

Air Conditioning Installation Contractor Hiring Guide & Checklist

Plumb Bob
Press



Tim Carter

Air Conditioning Installation Contractor Hiring Guide & Checklist

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Air conditioning units in your home have to be properly sized to fit your home. Your heating and AC contractor (HVAC) figures out how many supply ducts and return air ducts need to be in each room for the best air flow. Most of the local distributors who actually sell the AC equipment have special computer software that can analyze your plans. With this number, they can specify the correct equipment that can adequately cool your home.



Click on the titles to read these columns, contained right here in this document. At the end of each section, there is a link to more information available at the AsktheBuilder's web site.

But first, here are links to four exclusive Contractor Hiring Guide & Checklist videos that will help you with Finding a Pro, Contracts, Payments and Change Orders.



[Finding a Pro](#) is not always done on the Internet or using the phone book. Tim explains a better method.



After the bids are in and the contractor selected, what should be in the [contract](#)? Tim outlines eight items that must be in your contract.



[Payments](#) are important. When do you make them and how much? Tim explains three important concerns regarding your payments.



[Change Orders](#) can cost more than just additional money. They can delay the whole project. Discover what to do ahead of time.

Air Conditioning

[Central Air Conditioning](#) - Air conditioning a home properly will allow your family to be comfortable in the entire house. Central air conditioning systems must be sized correctly. Call a professional heating and air conditioning expert to calculate the proper size air conditioning unit for your house. If you already have a central air conditioning system, he can do the air conditioning troubleshooting for you.

[Heat Pump Facts](#) - Heat pumps are very popular units. A heat pump is one of the most complex units in a typical residential home. A special thermostat is required for the proper operation between heat pump operation and the auxiliary electric resistance heating. Here are some simple facts about the heat pump mechanics.

[Sizing Air Conditioning](#) - Calculating the proper size of your air conditioner is critical. If your HVAC system is not the proper size, your house will not be comfortable. Calculating heat gain can be done with the help of the Manual J. Get a copy for your air conditioning sizing.

[Air Conditioning](#) - Additional articles on air conditioning units and heat pumps. Search these columns to discover answers to some other HVAC questions.

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House Plans & Planning

[Home Plans](#) - House plans with detailed interior and exterior elevations and exact specifications will help make your dream home become reality. Be specific with house floor plans, and make your plans reflect exactly what you want down to the smallest detail. Avoid problems by drawing up precise home plans before your new home construction begins.

[Building a New Home - Get Organized](#) - Building a new home requires hundreds of choices. Get organized by keeping all of your choices and plans for your new home building project in a binder so no decisions fall through the cracks. Blueprints and specifications along with this binder will keep track of the entire project. Select amenities for your new home at the start so that workmen can plan openings and utility adaptations to stay on schedule.

[Detailed Plans and Specifications Minimize Mistakes](#) - Detailed blueprints, plans and specifications will help you avoid being sued by a contractor. Keeping a detailed account of work each day, along with photos, will arm you with data should a problem with your contractor arise.

[Home Remodeling](#) - Remodeling and new home construction share a lot of common items. But they differ in one major area - remodeling is done in the house where you are living. Daily routines are altered. Certain areas of your house may be unavailable during remodeling. No kitchen or bathroom will be a real problem. Read these tips to help minimize your interruptions.

[House Plans](#) - Additional columns covering house plans can be found online in the House Plans section of Askthebuilder.com.

Payments

[Contract Payments](#) - Detailed contracts noting exact contractor and homeowner specifications and listing payment schedules help avoid payment disputes.

[Payment Suggestions](#) - Before payment or work begins, establish detailed contracts, building plans, payment dates, affidavits and helpful construction reports.

[When to Pay for Remodeling Plans](#) - Never pay all of the money due for remodeling plans before the plans are complete. Once you give cash in advance for incomplete work, you lose all of your leverage. Up-front payment has left tens of thousands of people disappointed when the person never finished the job after being paid.

[Payments](#) - Read other online columns regarding making payments during construction at the AsktheBuilder.com website.

The columns shown above are only a sampling of the columns available to help you. Check the [AsktheBuilder](http://AsktheBuilder.com) website for more information on this and all aspects of Home Improvement.

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Homeowner: _____

Contractor: _____

Address: _____

Address: _____

City/State/Zip: _____

City/State/Zip: _____

Phone: _____

Phone: _____

Email: _____

Email: _____

Contractor's License Number # (where applicable): _____

Project Location (Jobsite Address): _____

Date Bid Submitted: _____ Date of Plans & Specifications: _____

CHECKLIST

What type of air conditioner do you intend to install?

- Heat Pump Standard Condensing Unit Natural Gas LP
 Other _____

Who is the manufacturer of the air conditioner you intend to use?

What is the model number of the air conditioner you intend to install?

What is the **manufacturer's** warranty?

Does the compressor have an extended or lifetime warranty? If so, what is the warranty? _____

Yes No

The current air conditioning unit may not be sized properly. It may have been undersized, oversized, additional living space may have been added, or energy efficiency improvements may have been made. The only way an air conditioner can be properly sized to the house is to perform *heat gain calculations*. Will you perform a heat gain calculation in order to properly size the new air conditioner?

Yes No

Will you provide me with a copy of your calculations?

Yes No

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What is the efficiency rating of the new air conditioner?

_____ SEER (Seasonal Energy Efficiency Rating)

_____ COP (Coefficient of Performance)

If this installation is a replacement air conditioner, the interior coil in the current furnace or air handler MUST be matched according to manufacturer's specifications to the new outdoor unit. If not, the outdoor unit may not deliver the publicized energy efficiency or SEER rating. Will you prove to me that the indoor coil will allow the outdoor unit to perform at its highest level of efficiency?

Yes No

What is the BTU input?

_____ BTU

What is the BTU output?

_____ BTU

Will you install the new air conditioner in accordance with the manufacturer's specifications?

Yes No

Do you intend to modify any of the ductwork as a part of your installation?

Yes No

If yes, please describe: _____

Older homes often have insufficient return air ducting in first and second floor rooms. Without return air, different rooms and floor levels can have widely ranging temperatures. A properly sized supply and return air duct system for each room, allows all rooms to be comfortable. If this installation is in an existing older home, do you plan to incorporate return air ducts in individual rooms and/or floor levels to achieve comfortable temperatures in each room of the house?

Yes No

Will you obtain a building and / or heating and air conditioning permit

Yes No

Will your installation be inspected and approved by the proper building department officials?

Yes No

Will you install a new A - coil?

Yes No

If no, do you intend to clean the existing A - coil?

Yes No

If this installation is a replacement, will you reclaim the existing Freon according to EPA regulations?

Yes No

Do you intend to install a new thermostat for the air conditioner?

Yes No

If yes, will it be programmable?

Yes No

Heat pumps often require specialized programmable thermostats. If a heat pump is a part of this installation, will you install the proper programmable thermostat?

Yes No

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Does your quotation include the re-connection or installation of all 120 /240 volt wiring to the new components? Yes No

Will all wiring be installed according to the National Electric Code? Yes No

Some HVAC companies use sub-contractors (Subs) to install their products. Subs sometimes are not adequately covered with proper liability and Workman's Compensation insurance. They often get paid a fixed sum of money which drives them to work faster. Subs are often not as responsive when a problem happens at a later date. Employees of the HVAC company are often a better way to go.

Who will perform the work on my house?

Own employees Sub-contractor Combination

Will you supply me with all sub-contractor's certificates of insurance indicating that they have Workman's Compensation coverage and General Liability coverage? Yes No

Will you remove all debris, including the old air conditioner, from the jobsite? Yes No

Will you supply a written copy of the manufacturer's warranty and installation specifications? Yes No

What is the length of your **(installer's)** warranty? _____ year(s)

Does it cover all labor and material? Yes No

OPTIONAL ADDITIONAL NOTES

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JOB COST BREAKDOWN

Materials

Permit

Demolition and Debris Removal

All Necessary Materials

Labor

Total Labor

Insurance

Workman's Compensation

Unemployment Tax

Overhead

Profit

TOTAL JOB COST:

PAYMENT SCHEDULE

Excessive advance or periodic payments before or during the work is completed often put a homeowner at risk. The homeowner basically become a lender. This is especially true if the job does not require any special or custom ordered materials at the beginning of the job. A fair payment schedule is one that allows the homeowner to pay only for labor and material that has been completed in a satisfactory manner. Periodic payments can occur every 3 - 4 days for small jobs or each week or month for large jobs. On large jobs, the amount of money paid out at any given time should not exceed the total sum of the items listed in the above cost breakdown plus a proportionate amount of contractors overhead and profit for completed in-place work. A homeowner should not have to pay full price for work that is unsatisfactory or incomplete.

Do you agree with this philosophy? Yes No

If "Yes", please complete the Payment Schedule on the next page.

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PAYMENT SCHEDULE

First Payment: _____% of Total Job Cost.

To be paid when the following work is complete:

Second Payment: _____% of Total Job Cost.

To be paid when the following work is complete:

Final Payment: _____% of Total Job Cost.

To be paid when all work is complete and satisfactory and all debris is removed from jobsite.

INSURANCE DOCUMENTATION

Contractor's Workman's Compensation Risk number or Private Policy number and Carrier number:

(PLEASE ATTACH A COPY OF YOUR CURRENT STATE CERTIFICATE OR PRIVATE CARRIER CERTIFICATE)

Contractor's Liability Insurance Company and Policy number:

(PLEASE ATTACH A COPY OF CERTIFICATE OF INSURANCE)

ANTICIPATED STARTING DATE: _____

PROJECTED COMPLETION DATE: _____

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REFERENCES (List only jobs of similar scope and nature)

Job completed approximately 4 years ago:

Name: _____

Address: _____

Phone Number: _____

Job completed approximately 2 years ago:

Name: _____

Address: _____

Phone Number: _____

Job completed within the past 60 days:

Name: _____

Address: _____

Phone Number: _____

Bidding Contractor's Signature: _____

Date: _____

OPTIONAL COMMENTS

End of Checklist

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CONTRACTOR HIRING GUIDE HELPFUL HINTS

Thanks for purchasing one or more of my Contractor Hiring Guide & Checklist products. I am quite sure you will be pleased with how they help you find a professional - or more importantly - allow you to quickly spot a scoundrel!

You will run into some resistance from contractors when they see the Contractor Hiring Guide & Checklist(s). Some will reject it entirely. That is OK. Be patient and continue to call contractors until you find one who accepts the Guide and Checklist at face value - a document that protects both you and the contractor.

USE TIPS

1. Insist that all questions be answered. Incomplete answers can lead to incomplete jobs.
2. Test the contractor's phone number on several occasions. Do you get a machine, voice mail or a human? Humans solve problems, not machines. Note response times. If it takes days to get a return call, this could spell trouble if you start a job with this type of person.
3. The cost breakdown is so important. It allows you to compare quotations quite easily. You can see why one quote is low and another is high. On larger projects, a blank space in the breakdown tells you an item has been forgotten!
4. Insurance coverage is mandatory. You want real copies with current dates to show that you will be covered if someone gets injured on your job. Remember that sub-contractors must have their own separate insurance coverage!
5. Start - Stop Dates will help you determine if the contractor is serious about your job. Ask about who will be working on your job and when they intend to show up. Ask about delays - what causes them and how long might they last.
6. References are critical. The key is to find ones from the different time periods. Ask the people different questions. The most recent reference can provide you with interesting data. For example, did the workers arrive when promised? If there was a delay, what was the problem? How long was the delay? Was the jobsite kept clean? Did anybody play loud music? What would the referral do differently if allowed to start the job over from the beginning?
7. Ask the referral from two years ago about warranty claims. Was repair work necessary? Were their severe problems? Was the contractor responsive? Were the defects fixed correctly the first time or were repeated attempts necessary?
8. The oldest referral has good information too. Ask how well the work has held up. Ask what they would do differently? Would they hire the contractor again, OR have they since found a different contractor who does better work? You might be surprised by their answers!
9. Contract Documents - Give serious consideration to attaching/referencing the Checklist as a part - or addendum - to your contract that you and the contractor sign. It can be used as a fact sheet/specifications describing what was promised by the contractor. Since I am not an attorney, I can't give legal advice. You may wish to consult with an attorney to see if your state law permits these kinds of attachments or addendums. I believe that virtually every state permits you to do this.

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HOW TO REALLY FIND A PRO

Finding a reliable, competent and skilled builder or remodeling contractor that can do all of the work will take some time but it is by no means impossible. If you understand some of the basic principles by which these people work, the task is not as mystical as it may seem. Quality contractors are proud of their work. They want it to be perfect or nearly so and they do not want any call-back or warranty problems. To achieve trouble free results, they know that high quality materials are an integral part of each project. Real professionals know that problems are public relations nightmares and drain profits.

Knowing this, you start your search for contractors by visiting the businesses that supply quality materials to these individuals. You might be surprised to find out that these businesses are often places that you have never heard of. In your instance, open the Yellow Pages and look under the heading HVAC Supplies. Many of the listings under this heading will be businesses that cater primarily to contractors and not consumers like you. Visit two or three of these places if possible. Try to do this in the middle of the morning or the mid-afternoon. Never go early in the morning, at lunch or the end of the business day. These are busy times when contractors are picking up supplies.

Once there, ask to speak with the manager or possibly the owner. Briefly describe your job to this person. Ask for a customer who has been buying for 15 or more years, one that routinely buys the highest quality materials, and who pays his monthly bill on time. If the business manager obliges you, you will have a list of high quality candidates. The final question to ask, if possible, would be names of contractors that this person would use to work on his or her own home.

If the manager will not release names, then go to Plan B. Do a stakeout of the business in the early morning and get business cards from the contractors who are buying supplies. Look for ones who are driving well kept vehicles that project a look of professionalism. You will still need to do more detective work, but your chances of hiring a pro are quite good.

Thanks again for your purchase. Don't hesitate to email me if I can help you in any way. Simply go to my website - AsktheBuilder.com - and look for the [Ask Tim](#) icon on the home page.

[Click here for other Contractor Hiring Guide & Checklists](#) available from AsktheBuilder.com.

Best regards!

Tim Carter - AsktheBuilder.com

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HOME PLANS

Home plans are the core documents that communicate what the home owner wants and what the builder needs to build. Without great house plans, a new home construction project can quickly become a sea of confusion, frustration and arguments. Many people think that house plans are just pretty pictures and floor plans, but believe me, they serve a far more important purpose.

Can you remember the last time you were involved in a dispute over anything? Chances are you prevailed if you had some form of tangible written evidence, photograph or object that proved your statements were true. But all too often people argue about spoken words that frequently turn into broken promises, simple misunderstandings, or worse yet - deception. This misery takes place everyday in the residential building arena. Homeowners get into heated disputes with builders and remodelers about any number of issues.

The sad fact is a vast majority of new home construction disputes can be settled quickly and efficiently with crisp plans and specifications that are developed long before the first spade of soil is turned at the jobsite. There are many reasons why good plans and specifications never get developed. Often the customer is unwilling to pay for the time and effort to produce the documents. Another common reason is the homeowner looks at a set of blueprints and thinks they are sufficient. Without ever seeing a first-class set of prints I can see why they might feel a deficient set will make do. After all, if they are good enough for the building department then they must be good enough for all involved.

Perhaps a few examples of dispute issues might convince you that you need top drawer plans and specifications for your new home. Imagine if you will a discussion between you and your builder about crown molding. You say you want it in all downstairs rooms. The builder agrees and draws one simple squiggly line on the plans in the cross section and adds "Crown Molding" with an arrow pointing to the line.

Months later while walking through the house as the finish work is being completed you see a small and simplistic paint-grade crown molding that is barely noticeable up in several rooms. You grumble and wonder why the carpenter didn't install the two piece stained oak crown molding you "thought" you mentioned to the builder.

As you walk into the bathrooms upstairs you shake your head and wonder who in the world put the toilet paper holder on the opposite wall from the toilet. It is barely reachable. Fortunately the carpenter who installed it walks in and you ask about the placement of this fixture. He simply states that is where he always put them. Need I go on?

The failure to develop good specifications and plans can also lead to cost overruns and a limited product selection for your finishes. A great set of plans includes numerous interior elevations that show you in two dimensions what a wall will look like when it is finished. These elevations can be as detailed so as to show exact locations of electrical outlets, switches and yes, toilet paper holders. New computer software allows architects and designers to show these in three dimensions as well.

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Knowing what you are going to see before it happens can often prevent costly change orders. Many people are unable to visualize what something might look like looking at a simple floor plan. Elevations help solve this problem.

Plans and specifications that do not include the actual selections of all fixtures, cabinets, tops etc. can cause you problems if you try to decide what you want during construction. A builder may ask you to go to the tile store 6 weeks before he needs the tile. But once there you fall in love with a special order tile that take 10 weeks to get. Who will pay for the time delay should you decide to order the special tile?

There are hundreds of scenarios that can be described. But one thing is for sure: Detailed plans with clear and precise specifications that outline each and everything you want will save you if push comes to shove. Time and again when I consult in the forensic construction expert work I perform I find that a great set of plans that were ignored by a builder or sub leads to their capitulation if the dispute is headed for a courtroom.

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BUILDING A NEW HOME - GET ORGANIZED

DEAR TIM: My husband and I are getting ready to build a new home. I am astonished at all of the details that need to be addressed. Each time we have a meeting with our builder all sorts of decisions need to be made. I am afraid that lots of information is going to fall through the cracks before the final walk through. What is a good way to keep track of all of this information? Julie J., Stillwater, MN

DEAR JULIE: Many people decide not to build a new home for this very reason! They are overwhelmed with the decision and product selection process and simply don't know where to start. Many people are afraid of making the wrong decision. The key is to approach the task in an orderly manner and start making product selections and decisions long before ground is broken.

The building and remodeling playing field is actually a minefield. Making decisions out of order or selecting a product without checking for conflicts with other products can trigger an explosion of extra costs and delays. Once upon a time a client of mine picked two elegant wall light fixtures that hung on each side of a bathroom medicine cabinet. Once they were installed I quickly discovered they prevented the medicine cabinet from opening. Because the homeowner had fallen in love with the fixtures, the problem was solved by relocating the electrical boxes. It was a costly mistake that I paid for.

You can avoid nightmares like mine with a simple job organizational binder. This is a nifty tool that works alongside your blueprints and any written specifications. I have found that the binder works best when it contains a section for each room of the house as well as a separate section for the exterior. Typical things you would find in each section would be photographs or illustrations of fixtures, installation instructions for appliances, fixtures or products, technical information showing supply pipe sizes, wire sizes, and the proper rough-in locations of these utilities.

Each section of the binder should also have a room finish schedule. This is a table that communicates to the builder and his subcontractors exactly what you want on every wall, floor ceiling, trim, door surface in each room. If the data in these schedules is accurate it is entirely possible for the workers to finish the job with little or no verbal communication.

You will need more than one binder for the job. At the very minimum you need three: one for you, one for the builder and one that is safely stowed in a lockbox at the job site. The subcontractors need the job site binder to refer to as they work each day. Use clear plastic pocket protectors to keep the individual pieces of paper safe from wet job site conditions.

Creating a complete organizational binder means that you need to make product selections before construction begins. This may seem unusual but you might as well resign yourself to it. There are numerous advantages. Pressure decisions are eliminated. Because it is early in the process, you have time to get items that might have to be special ordered. Waiting until the last minute to make selections often eliminates certain items because the job may have to grind to a halt for weeks or months.

Carpenters, plumbers and electricians need to know what they are installing three or four months from now so they get openings, pipes and wires in the correct spots. Every time I have tried to use

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ESP because I was trying to guess what a customer would want, I guessed wrong. Providing your builder with the correct information simply takes the guesswork out of the process.

If you really want your job to run smoothly you and your builder need to look at all of your selections and insure that there are no conflicts. Imagine your dismay when you discover that the electrical outlet for your night stand is behind your bed. Similar frustration happens when a central vacuum outlet becomes hidden behind a door that is always open. Pesky mistakes like this can be avoided with a little thought and attention to detail.

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DETAILED PLANS AND SPECIFICATIONS MINIMIZE MISTAKES

DEAR TIM: Recently, I received a summons to appear in civil court. The contractor who walked off my job is suing me for the remainder of the unpaid money stated in the contract. Because he avoided repeated calls and letters, I hired other workers to finish the job. What do you think is the best evidence I can produce to prove to the court system that I was a victim? In my opinion he deserves no money. Sue D., Sedona, AZ

DEAR SUE: Let me begin by telling you that I am not an attorney and can offer no legal advice. I can tell you, based upon my many years of being involved in differences of opinion with homeowners, what has saved me from having to work for free. The items that eventually become supporting evidence can be a thorn in one's side as the job progresses, but they are worth their weight in gold if a dispute arises at a later date. Hopefully you have many of the following things.

Perhaps the most powerful weapon a homeowner can possess when the going gets rough is an excellent set of plans and specifications. All too often standard plans have far too little detail. Too much is left to interpretation. For example, if the plans say you are to get crown molding does this mean a small thin piece of molding or a large combination crown molding? Detailed plans and specifications make these issues black and white not various shades of gray.

Almost every job requires multiple face to face meetings where many issues are discussed. It can be hard to take notes during these meetings, but this written record of the discussions can help jog the memory of a participant when the wrong light fixtures or floor tile are delivered or installed. These notes become iron clad if you write a letter summarizing the key points and send a copy to all who participated in the meeting. To make the notes armor plated, consider including a sentence stating that if a participant disagrees with anything in the letter they must respond in writing in a timely manner.

Photograph or video tape the progression of the job. Be sure to use a camera that can burn the date onto the image. Take many photographs, including close up photos, of things that will be hidden at a later date. Photos of structural connections where things are nailed or bolted together are often critical. Try to photograph concrete forms just before the concrete is poured. Imagine how difficult it is to guess the thickness of a concrete slab without doing destructive testing or using an expensive diagnostic device. A 35 cent photograph may come to your rescue.

A detailed diary of the events that happened each day can be very helpful. Long delays or periods of time when no one showed up to work are cast in stone with written daily notes kept in a journal. It is very hard to reconstruct events if they are taken from memories that are six or nine months old. Write down who showed up and what was accomplished. Photographs can be added to the diary that show daily progress.

In certain instances, weather data may help support your arguments. If you are not a trained meteorologist, data that you keep may not be considered accurate or true. Fortunately you can obtain vast amounts of weather data at little or no cost from your local National Weather Service office. They keep hourly logs of temperature, humidity, precipitation etc. On more than one occasion this precise data has won a court case for me.

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Almost all jobs have changes as the work progresses. These change orders must always be in writing. In addition to the description of what is changing and the cost of the change, each change order must contain a section that states how much extra time the change will add or detract from the job. You can see the value of this added feature when it is used in conjunction with the start and completion dates that are contained in the original contract.

Finally, if all communications break down, then all contact with the contractor must be in writing. All letters must be sent certified mail with a signed receipt request. You want to be able to prove that you tried your best to keep the lines of communication open at all times.

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CONTRACT PAYMENTS

DEAR TIM: You and other people constantly write about how homeowners need to protect themselves from contractors who take their money and perform shoddy work or no work and disappear. What about homeowners who don't pay for work? I have had several customers who nit pick a job to death and withhold tens of thousands of dollars until several small items are completed. I have bills to pay just like everyone else. What is a fair way to solve money problems between homeowners and contractors? Robin S., Kansas City, MO

DEAR ROBIN: Touche! Years ago, I was in a similar situation. I am convinced that hundreds and thousands of homeowners torment contractors for all sorts of reasons. Some of them are legitimate while others are based on past bitter experiences, lack of goodwill, and distrust of contractors as a whole. Unfortunately, there is a small group of very bad homeowners who simply wish to cheat contractors out of money just as there are deceitful contractors who abscond with hard earned homeowner dollars.

When I perform autopsies on these problems, I typically discover a common flaw. The contract between the parties is very vague about the payment terms and conditions. In some instances, wording allows contractors to get too much money in advance. In other instances, homeowners advance money to contractors in a spirit of good faith. Unless these homeowners are working with a contractor who has the highest level of professionalism and honor, the advancement of money before certain things are complete can be a recipe for disaster. The incentive to continue to work at the highest level of efficiency and quality has been removed once the money has been paid.

Contractors routinely present contracts to homeowners that contain loopholes. Imagine language that states, "Payment is due upon completion of work." Well, if I were a homeowner, I could feel justified in holding back the monies if the job were not completely finished. Imagine the nightmare of a job where \$100.00 worth of exterior work can't be completed until the spring thaw yet \$80,000.00 or more is due upon the total completion of the job. If both parties agree to the terms of a contract, then I maintain that they should abide by what the contract states.

There are countless ways to solve payment problems. Several have worked well for me no matter how large or how small a job might be. One element missing in almost every contract I have seen is a tiebreaker clause. It is wise for the parties to agree up front on an independent inspector who is willing to give a ruling as to the quality and completeness of work. In the event of a dispute between the parties, the inspector issues a written ruling that goes one way or the other.

I have found that it is very effective to state that progress payments are made on given dates for the work that is in place and completed to the satisfaction of the homeowner and/or independent inspector. A job cost breakdown that assigns a fair and real number to each aspect of a job is invaluable for this to happen in a fair way for both parties.

The homeowner has a given amount of time to make the payment after the bill is produced. Since the homeowner knows when monies are due, all inspections would have to be scheduled in advance. This allows the homeowner to feel confident the work is satisfactory as he writes the check to meet the deadline. The contract could contain language allowing the contractor to pull off the job if the

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money is not paid on time. No contractor really wants to do this for any number of reasons, but it limits the amount of financial exposure to a fixed sum of money. It also gives the contractor some leverage as very few homeowners want their job to be at a standstill.

Set standards in the contract, if possible and reasonable, with respect to work meeting the building code or more importantly set forth manufacturers' specifications. A benchmark of quality must also be established or you may never meet certain homeowner's expectations. The independent inspector may come into play in this event as well.

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PAYMENT SUGGESTIONS

DEAR TIM: My house was severely damaged by a natural disaster. My husband and I hired a contractor who was referred by a friend and whose state license is in good standing. We visited other smaller jobs to review his work. We signed a contract with him to perform \$250,000 in repairs. He has taken all of our money and only 1/3 of the work is complete, much of it against code. What should we have done to avoid this nightmare? J.C.

DEAR J. C.: After reviewing all of the details of your story, I can see that this person was a con artist from the start. All of the facts that you have presented indicate that this individual was not capable of performing a job of your scope. Furthermore, it appears that he had every intention of stealing your money. He has no honor and makes life miserable for all honest, stable, and trustworthy contractors.

Some state laws permit contractors to ask for and accept deposit money the day the contract is signed. In many cases, deposit money forwarded by a homeowner to a contractor is nothing more than a loan. You put yourself and your money at great risk if you advance money to a contractor for no good reason. Some contractors use deposit money to pay the bills of other jobs currently in progress. This business practice is often referred to as under-capitalization. In other words, their financial gas tank is running near empty.

Contractors deserve advance money in certain instances. For example, they may have to order custom non-returnable objects such as kitchen cabinets or custom windows or doors. A build/design firm may want the cost of the design work and the building permit covered as these items can only be used on your job. Design and planning costs can be negotiated during the bidding process. Costs for custom materials can be verified by asking for copies of the quotes from suppliers. Honest contractors generally will not hesitate to provide you with these numbers.

I also noticed that you allowed the contractor to begin work without finished, detailed plans that were approved by your local building department. This was a critical error on your part. It is vitally important to have finished plans and specifications BEFORE the contract is signed. The plans should be an integral part of the contract documents. An investment of \$250 or so with an attorney to review your contract would have been very prudent. The contract could have contained language telling the contractor that all work must be performed in accordance to the plans and specifications.

Payments of additional monies as the work progresses must be tied to specific progress points. You can agree to pay weekly or monthly for work that is complete and satisfactory. To aid you in determining what is a fair price to pay at each of these times, a detailed cost breakdown of the job costs is required. Had you obtained this breakdown of costs on your job, the money to pay for the yet unfinished work would still be in your possession.

I suggest that you contact your local building department as well. Often these agencies provide written progress reports during construction. These reports tell you whether or not the work is being completed in accordance with the building code laws. Make the contractor submit these reports, if they are available, at each request for payment.

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In addition, be sure you receive notarized affidavits from each person who has worked on your property or material supplier who has delivered materials. If your contractor has not yet paid these people, your nightmare is just beginning.

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WHEN TO PAY FOR REMODELING PLANS

DEAR TIM: My husband and I are remodeling our home to accommodate for our new arrival. We've been working with an architect who is not fully licensed at this time. This individual has been drawing up plans for our new project. The plans are not yet signed and sealed as he wants to send them to a licensed architect to have this done. But he wants us to pay the full amount of the plans prior to getting them signed and sealed. We're not sure if we should pay for the plans until everything is finalized. Please let me know if we should pay for them up-front or if we should wait until the plans are completely done. Julie S., Orlando, FL

DEAR JULIE: Congratulations on the expanding family! The answer is very simple if you ask me. I feel you should never pay in full for something until such time as you are completely satisfied. The fact that the unlicensed architect-to-be asked for the money before the job is complete is very troubling to me.

There are all sorts of reasons you should not pay in full until the job is complete. The money in your account is the only leverage you possess. The instant you hand over all of the money for the plans, you then rely on integrity, hope and good will to get what you want. This individual may have all of these qualities and more, but I do know he does not yet possess good business sense.

I can produce countless examples in the real world where you do not pay for things in advance in-full before you get them. There are many things where you do put down a deposit and possibly make timed payments as the work progresses, but to pay in full before delivery is a recipe for disaster.

Here is a true story that just happened to the son of a close friend. This young man wants to become a commercial pilot. He signed up for flying lessons and all the necessary ground school training to get the commercial license. The cost was staggering - somewhere above \$15,000. My friend co-signed a loan for his son with a bank, took the funds and paid the flight school for the flying lessons and schooling. They did this in advance to get a slightly reduced price. A month ago the flight school went bankrupt and the son only had 10 percent of his training complete.

The son and father still owe the money to the bank and they have virtually nothing to show for it. A similar thing could happen to you. This unlicensed architect may have made an enormous amount of mistakes in your plans. It could take many hours of redrawing to correct them. Once he has the money, he may be reluctant to make the changes in a timely manner. One thing we know for sure is that his incentive to do so will be greatly reduced. In fact, he will find that the additional work will create a large mental obstacle as he feels he is not getting any money to correct his mistakes should they exist.

At this point in time, you have enormous leverage. The plans he has been working on are of no value to anyone but you and your husband. No other homeowner would have interest in them as they are house-specific remodeling plans.

You simply tell this person that you are more than willing to write a check for 90 percent of the total due once the plans are signed and sealed by a real licensed architect. You then tell the architect-to-be that the remaining 10 percent of the money will be paid as soon as the building permit

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is issued. Keep in mind that the building department may request minor changes in the plans before a permit is issued. You still want to have some financial leverage in the event this happens.

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HOME REMODELING

25 Things You Must Know If You're Remodeling

Remodeling is as different from building a new home as night from day. When you visit your new home construction site, you can look around and then go home. You don't have to deal with the workers and the mess.

Remodeling is the exact opposite. Your normal routine is rocked to its core. Strangers, whom you have never seen, invade your home. The excitement of the job starting soon wears off and becomes a dull headache.

If the remodeling job is a major one, such as kitchen remodeling, or bathroom remodeling or even a room addition, the impact on your life will be significant. Many people are not prepared for the disruption, dust, and missed deadlines.

To make a remodel job go smoothly, it requires enormous amounts of planning. Be sure to convey your bathroom remodeling ideas or basement remodeling concerns or whatever room you are doing to your contractor at the beginning of the remodeling projects. The remodeling contractor is responsible for this, but you must make sure he or she has covered all of the bases. In my opinion, you can only do this if you have a clear understanding of all of the things that can go wrong during the remodeling process. With this knowledge, you can already have a strategy in place to eliminate problems before they happen.

Asbestos and Lead

Harmful basic chemical elements lurk like hidden time bombs in many existing homes. Two of the most prominent are asbestos and lead. Asbestos was commonly used in insulation pads that sat on top of furnaces and was used in wrapping materials around forced-air heating and cooling ducts.

Asbestos was also used in floor tiles, roofing, piping, adhesives, etc. In other words, it can be found just about everywhere. You need to make sure you identify potential trouble areas in your home and make sure your contractor deals with the danger in an approved manner during the asbestos removal.

Lead is a very serious hazard that can be found in many homes built prior to 1978. If your remodeling job involves scraping, sanding or removing anything that might contain lead paint, you better make sure all precautions are taken so your home does not become listed as a Superfund site. Lead poisoning is a possibility if not handled properly.

Bid Breakdowns

When you are soliciting bids from different contractors for your upcoming remodeling project, it is imperative that they submit detailed itemized bids. You need to know how much money is allocated for the labor and material for each part of the job.

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This information will be used by you to why the low bidder is low and why the high bidder is high. If there is an enormous amount of disparity between contractors when you compare the cost of the same task, this is an area that needs further discussion. For example, if you are getting a new roof put on and painting done and you have specified the exact shingle you want, then the actual itemized number for the shingles should be within \$50 or so of one another as both contractors should have calculated the same number of shingles.

The breakdown will also be an invaluable tool when you need to make payments. When a payment is requested, it becomes your job to view the work that is complete and ensure it is satisfactory. Refer to the initial bid breakdown and make sure to only pay for that amount of work along with a pro rata portion of contractor overhead and profit.

Customizing Touches

One of the most fulfilling things, I experienced as a remodeling contractor, was doing extra special things for customers. Creating special nooks or crannies, delightful custom window seats, maybe it was a special set of steps leading from a deck to a patio.

If you start to gather photographs from magazines and even the Internet that depict things you especially like, an experienced carpenter, painter or other trades person might be able to create it for you with very little extra work.

But you need to communicate these wants and desires in the planning stages. Photographs are an ideal tool for communicating what you want. My wife did this exact thing with me as she saw a gorgeous wood picket fence in a magazine. Without any plans and just working from the photo, I created a nearly exact copy. It doesn't cost one dime to ask for a price or express an idea.

Debris Removal

It is surprising to many people how much debris and garbage are created during a moderate to large remodeling job. The problem on a remodeling job is that you don't want it scattered or piled in the yard or left inside if at all possible. Any trash that is combustible represents a serious fire hazard as it is commonly stacked so there is lots of air around it. A spark from a plumber's torch, a carelessly discard cigarette, etc. can create an inferno that can cause serious damage.

To make matters worse, when debris is being created, often the structure is being altered. Some structures can lose much of it's fire stop characteristics, especially if drywall and plaster have been removed. Open walls and ceilings provide a pathway for rapid fire spread.

Include in your contract that all debris will be cleaned up each day and placed in a metal container that is placed safely away from your home. Request that the work area be broom clean each day and vacuumed at the end of each work week.

Duration of Job

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The last thing you want is your house torn up for an extended period of time. If you have seen your friends', relatives', co-workers' and neighbors' homes go through a remodeling job of any size, you know it can take a while. Anything that delays the job causes the pain threshold to rise exponentially.

Using your past experience and observations of other people's projects, you might be able to get a feel for the length of time a job should take. If a contractor says they can do a small room addition from start to finish in 10 days, ask him what magician will show up. You may be surprised as he may have the addition pre-built at a modular home factory!

It is possible to compress time schedules, but your job during the bidding process, is to request a detailed time line of what tasks are going to happen each day or each week. Compare the schedules that each contractor provides to see if each one has accounted for each task. If a contractor refuses to produce a schedule, it might be a sign of disorganization.

Dust Control

Even small remodeling jobs create dust. Large-scale demolition can create dust storms within homes. When you are interviewing contractors, during the bidding process, have detailed discussions about dust.

Take notes during these discussions. If the contractor says something that doesn't sound right, ask for clarification. When you talk with past customers of each contractor, ask specific questions about how well dust was controlled.

Some dust is inevitable, unless the contractor sets up a negative pressurization environment where the work is taking place. This setup costs extra money and is widely used by the mold abatement companies if you or someone in your family is sensitive to dust.

Keep in mind that homes equipped with recirculating forced air systems must be turned off during periods of dust creation. The return air aspect of the system can inadvertently pull dust into the system and broadcast it throughout the home.

Extra Telephone

It seems as if everyone has a cellular telephone today. But it is entirely possible for a battery to die or a cell phone to be forgotten at home or become damaged at the jobsite.

The last thing you want is a contractor or one of his subcontractors using your phone. One or two phone calls is not bad, but day-after-day use of your home phone can become very annoying.

It gets worse, some contractors give out your telephone number because they might expect a return call. You then become an unpaid secretary or a receptionist for the branch office of your contractor.

The solution is simple. Place language that your contractor must install a temporary land telephone line or at the very least buy a temporary cell phone that is kept at the jobsite for all subcontractors and employees to use. We have more options now than ever with respect to communication.

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Fumes

Many parts of the remodeling process can and do create fumes. The assembly of PVC plumbing pipes creates very noticeable fumes. Soldering copper tubing creates fumes as well, Drying paint liberates vapors into the air that contain a brew of different chemicals.

Urethanes, adhesives, etc. all create fumes that can invade your home during time periods where windows must be closed. These accumulated fumes can cause discomfort and actually sickness to people who might be acutely sensitive to some of these very peculiar chemical vapors.

Temporary space heaters used for all sorts of heating and drying purposes can create deadly carbon monoxide. Fumes can enter your home quite by accident and cause a problem. A heater placed innocently next to an air intake might cause massive amounts of carbon monoxide to be inject into your interior air. It is extremely important to discuss fumes with the bidding contractors and what they plan to do to minimize them in your home as they work.

HVAC Sizing

If your remodeling project involves adding additional space, there is a strong possibility you will have to upgrade or modify your existing heating and cooling system. Your existing furnace and air conditioner might be at the limit now with respect to the amount of heating and cooling BTU's they can handle.

It is extremely important that you discuss this possibility with the remodeling contractors during the bidding process. Talk with them about heat gain and heat loss calculations. If the contractor or sales person squints or tilts their head when you mention those words, you might be talking with the wrong person.

Once you have awarded the job to a contractor, it is imperative that the heating and cooling contractor come out and gather the necessary data to perform the needed calculations. These tell them whether or not your existing heating and cooling equipment will work.

Insurance Certificates

Unfortunately, we live in a society that seems to be over-populated with attorneys. These people need to feed their families and some of them seem to love to work on accident claim cases. You need to make sure you are never named as a party to one of these lawsuits.

You can do this by taking about insurance certificates with the bidding contractors. It is not always enough for a remodeling contractor to show you he has coverage for his employees. What is important is that each and every person who shows up to work at your home is indeed covered.

Although it is a lot of work, you must insist upon doing it. You must make it very clear to the bidding contractors that they must supply you with current workman's compensation and general liability insurance certificates for all subcontractors who plan to work on your job. These documents need to be produced the day the contract is signed.

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Matching Materials

Clothing, automotive, etc. styles change on a constant basis. The same is true for products used to build your home. Your existing home may have very unusual interior and exterior woodwork or plaster. If your remodeling contractor is a professional, he or she will know how to get exact matches on many of the materials used in your job.

There are many woodworking mills that can easily create identical profiles for door and window casing as well as crown molding and baseboards. It will cost more than buying stock trim, but the long-term value you add to your home by doing this will be well worth it.

With lots of extra effort, it is sometimes possible to get very close matches on brick and even ceramic tile. If you are trying to match brick, always go for the color match first and then the texture match. From the street, you rarely can detect texture but readily notice differences in color.

Pavement Problems

Do you have a gorgeous driveways, sidewalks and patios right now? If so, it would behoove you to take very good photographs to prove it. Remodeling activity almost always causes damage to existing paving materials around a house.

Dumpster deliveries, concrete trucks, lumber trucks, etc. can not only crack and break apart paving, but they can spill seas of motor or hydraulic oil on pristine concrete or blacktop.

It is imperative that you and the bidding contractors talk about how your paved surfaces will be impacted by the remodel job. Document what each contractor says and decide who has the best plan to protect your current investment. The last thing you need is an argument that a crack or an oil stain was already there. This is the reason for the photos you took prior to the remodeling project.

Be aware that large loaded delivery trucks can weigh as much as 20 times what your car weighs. It is no wonder thin concrete slabs crack and blacktop driveways crumble when a truck backs up onto it. Read the delivery tickets that are signed by the workers and most have damage waivers that relieve the truck companies of responsibility if a person allows them to drive onto your paved surfaces.

Payment Schedules

This is one of the most important parts of your remodeling job. The money you possess is the only leverage you have to ensure your job gets completed and done to a level of quality you have agreed upon in your contract.

All too often, people advance large sums of money to the contractor when the contract is signed. The only time this is necessary is when your job requires special order materials to be ordered before the job starts. Examples of this might be semi-custom or custom cabinets, a custom front door, custom garage doors, etc. Any materials that are commodity items that can be purchased at supply house do not qualify.

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Keep in mind that your contractor should have open accounts at all suppliers. If he does, why would he need advance money? He doesn't pay workers in advance, nor does he pay for supplies in advance.

You must always retain a sufficient amount of money to complete the project no matter what stage it is in. When you do pay for completed work, the contractor must supply you with notarized affidavits from all who have work on the job as well as all companies that have supplied material. Never issue a payment without having these documents. Get your payment calculator out and be sure the total amount you pay each time needs to match the amounts on all of the affidavits.

Plans - Triple Check Accuracy

As with new construction, the plans, blueprints, and written specifications are the primary tool that communicates to the remodeling contractor, suppliers and all subcontractors what is going to happen at your home. The ideal set of house plans would be ones that are so complete and so detailed that no one ever has to ask you a question. It is possible to do this as I have been blessed to work on such a job.

But this goal is very hard to reach. It requires you to think through the simplest things, such as the exact place where a toilet paper holder might go. You need to make all product selections, even paint and stain, before the job is even bid.

Is there a value to all of this? Absolutely, yes. If your plans are this complete, the bids you receive should be highly competitive. Dishonest contractors can't play the famous bait and switch game with absurdly low allowances for things when plans and specifications are complete and accurate.

Plumbing Disruptions

Many remodeling jobs involve plumbing. What may seem to be a very simple task of just turning off your main water valve and turning it back on can wreak havoc in an older home. When water lines refill from the rapidly incoming water, it can dislodge pieces of sediment from the sides of the older pipes. This sediment can clog faucet aerators, toilet fill valves and faucet valve cartridges.

It is very important that you discuss all plumbing jobs with your contractor before work begins. If water needs to be shut off to solder pipes, what happens if a small fire starts? If drain lines need to be cut into to install a new branch drain line, how long will the toilets in the house be inoperative? These simple questions need solid answers.

Avoid major plumbing changes on Fridays. If leaks develop after workers go home, will you be able to get instant repair service over the weekend? If you must have work done on a Friday, have a contingency plan in place. Make arrangements such that you can easily contact the plumber or the remodeling contractor in the event of plumbing problems.

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Porta-Potty

Bathrooms are private places. The last thing you need is a bunch of strangers with dirty clothes and muddy boots walking onto the clean throw rugs in your bathrooms or powder rooms.

Major remodeling jobs that will see many people at your home for weeks on end need a temporary toilet facility. Many of these are quite discreet and they allow you to maintain control of a very important part of your home. This is an important issue and you should not budge on it.

Make it very clear to the bidding contractors that a temporary toilet must be on the jobsite and that it must be serviced once or twice a week.

Pre-Order Materials

Any type of delay on a remodeling job creates havoc and stress. You can minimize delays by making sure the exact materials you need are at the jobsite long before they are needed.

This concept may seem simplistic, but it is often overlooked. If you have a safe and secure place to store products that are not readily available, why not buy them in advance and have them on hand?

Examples of this would be specialty faucets, hardware, light fixtures, ceramic tile, special-order windows and doors, and any other material that is not ordinarily in stock. It is also very important to inspect these items to make sure there are no defects and that they are exactly what you ordered. It is not uncommon for the wrong product to be shipped.

Protecting Finishes

Imagine how many trips up and down your stairs a remodeling contractor and his subcontractors might make as they remodel a second-floor bathroom. Without protection, the stairs, carpeting, handrails, walls, etc. can easily be damaged or scuffed.

I suggest having a very frank and open discussion with your contractor about what steps will be taken to protect all existing surfaces both inside and outside of your home. Take very good notes and write down in the contract any promises the contractor makes with respect to what he or she intends to do.

The marketplace is crammed with many surface-protection products that help contractors keep dirt and dust away from things that are important to you.

But keep in mind it doesn't stop with existing materials. Many a new tub has been scratched by a drywall or ceramic tile subcontractor. Finish carpenters can scratch new hardwood floors with tools when they come back to install toe stripping. Discuss all of these issues with your contractor so things that are in excellent shape stay that way.

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Scheduling

One of the top complaints of homeowners who have gone through a major remodeling job are delays caused by scheduling snafues. Large construction projects employ special people who are experts at coordinating the arrival of both materials and workers so that the job continues from start to finish with no disruption.

Small remodeling contractors can create simple charts that do the same thing. The trick is to correctly identify the realistic amount of time it takes to do a particular task and then place it in the right position on the schedule.

The next task is to determine which jobs can occur on the job at the same time. It is often possible for a plumber to be working inside a room addition while a bricklayer or siding contractor is applying the outer skin to the job.

Request a written schedule from your contractor in the bidding phase. See if any of the contractors you are talking with can produce one they are currently using on an existing job. If they can't, you better talk with past customers to see if the jobs they did progressed with little or no interruptions.

Selecting the Real Professional

I often think this is the Holy Grail of both new home building and remodeling. Every homeowner wants the best contractor, who is both professional and honest. These people do exist. They can often be found in just about every city and county in the nation.

If you hope you have the right contractor for the job, you may already be in trouble. You can't ever base decisions on hope. You start the process of finding the professional by conducting a thorough and in-depth interview. This may seem unusual, but it is a common practice in the business world.

You can ask very interesting questions and get some fascinating information. For example, ask a contractor the names of the last three books he has read. Ask if he attends remodeling conventions. If not, ask why. Ask them if they volunteer time. If so, where? Do they coach children's teams? When asked to produce an ID, does the contractor show you a driver's license or some other card? Never forget that it is your home and it represents an enormous investment. You must be sure you and your contractor are a close, if not perfect, fit.

Temporary Kitchens and Baths

If you have never kneeled down to wash dishes in a bathtub, you are not missing a thing. It is miserable and it is humiliating. It is also unnecessary.

If your kitchen is going to be torn up for several weeks, ask the bidding contractors how they intend to provide you and your family with temporary sinks, cooking appliances and refrigeration. Creative and professional remodeling contractors can often throw together a temporary kitchen that can roll into and out of the kitchen in progress each day.

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Bathrooms are even more critical. It is not uncommon for a professional remodeling contractor to build a temporary shower in some location while the primary bathroom is being remodeled. Sinks and toilets are a must. There must always be functioning sanitary plumbing fixtures for you at all times. Excuses are reasons for failure. Do not tolerate them.

Trees and Landscaping

The landscaping around your home may be priceless. How many years has it taken a particular tree to reach its current height? You may have tens of thousands of dollars invested in expensive flower, bushes, shade plants, etc. The last thing you need is permanent and irreversible damage to your trees and vegetation caused by an unknowledgeable contractor, subcontractor, excavator or delivery truck driver.

The best way to ensure you preserve all of your plants is to arrange a consult with a certified arborist long before your project begins. Get written instructions from this person as to what needs to be done to make sure all trees and plants will survive the remodeling ordeal.

Make these written instructions part of the bidding documents and part of your contract. Be sure the contractor you choose has sufficient general liability insurance to cover damages and that the policy specifically covers damage to trees and landscaping.

Valuables

This is an uncomfortable subject, but one that must be discussed. There is no doubt in my mind that your home contains valuables. They may be cash, jewelry, guns, art or stamp collections or even musical instruments.

Remember that your remodeling job will bring with it people you have never met, and employees who work for those people who may have never been properly screened. Never tempt these people by leaving valuable objects in plain view.

If you have things of great monetary or sentimental value in your home, it may behoove you to move them to another safe location during the remodeling process. Accidents can happen. Fires can start. Worse yet, loose talk at a drinking establishment might tip off criminals who learn about all of the wonderful and tantalizing things within the confines of your four walls. Eliminate this problem from the start by eliminating the source of temptation.

Weather Protection

Many remodeling jobs involve opening up your house to the weather. Extreme jobs could actually involve tearing off your entire roof or a part of it to add a second story or a large dormer. The job might be as small as adding a skylight. But Mother Nature might spoil the fun with a pop up thunderstorm or five days of non-stop rain. A snowstorm may even be thrown in for good luck.

The point is simple. You must know how your remodeling contractor is going to protect your home against all forms of weather while your home's outer defenses have been compromised by

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work-in-progress. You need to understand that giant tarps can blow away in moderate winds. Wind pressure can be enormous over large expanses of plastic or fiberglass.

Not only can rain and wind-driven rain be a problem, but extremes of heat and cold can create enormous amounts of discomfort. Discuss with your contractor, before the job starts, how air leaks will be stopped until such time as enough work is in place to minimize any loss of conditioned air from your home.

Work Days

Within a week or two, you will grow tired of the flow of people who come to your home to perform the remodeling work. It is important for your sanity and peace of mind for the workers to maintain a strict work schedule. When you get home from work, the last thing you need is noise, dust and activity at your home. Yes, that may be part of your families ordinary activities, but you don't need additional input for the remodeling contractor.

When you are bidding the job, ask each contractor to state the normal times workers will arrive and leave each day. Ask about weekend work. If you do not want workers to be around on weekends, make it clear for the beginning.

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CENTRAL AIR CONDITIONING

DEAR TIM: The air conditioning in my home has never seemed to work that well. My recent promotion and transfer have me moving into a new home that is in the very early stages of construction. What can I do to ensure the new home has a central air conditioning system that keeps all rooms comfortable no matter the outdoor temperature? Is it possible to have all rooms nearly the same temperature, as my existing home's second floor feels like an oven? Julie F., Comstock Park, MI

DEAR JULIE: Congratulations on your promotion! It is too bad you have been uncomfortable in your existing home for so long. I can think of many reasons why the central air conditioning in your existing home does not cool properly. Many of the problems might have been corrected with a simple service call from a professional who is an expert at air-conditioning troubleshooting. But it is entirely possible you have serious chronic air-conditioning system design flaws that would cost thousands of dollars to correct.

The central air-conditioning system in a home, as well as the heating system, is one of the most important parts of a home outside of a sound roof and indoor plumbing. The heating and air conditioning systems create an artificial climate inside a home. It is a very realistic expectation that this climate can be the same in each room. In my own home, each room, no matter the outdoor temperature or time of day (this is very important), can be within one or two degrees of any other room in my home. That keeps my family and me very comfortable.

It is unrealistic for you to expect your home to be a certain temperature no matter what the outdoor temperature is. In other words, if the outdoor temperature rises to 115 F, I would not expect you to be able to cool your home to a chilly 72 F temperature without considerable discomfort on days when the temperature was say 85 F.

Central air conditioning systems are designed to operate within a given range of temperatures. For example, the design temperatures in your part of the country may be only 20 degrees. This means that your air conditioner can only produce a 20-degree difference in temperature from the actual outdoor temperature to the lowest possible temperature the system can maintain indoors. It is possible to create a wider temperature spread, but oversizing an air conditioning system can result in short cycling when the air conditioner has little work to do.

If an oversized air-conditioning system short cycles or only has to drop the temperature a few degrees, it simply does not run long enough to remove humidity from the air. When this happens, the temperature inside your home gets to the desired level, but you feel cold and clammy. Properly designed central air-conditioning systems will run for ten or fifteen minutes at a time which allows them to extract humidity as the air flows across the cooling coils inside the air handler.



This home has two separate central air conditioning systems. One zone is the main floor, while the smaller unit cools the second floor.
PHOTO CREDIT: Tim Carter

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The key to getting an air conditioning system to work properly is to have a real professional size the equipment properly and install a ducting system that delivers the right quantity of air to each room of the house. Each room must also have a return-air duct inlet that vacuums hot air from the ceiling and returns this air to the central system to be cooled once more.

A professional air conditioning person will take your new-home plans and analyze them using sophisticated computer software. This process will determine both the BTU (British Thermal Units) heat gain and heat loss for EACH room of your new home. This same exercise can be done on existing homes. With this data, the professional can ensure the proper sized equipment is purchased, and the ductwork that provides air to each room is sized correctly. This is of the utmost importance.

Heat gain is the measurement of heat your house gains each hour during the summer months. This number can range from 20,000 in a smaller home to more than 90,000 in larger homes. There are many variables including but not limited to: amount of wall and ceiling insulation, number and size of windows facing west and south, amount of air infiltration, compass direction each wall of your home faces, number of people living in the home, etc. Heat loss is the amount of energy your home loses each hour when it is cold outside and you are trying to heat it.

My own home has a heat gain of nearly 77,500 BTUs. To offset this, I have two separate central air-conditioning systems. One is 2.5 tons and the other is a 5-ton system. These two central air-conditioning systems are completely separate from each other. The smaller one handles the second floor of my home which has much less square footage of living space than the first floor of my home.

The advantage of the two systems should be obvious. Each system is controlled by a separate automatic setback thermostat. At night, the thermostat for the first-floor system tells the first floor system to turn off all night since we are upstairs sleeping. In the daytime, the second-floor system is set to not work as hard, since we are downstairs. But one hour before bedtime, the automatic thermostat for the second floor resets itself and tells the outdoor compressor to get to work so the bedrooms are cool when we go upstairs.

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HEAT PUMP FACTS

Heat Pump Illustrations and Facts

Heat pumps are very popular machines. They appeal to many land developers and builders because they are relatively easy to install. Since electricity is already being extended into the subdivision and your home, there is no real extra utility costs. Installing natural gas lines and service is an extra step for a developer and a builder. Heat pumps don't require masonry chimneys for that matter. Do you see why they were easy to market to builders and developers?

Not an Easy Machine

Heat pumps may be easy to market and install, but they are by no means a simple machine. In fact, they are by far the most complicated machine that you will find in the average residential home. The controls, actual machinery, components, etc. are highly complex and require professional attention. They are by no means a do-it-yourself project. In fact, even people who work around them on a routine basis can make mistakes. Just ask my brother-in-law! He regularly helps and assists my heating contractor. One day, my brother-in-law thought he would take pressure readings on the outdoor compressor at his parent's home. Well, before you could say, "Watch what you are doing.", he lost all of the refrigerant out of the machine. I guess he wanted to do his part to increase the size of the ozone hole over the South Pole.

The Heat Pump Coil

Standard air conditioners have two coils. One distributes cooling and the other one disposes of collected heat. One of these coils is hidden inside your home in the furnace or air handler unit where the fan is located. The other coil is outdoors in the big metal contraption. Heat pump coils need to be designed a little differently because they have to serve both purposes. In other words, when the pump switches from heating to cooling, the tasks of the coils switch as well.

High Efficiency

How do heat pumps become more energy efficient? There are several primary ways. One of the most practical things to do is to increase the size or surface area of the indoor and outdoor coils. This will definitely help move heat one direction or another faster.

Heat pump manufactures are also re-introducing the expansion valve. This used to be standard equipment on air conditioners and heat pumps years ago. An expansion valve meters the flow of refrigerant. Because the internal pressure of the refrigerant in the system changed with a rise or fall in outdoor air temperature, metering the flow of Freon delivers just the right amount of heating or cooling to the living space. Prior to the re-introduction of expansion valves, a fixed orifice in the refrigerant system was used to regulate the flow of refrigerant.

Efficiency can also be improved by moderating the flow of air across the coils. You can do this by installing two speed fans or variable speed fans that sense when to move more or less air across the coils.

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The Defrost Mode

When the air temperature drops below 32 degrees outside and the outside air is fairly saturated with humidity, frost can form on the outdoor unit coils. This is perfectly natural. The frost can turn to a thin layer of ice rather quickly during periods of operation.

The most efficient heat pumps have sensors that tell the heat pump that ice is forming. When the sense ice, they actually send heat back outdoors to melt the ice. Less efficient heat pump models do this on a time and temperature basis and may send heat to the outdoor coil when it isn't necessary to do so. If this happens, you have to pay more to heat the house back up! Ask about this feature when you shop for a heat pump.

Heat Pump Thermostat

Don't buy just any thermostat for your heat pump system. Heat pumps require special thermostats. These instruments separate the two heating functions found in all heat pumps: the heat pump aspect and the auxiliary electric resistance heat. Wiring a heat pump thermostat is different and don't attempt to do it yourself. You can easily short out the device and ruin the sensitive electronic components inside the thermostat. Just ask my brother-in-law. He has burned up at least one or two of these as well.

Heat pump thermostats have a little light that tells you when the heat pump is using electric resistance heat. If you see this light on when the outdoor temperature is 40 F or higher, something is possible wrong with your unit or the thermostat. Call a qualified service person as soon as possible and have them check out all components. Electric resistance heat is very expensive and you can lose all of your energy savings in a short time if you rely solely on electric resistance coils to supply heat to your home.

Heat Pump Mechanics - Some Simple Facts

Just what is inside that big metal box / contraption on the exterior of your home? Let me tell you, it is a highly sophisticated machine. In fact, heating and air conditioning are by far the most complex craft in home building and remodeling.

The image to the right is a cut away illustration of a typical modern heat pump. The heart of the heat pump is the high efficiency scroll compressor. It takes the gaseous refrigerant and turns it into a liquid. The heat pump also contains high and low pressure switches, accumulators, a filter drier, discharge temperature switches, mufflers, vibration isolation plates, high efficiency fan to move air past the outdoor coil, and all sorts of wiring and copper tubing. They are complicated beasts to say the very least! Be sure you have a professional service or install your's!

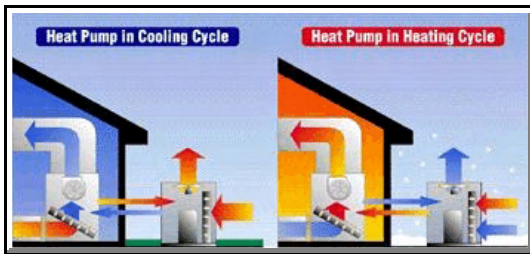


Cut away illustration of a typical heat pump.

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Three Types of Machines



A heat pump is not much different than a car with a transmission. You can go forward or reverse in a car. Flip the switch at your thermostat and the same thing happens within the heat pump.

The heat pump shown in the illustration to the left is the most common machine. It transfers heat from one body of air to another - an air to air transfer. Did you know that there are two other types of heat pumps? You bet! You can actually get a heat pump that takes heat from a body of water or from the earth itself. These are called water to air and ground to air transfer machines. The principals of operation are the same in all three. The water to air and ground to air heat pumps are actually more efficient if you have the ability to extract or dispose of heat from/into a body of water or the ground that has a nearly constant temperature of 55 F.

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SIZING AIR CONDITIONING

My friends - the Gibson's - purchased a tract home about 15 years ago. It was actually the sub-division model home. The front of the house has no less than 10 windows if I am not mistaken. One month ago their AC unit gave up the ghost. My HVAC man installed a new AC unit for them. The Gibsons had always complained about being uncomfortable. They thought the AC unit was low on Freon. It turns out the AC unit was never sized right from the get go. It was 1.5 tons too small!

To add insult to injury, the return air ducts from the second floor rooms were non-existent. There was just one central return duct in the second floor hallway. My HVAC man did a heat gain calculation to make sure that the proper sized unit was installed. He has a neat computer program that allows him to do this. You can do the same thing by hand - I have done it numerous times - and arrive at the same results.

One Size Doesn't Fit All

Tract houses often have similar sized AC units. The builder or HVAC person simply does one calculation and often applies it to all houses that are similar in size. Guess what? This doesn't work! In the case of my friends, the glass on the front of their house happens to face west south-west, the WORST possible direction! The blazing sun late in the afternoon cooks the inside of their house. I'll bet that a number of you reading this bulletin have similar situations.

Some HVAC contractors try to size AC units by doing a simple square foot analysis. They use a gross multiplier that ranges from 400 (older homes) to 1,000 (newer homes) sq. ft. of floor space per ton to arrive at total BTU heat gain or total tonnage. This method is unacceptable. If your HVAC person proposes this, find a qualified technician who understands heat gain and knows how to use Manual J.

The Bible - Manual J

Calculating heat gain is really complex. You must use a booklet called Manual J. This booklet takes you step by step through the process making you account for each and every source of heat. Many scientists have worked over the years to formulate the tables, formulas, and values that combine to form this bible of the air conditioning industry.

You can purchase a copy - and I URGE you to do so - if you want to really understand how air conditioning works. The ordering instructions can be found if you keep on reading.

The manual is actually a rather technical booklet, but if you follow instructions well, you can easily work out a heat gain computation of your own. You will at least get close. Don't get bogged down in all of the technical mumbo-jumbo within the manual. Simply take your measurements and crunch some numbers.

Finding a Professional

The same outfit that publishes Manual J also has a new program that will allow you to locate a professional who is dedicated to a high professional standard. They have a new certification program

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called the Air Conditioning Excellence (ACE) Technician Certification Program. Air conditioning contractors who are ACE certified meet a high standard because they have completed a comprehensive, industry education and examination process and have demonstrated technical expertise with numerous types of air conditioning (and heating) units in the field. They also have a thorough understanding of non-technical and safety issues that impact the equipment in your home. If you want a professional in your home, I suggest you look for someone who has this ACE certification.

Oversizing Equipment

Some people want to oversize their equipment so they are assured of being cool on those hot days. This can be a big mistake. You actually want to undersize your equipment ever so slightly. Researchers at Texas A & M found that air conditioners that were undersized by 10 to 20 percent are more efficient and more effective at removing water vapor (humidity) from your indoor air.

Now I will agree with them to a point, but I don't know if I would undersize my own equipment to the 20 percent benchmark! I would go 5 percent at the most....a totally unscientific approach since I have always sized the equipment on my jobs to match or slight exceed the calculated heat gain.

Oversizing a unit causes problems because the unit doesn't run long enough. You want your air conditioner to run for 15 - 20 minutes at a time. This allows the recirculating air to come into contact with the cold coil inside the air handler. This is how humidity is removed from the air. You will feel most comfortable when as much moisture is squeezed from the interior air as is possible. Short cycling air conditioners don't remove humidity well at all.

Calculating Heat Gain

The first thing you need to do to calculate the heat gain of your house is to purchase a copy of Manual J. This booklet is very likely at your local library and/or you may be able to borrow a copy from a local air conditioning distributor. The point I am trying to make is that it contains 116 pages of tables, examples, and other valuable information that is physically impossible for me to include in this tiny Bulletin.

My copy of Manual J has an awesome example computation. You can see the floor plan of the house and the computation sheet. This allows you to see how they arrived at all of the individual heat gain BTU's. The example computation will allow you to easily compute your own house's heat gain.

The following instructions are meant to HELP you make sense of the rather technical Manual J. Without the following notes, I'm afraid that you might give up in frustration.

You can purchase your own copy of Manual J by contacting the following Association. The cost (\$65) is steep, but there is no other booklet like it. The 561 page, Manual J Residential Load Calculation Full edition is \$130:

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Air Conditioning Contractors of America (ACCA)
2800 Shirlington Road
Suite 300
Arlington, VA 22206
www.acca.org
Phone - 703-575-4477

Calculate Temperature Difference

OK, it gets much hotter on average in Las Vegas or Dallas than it does in Chicago. This is important as you need to keep in mind the heat intensity when sizing AC. Manual J has extensive tables that will list your city or town or one very near you. There is a temperature listed that will usually only be exceeded 2.5% of the time. In other words, it can get hotter than that temperature but only for short periods of time. You don't want to design your system for worst case scenarios. If you do this, it will be oversized.

75 to 78 degrees is the recommend interior temperature. You subtract 75 degrees from the temperature listed for your city. This is your design temperature. You will have to round this value to some factor of 5 for all subsequent calculations. In other words, if you arrive at 23 degrees, call it 25.

Heat Gain Through Windows / Glass Surfaces

The largest and most direct source of heat gain is glass. You know this anytime you have stood in front of a window on a hot sunny day. You feel like an egg in a skillet.

Heat gain through glass is affected by the compass direction the glass faces, whether or not the glass is shaded by an awning or trees, the layers of glass, and the total surface area of the glass. This aspect of your calculations is critical. If you make a mistake here, it can be big. Take accurate measurements and be sure of your compass directions.

Your BTU heat gain calculations start once you have measured all of your windows and noted all of the other data. I prefer to add up all of the square footages of the glass that face a certain compass direction. I then only have to go through the calculation one time.

Locate the proper table(s). You will need to know your design temperature, the compass direction, type of shading, and glass thickness. Once you zero in and find the right values, you will cross reference these to a number that is called the "Heat Transfer Multiplier" (HTM). You take this number and multiply it times the square footage of glass surface for that particular compass setting and shading requirements. The resulting number is the number of BTU's that you are "gaining" through your glass. Write this number down as you will be adding up ALL of the BTU's to get to your total Heat Gain. Note the vast difference in the numbers between similar windows that face West and ones that face North.

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Heat Gain of Exterior Doors

You now proceed through the same exercise for your exterior doors. You will be asked to select a door type and then find your design temperature and cross reference once again. Use this HTM and multiply it times the total square footage of exterior door types. Once again the resulting total will be BTU's of heat gain from the doors.

Heat Gain Through Walls, Ceilings and Floors

You will need to follow the same steps you did in the above exercises to get the BTU heat gain from all other surfaces that are in contact with the hot, humid outdoor air. This simply requires accurate measurements on your part and an investment of time. Do it on a step by step basis following all of the steps in Manual J.

Air Infiltration

All houses leak air. Old houses tend to leak more air than newer ones that are of moderate to high quality. There is a special calculation that you must do to find out the BTU's of heat gain your house experiences from air infiltration. You basically have to calculate the total cubic foot area of your house multiply this times .40 and divide the result by 60. This gives you the cubic feet per minute (CFM) of air infiltration. You multiply this final CFM value time the HTM value on the Air Infiltration table. Having fun yet?

Latent Heat Gains

Manual J will then walk you through a process of determining some hidden heat gain sources. The occupants of the building create heat as do appliances and light fixtures. All of this - even though it is not great - must be accounted for.

The net result of all of this effort is a total heat gain which should be somewhere in the neighborhood of tens of thousands of BTU's. My own home has a total heat gain of about 68,000 BTU's. Remember, you divide the total BTU's by 12,000 to reduce the BTU heat gain into tons of AC. Take your time with the calculations and you will be rewarded. The entire process should not take you over three hours.

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