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HEATING & AIR CONDITIONING

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TSB: 00-12
Date: 10-31-00

Subject: Light Flicker

Introduction:

During the summer months a reoccurring incidence of light flicker or dimming upon an outdoor unit start-up is reported to After Sale Support. The number of calls has been on the increase since the introduction of the Climatuff Scroll Compressor. In this document we will discuss the source and effect of light flicker, how to verify the voltage drop and possibly to minimize the momentary dimming to a more acceptable level.

Discussion:

Flicker is a term used to describe the brief voltage drop that occurs due to the combination of system impedance and the high current inrush required by most motors to start. This power sag caused by an instantaneous spike in current flow somewhere in the electrical system usually lasts less than 1-2 seconds. However, the magnitude, duration and intensity of the flicker can vary from being imperceptible to requiring digital clocks and computers to be reset.

Numerous studies by local utility companies have concluded that this electrical phenomenon occurs when an inductive load, such as a motor from a dishwasher, disposal or air conditioner starts. During the initial start of these motors, the locked rotor amps can be 5 to 7 times the normal running current. Many power companies size their transformers to accept this varied amperage demand. However, with the design characteristics of the scroll compressor, and the inertia needed to start the larger scroll mass, the initial starting current on some models develop 15-25% higher inrush current on the start up than the similarly size reciprocating compressor. This may exceed the utility company's standard starting current per ton calculation. Also, found to contribute to voltage drop in some cases, is the length and wire size which are usually designed for amperages associated with running loads, not peak in-rush, and consequently the lights may dim when motors start.

Flicker can be difficult to resolve and may never be completely eliminated, because it is a natural result of current flowing through a fixed resistance. Elimination of the flicker would require elimination of the current, which means the motor must be turned off. If, however a lighting circuit has been installed on the same buss as a 115v motor circuit, the solution would be to move the lighting circuit to a different phase or buss bar in the circuit breaker panel.

In a consumer study it was established that 40-watt clear light bulbs produce objectionable flicker at lower voltage dips because its smaller filament cooled more rapidly, and thus light variations were more noticeable with the smaller rating. Similar comparison was made between incandescent and fluorescent bulbs (both 40W). An investigation revealed that the phosphorescent coating of the fluorescent bulb helped to maintain its luminosity during voltage dips. While 40W clear light bulbs are less popular than frosted 60W or 100W, they are often used in ceiling fan or chandelier light fixtures visible in entertainment areas of the home where consequences of noticeable light flicker might be aggravating and cause complaint.

Many times changing the light bulbs to frosted (versus clear), increasing the wattage, or changing the type of bulb will help to diminish the situation.

The following test is intended to measure and record the electrical effects of the residential outdoor product and the influence of the home internal wiring and external service entrance. Measurements will be taken, as described in the instructions provided, to identify possible problems that can be addressed to resolve light flicker problems.

To verify if the air conditioner electrical components are working properly and not contributing to the light flicker or voltage drop, the following should be confirmed prior to this procedure.

1. Check all wiring & terminals to ensure good connections.
2. Check capacitors, start relays & contactors.
3. Establish compressor amp draws are within manufacture's specifications.

Follow the instruction below and fill out the table provided.

Caution: Measurement will be taken with the power ON and caution is advised to avoid Electrical Shock.

1. Record the Model and Serial Numbers of the Equipment in the space provided.
2. At the outdoor unit with the outdoor unit OFF, measure the voltage available at the compressor contactor. Enter this value in column A as open circuit voltage.
3. Measure the voltage at the contactor with the system operating. Make sure the system has been on for at least 5 minutes. Enter this in column B. This is the running voltage.
4. Subtract column B from Column A and enter the value in column C. This is the total voltage drop including the service entrance and unit wiring. The acceptable range for running voltage drop is 0 to10 volts.

Note: The next step is to determine the actual voltage drop when the compressor tries to start, however the voltage drop measured in the 115v circuit should identify the maximum voltage drop created.

5. Open the disconnect and remove power from the outdoor unit. Remove the Compressor start lead from the start capacitor. This should be an Orange lead. Open the 24-Volt control circuit to the contactor or Yellow control wire.
   Connect a voltmeter to record the minimum voltage during the start attempt, to an available 115-Volt outlet.
   An extension cord may be used to have better access to the 115-Volt source. Close disconnect.
   Connect the Yellow contactor control wire **for 2-3 seconds while measuring the minimum voltage from the 115-Volt line**.
   Note this reading and multiply it by two (2) and record this reading in column D. This is the voltage during starting or locked rotor.
6. Remove power from outdoor unit. Return wiring to normal.
7. Subtract voltage D from voltage A; Record this in column E. This is the starting voltage drop.
8. The acceptable range is for starting voltage drop is 0 to 18 volts.

9. If (C) the running voltage drop exceeds 10 volts and the starting voltage drop is within the acceptable range the unit wiring may be undersized for the length of wire used.
10. If (E) the running voltage drop is less that 10 volts or is acceptable and the starting voltage drop exceeds 18 volts, the service entrance cable and or transformer may be undersized.

Unit Model # _____ Unit Serial # _____

Start Kit (Check one) ___ None ___ Relay & 135 MFD

___ Relay & 2(135 MFD) ___ PTC Start Device

___ Other Describe _____

	A	B	C	D	E
Test	Open Circuit Voltage	Running Voltage	Running Voltage Drop 0 to 10 volts?	Start Voltage 115 volt Reading X 2	Start Voltage Drop 0 to 18 volts?
Example	235	230	5 OK	223	12 OK

Summary:

- Is (C) the running voltage drop less than 10 volts?
  If Yes, the outdoor unit power wiring is properly sized.
  If not check for under sizing for the unit ampacity and wire length.
- Is (E) the start voltage drop less than 18 volts?
  If Yes, the service entrance and transformer is sized properly.
- If (E) the start voltage drop is less than 6 volts the wiring is considered good.
- If the start voltage drop is between 6 and 18 volts, and does not have a start kit, a start kit will reduce the time required for the compressor to start and help to diminish light flicker.

Note: ***The capacitor start kit does not significantly reduce the voltage drop seen at the residence. However, the start kit does reduce the starting time (duration). This is due to the larger phase shift producing higher torque and greater rotor acceleration on start. This reduces the duration of the flicker, which makes it less noticeable to the human eye. From a customer's perspective, reducing the duration often works just as well as lowering the magnitude of the flicker.***

- If the start voltage drop is greater that 18 volts, a start kit has been applied and light flicker is still a problem, the Power Company must be contacted to help resolve the issue.

Issued by: Product Support