CAHI™ CONNECTICUT ASSOCIATION OF HOME INSPECTORS, INC.

MONTHLY

News and Views from the Connecticut Association of Home Inspectors, Inc. April 2007

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Meeting Dates

Apr 25 ***Air Conditioning*** **– Manufacturer's Rep**

May 23 ***Asbestos & Lead*** **- Douglas Auvine from IAQ Plus**

Jun 9 ***LAST CHANCE*** **- Ct Law Seminar**

Holiday Inn
201 Washington Ave
North Haven
(203) 239-6700

Inspecting Central Air Conditioning or Cooling System

Article submitted by Scott Monforte

I. **A/C COMPONENT LIST -** Basic Air Conditioning Components Inspection List

Conventional cooling systems include the following components:

1) Indoor Components

   a) Air Handler Unit (AHU) which typically includes the following:
      - Air filters - located at return registers or possibly at or in the air handler
      - Return Plenum
      - Blower fan in a blower compartment
      - Evaporator Coil
      - Supply plenum

   b) Supply air ducts and registers

   c) Return air ducts and registers

2) Outdoor Air Conditioning System Components:

   a) Condensing coil

   b) Outdoor cooling fan

   c) Electrical shut-off switch for service

Rooftop combined units: While the list above describes the common components of a typical residential air conditioning system, other configurations and packaged units are also in increased use in both residential and commercial installations. Alternative designs may combine all components except for the duct work in a rooftop mounted unit.

Wall convector units are often used for both heating and cooling in commercial installations and high-rise apartment buildings. Wall-mounted heating and cooling convector installations may be designed with one central heater or cooling system which feeds multiple units with chilled or heated water or possibly refrigerant from a single remote heating and cooling heat pump. Another common residential alternative dispenses with duct work entirely, using a wall-mounted indoor evaporator/blower unit and a separate outside compressor/condenser. In this latter split design, one compressor/condenser may serve multiple wall-mount indoor units.

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President's Corner

Bernie Caliendo

For those of you who attended the Building Science Seminar, thanks for coming! We had 90 attendees who all received 8 hours of continuing education towards license renewal. At this stage of the game, I assume the hours were not needed but the information and technologies Joe presented were invaluable. That was one of the best seminars CAHI has ever produced and the price to members was right. FREE! Even non-members paid a fee that was beyond reasonable for a seminar of this caliber.

We have quite a line up of topics and presenters for our monthly meetings booked through the fall and Director Scott Monforte has been working hard for our educational needs. Remember, July 1st starts a new licensing cycle and continuing education credits start at zero again. For those of you who have not attended a CT Law Seminar since July 1, 2005, you need one for renewal by June 30th. See the notice in this newsletter for our June 9th law seminar. Sign up today!

The beginning of May brings us to membership renewal time again. This year everyone will receive an invoice/notice by US mail. Our dues remain the same: Licensed inspectors $195.00 and Interns $145.00. Business memberships have been eliminated and Associate memberships are $100.00. Please fill out the application. We can't update your information in our records and on the web site unless you let us know of any changes. We want to make sure everything is correct, so **please fill out the application even if you have no changes**. You can renew by mailing in the form with a check or your credit card information filled out, signed and mailed to CAHI at the address on the application, or you can fill out the application and pay by credit card online on our web site.

Dues are due June 1st. Please be on time. We don't want to send you a late notice. As your payment is received, you will be sent a membership certificate suitable for framing.

Most of all, we thank you for your continued support and membership. Always feel free to contact me with any questions or concerns.

Bernie

RECALLS

U.S. Consumer Product Safety Commission

Amprobe Recalls Clamp Meters Due to Shock Hazard

Name of product: Amprobe Digital Clamp Meters used for electrical testing

Manufacturer: Amprobe Test Tools, of Everett, Wash.

Hazard: The meters can fail to give an appropriate voltage reading, resulting in the operator believing the electrical power is off, which can pose a risk of shock, electrocution, or thermal burn hazard.

Incidents/Injuries: Amprobe is aware of one report of a clamp meter displaying an incorrect voltage reading. No injuries have been reported.

Remedy: Consumers should stop using these recalled clamp meters immediately and contact Amprobe for a free replacement clamp meter.

To see this recall on CPSC's web site, including pictures of the recalled product, please go to:
http://www.cpsc.gov/cpscpub/prerel/prhtml07/07130.html

Venmar Ventilation Inc. Recalls Heat Recovery Ventilators Due to Fire Hazard

Name of product: Heat Recovery Ventilators

Manufacturer: Venmar Ventilation Inc., of Quebec, Canada

Hazard: The motors in these units can overheat, posing a fire hazard.

Incidents/Injuries: Venmar Ventilation has received four reports of ventilator motors overheating resulting in fires causing extensive property damage. One incident in Michigan reportedly resulted in about $1 million in damages.

Remedy: Consumers should immediately turn off and unplug their ventilators, and contact Venmar to receive instructions on how to participate in the recall. Venmar will provide a free safety device that will shut off the ventilator if the motor overheats.

To see this recall on CPSC's web site, including pictures of the recalled product, please go to:
http://www.cpsc.gov/cpscpub/prerel/prhtml07/07143.html

Connecticut Association of Home Inspectors, Inc.

Last Chance

"Ct Law Seminar"

Spend a morning with Attorney Kent Mawhinney

Dear Fellow Inspectors,

As we have received over two dozen calls asking about the required law seminar, CAHI has decided to schedule one more law seminar this renewal cycle for those in need.

Anyone who has had an inspector's license since July 1, 2005, MUST have a 3-hour "Ct Law Seminar" in their continuing education portfolio in order to renew your license by June 30, 2007. The Department of Consumer Protection and the Home Inspection Licensing Board **WILL** be conducting a random audit this year to make sure inspectors are obtaining a minimum of 20 hours of continuing education during this 2-year cycle, July 1, 2005 to June 30, 2007 (including the 3 hour Law, Rules & Regulation course) for licensing renewal.

Date & Time: **Saturday, June 9, 2007 from 8:30 to 11:30 am.**

Location: **Holiday Inn, 201 Washington Ave (RT 5) North Haven, CT.**

Fee: **$99.00** Don't wait. Sign up today!

Doors open at 8:00 am, continental breakfast & refreshments will be served

REGISTER & PAY

1. **Online**: **www.ctinspect.com** - On the home page click on "Special Events", click on "CT Law Seminar", click on "add to cart", fill out the form and pay by credit card.

-or-

2. **US Mail:** Fill out the form below, detach and mail with payment to CAHI, 75 Pond View Circle, Beacon Falls, CT 06403

.....

CT Law Seminar 6/9/07

Name:_____

Address:_____Town:_____State:_____ Zip_____

E-Mail Address:_____ Ph # ( )_____-_____

Payment type: [ ] check enclosed **OR** [ ] charge (Visa, M/C or Discover) circle one

Name on card:_____Card Number:_____Exp____-_____

Signature:_____ Amount: $99.00

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CONTROLS & SWITCHES - Switches and Controls on a typical split system with indoor and outdoor components:

If the A/C system won't operate, before requesting a service call check that it is turned on and that the thermostat is properly set.

- Compressor circuit breaker: in the electric panel there will be a switch controlling power to the compressor/condenser unit
- Compressor service switch: at the compressor/condenser unit, typically on a building wall near the outdoor unit, may be a breaker, fuse block pull-out, or switch
- Air handler circuit breaker: in the electric panel there will be a switch controlling power to the air handler/blower circuit
- Air handler service switch: at the air handler/blower unit, typically on the unit or on a building surface close to it
- Thermostat: which acts as a switch to turn on the A/C equipment, typically wall mounted in the living area. The thermostat may have both a temperature setting switch and a switch that can be moved to "cool", "off", or "heat" positions. For the thermostat to call for cooling it must be in the "cool" position and the temperature set to a level below the ambient air temperature at the thermostat location.
- Overload reset buttons: may be present on the blower motor in the air handler/blower compartment
- Air handler blower compartment access door switch: present on newer units, shuts off the blower fan as a safety control if the door is opened.

Notes: If the A/C system is not running, check these switches. Not all of these switches will be present on every system; fuses may be used instead of circuit breakers; fuse pullouts may be used instead of a circuit breaker or fuse at some service switches.

A/C DATA TAGS - Air conditioner data tags

A metal tag is usually affixed to the outdoor compressor housing. Depending on the age and equipment manufacturer the format and content of data on this tag varies, but typically the tag will allow you to discover the following data:

- The equipment manufacturer
- **BTUH Capacity**: The A/C system cooling capacity, either explicitly stated in thousands of BTU's (British Thermal Units) per hour (BTUH) or implicitly given by other data, or coded in the unit's model number.
- The **month and year of manufacture**, possibly also encoded in the unit serial number. Since the typical life of an A/C compressor is about ten years, one would like to know the probable age of the equipment.
- The permitted ampacity of the equipment electrical circuit protection (fuse or circuit breaker amps)
- The **Energy Efficiency Ratio** of cooling equipment is basically the amount of electricity you consume to obtain a given amount of cooling ability. It's expressed as (KW per hour of electricity used) / Thousand BTUs - this number is probably not going to be found on the equipment itself but may be in its documentation.

A/C ENERGY SOURCES, Air Conditioning System Type by Energy Source - Air conditioning systems use four common energy sources:

Air-cooled air conditioners (shown in the photo below) This refers to the use of air to cool the compressor and the condenser coil used to return the refrigerant gas to a liquid state. These split systems usually have an inside evaporator cooling coil installed to work along with the blower and duct system which might also be sitting atop a heating furnace. The outside half of the equipment contains the compressor and condenser coil.

Water cooled air conditioning systems These work in a manner similar to the system listed above, but use water as a chiller to remove heat from the high temperature gas in the (usually, but not always, outside) compressor/condenser unit.

Independent Systems are air conditioning systems which do not make use of an existing blower and duct work installed for central heating. These include ductless systems mounted on roofs or in attics and wall-mounted units which may include an indoor fan and evaporator coil to produce cooled and dehumidified air, but which route refrigerant to an outside compressor/condenser unit.

Gas Chillers These systems operate by the same

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principles as the above units, but they use heat to cause the refrigerant gas to change states rather than compression and expansion by a compressor motor. (Some refrigerators, including ones used in recreational vehicles also operate on this principle, as they can cool without requiring electricity to operate a compressor. Ammonia was the traditional gas used for this type of system.)

II. RATED COOLING CAPACITY - How to Determine Air Conditioning Equipment Rated Cooling Capacity

The cooling capacity of an air conditioning system is expressed in BTU's or tons. One ton of cooling capacity equals 12,000 BTU's/hour of cooling capacity.

"One ton" of cooling capacity, historically, referred to the cooling capacity of a ton of ice. Tons of ice does not explain a key ingredient in the comfort produced by air conditioning systems, dehumidification of indoor air - that is, taking water out of the air. Cool air can hold less water (in the form of water molecules or gaseous form of H2O) than warm air. Think of the warmer air as having more space between the gas molecules for the water molecules to remain suspended. When we cool the air, we in effect are squeezing the water molecules out of the air. When an air conditioner blows warm humid building air across an evaporator coil in the air handler unit, it is not only cooling the air, it's squeezing out some of the water in that air. Both of these effects, cooler air and drier air, increase the comfort for building occupants.

There are several ways to determine the rated cooling capacity of an air conditioning system's equipment:

Air Conditioning Equipment Age and Capacity from Equipment Numbers

Age from Serial # - Serial number formats vary by range of years over which equipment was manufactured, and may vary among countries of manufacture for a given company's equipment, for example between the U.S. and Canada for Carrier air conditioning equipment. *Example: A Carrier Compressor/Condenser Serial # 1389E54894 on a compressor unit.*

Air conditioning equipment age from serial number for the example above, the equipment was made after 1980. The first four digits of the serial number are week and year of manufacture, in this case, week 13 of 1989.

Equipment Capacity from Model # - *Example: Carrier A/C Compressor Condenser Model# 38XD12400* (same unit as used for the serial number example above), there is variation in how Carrier assigned these numbers but typically the numbers indicate either tonnage or MBTUH. This example has digits in the 4th and 5th positions (right hand 5 digits), so the rating is in MBTUH for this number and "24" signifies 24 MBTUH or 2 tons of capacity.

Guide to Heating and Air Conditioning Equipment model numbers, serial numbers, age, and capacity: See Technical Reference Guide, published by Carson Dunlop Weldon & Associates, Ltd., Toronto, 2006 for a $69.00 book which translates air conditioning equipment model numbers and serial numbers into date of equipment manufacture and rated BTUH capacity.

Equipment Capacity from Equipment RLA # - RLA or Running Load Amps is the current draw when the equipment is operating, excluding the current draw during startup, but when the compressor is under load. On a single-phase 240V circuit feeding an A/C compressor/condenser unit, the equipment will draw typically 5 to 6, (7 in some cases) RLA per ton of cooling capacity. So if the data tag on a compressor shows its RLA rating=21.2 I would rate the system as 21.2/7=3 Tons. Translating Tons into BTUH, 3 tons x 12 MBTUH/ton = 36,000 BTUH estimated Cooling Capacity. Details of this and related calculations are in the "Guide" book cited above.

COOLING RULES OF THUMB - determining Cooling Capacity Requirements - A home inspection does not involve the calculations of heat gain necessary to decide if the cooling capacity on a building is adequate, but the inspector is expected to examine and report on the rated system capacity (such as "36,000 BTUH") and on the presence or absence of cooling sources in the habitable rooms of the building.

Air conditioning capacity requirement - rule of thumb for relatively cool climates such as the Northeastern United States: one ton per 400 sq.ft. (Commercial) or one ton per 500 to 1000 sq.ft. (Residential) or one ton per 400 to 800 sq.ft. (Space Pak Systems). . Or a 3000 sq.ft. house may require a 5-ton unit. Or count the supply outlets: 10 outlets @ 100 cfm (estimated) = 1,000 cfm = 2.5 tons needed.

Can an air conditioning system have too much capacity? Perhaps. If a system is over sized for a building it may be able to drop the indoor temperature so rapidly that the cooling cycle is too short to permit adequate reduction in the humidity level. Remember that indoor comfort is a function of both temperature and relative humidity. If the

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"on cycle" of the A/C system seems unusually brief, or if the indoor humidity is not dropping, this question merits further investigation.

III. INSPECTION LIMITATIONS - Air Conditioning System Inspection Limitations

COOLING SYSTEM INSPECTION LIMITATION: We check for normal temperature differential between input and output air, unusual operating noises, visible damage or defects, and a variety of other possible defects. This inspection is not technically exhaustive; a more thorough inspection, also not technically exhaustive, can be performed by a qualified HVAC service professional, and is recommended when any defects or malfunction are suspected.

Central Air Shut Down, Not Tested, May be Not Useable

... The central air conditioning equipment is in questionable condition and may not be operable. As the equipment had clearly been shut down for a considerable time.

... we were not able to test-operate this equipment and we recommend that you make no attempt to turn it on before having it examined by a qualified air conditioning service person. Operating equipment which has been "shut down" without proper preparation risks costly damage to the compressor or other components. If replacement of major components is required, repair may involve significant expense.

SYSTEM OPERATION - Air Conditioning System Operation Observation:

Observation:
... The system operated normally at the time of our inspection.
... *Caution:* The equipment was not run and therefore not tested because outside temperature was estimated to be at or below 50°F.
... The system has been "shut down" for some time.
... In cold weather operation could damage the compressor, particularly if it has been left "shut down".
... Individual components were not operated - see note below.
... Any deficiencies noted were based only on visual inspection. We did no electrical, gauge or pressure tests on this equipment.

Operating Note: Many such systems must be left with power turned on (we found switches in the "off" position) for 24 hours prior to running the equipment. This permits heaters at the compressors to assure good oil flow in those components. To operate the equipment without this step risks very costly damage to the compressor.

When a system is not operated we can make no representation that it functions correctly and adequately. We recommend that you ask the owner about the condition of this equipment. If weather permits, it should be checked by an HVAC service person and returned to operating status prior closing sale.

OPERATION DEFECTS - Air Conditioning System Maintenance & Operating Defects

Observation: Compressor Defects
... The compressor was short-cycling,
... The compressor was noisy, during startup,
... The compressor squealed at startup, indicating that service is needed promptly to prevent possibly costly damage to the system. This repair/maintenance item should not be deferred.

Evaporator Coil Defects: dirty, blocked, frost, size, placement
... The air filter itself was very dirty - a source of increased operating costs. Very dirty filters can eventually block the fan itself, leading to more costly repairs. The filters should be changed monthly when the system is in use. Failure to properly filter dust from the return air supply can load the fan or evaporator coil with dust and prevent proper system operation. Installing a filter is normally a minor expense.

Dirty, blocked evaporator coils can result in improper system operation, very low output temperatures, low air flow (compensated sometimes by increased fan speed), and sometimes frost on the coil and failure of system components.

... Evaporator coil cleaning often requires cutting refrigerant lines, removal of the coil and other components for cleaning, and reinstallation, pulling a vacuum on the refrigerant lines, and recharge with refrigerant. Such service and repair may involve significant expense.

OPERATING CONTROLS - Air Conditioning System Operating Controls

Basic inspection and inspection report information for A/C controls: The system is operated by thermostat

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in the living area. If multiple air handling units and compressors are installed you should find a thermostat for each area served by that equipment. Some air conditioning system designs may use a single air handler and compressor, but may add zone dampers in the duct work to provide individual "zoning" of cool air distribution. In this case each zone thermostat both calls for the system blower/compressor to operate and also causes a motorized zone damper to open to direct cool air to a particular portion of the building. An ordinary home inspection is unlikely to address proper operation of motorized zone dampers. (Manual duct dampers may also be present in duct work to manually balance air distribution among building areas. Be sure to look for these when diagnosing poor cool air delivery to an area.) Also see our note below about the presence of multiple switches and controls.

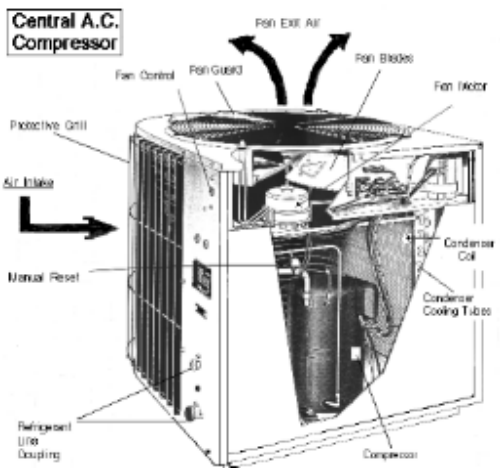
Air Conditioning Automatic Safety Controls – Cooling

Electric Power Controls: Safety disconnects should installed outside next to the compressor/condenser unit and are often also installed next to or mounted on the air handler/blower unit.

If you cannot find an outside electrical disconnect, one should be installed. These controls are recommended for safety to reduce the temptation to open the cabinet and work on the equipment with power on. Working on electrically "live" cooling equipment risks both shock and mechanical injury such as being cut by the fan if the motor starts unexpectedly. Safety shutoffs are required for new equipment.

Amperage rating of safety disconnects and A/C circuit breakers: the safety switch on newer equipment may be a simple pull-out fuse-block type power disconnect, leaving circuit protection to be provided only at the circuit breaker or fuse for the A/C circuit where it originates in the electrical panel. Where the actual over current protection is provided (at older circuit breakers used as auxiliary safety disconnects at the equipment, and at the main panel at the origin of the cooling circuit for the compressor/condenser unit) electrical overload protection can be 25% overprotected by one step – e.g. #10 wire - 40 Amps. But if data plate indicates an "ampacity" number, that is the *required service,* i.e. that is an operating number, not a startup load range.

Multiple switches are often present on cooling systems. As we reminded in the previous chapter, if the air conditioning system won't run, before requesting a service call check all of the switches as well as the thermostat for proper settings.



The (usually) outdoor half of a typical air conditioning system is a unit containing the refrigerant compressor and condensing coil. The compressor draws refrigerant gas from the building's inside components, and compresses the gas to high pressure. The evaporator coil then cools the high pressure high temperature gas to a liquid state. The heat produced in these steps is transferred to the outside by a fan which blows outside air across the condensing coil. The liquid refrigerant is then able to return to the indoor components for cooling and dehumidifying the building interior.

Minimum Air Conditioner Compressor Unit Observations: The compressor and fan operated normally. The rated cooling capacity, estimated age and general condition of the unit are reported below OR ... We did not operate this equipment because ... so you should....

INSTALLATION ERRORS - Air Conditioning Compressor Installation Errors & Damage

Air Conditioning Compressor Location Problems Inadequate clearance:

Typical outside air-cooled A/C compressors require a minimal clearance around the unit to provide adequate air flow so that the condenser coils will be cooled efficiently. Units mounted too close to a wall, surrounded by shrubs, or multiple units located too closely together

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may not receive enough cool air flow to function properly. The result can be a shorter compressor life (expensive) and/or less efficient cooling operation (higher operation costs).

Refrigerant Line Defects

Absence of slack in the coolant lines at the compressor units can cause leaks: should the compressor move, perhaps because its supporting pads settle, there will be likely leaks at these lines. You should review this question with your HVAC service person. This item may be deferred until next maintenance or service.

Missing insulation on the refrigerant lines, particularly on the larger suction line, will cause condensation and drips from the lines in humid areas. I've seen very costly building damage where lines were not properly insulated indoors: condensate drips wet gypsum board walls, leading to a costly mold remediation project. Missing insulation also probably increases system operating cost.

CONDENSING COIL FINS - Air Conditioner Condensing coil fin damage If the condensing coil fins are extensively bent and damaged, airflow across the coil is impeded, causing the same failures and operating cost issues described above for the compressor too close to the building wall.

Air Conditioning Compressor/Condenser Unit Support Pads Outside A/C compressors are typically supported on a concrete pad, concrete blocks, or a vinyl pad. The pad should be level and secure against movement.

Compressors which are badly out of level may fail to function properly and need adjustment. Tipping and moving compressors can also cause leaks in refrigerant lines.

COMPRESSOR NOISES - How to Diagnose Air Conditioner Compressor Noises

... We observed unusual noise at the compressor, a condition which could indicate either a service and adjustment requirement, or an upcoming costly repair involving replacement of this component. You should have the system checked promptly by an air conditioning service technician.

... Compressor noise could be due simply to loose hardware such as a loose shipping bolt, tubing, or a broken spring.

... Compressor noise could also be due to refrigerant liquid "flood back" into the compressor crankcase. If this is the problem, the noise will appear only at the interval of compressor start-up. That's why it's useful for the inspector to be right at the compressor unit when the air conditioning system is first turned-on. If this is the problem, a crankcase heater can be installed to address this defect.

... Another source of compressor noise include a low oil condition in the unit - diagnosed perhaps by observing evidence of compressor oil leakage on or around the unit.

... Some compressors emit a high pitched noise during normal operation.

... Compressor noises, at least the costly ones, are usually due to a loose connecting rod, piston pin, crankshaft, or other internal part. Since compressors on most modern commercial and residential air conditioning systems are a sealed unit, the only repair is to replace this (costly) part.

HARD STARTING - How to Diagnose Air Conditioner Compressor Hard Starting A "hard starting" compressor may stutter or begin to cycle-on then stop, then restart. If a compressor is frequently tripping the circuit breaker (or blowing the fuse) which protects its circuit, repair is needed. Abnormally low line voltage may also be causing a compressor to "hard start".

When an air conditioning compressor has been running, it has pumped refrigerant to a high pressure condition in the compressor head. When an A/C system compressor is running and is unexpectedly shut off, perhaps by a human testing a thermostat or switch, if the system is immediately turned back on, some compressors, particularly older window and wall units, may be unable to re-start against this high head pressure. Simply waiting a few minutes for pressures to equalize may be all that's needed. So if the compressor is not starting in this condition, we simply turn it off and wait. If this problem is happening often, a service technician may install one of several versions of "hard start kit".

A "hard start kit" is basically a capacitor which gives an extra electrical "jolt" to the compressor motor to get it

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moving. A starter relay may also need to be installed or replaced. Some air conditioning compressor brands do not usually need a hard start kit. GE, Trane, and Manurope are examples that do not usually take this kit.

How to Diagnose an Air Conditioner Compressor Which has Lost Cooling Capacity - A compressor which appears to have lost cooling capacity can be diagnosed by a service technician who can connect the appropriate test gauges to the system. Lower than normal discharge pressure and higher than normal suction vacuum will indicate this problem. But before assuming that something is wrong with the air conditioning compressor, some basic investigation is in order.

Cooling Capacity of the Air Conditioning Equipment - The cooling capacity of air conditioning equipment refers to the ability of the compressor/condenser (usually outside) and the air handler/evaporator (usually inside) to deliver cool air to the occupied space. Briefly, the compressor/condenser draws refrigerant gas from the building air handler, compresses it and cools it back to a liquid refrigerant, and the air handler/evaporator coil permits liquid refrigerant to evaporate inside a cooling coil, across which the fan blows building air to cool and dehumidify it. The particular combination of this equipment has a cooling capacity, usually rated in BTUh or thousands of BTU's of cooling capacity per hour, documented on equipment data tags discussed above at "RATED COOLING CAPACITY."

BLOWER FANS & FILTERS - Air Conditioning System Blower Fans & Filters

Air Conditioning Filter Location & Condition - Locate and document the placement of the HVAC system air filters - for examination and regular changing during the cooling season.

Filter accessibility: I frequently see HVAC systems designed by someone who obviously has never had to service them. Placement of filters and air handler access doors in very hard-to-access locations such as at the far end of a minuscule attic behind a forest of trusses means that the system is very unlikely to receive the periodic inspection and maintenance it needs. I prefer to see A/C and heating filters placed at the building side of the air return register or grille, so as to protect the return duct from debris accumulation. The more common filter placement on many systems is right at or in the air handler.

Dirty Air Filters are a source of increased operating costs and poor cooling system operation. Dirty air filters can:

1. Reduce air flow in the building.
2. Cause dirt to accumulate on the fan blades, wasting your energy dollars.
3. Cause excessive dirt build-up inside the duct system, leading to mold or allergen problems in a building and to the need for more costly duct cleaning or replacement.
4. Block the cooling coil itself with dirt, reducing system effectiveness and possibly leading to costly repairs.
5. Eventually block the fan itself, leading to more costly repairs.

The filters on an air conditioning or hot air heating system should be changed monthly when the system is in use. Discuss with your heating/cooling service professional the possible need to clean the blower fan and duct work.

No Air Filters on an HVAC System: Failure to properly filter dust from the return air supply will load the fan and cooling coil, dirty the duct system, and lead to the problems listed above. As the ductwork debris level increases you increase the risk of forming an allergen or mold reservoir, especially if there are water or condensate leaks into the duct system interior. If a filter is not present, have one installed. Installing a filter is normally a minor expense. Duct cleaning or replacement can be a significant expense.

Air Conditioning Blower Fan Condition

Filters protect the blower assembly: The typical A/C system circulates air through the building duct work using a "squirrel cage" blower fan. It is very important for you to check and change air filters at least monthly when the system is in use to protect the blower fan from dirt clogging. The blades of a squirrel-cage fan are cupped in order to cause the spinning cage to move air. Dirt accumulation on the blades fills-in this cupped area, ultimately changing the "cup" to a simple flat area. The fan will spin just fine but I've seen air-flow literally double when a very dirty fan of this type was cleaned or replaced.

Very dirty, wet, leaked-into, or rodent-infested blower compartments risk indoor air quality and

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health issues in buildings. This unit needs cleaning and a check for unsafe wiring due to leaks.

BLOWER OPERATION: For effective operation of this system it is essential that it never be operated without air filters in place. If you permit the filters to become very dirty you may need expensive special cleaning or other repairs.

RETROFIT SIZING - Air Conditioning Retrofit Errors, A/C Added to Heating System, Improper Cooling System Sizing

The typical indoor half of an air conditioning system is comprised of a blower fan which moves building air (through return ducts) across an evaporator coil (which cools and dehumidifies the building air) and then through supply ducts to various building rooms. Liquid refrigerant is metered into the evaporator coil where it evaporates or changes state from a liquid to a gas. This state change from liquid to gas absorbs heat and thus cools the evaporator coil. As air is cooled by moving across the evaporator coil, moisture is removed from the air (cool air holds less moisture than warm air). The condensate is moved to an acceptable disposal point, perhaps by a condensate pump to a building drain.

The photo shows that an evaporator coil has been added atop an existing heating furnace. Using the existing blower and duct work and simply adding an evaporator coil atop the unit is a common way to add air conditioning to an existing furnace and duct system.

But if you see that the evaporator coil is much larger than the furnace blower atop which it sits, the system is not properly designed and will not work correctly. For example, when the new coil is too large, the blower will not move enough air across it, probably leading to the evaporator coil becoming blocked by ice. An expert should evaluate the system when you see this condition.

Other A/C Evaporator Fan Unit/Blower Defects - Frost Build-up Frost build-up indicates an air flow or refrigerant problem. A blocked coil (by dirt) or a blower fan which has lost its ability to move air (such as a dirty squirrel cage fan) will reduce air movement across the coil and lead to frost build up there. I suspect this is the more common cause of this defect.

Improper metering or an improper charge or amount of refrigerant in the system can cause frost build-up on the evaporator or cooling coil. The system will not operate properly and will lose cooling capacity if the evaporator coil becomes blocked with frost or ice.

CONDENSATE HANDLING - Air Conditioning Condensate Handling Defects

Improper handling of air conditioning system condensate is one of the most commonly reported set of A/C system defects, perhaps in part because these defects are easily observed visually, and perhaps also because some A/C installers do not follow basic plumbing and building code requirements for handling the discharge of the condensate produced when an air conditioning system is operating. Condensate leaks or discharge errors (such as the drips into the dog bowl and cooking pot in this attic) present several risks of ugly surprises in buildings including:

First locate and document where condensate discharge is carried

- a plastic line draining outside
- a floor drain
- a sump pit
- a hole in the floor
- a reservoir lift pump which pipes condensate to: (a properly connected building drain; something else)

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- the pump exit line is taken to the house main waste line a dirt floor or crawl space

Look for corrosion or water stains on floor surfaces around the equipment, at the condensate drip pan and at bottom of the "A frame" cooling coil, indicating that the drain may need cleaning and more important, indicating that the condensate is leaking out of the equipment or drains and not being carried to an acceptable disposal point.

DRIP TRAY DEFECTS - Air Conditioning Condensate Drip Tray Defects

A missing condensate drip tray risks leaks into the attic ceiling, where condensate can damage the building or cause a (hidden) mold problem, especially if condensate is leaking onto the upper, hidden (by insulation) attic side of drywall forming a ceiling of a room located below the equipment. Both the drywall and the insulation itself may become mold reservoirs.

When an air conditioning unit is located in an attic where damage may result from condensate overflow from the primary condensate collection and drain equipment, an additional water-tight corrosion-resistant pan (a condensate drip tray or "drip pan") should be installed below the cooling equipment to catch overflowing condensate should the primary condensate drain become clogged. An alternative design provides one pan with a standing overflow and a secondary drain.

The condensate drip tray requires its own separate drain. Alternatively, some installations provide a float switch in the tray which senses the presence of water and shuts down the air conditioning system. The discharge point of all of the condensate drain lines, that is the system condensate drain and the overflow pan drain, must be readily observable. Condensate tray shows evidence of leaks: since normally condensate produced in the indoor air handler is carried from the air handler interior to a condensate drain, we don't expect to see condensate falling into the condensate overflow drip tray. If we see evidence of leaks into the condensate tray, the air conditioning system service technician should investigate the cause of this condition.

CONDENSATE LEAKS - Air Conditioning System Condensate Leaks When a cooling coil is installed atop a hot air furnace, air conditioning condensate leaks may drip onto the furnace heat exchanger. *Warning:* leaks onto a furnace heat exchanger can cause rust damage and holes, risking dangerous carbon monoxide leaks and requiring replacement of the heating system. Further investigation of the source of leakage and the condition of the furnace heat exchanger is needed promptly - this is a safety concern.

Condensate Line maintenance tip: If the condensate line becomes plugged, system condensate overflow will spill onto and rust and possibly seriously damage the furnace heat exchanger. During system operation you should periodically confirm that condensate is being discharged properly.

This sequence of photos shows what happens when an amateur rigs up a condensate drain in an attic. The plastic piping was not securely supported and when touched, fell apart to spill condensate into the attic floor and into the ceilings below. Condensate leaks into an attic ceiling risk not only damage to the building but a hidden mold reservoir in the building insulation or on the attic side of the ceiling drywall below.

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New Address

CAHI Treasurer
75 Pond View Circle
Beacon Falls, CT 06403

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Condensate leaks from the air handler's internal drip tray (below the evaporator coil) occur if the internal drain is clogged. When condensate wets the insulation on the interior of the blower compartment, there is risk of problematic mold growth in the system. In warm humid climates such as the Southern U.S., high levels of condensate production in the air handler unit can also result in movement of condensate downstream into the supply duct, forced there by the blower itself.

Missing air conditioning condensate trap: ... We did not see a trap on the condensate line itself - usually installed as good practice - ask your HVAC service person about this detail. It could be required for sanitary or other reasons. CONDENSATE TRAPS have several functions including avoiding possible draw of unsanitary air or bacteria back into the building air supply.

CONDENSATE DRAINS - Air Conditioning Condensate Drains into Building Plumbing Vent

*** Safety Recommendation: this condensate line is connected to the house drain/vent piping - risking **possible bacteria or even dangerous sewer gases entering the building air** handling system. Good practice includes a moisture trap (just as with other

plumbing drains) and routing of the condensate to a wet drain line or preferably outside to discharge into the gutter system or to the ground.

Here is a second example of the same defect: the condensate line is connected to the house drain/vent piping; according to some experts and plumbing codes this is an improper plumbing connection, and for some lines there also is no condensate trap in this plumbing arrangement, risking possible bacteria or even dangerous sewer gases entering the building air handling system. Good practice includes a moisture trap (just as with other

plumbing drains) to help prevent this problem. Our understanding is that, despite this very common installation found in our area, this is an improper plumbing connection which is dumping liquids into plumbing lines intended for dry-use only. Correction by a qualified plumber does not usually involve significant expense.