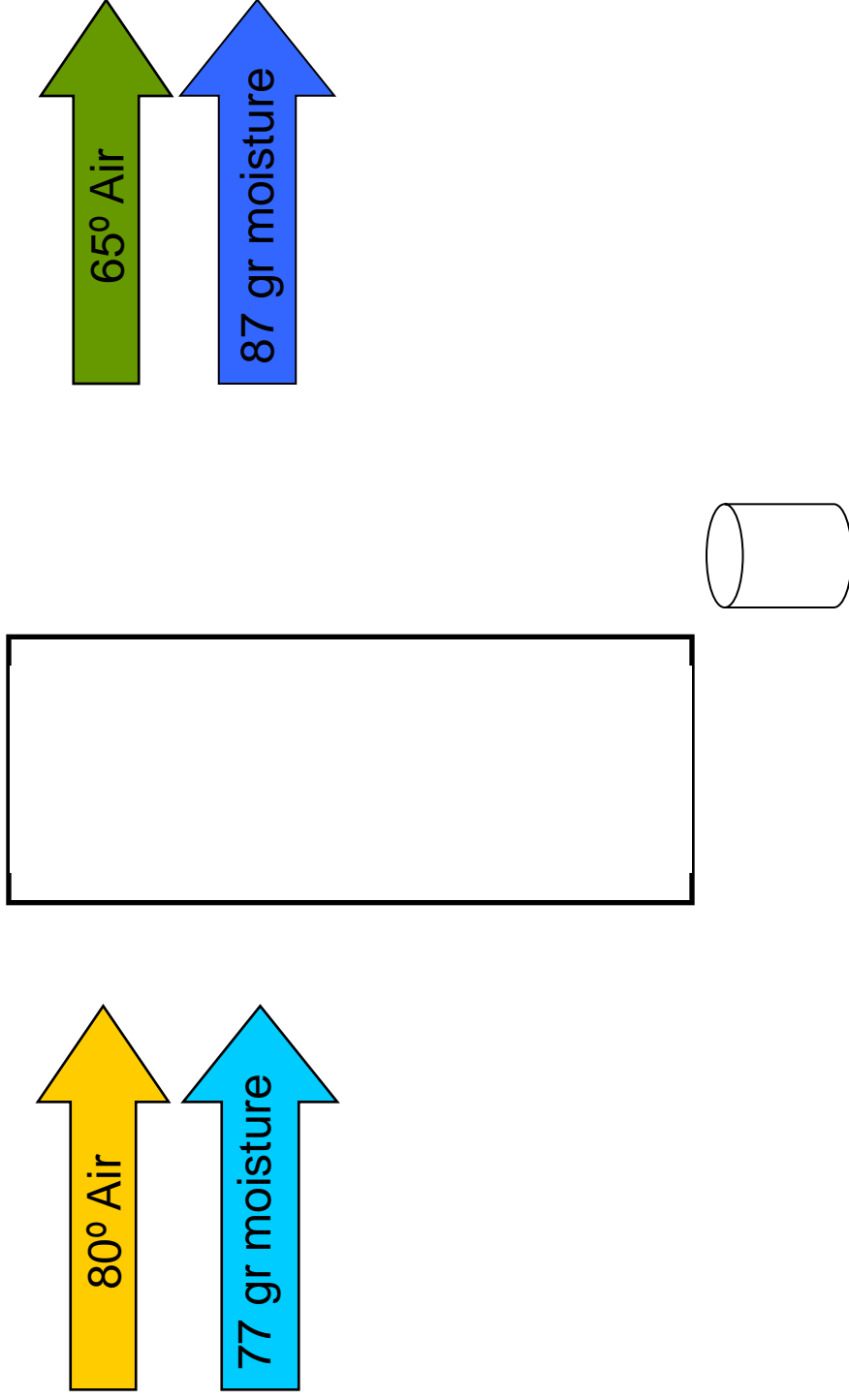
Lost Latent Capacity Recovered as Sensible Capacity

and like an evaporative cooler the moisture evaporates

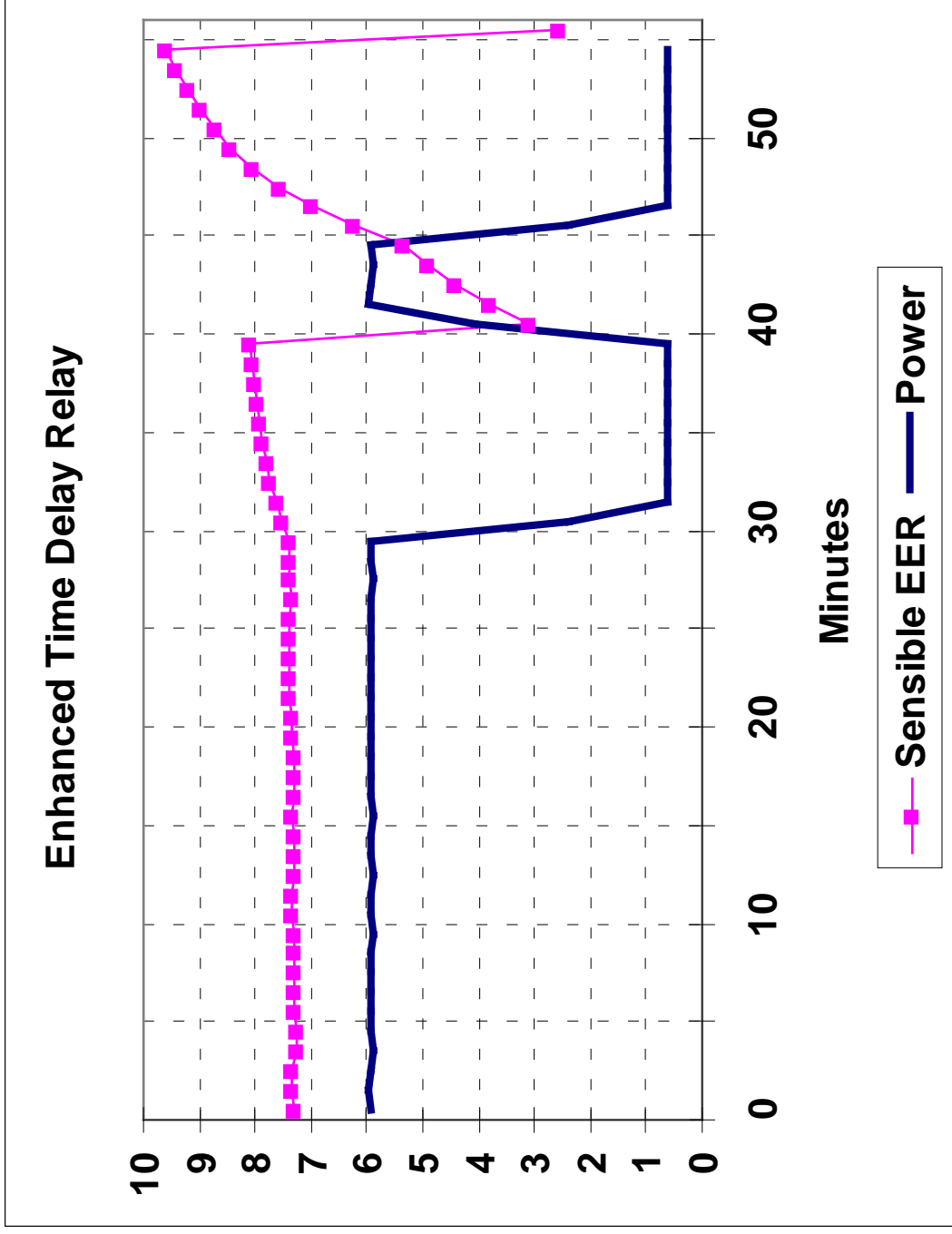


Lost Latent Capacity Recovered as Sensible Capacity

cools the air and dries the coil



Increased Fan-off Time Delay for Sensible EER in Dry Climates



Calculating the Sensible EER

$$\text{Sensible Capacity} = 1.08 \times \text{CFM} \times \text{Temp. Drop}$$

$$\begin{aligned} \text{Sensible Capacity} &= 1.08 \times 1200 \text{ CFM} \times 16^\circ\text{F} = \\ &20,736 \text{ Btuh} \end{aligned}$$

$$\begin{aligned} \text{Sensible EER} &= \\ \text{Sensible Capacity} / \text{Watts} \end{aligned}$$

$$\begin{aligned} \text{Sensible EER} &= \\ 20,736 \text{ Btuh} / 3000 \text{ Watts} &= \\ \mathbf{6.9 \text{ EER}} \end{aligned}$$

The Fan Only Sensible EER

Sensible Capacity =
 $1.08 \times \text{CFM} \times \text{Temp. Drop}$

Sensible Capacity =
 $1.08 \times 1200 \text{ CFM} \times 8^\circ\text{F} =$
10,368 Btuh

Sensible EER =
Sensible Capacity / Watts

Sensible EER =
 $10,368 \text{ Btuh} / 600 \text{ Watts} =$
17.3 EER

Fan Only ECM - Low Speed Sensible EER

$$\text{Sensible Capacity} = 1.08 \times \text{CFM} \times \text{Temp. Drop}$$

$$\begin{aligned} \text{Sensible Capacity} &= 1.08 \times 600 \text{ CFM} \times 8^\circ\text{F} = \\ &5,184 \text{ Btuh} \end{aligned}$$

$$\begin{aligned} \text{Sensible EER} &= \\ \text{Sensible Capacity} / \text{Watts} \end{aligned}$$

$$\begin{aligned} \text{Sensible EER} &= \\ 5,184 \text{ Btuh} / 60 \text{ Watts} &= \\ 86.4 \text{ EER} \end{aligned}$$

Western Cooling Control™ Dialogue Script

Step 1 (Planting the seed) – *The company dispatcher contacts customer to remind them of their upcoming service. During this conversation the dispatcher mentions the utility program and the Western Cooling Control™.*

“Good morning Mrs. Doe. I am calling to remind you of your upcoming service. While our technician is servicing your unit, he can also evaluate the system to see if it’s eligible for an efficiency upgrade through the (utility name) Program. Our company is offering a new energy saving control for your air conditioner through this program called the Western Cooling Control™. Please ask the technician for more details.”

Step 2 (Present the Information) – *Technician arrives on time with service vehicle stocked with the Western Cooling Control™, marketing sheets, and shoe covers.*

POINT OUT THE FOLLOWING ON THE MARKETING SHEET

“Good morning Mrs. Doe. Before I start your service, I’d like to inform you about an energy efficiency program that we are participating in. The program is called the (utility name) Program and is funded by (utility name). The purpose of this program is to increase the operating efficiency of your air conditioner by installing a Western Cooling Control™. This “smart” control works by keeping your indoor fan running 2-5 minutes after your compressor shuts off. By doing so, it blows the cool residual air stored in your air conditioner back into your home. It would otherwise be wasted. This is a simple and inexpensive way of getting the most from your air conditioner. In fact, this control has the potential of saving you 10% or more on your cooling energy cost!

I encourage you to read this marketing sheet while I evaluate your system. Please feel free to ask me any questions.”

Step 3 (Present the Opportunity) – *Before informing the customer of their eligibility, be sure to confirm that the system does qualify. Please remember that evaporative coolers, mini-splits/multi-splits, PTAC, or window air conditioners do not qualify.*

“Great news Mrs. Doe, your system qualifies! This makes you eligible for a \$XXX.00 rebate! I have the Western Cooling Control™ on my van and can have it installed in about 15 minutes. Our company’s cost to install the Western Cooling Control™ is \$XXX, however, after your \$XXX.00 rebate, you will only pay \$XXX.00. Do you have any questions? Would you like me to proceed?”

Step 4a (Install the WCC) – *Install the Western Cooling Control™ according to installation instructions provided. Be sure to inform the customer about the operating differences they will notice and hand the customer the utility branded informational handout.*

“All finished Mrs. Doe, I’ve installed the Western Cooling Control™. You will notice the fan will run a bit longer. That is exactly how it is supposed to work. Having the indoor fan run longer delivers more cooling to your home, keeps the compressor from cycling as often, and saves you money on your electric bill.

Step 4b (Customer is undecided) – *At this point the customer may be undecided and need more time to make a decision. DO NOT PRESSURE THE CUSTOMER. Politely explain to the customer that the utility sponsored program is only available for a limited time and that they may miss the opportunity if they wait too long. Leave them a business card in case they change their mind.*

Western Cooling Control™ Enhanced Time Delay Relay Installation Procedure WCC1

This procedure explains how to install the **WCC1** Western Cooling Control™ (WCC) enhanced time delay relay.

Warning: *Make sure that power to the furnace is off before installing the Western Cooling Control™ relay.*

The WCC1 works on any furnace with standard 24 VAC thermostat wiring. It does not affect heating operation of the furnace.

If installed on a heat pump, additional controls are required to prevent WCC1 from activating during heating operation.

Always cycle the unit after installation to ensure proper function.

The WCC1 will run the blower after the compressor shuts off to extract the evaporative cooling capacity of the condensed water on the indoor coil. After the additional cooling has been extracted, WCC will turn the blower off. The amount of time the fan stays on gets longer as the compressor run time gets longer, up to a maximum of 5 minutes.

Procedure

1. Use the thermostat to turn the air conditioner on 'COOL' and ensure that the compressor and indoor fan come on.
2. Turn the air conditioner off at the thermostat and record the length of the original fan off delay.
3. Disconnect power to the furnace and access the furnace 24V terminal block.
4. Mount the WCC to the inside of the furnace cabinet using self-tapping sheet metal screw. Cover the tip of the screw with the provided tip protector.

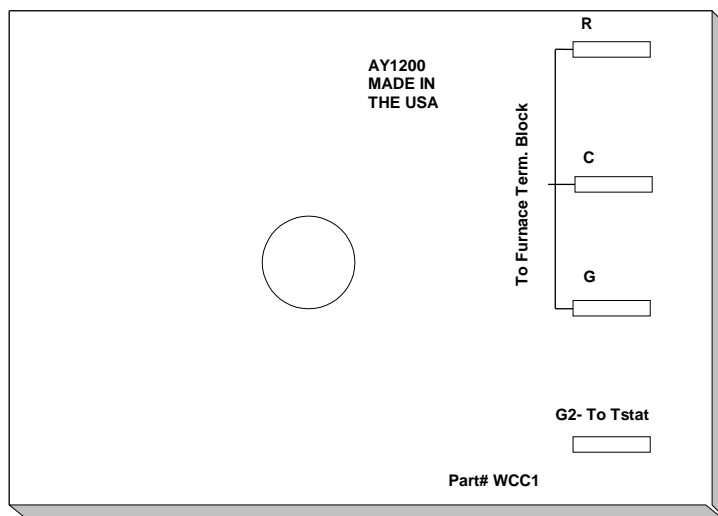


Figure 1. WCC1

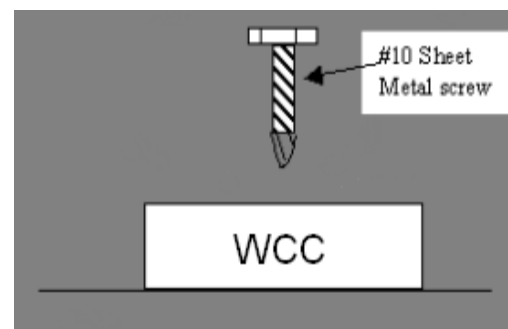


Figure 2. Mounting Inside Furnace

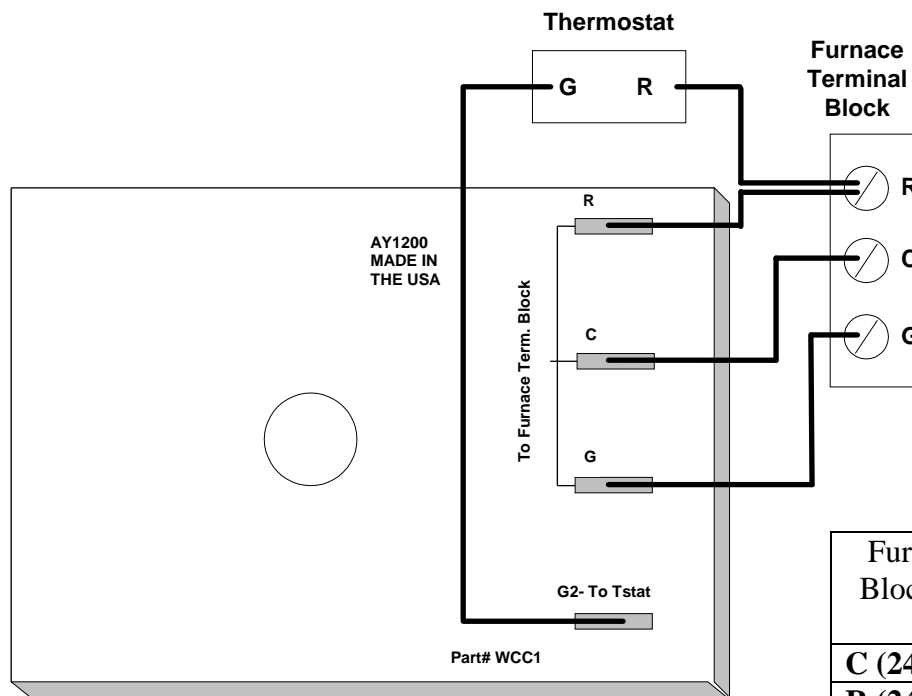


Figure 3. WCC1 Wiring

Furnace Terminal Block Description*	WCC1 Terminal Labels
C (24V Common)	C
R (24V Hot)	R
G (Fan)	G
* Letter designation and wire color may vary on the furnace	

Table 1. Terminations at Furnace

5. Check the wires to the terminal block.
Do the colors of the wires match the terminal block labels? If not, write down which color wires go to which terminals.
6. Locate the **G (Fan)**, **R (24VAC Hot)**, and **C (24VAC Common)** terminals on the furnace terminal block
7. **Disconnect** the Fan signal (green wire) coming from the thermostat at the furnace terminal block and connect it to your wire from **G2 - TO TSTAT** on the WCC1 using a wire nut. **Do not disconnect any other wires.**
8. Connect the remaining three wires from the WCC1 (R, C, and G) to the furnace terminal block as indicated in Table 1 and Figure 3.
***Check to make sure all connections are secure and no electrical shorts have been caused between terminals.**
9. Replace and secure the blower compartment cover.
10. Turn on power to the furnace.
11. Use the thermostat to turn the AC on 'COOL' and confirm that the compressor comes on and the fan comes on.
12. Turn off the AC at the thermostat. Make sure the compressor turns off and record the length of the final fan off delay.
 - a. *If the fan continues running for longer than 5 minutes after the compressor turned off: 1) Verify that the thermostat is not calling for fan, 2) Double check that the wiring is correct, 3) Refer to the Troubleshooting Guide for more information on using WCC with power stealing thermostats.*
13. From the thermostat, test the system to make sure all operating modes are functioning correctly.

Western Cooling Control™ Enhanced Time Delay Relay

Installation Procedure: WCC20

This procedure explains how to install the **WCC20** Western Cooling Control™ (WCC) enhanced time delay relay.

The WCC20 will run the blower after the compressor shuts off following a cooling cycle to extract the evaporative cooling capacity of the condensed water on the indoor coil. After the additional cooling has been extracted, WCC will turn the blower off. The amount of time the fan stays on gets longer as the compressor run time gets longer, up to a maximum of 5 minutes.

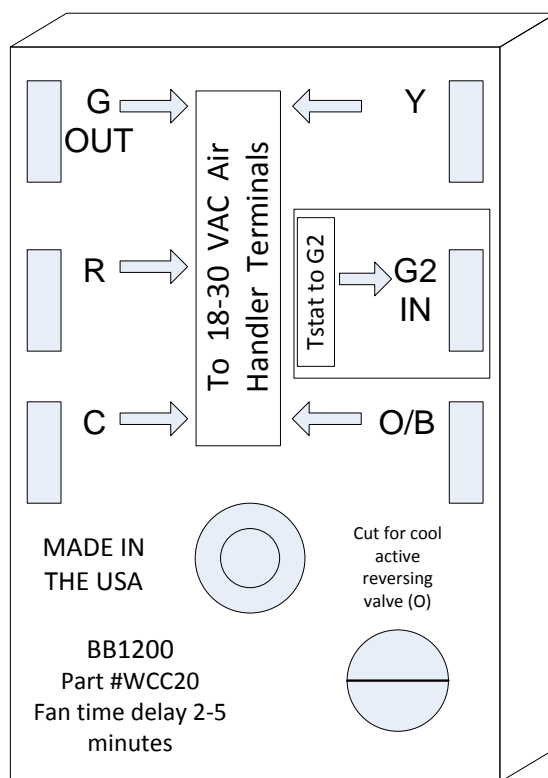
WCC20 works on any air handler with standard 24V thermostat inputs. It can be configured for:

1. Heat pump, with no blower off delay extension during heating (see Figure 1)
2. Air conditioner (see Figure 2)

Procedures for each configuration are described separately. Follow the instructions for the type of installation you are performing.

Your WCC20 package contains the following parts:

WCC20 Included Parts	
Part Description	Quantity
WCC20	1
Wiring Harness	1
Wire Nut	1
Self-Tapping Sheet Metal Screw	1
Screw Tip Cover	1



Warning: Make sure that power to the air handler is off before installing the Western Cooling Control™.

Remove power prior to cutting or reconnecting the reversing valve action jumper.

Always cycle the HVAC unit through Heating, Cooling, and Fan operating modes after installing WCC20 to ensure proper function.

WCC20 Procedure for Heat Pumps

1. Use the thermostat to turn the heat pump on 'COOL' and ensure that the compressor and indoor fan come on.
2. While the heat pump is on and in cooling mode, check to see if the reversing valve signal (O/B) is active during cooling or active during heating. **If the reversing valve is active during cooling, cut the jumper on WCC20 before installing on the system.**
3. Turn the heat pump off using the thermostat and record the length of the original fan off delay.
4. Use the thermostat to turn the heat pump on 'HEAT' and ensure that the compressor and indoor fan come on
5. Turn off the heat pump at the thermostat, make sure the compressor turns off and record the original blower off delay.
6. Disconnect power to the air handler and access the 24V terminal block.
7. Mount the WCC to the inside of the controls compartment and/or in a safe operating location using self-tapping sheet metal screw. Cover the tip of the screw with the provided tip protector.
8. Check the wires to the terminal block. Do the colors of the wires match the terminal block labels? If not, write down which color wires go to which terminals.
9. Disconnect the Fan signal (green wire) coming from the thermostat at the air handler terminal block and connect it to your wire from **G2 - IN** on the WCC20 using a wire nut. **Do not disconnect any other wires.**
10. Connect the remaining 5 wires from the WCC20 (R, C, Y, O/B, and G-Out) to the air handler terminal block as indicated in Table 1 and Figure 1. **Note: C or common wire should be hard wired using an existing common wire or terminal. Do not wire C or common to ground.**

Figure 1 WCC20 Wiring for Heat Pumps

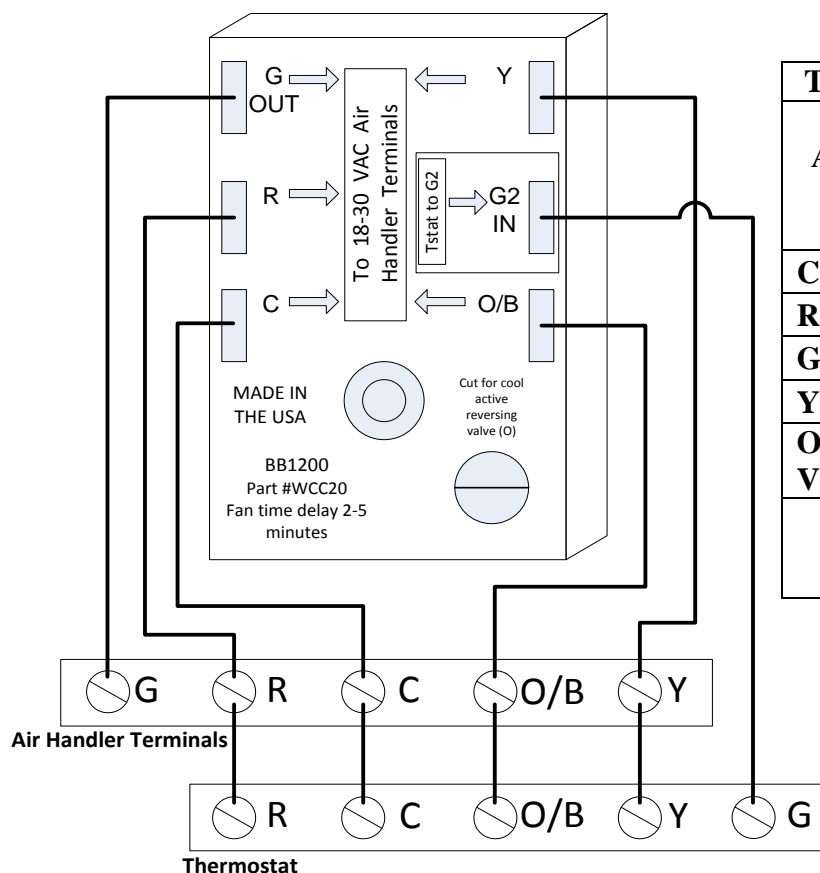


Table 1. Terminations at Air Handler

Air Handler Terminal Block Description *	WCC20 Terminal Labels
C (24V Common)	C
R (24V Hot)	R
G (Fan)	G OUT
Y (Compressor)	Y
O/B (Reversing Valve)	O/B
* Letter designation and wire color may vary on the furnace	

11. **Check to make sure all connections are secure and no electrical shorts have been caused between terminals.**
12. Replace and secure the blower compartment cover.
13. Turn on power to the air handler.
14. Use the thermostat to turn the heat pump on 'COOL' and confirm that the compressor and indoor fan come on.
15. Turn off the heat pump at the thermostat, make sure the compressor turns off, and record the final blower off delay.
If the fan continues running for longer than 5 minutes after the compressor turned off: 1) Verify that the thermostat is not calling for fan, 2) Double check that the wiring is correct, 3) Refer to the Troubleshooting Guide for more information on using WCC with power stealing thermostats.
16. Verify that the final cooling blower off delay is at least two minutes. *If the final delay is less than two minutes, recheck the jumper and reversing valve signal (Step 3).*
17. Use the thermostat to turn the heat pump on 'HEAT' and confirm that the compressor and indoor fan come on.
18. Turn off the heat pump at the thermostat, make sure the compressor turns off and record the final blower off delay.
19. Verify that the final heating blower off delay is equal to the initial heating blower off delay.
If the final delay is longer, recheck jumper and reversing valve signal (Step 3).
20. Use thermostat to make sure all operating modes are still functioning correctly.

WCC20 Procedure for Air Conditioners

1. Use the thermostat to turn the air conditioner on 'COOL' and ensure that the compressor and indoor fan come on.
2. Turn the air conditioner off using the thermostat and record the length of the original fan off delay.
3. Disconnect power to the furnace and access the furnace 24V terminal block.
4. Mount the WCC to the inside of the controls compartment and/or a safe operating location using self-tapping sheet metal screw. Cover the tip of the screw with the provided tip protector.
5. Check the wires to the terminal block. Do the colors of the wires match the terminal block labels? If not, write down which color wires go to which terminals.
6. Disconnect the Fan signal (green wire) coming from the thermostat at the furnace terminal block and connect it to your wire from **G2 - IN** on the WCC20 using a wire nut. **Do not disconnect any other wires.**
7. Connect the remaining four wires from the WCC20 (R, C, Y, and G) to the furnace terminal block as indicated in Table 2 and Figure 2. O/B can be ignored for AC units (Ensure the unused O/B wire in the wiring harness is wrapped around the wiring harness). **Note: C or common wire should be hard wired using an existing common wire or terminal. Do not wire C or common to ground.**

Figure 2. WCC20 Wiring for Air Conditioners

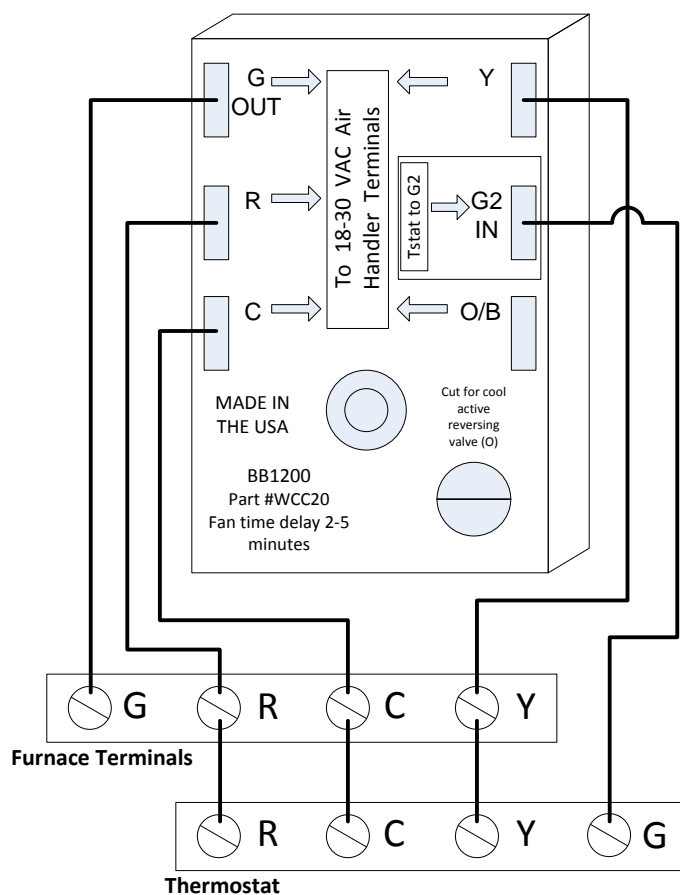


Table 2. Terminations at Furnace	
Furnace Terminal Block Description *	WCC20 Terminal Labels
C (24V Common)	C
R (24V Hot)	R
G (Fan)	G OUT
Y (Compressor)	Y
Not Used	O/B
* Letter designation and wire color may vary on the furnace	

8. **Check to make sure all connections are secure and no electrical shorts have been caused between terminals.**
9. Replace and secure the blower compartment cover.
10. Turn on power to the furnace.
11. Use the thermostat to turn the air conditioner on 'COOL' and confirm that the compressor and indoor fan come on.
12. Turn off the air conditioner at the thermostat. Make sure the compressor turns off and record the length of the final fan off delay.
If the fan continues running for longer than 5 minutes after the compressor turned off: 1) Verify that the thermostat is not calling for fan, 2) Double check that the wiring is correct, 3) Refer to the Troubleshooting Guide for more information on using WCC with power stealing thermostats.
13. Verify that the final cooling blower off delay is at least two minutes. *If the final delay is less than two minutes, recheck your wiring and verify WCC20 jumper is not cut.*
14. Use thermostat to make sure all operating modes are still functioning correctly.

Western Cooling Control

Enhanced Time Delay Relay

Troubleshooting Guide: **Power Stealing Thermostats**

Certain electronic thermostats “steal” power from the 24V system to power themselves. To stay powered, they allow a small current to flow back to the furnace/air handler even when there is no call for cooling or heating. These are known as power stealing or parasitic thermostats.

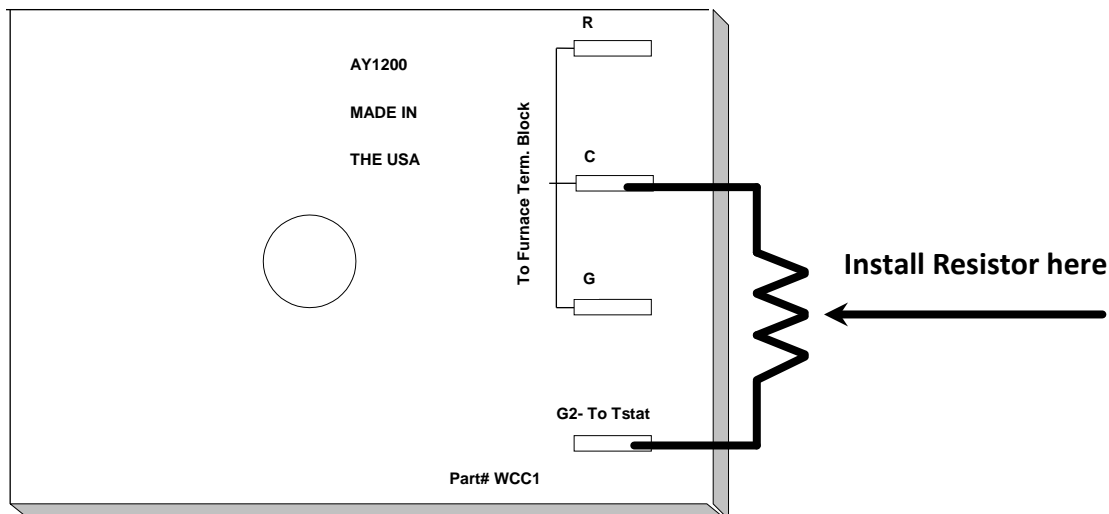
In most cases the constant flow of current isn't a problem because it is very small, usually only a few milliamps, and electrical components in the furnace/air handler provide sufficient load to prevent it from being detected as a thermostat call. In some cases, more commonly with older thermostat models which require higher parasitic current to stay powered, compatibility problems can occur with certain furnace/air handler models or add-on components.

To solve this problem, the thermostat manufacturers often ship a small resistor (3 to 4 W, 250 to 1000 Ohm) with the thermostat. The resistor is installed between 24V common and the terminal (usually heating / White) that is incorrectly sensing the thermostat call.

Very rarely, on certain systems, Western Cooling Control (WCC) enhanced time delay relay may detect parasitic current on the Green thermostat wire as a call for fan. If you install a WCC and the fan runs constantly with no thermostat call, this is the most likely cause.

The recommended solution is to install the resistor provided by the thermostat manufacturer, or a similar resistor if the one from the manufacturer isn't available, between the G2 and C terminals on the WCC. This will reduce the current to the G2 terminal where the fan call is sensed. WCC requires less than 015mA on G2 when the thermostat is not calling for fan.

Most systems will not need the resistor. Only install it if necessary.



Western Cooling Control™

Quality Assurance Checklist

This checklist has been created by Proctor Engineering Group's quality assurance department. The purpose of this checklist is to ensure that technicians are installing WCC's in accordance with the installation instructions. This checklist should be followed during every installation.

- ☐ - Educate the customer on how the WCC works and how the operation of their air conditioner will change after the installation.
- ☐ - Ensure the customer understands that the longer fan cycles they will experience with the WCC installation is normal and this is how the WCC saves them money on their cooling bill.
- ☐ - Cycle the system in heating, cooling, and fan only mode to confirm proper operation. This will help eliminate call backs.
- ☐ - Lower the thermostat setting in cooling mode to get the compressor to come on.
- ☐ - Raise the thermostat setting to get the compressor to shut off and record the initial blower off delay in minutes and seconds.
- ☐ - Mount the WCC on the interior of the unit in a **safe operating location**, preferably in the control compartment. If exposed, cover the self-tapping screw with the rubber screw tip protector provided.
- ☐ - The WCC common wire (blue wire) should be wired directly back to low side of transformer (24V). This can be done at the terminal block, with a spade connection, piggy back, or splice method if necessary. **Wiring common to ground is unacceptable and will result in an immediate fail.**
- ☐ - Place the utility approved WCC sticker on exterior of unit in clear sight, near the nameplate, control panel, or blower door.
- ☐ - Lower the thermostat setting in cooling mode to get the compressor to come on.
- ☐ - Raise the thermostat setting to get the compressor to shut off and record the final blower off delay in minutes and seconds.
- ☐ - Cycle the system in heating and fan only mode to confirm proper operation.
- ☐ - Provide the customer with the utility approved WCC information leave behind sheet.